

**THE HORSE AND DEER FLIES
(DIPTERA, TABANIDAE)
OF TEXAS**

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ABSTRACT

The horse and deer flies (Diptera: Tabanidae) are of economic importance due to the annoying blood-feeding habits of the females and their ability to spread diseases of veterinarian and medical importance. Severe attacks on livestock prevent normal feeding activities and may contribute to poor weight gain and/or milk production. Species that are notorious human pests may also have a negative economic impact by limiting the use of recreation areas for fishing, hunting, and leisure. This publication is the first attempt to summarize available knowledge of the tabanid fauna of Texas. It is based on a combination of published records, recent collections, rearing of field-collected larvae and pupae, and examination of the collections of numerous universities, museums and private individuals. To date, 109 species of Tabanidae are known to occur in Texas. Twenty-three species are reported from the state for the first time and an additional 36 species thought to possibly occur in the state are discussed. This publication presents current knowledge on the systematics and biology of the Tabanidae of Texas, and contributes to the study of biodiversity of the state's insects. Biogeographic affinities of tabanid species are discussed. Descriptions of developmental stages, natural enemies, collection methods, and taxonomic characters are included. This publication contains taxonomic keys for identifying larval stages to genus, and adult specimens to the genus and species levels. In some cases, such as for *Chrysops* and *Tabanus*, separate keys are presented for male and female specimens. Photographs of wing patterns of *Silvius*, *Neochrysops*, *Chrysops*, *Diachlorus*, and *Haematopota* are included. A listing of historic references, description, comments section, distribution map illustrating county collection records, and a detailed collection information is given for each species. Comment sections describe the species' occurrence in neighboring states, national distribution and larval habitat.

DEDICATED

To

Dr. Alexander Graham Bell "Sandy" Fairchild
1903-1995

and

Dr. LaVerne Leroy "Verne" Pechuman
1913-1992

ACKNOWLEDGEMENTS

We express our utmost gratitude to two recently deceased colleagues to whom this report is dedicated: to Dr. A. G. B. "Sandy" Fairchild for careful and critical review of several drafts of the manuscript and for his excellent suggestions regarding nomenclatural matters and keys, and to Dr. L. L. "Verne" Pechuman for providing copies of his extensive distributional records for Texas and for his guidance and encouragement. Not only were Sandy and Verne colleagues, they were our mentors and friends for the past three decades. They were gentlemen and scholars in the truest sense. Their friendship, counsel, and guidance will be sorely missed.

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THE HORSE AND DEER FLIES (DIPTERA : TABANIDAE) OF TEXAS

INTRODUCTION

OVERVIEW

Tabanidae are of economic importance due to the blood-feeding habits of the females of most species. These insects have been implicated in the transmission of diseases of veterinary and medical importance (biological transmission of erlichiosis of deer and elk and mechanical transmission of anaplasmosis, anthrax, bovine besnoitiosis, tularemia, infectious anemia, vesicular stomatitis, bovine leukemia, and hog cholera). In addition, severe attacks on livestock prevent normal feeding activities and may contribute to poor weight gain and/or milk production. Some species are also notorious human pests and may result in negative economic impact by limiting the use of recreation areas for fishing, hunting, and leisure.

The family Tabanidae (DIPTERA), commonly referred to as horse and deer flies, includes approximately 4,300 species worldwide. No species are known from the Hawaiian Islands and some other parts of Pacific Oceania, but elsewhere one or more species can be expected to occur wherever man, domestic livestock, or suitable wild hosts are found. Because of their medium to large size, striking appearance, and blood-feeding habits of the females of most species, these insects have been frequently collected and studied. The adults, therefore, are relatively well known taxonomically, especially in the Nearctic Region. The most recent catalog (Philip 1965) lists 292 species in 26 genera in America north of Mexico, but several additional species are now recognized, and several nomenclatural changes have been made or are pending. As a result of these changes, about 328 species and four subspecies in 25, possibly 26, genera are presently recognized.

Keys for identification of the known Nearctic fauna were presented by Brennan (1935) for species now placed in the subgenera Pangoiinae and Chrysopsinae, and by Stone (1938) for species of the subfamily Tabaninae. Several authors have since published keys to one or more Nearctic genera (e.g., Philip 1954, 1955; Pechuman 1964; Teskey 1983). Numerous authors have published treatises on the tabanid fauna of specific states including three adjacent states, Arkansas (Schwardt 1936; Carlton & Lancaster 1995), Louisiana (Tidwell 1973), and Oklahoma (Wright *et al.* 1986). Several papers by Burger (1974a, 1974b, 1974c, 1975) dealing with the tabanids of Arizona and adjacent areas provide useful information on several species found, or likely to be found, in western Texas.

Also, the general distribution maps and distributional notes provided in Pechuman *et al.* (1983) have proved useful for Texas species.

The present report is the first attempt to summarize the available knowledge of the tabanid fauna of Texas. It is based on a combination of published records, recent collections, rearing of field-collected larvae and pupae, and examination of the collections of numerous universities, museums and private individuals in Texas and elsewhere. In addition, L. L. Pechuman (deceased), Department of Entomology, Cornell University, made available his detailed distributional data and collecting records for Texas Tabanidae. Also, much of the current understanding of the seasonal and geographic distribution of Texas Tabanidae, especially of southeastern Texas, is the result of the extensive field and laboratory efforts of Patrick H. Thompson in the 1970s. Before leaving Texas, Thompson deposited an extensive selection of scientific literature on the Tabanidae and the bulk of his collection with the Department of Entomology at Texas A&M University. The authors are very grateful for his dedication and enthusiasm which have greatly enhanced the value of this report.

Relatively few published records are available on the Tabanidae of Texas. Osten Sacken (1876) reported Texas collections for four species of *Tabanus* Linnaeus. Brennan (1935) and Stone (1938), in their monographic works mentioned previously, provided some Texas records and, in addition, noted by way of general accounts that several other species probably occur in Texas. Philip (1947, 1950c), in a catalog of the Nearctic Tabanidae and its supplement, listed numerous species from Texas, but did not provide any specific locality data or dates of collection. McGregor and Schomberg (1952) published a lengthy list of species collected in Texas, but these authors also failed to provide information on localities and dates of collections. Many short papers of relevance have been published, some covering selected areas of the state (Thompson 1973a & b, 1974a & b, 1975a & b, 1976, 1977; Thompson *et al.* 1977; Thompson *et al.* 1978) and others including descriptions of new taxa or immature stages based at least in part on Texas specimens (Easton *et al.* 1968; Pechuman 1938, 1960; Philip 1962; Townsend 1898a; Goodwin 1986, 1987, 1994). Kingston (1983), in an unpublished thesis, provided information of tabanid species of the Texas rolling plains.

Geographically, Texas is located near the juncture of the Nearctic and Neotropical realms. The dividing line, between the moisture sufficient eastern United States (U. S.)

and moisture dependent western U. S., follows a north-south line through Texas. This ecologically dynamic area, combined with the size of the state and its known physical and biological diversity, renders the tabanid fauna to be among the more diverse within the 48 contiguous states. No taxonomic keys covering the known or likely tabanid fauna of the state have ever been published, and most existing keys covering components of the Texas fauna were published more than 40 years ago. Since then, there have been numerous nomenclatural changes, and several new taxa have been recognized.

To date, 109 species are known to occur in Texas (Table 1). Twenty-three of these 109 are apparently new

Hybomitra phaenops, *H. rhombica*, *H. rubrilata*, *Tabanus limbatinevris*, *T. mogollon*, *T. turbidus*, and *T. zythicolor*. Detailed collection data is also provided for the first time for nine species previously reported from Texas but without complete collection data including *Chrysops dissimilis*, *Agkistrocerus finitimus*, *A. megerlei*, *Tabanus calens*, *T. equalis*, *T. imitans*, *T. nefarius*, *T. quinquevittatus*, and *T. reinwardtii*. An additional 36 species are thought to possibly occur in the state (Table 1).

This report provides current knowledge on the systematics and biology of the Tabanidae of Texas. It also contributes to the study of biodiversity of Texas insects and provides baseline data for detecting future changes in diversity and distribution resulting from changing habitats and environmental conditions. Our hope is that this document will spur interest in the diverse array of potential research topics on this important group of insects and serve as a starting point for those electing to pursue them.

BIOLOGY

Studies of tabanid biology have been hampered by the long life cycle of these flies, their predacious and cannibalistic larval habits, reluctance of captive adults to feed, and by refusal of adults to mate in captivity. Recent workers (e. g., Thompson *et al.* 1979) have succeeded in developing satisfactory adult blood-feeding and/or larval rearing systems for some species, but mating remains a major obstacle in establishing laboratory colonies of any species.

Although 4,290 valid species of Tabanidae are known to occur (Fairchild and Burger 1994), information on the juvenile stages is available for less than 15 percent. Hennig (1952) listed the species for which descriptions of the immatures were then available. Teskey (1969) reviewed the available information on immature stages of eastern Nearctic species and provided a comprehensive treatment of their taxonomy and biology. Teskey's work has been supplemented by numerous shorter papers (Burger 1977; Goodwin 1972, 1973a, b, and c, 1974, 1976a and b, 1986, 1987, 1994; Lane 1975, 1976, 1979; Teskey and Burger 1976; Tidwell 1973; Tidwell and Tidwell 1973). Based on the combined efforts of these authors, comparable descriptions of the immature stages are available for about 56 percent of the Nearctic tabanid species.

--Eggs--

Tabanid eggs are deposited in spring, summer, or early fall and have been found principally on the leaves or stems of vegetation hanging over aquatic habitats. It is not uncommon, however, to find eggs on stones, logs, and other objects near aquatic situations (Tidwell and

TABLE 1. Number of Species of Tabanidae Known or Thought Possibly to Occur in Texas

Taxa	Occur	Possibly Occur
SUBFAMILY PANGONIINAE		
TRIBE PANGONIINI		
Genus <i>Apatolestes</i>	2	-
Genus <i>Asaphomyia</i>	1	-
Genus <i>Esenbeckia</i>	4	-
TRIBE SCIONINI		
Genus <i>Goniops</i>	-	1
SUBFAMILY CHRYSOPSINAE		
TRIBE BOUVIEROMYIINI		
Genus <i>Merycomyia</i>	-	1
TRIBE CHRYSOPINI		
Genus <i>Silvius</i>	5	1
Genus <i>Neochrysops</i>	-	1
Genus <i>Chrysops</i>	32	10
SUBFAMILY TABANINAE		
TRIBE DIACHLORINI		
Genus <i>Anacimas</i>	-	2
Genus <i>Diachlorus</i>	1	-
Genus <i>Chlorotabanus</i>	1	-
Genus <i>Stenotabanus</i>	2	1
TRIBE HAEMATOPOTINI		
Genus <i>Haematopota</i>	-	1
TRIBE TABANINI		
Genus <i>Leucotabanus</i>	1	-
Genus <i>Agkistrocerus</i>	2	-
Genus <i>Whitneyomyia</i>	1	-
Genus <i>Hamatabanus</i>	-	2
Genus <i>Hybomitra</i>	6	3
Genus <i>Tabanus</i>	51	13
TOTALS	109	36

state records including *Apatolestes aitkeni*, *A. michineri*, *Silvius gibsoni*, *Chrysops beameri*, *C. bistellatus*, *C. celatus*, *C. dacne*, *C. dorsopunctus*, *C. fulvaster*, *C. geminatus*, *C. hyalinus*, *C. macquarti*, *C. moechus*, *C. parvulus*, *C. sequax*,

Hays 1971, Foster *et al.* 1973). Based on meager information, it seems that eggs of species developing in terrestrial habitats are associated with lower leaves or branches of small plants and trees. Eggs are deposited in masses of from 100 to 500 and may be in one or several tiers. The single tier arrangement may consist of eggs attached to the substrate by their tips (many *Chrysops*, some *Tabanus*, and *Goniops*) or along their whole length (some *Chrysops*). Masses with two or more layers usually taper toward the apex with successive tiers. This type is deposited by a few *Chrysops* and most *Tabanus*, *Hybomitra*, and *Merycomyia*. When first deposited the eggs are whitish, but typically darken to shades of brown or black before hatching.

--Larvae--

The larvae of most species of tabanids occur in moist areas ranging from mud on lake bottoms to less moist areas along shorelines. Other habitats include rotten logs and tree holes. While most tabanids are considered aquatic or semiaquatic in the larval stage, certain species, such as *Tabanus sulcifrons*, *T. sackeni*, and *T. abactor*, have been found in fairly dry soil (Schomberg 1952, Goodwin 1976b, Montandon *et al.* 1993). Many species are typically associated with a rather specific habitat, but *Tabanus subsimilis*, *T. atratus*, and *T. lineola* utilize a wide range of wet soil habitats.

Most tabanid larvae are considered to be predacious on various soil invertebrates such as earthworms and soft-bodied dipteran larvae. Many, especially the larvae of horse flies (Subfamily Tabaninae) exhibit cannibalism, at least in the laboratory. Deer fly larvae (*Chrysops* spp.) are thought to feed on vegetable material but have been observed feeding on dipteran larvae in captivity (Logothetis and Schwardt 1948). Goodwin (1982) also observed predation and cannibalism by one species of *Chrysops*.

The larvae undergo 6 to 13 molts and overwinter. In the spring or summer, they move to slightly drier soil to pupate. Larvae of some species in drying habitats occasionally form a mud cylinder which provides a suitable and protective pupation site (Drees 1987). The majority of Texas species probably have a single generation per year. Some of the very large species (e.g., *Tabanus atratus*, *T. americanus*) may require two or even three years to complete a life cycle (Schwardt 1932).

--Pupae--

Pupae are usually found in drier areas above the waterline as they are air breathers. As they are inactive and do not float, they are not easily collected. Characters of the adults, such as the eyes and frontal features and sometimes the abdominal pattern, are often visible through the cuticle several days before eclosion.

The pupal period varies from 4 to 21 days, depending on the species and ambient temperature.

--Adults--

The females of most Texas tabanids require a blood meal for the first gonotrophic (egg-producing) cycle and may produce further batches of eggs with subsequent blood meals. Autogeny, the ability to mature eggs without taking a blood meal, is known for some tabanids (Thomas 1972). The females of many species of tabanids tend to attack specific areas of a host's body when seeking a blood meal (Mullens and Gerhardt 1979), but the reasons for this behavior are poorly understood. Males, and sometimes females, feed on pollen and nectar which may enhance survival and/or oogenesis (Roberts 1967, Wilson and Lieux 1972, Magnarelli and Anderson 1981).

Adult males tend to emerge slightly in advance of the females. The sex ratio is about 1:1. Males often hover or rest on vegetation waiting for females to pass by. Mating appears to take place in flight, but this has only been observed for a few species. Swarming, hovering, and mating have been discussed by various authors (e.g., Bailey 1948, Blickle 1959, Catts and Olkowski 1972). Wilkerson *et al.* (1985) provide an excellent overview of such behavior.

Members of both sexes of some species of tabanids can be observed flying low over pools and streams, occasionally touching the water surface. Resting adults are sometimes seen on the moist mud around such areas and have also been observed in low trees and bushes. Dirt paths and the edges of woods apparently serve as natural flyways.

Tabanids fly well and may disperse 1 to 2 km from their breeding sites, though most probably do not fly that far (Thornhill and Hays 1972). Sheppard and Wilson (1976) recaptured *Tabanus lineola* up to 6.8 km from the release point. Most tabanids are diurnal, but some are crepuscular or nocturnal, and many show definite activity patterns (Roberts 1974, Burnett and Hays 1977). These activity patterns have been linked to various meteorological factors, notably barometric pressure and temperature (Alverson and Noblet 1977, Burnett and Hays 1974, Schulze *et al.* 1975).

SPECIES DIVERSITY AND DISTRIBUTION

As the largest of the 48 contiguous United States, Texas provides an enormous variety of habitats for both plant and animal life. Nearly 1,000 miles in both north-south and east-west dimensions, Texas covers 267,000

square miles, or about 171 million acres. Rivers and lakes cover roughly 6,000 square miles. It is interesting to note that all major lakes, except Caddo Lake, are manmade impoundments. Six major river basins (Trinity, Neches, Brazos, Colorado, Guadalupe, and Nueces) flow southeasterly into the Gulf of Mexico, and three (Canadian, Red, and Sulfur) are part of the Mississippi River system. From the east, elevation above sea level increases gradually from around 60 meters (0 meters at the coast) up to 2,000 m in the west. Some mountains in extreme western Texas exceed 2,400 m. Mean annual precipitation decreases from east to west, from 1,450+ to 200 mm or less. Changes from north to south include mean annual temperature (13-23°C) and mean length in frost free days (185-320 days). There is also considerable diversity in soil types. For more detailed discussion on these and other variables, as well as for excellent maps, readers are referred to the *Atlas of Texas* (Arbinger 1976).

Many authors have recognized the geological and climatological diversity of Texas and its impact on species diversity and distribution of animals and plants. Another factor of significance is that Texas is located at the southern limit of the Nearctic realm, hence it is influenced from the south by species of plants and animals of Neotropical origin.

Dice (1943) recognized, in general, the biotic diversity of Texas in his division of the entire continent into biotic provinces. He stated that a biotic province is:

. . . a considerable and continuous geographic area and is characterized by the occurrence of one or more ecologic associations that differ, at least in proportional area covered, from the associations of adjacent provinces. In general, biotic provinces are characterized also by peculiarities of vegetation type, ecological climax, flora, fauna, climate, physiography, and soil.

Blair (1950), using the biotic provinces presented by Dice (1943), attempted a more detailed division of Texas into provinces. Although he emphasized that such a division needed to consider all ecological factors, his biological considerations were very limited as noted in the following quote:

The present report attempts to fix the boundaries of the biotic provinces of Texas more accurately than was done by Dice in his general report dealing with the provinces of the entire continent. The distribution and classification of biotic provinces in the state are examined in the light of distribution of topographic features, climate, vegetation types, and terrestrial vertebrates exclusive of birds (Blair 1950).

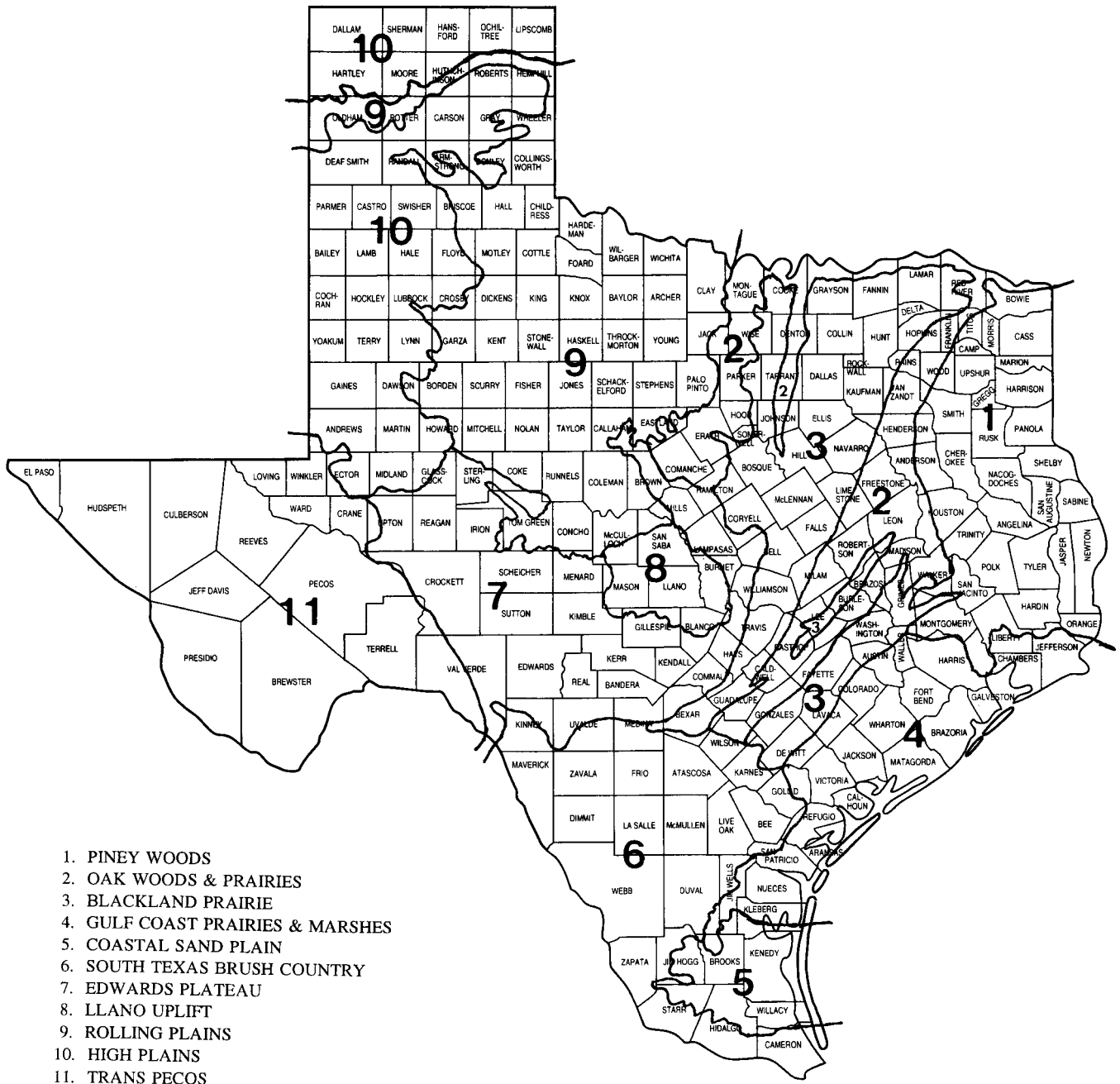
Nevertheless, Blair recognized and characterized seven of

Dice's biotic provinces occurring in Texas. Also, in discussing the fauna of Texas, Blair utilized the three major biotas of Texas first recognized by Cope (1880), including a Sonoran fauna (associated with the arid southwest), an Austroriparian fauna (associated with the forests of the eastern U. S.), and a Neotropical fauna (extending northward through eastern Mexico into Texas).

Regarding vascular flora of Texas, Gould *et al.* (1960) recognized 10 vegetational areas in Texas. Hatch *et al.* (1990) recognized the same zones when preparing the *Checklist of the Vascular Plants of Texas*. The ecological factors affecting the distributions and associations of vascular plants are the same as those previously noted. Although none of the boundaries of the biotic provinces and vegetational areas are identical, there is similarity.

More recently (Anonymous 1978), an interdisciplinary team divided Texas into 11 natural regions (Map 1) and provided general descriptions of each region, and of subregions in some cases. As stated in the report, the team sought a system that would not only recognize the broad natural regions of the state but also serve as common reference scientists, students, visitors, decision makers, and all citizens and contribute to the selections and preservation of unique, significant, unusual, and scenic resources, including rare or endangered species, geological formations, and ecosystems.

Unfortunately, the Tabanidae of Texas have not been sufficiently collected to allow an accurate comparison of tabanid species diversity and distributions to either the biotic provinces, the vegetational areas, or the natural regions. It might be assumed that the ecological diversity of Texas, its close proximity to the Neotropical realm, its vertebrate and vascular plant diversity, etc., would contribute to a diverse tabanid fauna. This is supported by the confirmed presence of 109 species in 13 genera and the suspected presence of an additional 36 species including representatives of six additional genera. Table 2 compares the tabanid fauna of Texas with that of several other states based on statewide studies published from 1950 to the present. Georgia currently has the largest number of species of Tabanidae known for any of the 48 contiguous states with 133 species representing 17 genera. Georgia has been much more thoroughly surveyed for Tabanidae than Texas, and there is little chance that more than one or two additional currently recognized species will be found there. In Texas some intensive collecting, especially in counties bordering Louisiana, Arkansas, and Oklahoma, and in the mountains or western Texas will probably yield specimens of at least 25 of those 36 species considered herein as likely to be present. Should this prove to be true, Texas would then rival Georgia for the most diverse fauna among the 48 contiguous states.



Map 1. The eleven natural regions of Texas (redrawn from Anonymous, 1978).

TABLE 2. Species and Generic Diversity of Tabanidae by State (Based on 1950 and later published and unpublished reports).^a

STATE	SPECIES	GENERA	SOURCE
Alabama	107	14	Hays ^b
Arizona	44	11	Burger (1974b)
Arkansas	80	9	Carlton and Lancaster (1995)
California	73	11	Middelkauff and Lane (1980)
Connecticut	58	3	Fairchild (1950)
Florida	106	14	Jones and Anthony (1964)
Georgia	133	17	Beshear and Howell (1985)
Idaho	52	8	Nowierski and Gittins (1976)
Illinois	83	10	Pechuman <i>et al.</i> (1983)
Iowa	48	7	Richards and Knight (1967)
Kentucky	54	7	Burnett <i>et al.</i> (1978)
Louisiana	95	11	Tidwell (1973)
Michigan	93	8	Hays (1956)
Missouri	54	9	Andrews and Wingo (1975)
New York	108	7	Pechuman (1981)
Oklahoma	64	9	Wright <i>et al.</i> (1986)
Pennsylvania	60	5	Frost and Pechuman (1958)
South Carolina	107	14	Ezell <i>et al.</i> (1974)
Tennessee	95	14	Goodwin <i>et al.</i> (1985)
TEXAS	111	13	
Virginia	95	13	Pechuman (1973)
West Virginia	68	9	Drees <i>et al.</i> (1980)
Wisconsin	66	5	Roberts and Dicke (1958)

^a Numbers provided above may differ from those in reference cited because varieties and subspecies are not included above unless currently recognized as distinct species; also, numbers above do not include additional state records reported since the cited statewide reference.

^b Personal Communication

There are some general comments that can be made about the tabanid fauna of Texas in relation to the 11 natural regions mentioned above. There are for example, seven or eight species (*Stenotabanus magnicallus*, *S. pechumani*, *Tabanus acutus*, *T. eadsi*, *T. hinellus*, *T. nigrovittatus*, *T. texanus* and, if present, *Chrysops atlanticus*) of Tabanidae whose known and likely distribution is limited to the Gulf Coast prairies and marshes region. Species of the genus *Apatolestes* are probably limited to the Trans Pecos region. Otherwise, species either have known distributions that include two or more regions or have such limited known distributions that it is not yet possible to reach conclusions on their affinities with the natural regions of the state.

Without question, however, the Texas tabanid fauna is influenced by the fauna of adjacent areas. The authors do not believe that the three "faunas" designated by Cope (1880) and used by Blair (1950) to discuss vertebrate distributions in Texas are satisfactory for explaining tabanid distribution. One of these faunas, the Neotropical, will be retained. Remaining influences will

be termed eastern Nearctic (includes Cope's Austroriparian), northern Nearctic, and western Nearctic (includes Cope's Sonoran).

The presence of four species of *Esenbeckia*, two and possibly three of *Stenotabanus*, and one each of *Chlorotabanus*, *Diachlorus* and *Leucotabanus* clearly demonstrate the Neotropical affinities of the Texas fauna. All five genera are widespread and 5-10 times more diverse in species in the Neotropical than in the Nearctic. Within the large genus, *Tabanus*, there are also distinct Neotropical affinities. The *lineola* complex of *Tabanus*, most recently treated by Fairchild (1983), includes 16 species that are entirely Neotropical, two that are entirely Nearctic, and five that are found in both realms. The Texas fauna includes four species in this complex (*T. colombensis*, *T. lineola*, *T. hinellus*, *T. subsimilis*), all of which are present in both realms. Other species of *Tabanus* with Neotropical affinities include *T. dorsifer*, *T. pruinosis*, and *T. pungens*.

Western Nearctic influence is illustrated by the presence of two species of *Apatolestes* and the five species of *Silvius*, subgenus *Griseosilvius*. The former is

an exclusively southwestern genus centered in California with a few of the 15 known species extending eastward into Nevada, Arizona, New Mexico and Texas and southward into northern Mexico. The latter genus is Holarctic, but in the Nearctic it is primarily western, especially the subgenus *Griseosilvius*. One species of this subgenus extends eastward into Illinois, Tennessee, Mississippi, and probably Kentucky, but the other four are exclusively western, and three have ranges that include northern Mexico. There is also a complex of about eight species of *Chrysops* readily recognized by the markedly swollen basal segments of the antennae that are exclusively western with the overall range from southern Canada into northern Mexico. Three of these species (*C. facialis*, *C. fulvaster*, *C. virgulatus*) are present in the western two-thirds or less of the state. *Chrysops dissimilis* is presently known only from the western Nearctic. Similarly, several species of *Tabanus* (*T. abactor*, *T. erythraeus*, *T. gilanus*, *T. laticornis*, *T. mogollon*, *T. punctifer*, and *T. stonei*) are western in overall distribution and reach their known eastern limits in west or central Texas.

In total numbers, the Texas fauna is most influenced by the eastern Nearctic fauna as evidenced by the presence of the monotypic *Whitneyomyia* which reaches its western limit in Texas. Should examples of two other monotypic genera (*Goniops*, *Neochrysops*) or of several small genera (*Merycomyia*, *Anacimas*, *Hamatabanus*) be found in Texas, they would represent the western, or at least southwestern, limits of these eastern genera. The presence of two species of *Agkistrocerus* in Texas also may demonstrate eastern Nearctic influence, but this remains to be determined as a third species from Mexico has been assigned to this otherwise eastern Nearctic genus. Most of the species of *Tabanus* (50) and *Chrysops* (34) known or suspected to occur in Texas are predominantly eastern Nearctic in overall distribution and reach their western or at least southwestern limit in Texas.

The northern Nearctic influence includes two genera (*Hybomitra*, *Haematopota*). Both have their greatest species diversity in the old world Palaearctic. The range of *Hybomitra* extends southward into the Oriental realm, and the range of the latter extends southward into both the Afrotropical and Oriental realms. Five species of the former reach their southern limits in Texas, and four others may possibly be present. One species of *Haematopota* may be present.

Too little is known about the genus *Asaphomyia* to associate it accurately. At present two species are known, one from Florida and one from Texas. The Florida species is known from one county in central Florida. The Texas species has been collected in four south Texas counties, but it has not been collected since 1970.

The general comments presented above on the

biogeographical affinities of Texas Tabanidae are summarized in Table 3.

NATURAL ENEMIES

Numerous accounts of natural enemies of various developmental stages of tabanids have been published, but the impact of these agents on tabanid population levels is unknown. Jenkins (1964) lists predators, parasites, and pathogens of Tabanidae.

Egg parasites include wasps in the families Trichogrammatidae and Scelionidae (Stone 1953b, Dukes and Hays 1971). Parman (1928) reported using egg parasites to help reduce horse fly population levels in Texas. Predators of tabanid eggs, such as lady beetles, were discussed by Jackson and Wilson (1965).

Larvae are parasitized primarily by dipterans in the families Tachinidae and Bombyliidae, but the incidence of parasitism is low. Pupal parasitism by hymenopterans in the families Diapriidae and Pteromalidae has also been reported (Goodwin 1968, Teskey 1969). Larval predators include fish, shore birds, and dragonfly naiads (e. g., Johnson and Hays 1973). An unknown amount of mortality also results from predation or cannibalism within the family Tabanidae itself, especially in the genera *Tabanus* and *Hybomitra*.

The red imported fire ant, *Solenopsis invicta* Buren, has been reported to prey on the pupal stages of Tabanidae (Drees 1987, Johnson and Hayes 1973). This fire ant is abundant in the eastern two-thirds of Texas, but its impact on tabanid populations has not been quantified.

Adults have been reported to be parasitized by sarcophagid flies (Thompson 1978a), and adult predators include robber flies, spiders, dragonflies, and birds. Bembicine wasps, such as the "horse guard," *Strictia carolina* (Fabricius), frequently provision their nests with tabanids (Roberts and Wilson 1967). Snoddy (1959) discussed the feeding of cattle egrets on adult tabanids, noting that an average of 51.5 horse flies (59 percent of all specimens) were found in the stomachs of 5 egrets examined per week over a 2-month period. Pathogens of Tabanidae, mostly fungi, are addressed by Anthony (1977).

ECONOMIC IMPORTANCE AND CONTROL

The economic importance of horse and deer flies results from the vicious and persistent biting habits of the females of most species. Also, as with many other biting

TABLE 3. Probable Biogeographic Affinities of the Species of Tabanidae Known or Likely to occur in Texas.

<p>NORTHERN NEARCTIC INFLUENCE</p> <p><i>Haematopota americana, Hybomitra aatos, difficilis, fulvilateralis, lasiophthalma, nigricans, phaenops, rhombica, rubrilata, trispila</i></p>	
<p style="text-align: center;">WESTERN NEARCTIC INFLUENCE</p> <p><i>Apatolestes aitkeni, philipi, Asaphomyia texensis, Esenbeckia delta, incisuralis, michineri, tinkhami, Silvius (A.) ceras, S. (G.) gibsoni, jeanae, pollinosus, quadrivittatus, sayi, Chrysops dissimilis, facialis, fulvaster, pachycerus, virgulatus, Tabanus abactor, erythraeus, laticornis, mogollon, punctifer, stonei</i></p>	<p style="text-align: center;">EASTERN NEARCTIC INFLUENCE</p> <p><i>Goniops chrysocomus, Merycomyia whitneyi, Neochrysops globosa, Chrysops abatus, aestuans, atlanticus, beameri, bistellatus, brimleyi, brunneus, callidus, carbonarius, celatus, cincticornis, cursim, dacne, dimmocki, dorsopunctus, flavidus, fulvistigma, geminatus, hinei, hyalinus, impunctus, macquarti, moechus, montanus, niger, nigribimbo, parvulus, pikei, pudicus, reicherti, separatus, sequax, univittatus, upsilon, vittatus, Anacimas dodgei, limbellatus, Whitneyomyia beatifica, Hamatabanus annularis, carolinensis, Tabanus aar, abdominalis, acutus, americanus, aranti, atratus, atripennis, calens, cheliopterus, coarctatus, cymatophorus, eadsi, equalis, fairchildi, fulvulus, fuscicostatus, gladiator, imitans, limbatinevris, longiusculus, longus, maculipennis, melanocerus, mixis, moderator, molestus, mularis, nefarius, nigrescens, nigripes, nigrovitratus, pallidescens, petiolatus, proximus, pumilus, quaesitus, quinquevittatus, reinwardtii, rufofrater, sackeni, sparus, stygius, sublongus, sulcifrons, texanus, trimaculatus, turbidus, venustus, wilsoni, zythicolor</i></p>
<p>NEOTROPICAL INFLUENCE</p> <p><i>Diachlorus ferrugatus, Chlorotabanus crepuscularis, Stenotabanus (S.) guttatus, S. (A.) magnicallus, pechumani, Leucotabanus annulatus, Tabanus colombensis, dorsifer, hinellus, lineola, pruinosis, pungens, subsimilis</i></p>	

insects, there is potential, if not actual risk of the transmission of agents of human and animal disease.

Although uncommon in urban areas, elsewhere tabanids may be very annoying to both man and livestock. Outdoor industry and recreation may be hampered. In the U.S. and Canada, species of *Chrysops* (deer flies) are most often pests of humans around lakes and streams and in woodlands. In coastal beach areas of the eastern and southern U.S., species of *Tabanus* (horse flies) are typically the main concern, but in salt marshes away from the beaches species of both *Chrysops*

and *Tabanus* are important. Species of *Hybomitra* (horseflies) are also serious human pests in northern forested areas of the U.S. and Canada. In Texas, species of *Chrysops* have frequently been reported as pests of humans in the extensive forested areas of east Texas and also in the residual forests along rivers and streams in central and north Texas. Only a few species of *Hybomitra* occur in Texas, and none has been reported to reach pestiferous levels. Species of *Tabanus* have been reported as pests of livestock in a variety of areas across the state including pasture areas along the southern coasts, in the river bottoms of central Texas,

and the rolling hills of north Texas. Individual species noted as significant pests include *Tabanus abactor* in most of the northern two-thirds of the state and both *T. atratus* and *T. subsimilis* throughout the state. Biting fly activity has been reported to lead to loss of revenue and lowered property values in certain parts of the United States (Gerhardt *et al.* 1973), but no such reports have been documented for Texas.

Pastured cattle and other livestock, as well as wild ruminants, may suffer severely from heavy attacks of tabanids, and nervous activity may disrupt normal grazing patterns. Dense fly populations are thought to contribute to losses in weight gain or milk production in cattle (e.g., Bruce and Decker 1951, Grannett and Hansens 1957), and blood oozing from wounds inflicted by tabanids may be fed upon by other flies (Garcia and Radovsky 1962), increasing the risk of infection. However, good data on the true economic importance of these flies is lacking, and as Steelman (1976) discussed, there is need of further studies to determine the economic impact of tabanids on livestock.

Krinsky (1976) presented an exhaustive review of the published literature on the role of tabanids in transmission of human and animal diseases. More recently, Foil (1989) reviewed this issue. In the arena of biological transmission, these insects remain of limited concern to humans as only one human parasite, *Loa loa*, restricted to Africa, is known to be biologically transmitted by tabanids. It is interesting to note, however, that a North American species of deer fly has been shown capable of supporting natural development of the parasite, thus suggesting the potential for the disease to be introduced via travel to the United States by infected individuals. Two other filarial parasites, one affecting North American wild ruminants (deer, elk) and the other affecting kangaroos in Australia, are also biologically transmitted by tabanids, as are two protozoans, one found in turtles and the other a widespread parasite of low pathogenicity in domestic and wild ruminants.

Mechanical transmission is of more concern, primarily regarding livestock and wild ruminants. Foil (1989) states: "The characteristics of a 'good' mechanical vector are, one that is frequently interrupted in feeding, is highly mobile and has large mouthparts to transfer agents; all these are characteristics of tabanids." Another important characteristic is persistence, and tabanids are very persistent, rapidly returning to the same or a nearby host to bite again when disturbed before becoming engorged.

According to Foil (1989), recent studies have clearly demonstrated that mechanical transmission of disease by tabanids occurs. Among viral diseases, transmission of equine infectious anemia, vesicular stomatitis, bovine leukemia and hog cholera by tabanids has been demonstrated. Mechanical transmission has

also been demonstrated for the causative agents of anaplasmosis, anthrax, bovine besnoitiosis and tularemia. In addition, mechanical transmission of protozoans of the genus *Trypanosoma* occurs, including *T. evansi* in Africa and probably *T. vivax* in Central and South America, Indonesia and other Pacific areas, and possibly in Africa where tsetse flies are the biological and primary vector of *T. vivax* and related species.

No definitive studies of the economic importance of individual or multiple species of Tabanidae in Texas have been done. Alderink and Dietrich (1983) provided an interesting assessment of anaplasmosis in Texas beef cattle. These authors mentioned the possibility that one or more species of tabanids might be involved in the transmission of the disease.

Prospects for control of tabanids are not particularly good, due to the variety of species often present in an area, their varying biological characteristics and seasonal distributions, the fact that the flies spend little actual time on the host, their flight capabilities which allow rapid reinvasion of cleared areas, and other factors. Chemical applications to livestock may be of limited use for short-term control (Bay *et al.* 1977; Blume *et al.* 1971, Brown and Lancaster 1973, Harris and Oehler 1977). Area wide chemical applications for adult control can be temporarily effective if timed properly (Hansens 1981) but are usually less effective than mosquito control measures (Axtell and Dukes 1974). Insect repellents in aerosol or impregnated mesh shirts offer temporary relief from deer fly annoyance for humans (Catts 1968, Gilbert 1957). Chemical control of larvae (e.g., Wall and Marganian 1973) may lead to destruction of nontarget organisms and disruption of ecosystems.

Water management has been used for control of tabanids (Anderson and Keen 1969), though such manipulation may not be possible or desirable. Pechuman (1981) mentioned that, on farms with only small ponds and seepage areas, it may be possible to remove most available oviposition sites and thereby reduce the numbers of adults during the next flight season, but this approach has not been confirmed. Trapping devices are ecologically attractive and catch large numbers of tabanids. With the possible exception of large-scale efforts in coastal areas (Wall and Doane 1980), effectiveness in suppressing tabanid populations over time has not been well documented. Wilson (1968) caught over 95,000 tabanids in five days on 20 CO₂-baited sticky traps around a cow pasture, but noted only short-term reductions in horse fly levels on cattle.

Under heavy tabanid attack, animals often seek shelter in dense vegetation, water, or man-made enclosures. Grouping behavior may also be defensive. Duncan and Vigne (1979) observed that horses in large groups were attacked less than those in small groups. A barn or shed may allow the animals to avoid the flies,

but the loss of grazing time may negate any beneficial effect. Again, this has not been evaluated.

With the exception of Parman (1928), the potential use of predators, parasites, and pathogens as biological control agents has not been examined in any detail and bears further study.

COLLECTION, HANDLING AND PRESERVATION

--Juvenile Stages--

Since this presentation is devoted primarily to adult Tabanidae, detailed methodology for working with juvenile stages is not included. Such methods are discussed by Jones and Anthony (1964), Burger (1977), Goodwin and Murdock (1974), Lane (1975, 1976), Teskey (1969), and Tidwell (1973). Separating larvae from their substrate is difficult and laborious, and various washing or drying racks to assist in this have been devised (Edwards *et al.* 1974, Lane and Anderson 1976, Tashiro and Schwardt 1949, Teskey 1962). If live larvae are obtained, rearing may yield excellent adult specimens, and larval and pupal skins may be recovered for taxonomic study. If preservation is necessary, it is best to kill larvae and pupae in water heated to 80-85°C and transfer them to 70 percent ethyl alcohol for permanent storage. Isopropyl alcohol, but not formalin, also may be used. Accompanying label information should include locality, date, collector, preservative, and habitat in which the specimens were found.

--Adults--

Some methods of collecting adult tabanids were reviewed by Thompson (1969) and Roberts (1978). The standard aerial net has been the most commonly used tool. Swinging the net in a circular fashion about the head and body while walking along woodland paths, streams, etc., usually will yield excellent series of species that attack man. The use of a bait animal, such as a steer, often will attract females of many tabanid species which can be netted.

Males and non-blood-feeding females are more difficult to collect, but can be obtained by sweeping flowers and vegetation, by rearing immatures, or by certain flight-interception traps (discussed below). Kniepert (1979) used a piece of shiny, black plastic to attract male tabanids that apparently mistook it for a pool of water, and netted the flies as they dipped toward or landed on the surface.

Various traps have been widely used for survey and

seasonal distribution and relative abundance studies, although Mullens and Gerhardt (1979) cautioned that trap types may have inherent biases in their catch due to the characteristic attack patterns of the different species. Roberts (1976b) examined the relative efficiency of some of the most commonly used trap types for collecting tabanids and found CO₂-baited Malaise and canopy traps most effective. Variations on the Malaise trap (Malaise 1937) will capture both males and females, and may be found in publications by Burnett and Hays (1977), Gressitt and Gressitt (1962), Roberts (1972), Townes (1962), and others. Sticky traps (Dale and Axtell 1976, Roth and Lindquist 1948, Snoddy 1970) have been used by some workers to capture large numbers of tabanids, but specimens often are hard to identify, require a solvent to remove the adhesive, and are poor museum material. Steelman *et al.* (1968) designed a trap that is carried atop a truck or boat and sweeps flying tabanids into a collecting bag for future retrieval. Emergence traps also have been used (Maccreary 1940, Rockel and Hansens 1970).

Roberts (1965) used a steer-baited trap similar to the Magoon trap (Magoon 1935) to collect female tabanids. The box trap (Morris and Morris 1949), originally used in Africa for tsetse fly studies, has been adapted and used in the United States for tabanids, especially in coastal areas (Dale and Axtell 1976, Granger 1970, Hansens *et al.* 1971). Manitoba or canopy traps (Thorsteinson *et al.* 1965) date from Thorsteinson's (1958) original heliothermal trap, and some variations have been described in publications by Adkins *et al.* (1972), Axtell *et al.* (1975), Catts (1970), and Pechuman (1981).

Other methods of obtaining adults include the use of light traps (Anthony 1960, Frost 1953), food baits (Frost 1953, Jones and Anthony 1964), examination of spider webs and window sills, and searching solitary wasp nests.

Factors that influence tabanid attraction have been widely studied but are still not entirely understood. Numerous workers have shown that CO₂ is very attractive to female tabanids (Anderson, *et al.* 1974, DeFoliart and Morris 1967, Knox and Hays 1972, Roberts 1971; Wilson, *et al.* 1966), but too much actually may decrease trap catches (Roberts 1975). More recently, another chemical attractant has been shown to increase the catch in a variety of traps. Use of this chemical, 1 Octen-3-ol ("Octenol"), is discussed by French and Kline (1989). Trap or host color has an influence, with dark colors generally favored for attack (Bracken, *et al.* 1965, Tashiro and Schwardt 1953). Roberts (1970) and Bracken, *et al.* (1965) observed that contrast with the background was also important. Decoy shape (Thorsteinson, *et al.* 1966) and pattern (Hansens, *et al.* 1971) may also affect trap catches. Other factors include height (Roberts 1976 a), motion (Phelps and

Vale 1976), and possibly heat (Thornsteinson 1958). Browne and Bennett (1980) reported blue, black, and red as preferred colors and found no preference for moving versus stationary decoys.

Some of the more commonly used traps are shown in Figure 1. Note the use of targets (black balls and black panels) with the canopy traps.

Collecting of adult horse and deer flies is most productive near breeding areas such as ponds or marshes and along natural flyways such as forest-field interfaces, streams, and roads in woods. Regardless of the method of collection, specimens should be pinned fresh with collection data, including locality, date, collector, and other pertinent information written on a label and affixed to the pin. If the circumstances are such that specimens of adults must be stored unpinned, liquid preservatives should not be used. Dried specimens may be placed in single layers, not touching each other, with layers separated by dry tissue paper. Cotton should not be used as it becomes entangled in appendages and may damage the specimen when removed. The dry specimens can be relaxed later and pinned, as outlined in most general entomology textbooks. Specimens can also be frozen fresh, before they dry out, again in layers and none touching, but should be pinned very soon after removal from the freezer. Dirty or greasy specimens can usually be cleaned satisfactorily by immersion in ethyl acetate for a few hours. Specimens collected or stored in alcohol are sometimes encountered. If simply pinned and allowed to dry without special treatment, such specimens are usually difficult, if not impossible, to identify, and rarely, if ever, make good museum specimens. However, reasonably good quality specimens can be obtained if such specimens are processed following the technique based on Steyskal (1985): (1) remove specimens from alcohol and pin; (2) submerge pinned specimens in methyl or ethyl cellosolve for about 24 hours; (3) remove specimens from cellosolve and shake or blow off excess surface fluid; (4) submerge specimens in ethyl acetate for four hours to overnight; (5) remove specimens from ethyl acetate, blow or shake off excess surface fluid, and allow to dry; and (6) add labels (steps involving ethyl acetate should be done under exhaust hood).

CLASSIFICATION

The current suprageneric classification is based largely on the work of Mackerras (1954, 1955a & b). Fairchild (1969) discussed the classification of the Neotropical fauna, shifting the genus *Leucotabanus* Lutz from the tribe Diachlorini to the Tabanini, but otherwise his system does not affect the fauna of Texas. Classification of the North American fauna has been

most recently treated by Philip (1965). Names used herein are based on the latter paper except for species described subsequently and where more recent nomenclatural changes are applicable.

Three subfamilies, represented by seven tribes, comprise the known and possible fauna of Texas. The subfamilies, tribes, genera, and number of species per genus reported from or possibly occurring in Texas are provided in Table 1, page 2.

TAXONOMIC CHARACTERS

A thorough discussion of the generalized external morphology of the larvae, pupae and adults is beyond the scope of this document. However, to facilitate the use of the taxonomic keys and brief species descriptions, those elements of morphology used herein are briefly described and/or illustrated. For more detailed treatments of tabanid morphology, refer to Teskey (1969) for larvae and pupae and Teskey (1990) for adults.

--Eggs--

Eggs are too poorly known to attempt to establish means of identification. Examples of some egg masses are shown in Figure 2.

--Larvae--

Except for larvae of *Goniops*, which are club-shaped, larvae of species known or thought to occur in Texas are morphologically similar. Most are whitish (sometimes shades of brown to black or green) and spindle-shaped, being widest near the middle and tapered at both ends. The degree of tapering varies and, while being of some taxonomic use, seems to reflect type of habitat. Larvae of species utilizing dry or sandy soil conditions are often more blunt at both ends, while more tapered larvae are typical of very moist habitats. The greenish appearance is due to the color of the hemolymph ("blood") and usually becomes brown in preserved specimens. Larvae typically bear darker markings in the forms of rings, spots and dashes. These markings are due to the presence of pubescence (microscopic hairs or scales) that are darker in color than the general body surface, or integument.

Tabanid larvae (Figure 3) do not have a distinct, fixed head. They possess a retractile head capsule (Figure 3A, 3B) that in dorsal view is elongate, usually 3-4 times as long as wide, widest near middle or a little posterior of middle. The obvious structures of the head capsule (visible only under high magnification) include the epicranium (**epic.**), cephalic brushes (**ceph. b.**),

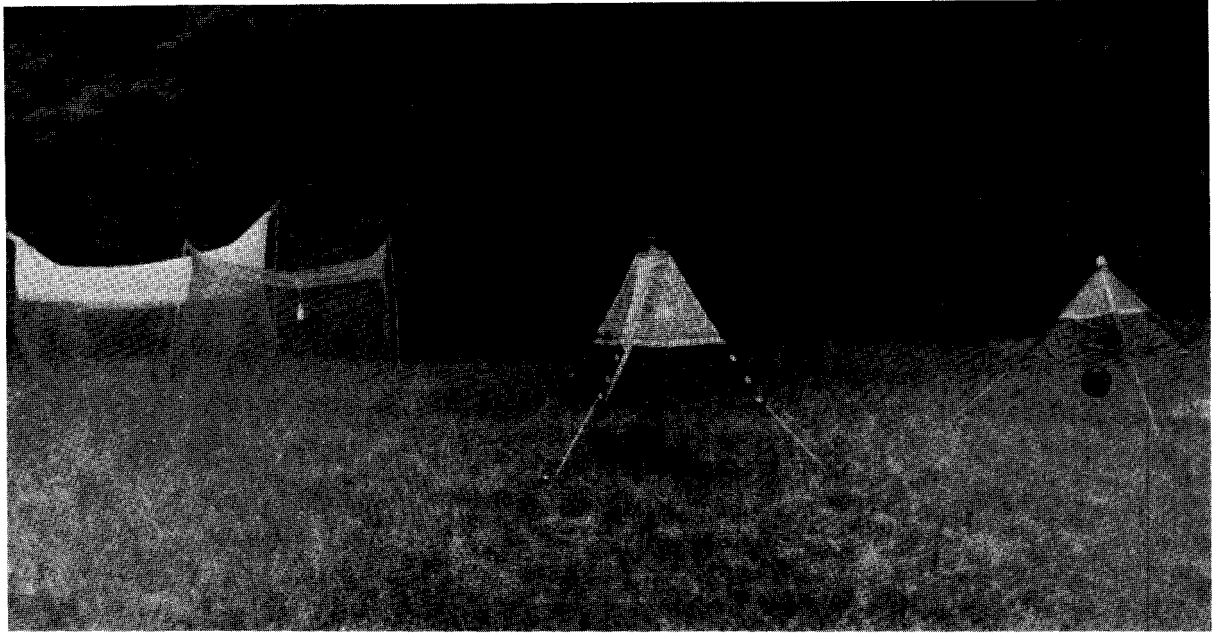


Figure 1. Examples of traps: two malaise traps at left and two canopy (Manitoba) traps at right (note used of black balls and black panels with canopy traps).

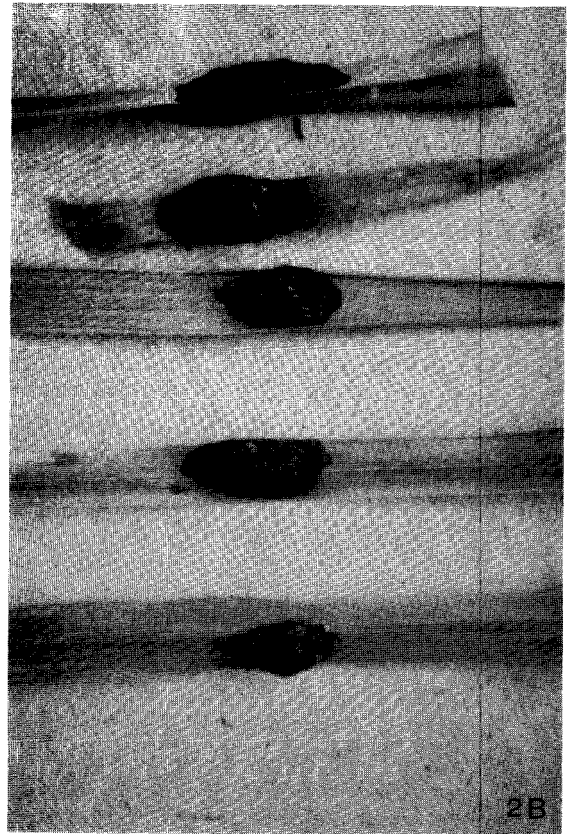
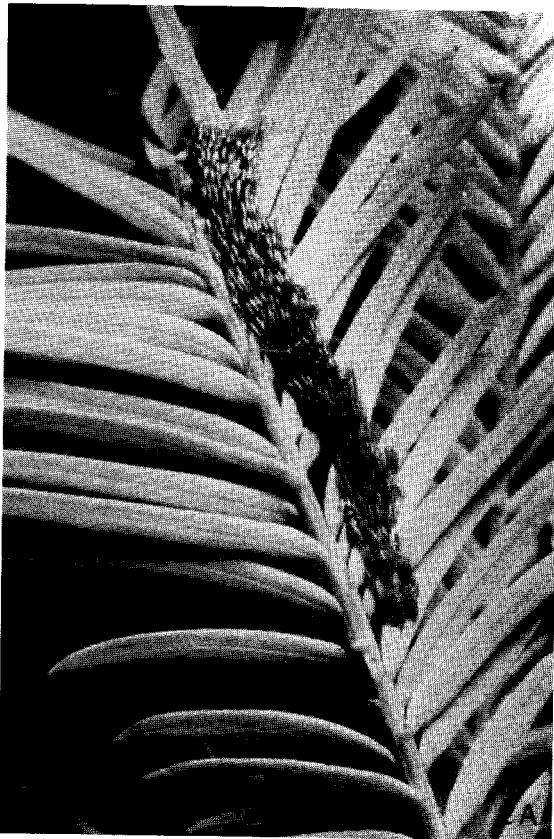


Figure 2. Eggs of Tabanidae: 2A - *Chrysops*; 2B - *Tabanus*.

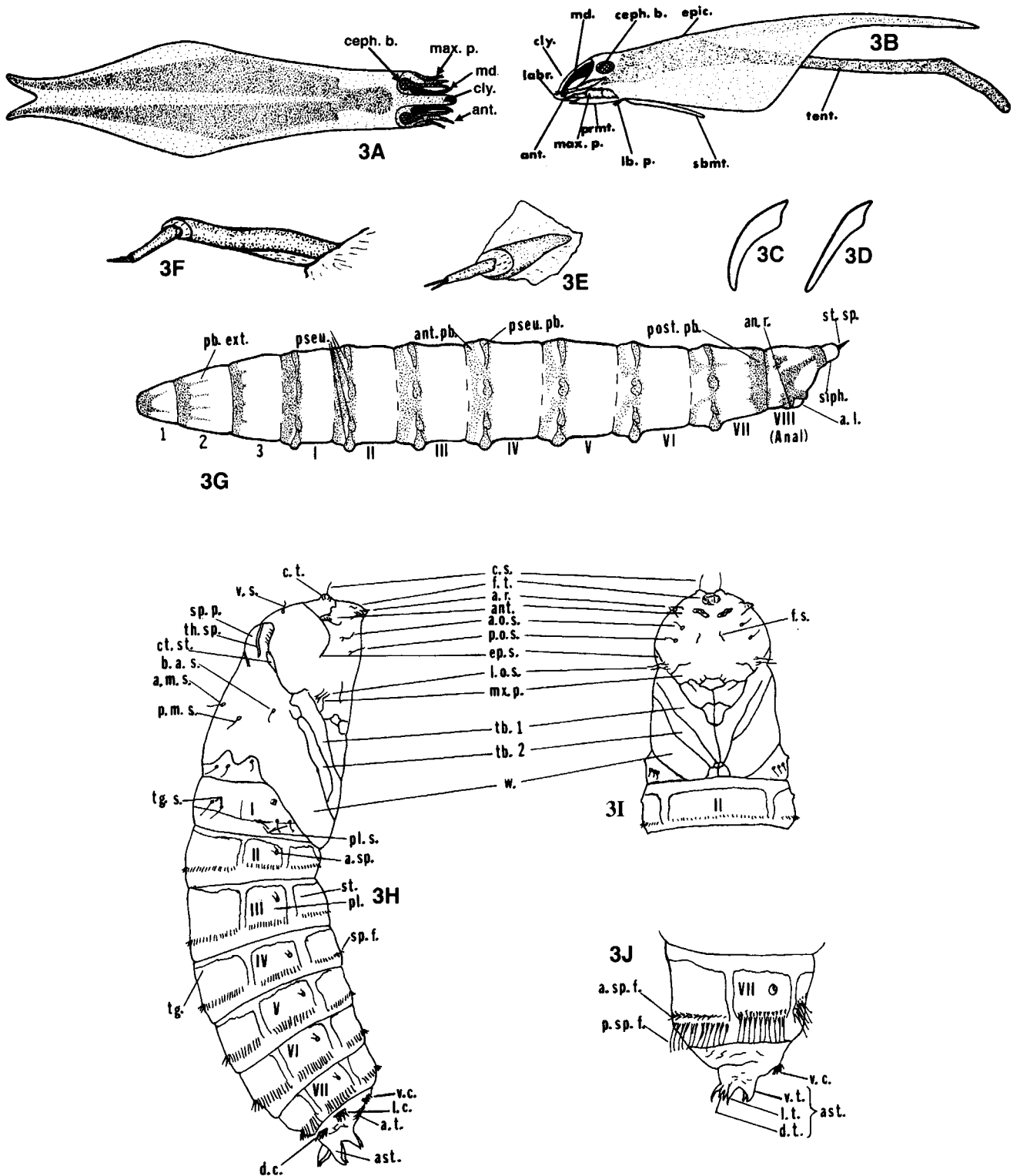


Figure 3. Juvenile Characters (3A-3G, Larval Characters; 3H-3J, Pupal Characters): 3A - Dorsal view of head capsule; 3B - Lateral view of head capsule; 3C - Curved mandible; 3D - Straight mandible; 3E - Antenna; 3F - Maxillary palp; 3G - Lateral view of generalized larva; 3H - Lateral view of generalized pupa; 3I - Ventral view of anterior 1/2 of generalized pupa; 3J - Slightly oblique, lateral view of posterior end of generalized pupa (see text for discussion and explanation of abbreviations).

mandibles (**md.**), clypeus (**cly.**), labrum (**labr.**), antennae (**ant.**), maxillary palpi (**max. p.**), prementum (**prmt.**), submentum (**sbmt.**), and tentorial rods (**tent.**). Only the mandibles and cephalic brushes are currently used in keys for identification. The mandibles (Figure 3C, 3D) may be nearly straight, without teeth (serrations) on the ventral surface, or more commonly they are curved and often serrate ventrally. Figures 3E and 3F, respectively, illustrate the antenna and maxillary palp enlarged. The antenna is of limited taxonomic value. The body of the larva (Figure 3E) is comprised of three thoracic segments (1-3: prothorax, mesothorax and metathorax), seven abdominal segments (I-VII) and an anal segment (VIII). Under magnification, the integument typically bears internal striations (structural lines) running the length of the segments. Presence or absence of striations and average distance between striations of the dorsal, ventral and lateral surfaces of the various segments is useful in species, and sometimes in generic identification. Striations, if present, cannot be seen in areas covered by pubescence.

The thoracic segments bear no obvious structural features, whereas one or more of the abdominal segments usually has pseudopodia (fleshy projections, or "false feet", used in locomotion). When present on an abdominal segment, there are usually three or four pairs -- dorsal (**d.pseu.**), lateral (**l.pseu.**), ventrolateral (**vl. pseu.**) and ventral (**v.pseu.**). The ventrolateral pseudopodia are missing when only three pairs occur (e.g., genus *Chrysops*). Individual segments may be entirely non-pubescent, or they may bear pubescence in the forms of rings, lines or spots. The thoracic segments typically have anterior pubescence (**ant. pb.**) encircling, or nearly encircling one or more segments. The anterior pubescence may have posteriorly directed pubescent extensions (**pos. ext.**). Posterior pubescence (**post. pb.**) is not often present on the thoracic segments. When present, the pubescence of the abdominal segments may include anterior and posterior pubescence as well as pseudopodial pubescence (**pseu. pb.**). The anterior and pseudopodial pubescence may be united on some segments. The pseudopodial pubescence sometimes has posterior extensions, and the posterior pubescence may have anterior extensions (**ant. ext.**).

The **anal segment** midventrally bears the anal opening, a linear slit on the midline of the anal lobe (**an. l.**). The anal lobe is surrounded by a somewhat protuberant, fleshy anal ring (**an. r.**). The anal lobe and ring are typically pubescent, and the pubescence of the anal ring is often connected to midlateral pubescence of the anal segment. The pubescent pattern of the anal segment plays a very significant role in separation at the species level. At the posterior end of the anal segment is the posterior spiracle, a vertical slit along the midline. The spiracle is occasionally sessile (directly on the surface of the anal segment as in *Goniops*), but it is usually at the end of a tubular, protrusible respiratory siphon (**siph.**). Although internal, a pair of dorsal tracheal trunks, or tubes, are

usually visible through the dorsal integument of live larvae extending from the base of the respiratory siphon anteriorly to the vicinity of the metathoracic segment. The tracheal trunks are often darkened over the portion in the anal segment. Whether or not these large tracheal tubes in dorsal view are sinuous or straight, and/or taper gradually from posterior to anterior or are sharply constricted near the metathorax is of some taxonomic significance. In some species, there is a protrusible (exertile) stigmal spine (**stig. sp.**) which can be extended and retracted through the spiracular opening.

--Pupae--

Pupae (Figures 3H, 3I, 3J) are relatively uniform structurally. They may be yellowish, greenish, brown or black, or a mixture of these colors. Most tend to be paler during the early part of the pupal period, becoming progressively darker with time. They are heavily sclerotized (i.e., the external surface is structurally rigid or hardened) and bear numerous structures (projections, ridges, tubercles, spines, setae, etc.) useful in identification. Typically the general surface is rather smooth, but in a few cases (e.g., *Diachlorus*) the surface exhibits a reticulate (net-like) pattern. The presence or absence, shape and dimension of the various structures, and the presence, absence, arrangement and number of spines are the characters of major importance in identification.

The three body regions (head, thorax and abdomen) are easily distinguished. The head (Figures 3H, 3I) bears the following key features: callus tubercles (**c.t.**), callus setae (**c.s.**), frontal tubercle (**f.t.**), antennal ridges (**a.r.**), antennal sheaths (**ant.**), anterior orbital setae (**a.o.s.**), posterior orbital setae (**p.o.s.**), epicranial suture (**ep. s.**), lateral orbital setae (**l.o.s.**), maxillary palpal sheaths (**mx. p.**), and vertexal setae (**v.s.**). The callus setae especially, and those at other locations, may be unisetose (one seta on each tubercle, or at each location) or bisetose (two setae on each tubercle, or at each location). A distinct transverse suture marks the posterior end of the head region dorsally.

The large, distinct thoracic spiracular prominences (**sp. p.**) are located dorsolaterally at the anterior end of the thorax (Figure 3H). The transverse suture separating the head and thoracic regions crosses the body between or just in front of the spiracular prominences. The degree, if any, to which the spiracular prominences exceed the transverse suture is sometimes useful in identification. The prominences bear the thoracic spiracles (**th. sp.**) whose length and general shape are relatively species specific. Other obvious structures of the thorax include: basal alar setae (**b.a.s.**), anterior metanotal setae (**a.m.s.**), posterior metanotal setae (**p.m.s.**), metanotal setae (**mt. s.**), and the wing (**w.**) and tibial sheaths (**tb.1, tb.2**). The various setae may be sessile (i.e., arise directly from the surface of the thorax), or they may be tuberculate (i.e., arise from tubercles which project above the general surface).

The abdomen (Figures 3H, 3J), as in the larva, is comprised of seven segments (I-VII) plus the anal segment. Segments II-VII are readily recognized as they are made up of three distinct regions, the tergum (**tg.**), pleuron (**pl.**) and sternum (**st.**) and are almost completely encircled by a ring of spines in the posterior half of each segment. These "rings" of fringe spines may be made up of a single ring (unseriate) or two distinct rings (biseriate) of spines. When the rings are biseriate, either the anterior or posterior ring may be reduced in number, or entirely absent, from some regions. Only the tergum and pleuron of the first abdominal segment are visible. The segment bears tergal (**tg.s.**) and pleural (**pl. s.**) setae. These setae may be sessile or tuberculate, or in some cases (e.g., *Chlorotabanus*) they may be replaced by a more or less complete row of spines that are relatively similar to the fringe spines of succeeding segments. Abdominal segments I-VII each also have small spiracles (**a. sp.**) on the pleuron.

The anal segment bears at its posterior end the anal aster (**ast.**) which is typically comprised of three pairs of slender, tapered, pointed projections, the dorsal (**d.t.**), lateral (**l.t.**) and ventral (**v.t.**) tubercles. In at least one case (*Goniops*), the aster has only one pair of tubercles, and in a few cases the dorsal tubercles are reduced or absent. Near the base of the aster in females are the dorsolateral (**d.c.**), lateral (**l.c.**) and ventrolateral (**v.c.**) combs which are tubercles that bear one to several spines each. In males, the ventrolateral combs are united into a single ventral comb (**v.c.**). The dorsolateral and/or lateral combs may be drastically reduced, or even absent in some species.

--Adults--

Adult tabanids (Figures 4, 5 & 6) range from 5 mm to more than 25 mm in length. Useful structural characters are few and are limited primarily to the head and its appendages. Sexual dimorphism is readily apparent, particularly by the eyes which touch along the vertical midline (**holoptic condition**) in males (Figures 4M, 5B) of all Texas species while being distinctly separated (**dichoptic condition**) by the frons in females (Figures 4L, 5A, 5C, 6A). Eye color and pattern (Figures 5C, 5D) has been used by some authors in taxonomic keys (e.g., Chvala *et al.*, 1972), even though both the color and pattern disappear shortly after death. Color and pattern can be briefly restored to nearly natural in most specimens by submerging the entire specimen in ethyl acetate for an hour or more. This procedure does not usually damage the specimen and may even intensify the body pattern, but the procedure is much too time-consuming for routine use.

A quicker method of reviving eye color and pattern is discussed by Price and Goodwin (1979). This method requires the removal of the head which is then placed in a glass vial filled to the maximum with water (The head usually will float on the surface). A stopper is carefully placed in the mouth of the vial and pressure is exerted by

hand on the stopper. The resulting pressure inside the vial will force water into the cavities of the head and temporarily restore the eye pattern. The head can later be dried and either glued to the specimen or to a card on the pin. Unfortunately, the pubescent pattern, color and general appearance of the head is usually permanently altered. Nevertheless, it is very useful when a good series is available.

As with all insects, tabanids have compound eyes made up of individual image-producing units termed ommatidia. The surfaces of these individual units are termed facets (of the eye). In female tabanids the facets are of uniform size, but in males of most species there are usually areas of large and small eye facets (Figure 5B). The relative degree of difference in size of facets, the sharpness, or distinctness, in the line of demarcation between the two sizes and the extent of the eye covered by the two sizes aid in separation of closely related species. Another important feature of the eyes is whether or not the eye, or part of the eye, is evidently pilose (hairy). Also, the presence of long hairs on the midline between the eyes is an important feature for identifying some males.

Although some species are essentially unicolorous, the majority exhibit relatively distinct color patterns on the abdomen, thorax, and/or wings, and consequently, color and pattern of the body and its appendages play a major role in identification of species. This is especially true for the males, which, due to sexual dimorphism, lack most of the useful structural characters of the female frons. Since color and pattern play such an important role in species identification, caution must be used when examining specimens showing evidence of rubbing or greasing. The same is true when examining specimens lacking part or all of appendages such as antennae and palps. Access to a comparative collection is extremely helpful. Newer methods, such as electrophoresis (Hudson and Teskey 1976) are being used to supplement traditional taxonomic methods, but these methods are too time-consuming and expensive to use in routine identifications. The following brief account of adult morphology is provided to assist the user in applying the keys and descriptions provided herein.

The body is divided into three distinct regions; **head**, **thorax** (with wings and legs) and **abdomen**. The head (Figures 4L, 4M, 5A-D, 6A) is relatively large. In the female (Figure 4L), the eyes are separated by the **frons**, which is usually pubescent over part of its surface. At the lower end of the frons, there is usually a **basal callus** (in the genera *Chrysops*, *Silvius*, and a few others the **basal callus** is referred to simply as the **callus**) above which may be an isolated or connected **median callus**. Presence or absence, color, size, and shape of these calli are important aids to identification. The upper part of the frons (**vertex**) may be pubescent or bare and shiny. In some (subfamilies Pangoniinae and Chrysopsinae), three **ocelli** are usually present in the center of the upper one-third of the frons. They may be sessile or on a raised tuberculate area. In the

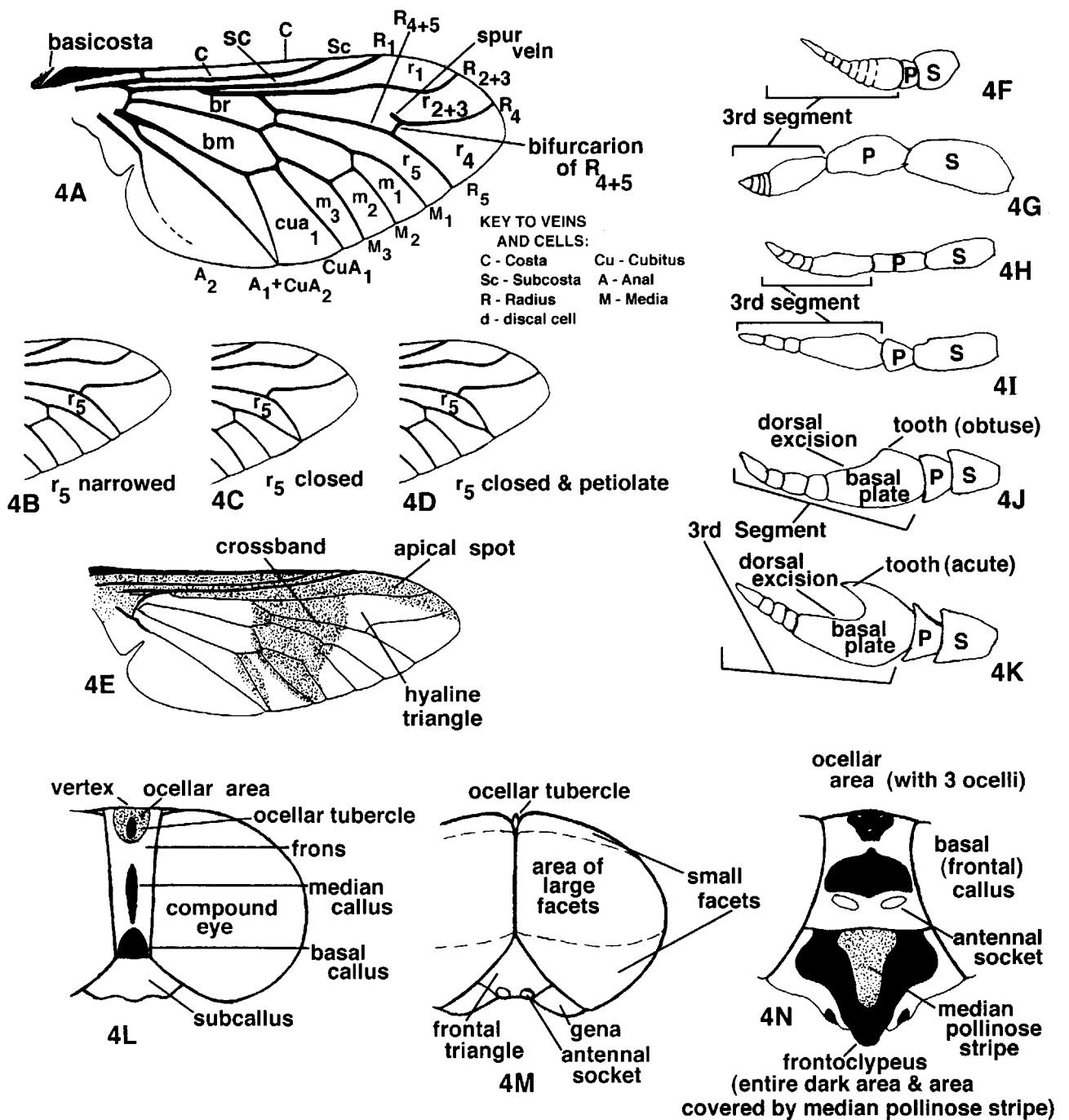
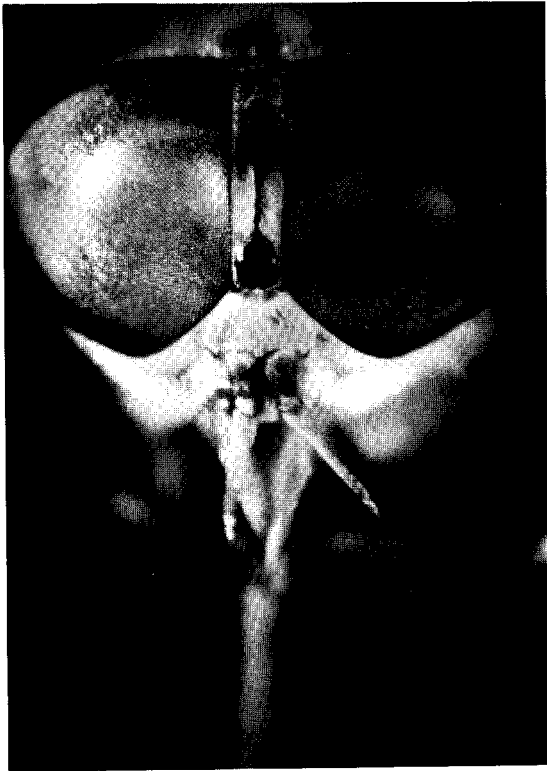
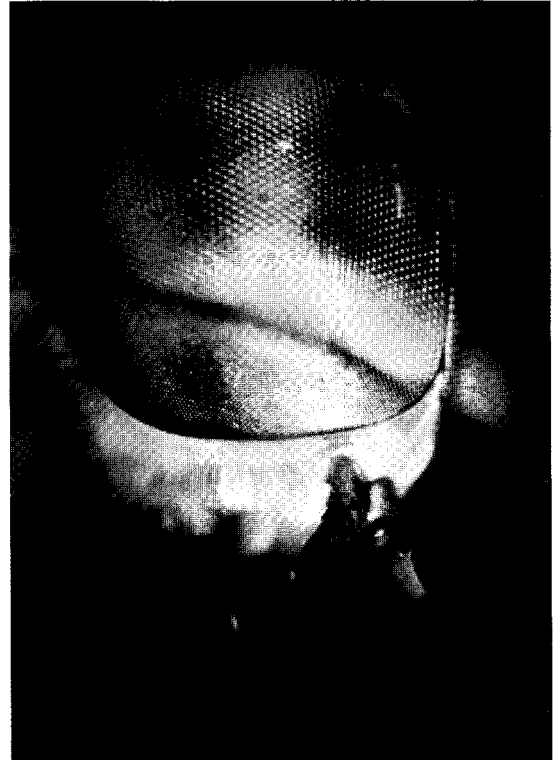


Figure 4. Adult Characters (4A-4E, Wing Characters; 4F-4K, Antennal Characters and Variations; 4L-4N; Head Characters): 4A - Generalized wing showing veins, cells, basicosta, bifurcation of vein R_{4+5} , and spur vein (Note: cell r_5 open); 4B, 4C, and 4D - Apex of wing showing cell r_5 , narrowed, closed, and closed and petiolate, respectively; 4E Generalized wing of *Chrysops* showing major areas; 4F - Antenna of *Apatolestes* (illustrative of PANGONIINAE in Texas); 4G - Antenna of *Chrysops* with scape and pedicel enlarged; 4H - Antenna of *Chrysops* with scape and pedicel of "normal" size; 4I - Antenna of *Haematopota* (Note: only 3 terminal annuli); 4J - Generalized antenna of Tabaninae (excluding Haematopotini) with shallow dorsal excision and weakly developed tooth with obtuse apex; 4K - Generalized antenna of Tabaninae (excluding Haematopotini) with deep dorsal excision and strongly developed tooth with acute apex; 4L, 4M, respectively - Generalized anterior views of head of female and male Tabaninae (antennae removed) showing important structures and areas; 4N - Generalized anterior views of head of female *Chrysops* (antennae removed) showing important structures and areas (see text for discussion and explanation of abbreviations).



5A



5B



5C



5D

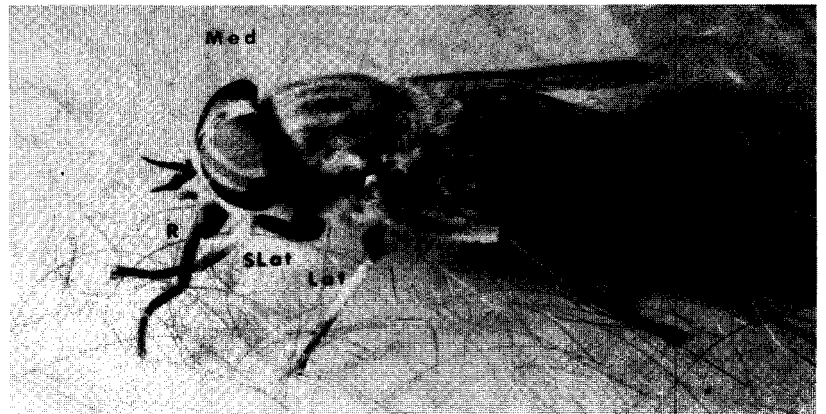
Figure 5. Photographs of heads of tabanids: **5A & 5b** - heads of *Tabanus* female and male, respectively (note areas of large and small facets in 5B; compare with Figures 4L & 4M); **5C & 5D** - heads of *Tabanus* and *Chrysops*, respectively, to illustrate eye pattern.



6A



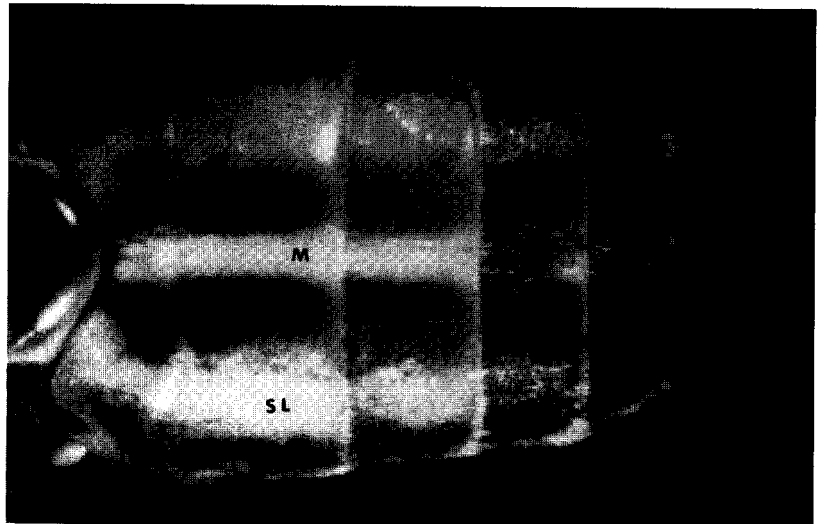
6B



6C



Ta 6D



6E

Figure 6. Head, thoracic, and abdominal features of tabanids: **6A** - frontal view of facial area of *Chrysops* (compare with Figure 4N); **6B** - dorsolateral view of thorax to illustrate mesonotum (M), prescutellum (P), scutellum (S), and notopleural lobes (N); **6C** - dorsolateral view of *Tabanus* to illustrate median (Med), sublateral (SLat), and lateral (Lat) pale thoracic stripes; **6D** - enlarged view of tabanid leg to illustrate coxa (C), femur (F), tibia (Ti), and tarsus (Ta); **6E** - dorsal view of *Tabanus* abdomen to illustrate median (M) and sublateral (SL) longitudinal stripes.

subfamily Tabaninae, ocelli are usually absent, but an **ocellar tubercle** (raised, usually shiny, rounded area) is sometimes present (e.g., species of *Hybomitra*). In males (Figure 4M), virtually all of the frons is missing as the eyes touch on the midline. There is usually a small area, the **frontal triangle**, present between the lower margins of the eyes, and there is a small **vertexal (frontal) tubercle** between the eyes above. This tubercle, which sometimes extends above the upper margin of the eyes, may be bare and shiny, pollinose (i.e., with a velvety covering), and weakly to heavily pilose. Immediately below the frons is an area termed the subcallus which is usually pollinose, but may in some species be partly to entirely denuded (bare) and shiny. Immediately below the subcallus near the midline are the antennae. The tabanid **antenna** (Figures 4F-K) is described as three-segmented. The **basal segment**, the **scape (S)**, and the **second segment**, the **pedicel (P)**, vary in shape and relative lengths as well as color. The **third segment**, sometimes termed the **flagellum**, is the most variable. In most genera of the subfamily Pangoniinae, the third segment is comprised of 7-8 moderately distinct, ring-like, partially movable subsections termed annuli. The basal 2-3 annuli are usually of greater diameter. In a few Pangoniinae, and all species of Chrysopsinae and Tabaninae, the third segment is comprised of a large basal portion, the **basal plate**, and an apical portion comprised of only 3-4 annuli. The basal plate may be slender, or it may be expanded in vertical dimension near the base. In the latter condition, the upper tip of the expanded part is termed the **tooth**. This "tooth" sometimes extends forward toward or even over the basal annuli. The area of the basal plate from the tooth to the apex of the plate may be concave (indented). If so, the concavity is termed the **dorsal excision**. The tooth, in side view, is termed **acute** if it forms an angle of less than 90°, and **obtuse** if the angle is greater than 90°. Shape and color, angle and size of the tooth and presence or absence of a dorsal excision are important features. Below and to the sides of the antennae is the facial area. The lateral parts of the facial area bordering the eyes and the bases of the antennae are the **genae** (singular, gena). The central area directly below the antennae is the **frontoclypeus**. The color and degree of pollinosity of the frontoclypeus, and the color and extent of the beard (hairs of the facial area) are important features. Just below the frontoclypeus are the mouthparts. The two obvious components are the paired 2-segmented **palpi** (singular, palpus) and the proboscis which includes most of the remaining mouthparts. The shape and color of the palpi, and the color of the hairs on the palpi, and the length and extent of shiny, non-pollinose areas on the proboscis have been proven of taxonomic significance.

The **thorax** (Figure 6B, 6C) bears the wings and legs. Although the thorax consists of three segments (prothorax, mesothorax and metathorax), the line of separation between these segments is not easily seen. However, only a few parts of the thorax are used in the keys and descriptions.

Dorsally (Figure 6B), the central area is the **mesoscutum (M)**. At the rear of the mesoscutum is a obvious transverse suture at the center of which is a narrow, raised, transverse ridge, the **prescutellum (P)**. Immediately behind the prescutellum is a more or less triangular area, the **scutellum (S)**, which extends over much of the first abdominal tergite medially. Laterally on each side of the mesoscutum, just anterior and medial of the wing bases are the rounded, slightly raised **notopleural lobes (N)**.

The color of the scutellum and notopleural lobes, especially when contrasting with color of the mesoscutum, are taxonomically significant, as is the overall color pattern of the mesoscutum, if any. The "typical" pattern of the mesoscutum (Figure 6C) consists of five longitudinal lines, a median line (**Med**) and both sublateral (**SLat**) and lateral (**Lat**) lines on each side between the median line and the wing bases. The median line is usually the most slender. The pattern is usually constant in series of fresh and well-preserved, pinned specimens, but it can be damaged, or even obliterated, by aging, rubbing, wetting, and collection into or preservation in fluids. Between species there can be considerable difference in pattern. Median, sublateral and/or lateral lines may be distinct, indistinct, or absent, or the entire pattern may be absent. Sexual dimorphism sometimes affects pattern, most typically resulting in the pattern in males being absent or greatly obscured by an abundance of long, thick, erect hairs on the dorsal surface of the mesoscutum. Laterally and ventrally, the color of the hairs of the thorax (below and anterior of the wing base and above the legs) and the color of the halteres (small club-shaped structures just behind the base of each wing) are of some use in identification.

The **wing** (Figure 4A-E), however, is especially useful. Important features of the wing include color and pattern. Wings range from hyaline, or "glass clear" (i.e., transparent; completely without color except for the wing veins), to totally infuscated (i.e., entire membrane of wing colored, usually brownish to blackish). Between the extremes of hyaline and completely infuscated are wings with spots, bands or large areas with infuscation (darkening of wing) of varying degrees. In the genus *Chrysops*, the wing pattern (Figure 4E) is so important that selected areas of the wing have been named. Typically, a **crossband** of dark infuscation crosses, or nearly crosses, the wing from front (anterior) to back (posterior). Also, in most species there is an extension of infuscation from the anterior part of the crossband toward the tip of the wing. This dark area is the **apical spot**. When present, the apical spot ranges from as little as a very narrow band along the anterior margin of the wing to so large as to include virtually the entire wing distal to the crossband. However, between the crossband and the apical spot there is usually at least some hyaline membrane, and this area, regardless of shape, is the **hyaline triangle**. In other genera infuscation is more typically in the form of spots, or maculations. The crossveins are the most common areas for spots, but they may also be present

on the longitudinal veins as in the genus *Silvius*. Infuscation along, or bordering, the longitudinal veins is also common in some species, as is pale to very dark infuscation of the entire, or large parts of the wing.

The wing (Figure 4A) is divided by the veins and crossveins into cells. Veins, crossveins and cells are generally designated by a letter or letter and number combination. Capital letters designate veins, small letters designate crossveins and cells. Two cells, the costal cell (**cell c**) and the discal cell (**cell d**), are usually referred to by their full names. Cells r_{2+3} and r_4 are collectively termed the apical cells, and cells r_5 , m_1 , m_2 , m_3 and cu_a1 are collectively termed the posterior cells. Cell r_5 is important as it varies from totally open (Figure 4A) to narrowed (Figure 4B) to closed (veins R_5 and M_1 unite at wing margin as in Figure 4C) to closed and petiolate (veins R_5 and M_1 unite before the wing margin and continue to margin as a single vein as in Figure 4D). Another venational feature is the presence or absence of a **spur vein** (Figure 6B) from vein R_4 just distal from the **bifurcation of veins R_4 and R_5** . Also, at the base of the costa is a distinctly set off, apically pointed **basicosta**. The degree of setation of the basicosta in comparison to the setation of the costa is important in separation of the tribes of the subfamily Tabaninae.

Ventrally, the **legs** (Figure 6D) are the key features. Composed of four obvious parts from base to apex [**coxa** (C), **femor** (F), **tibia** (Ti), and 5-segmented **tarsus** (Ta)], the color and pattern of the legs and/or individual segments is very useful. Also, on many species the hind tibiae bear a moderately to very distinct row of long hairs on the apical one-half to two-thirds called the **hind tibial fringe**. Presence or absence and color of this fringe has some taxonomic value. Finally, the hind tibiae of the subfamilies Pangoniinae and Chrysopsinae have an apical pair of usually distinct **spurs** (enlarged setae) which are not present in the subfamily Tabaninae.

The **abdomen** consists of ten segments, but the last two are greatly modified and reduced. The remnants of these segments can be seen only if the reproductive terminalia are extended for microscopic examination. The dorsal surface of the first segment is largely hidden by the scutellum of the thorax, but that of the next seven segments is usually visible. Color and pattern of the dorsal surface of the abdomen are very significant factors in species identification. It may be unicolorous, or a mixture of colors. The simpler patterns of mixed colors involves either some segments of one color and others of a different color, or some segments with the anterior and posterior portions of different colors, or a combination of the two. More commonly, the abdomen can be described as having a "ground", or predominant, color on which there is a contrasting pattern of spots or lines. The lines (Figure 6E) may be median, dorsolateral, or lateral in position. Median lines may be parallel-sided (i.e., outer edges smooth) or serrate (i.e., outer edges expanded toward posterior end of

segments to give a "sawtooth" appearance). Dorsolateral and lateral lines may be relatively parallel-sided or somewhat serrate or irregular along one, usually the outer, surface. Lines may be "complete" (i.e., continuous over most of abdominal length) or "broken" (i.e., composed of a sequence of at least partially separated spots, each spot usually on a separate segment). When lines are not present, the contrasting marks are usually called triangles or spots. Triangles usually refer to markings along the dorsal midline whereas spots are dorsolateral markings. Color and pattern of the ventral surface of the abdomen is sometimes important in distinguishing closely related species, but the distinctions are usually based on reference to specific segments (sternites) without reference to lines, spots and triangles. Finally, when the pattern of individual segments, or groups of segments, is mentioned, the dorsal and ventral surfaces of the segments are often termed tergites and sternites, respectively.

In addition to the morphological terms mentioned above, there are a few descriptive terms used in the keys and descriptions that may not be unfamiliar to the reader in the context used herein. These terms are briefly defined below:

concolorous: of essentially same color when used in reference to two or more separate areas

contiguous: touching

diffuse: referring to the outer edges of areas of color (e.g., abdominal triangles, spots and stripes) or infuscation (e.g., crossband and apical spot of wings) fading gradually and irregularly so that there is no distinct edge or margin

dilute: usually referring to wing pattern that is pale or thinned out

fenestrate: with transparent or window-like clear spot in a cell in an otherwise dark area of wing

fuscous: dark brown to nearly black

geminate: refers to dorsal abdominal marks arranged in pairs composed of two similar parts, or to a single middorsal mark seemingly formed by the median union of two similar parts

globose: used in reference to body region (especially head or abdomen) being unusually enlarged ("swollen") in comparison to that of related species

incrassate: used in reference to the antennae, or individual antennal segments, being markedly or distinctly enlarged ("swollen") in comparison to those of related species

quadrate: refers to a structure (e.g., a callus) or a region being more or less square in outline even though edges may be somewhat rounded

saturate: refers to a wing picture, or pattern, or a part thereof (e.g., crossband) being uniformly and intensely darkened, usually dark brown to black

subequal: a region or structure that is termed subequal to another when it is very slightly smaller, shorter, narrower, than the former

subquadrate: (see quadrate above) not quite square, usually wider than high, approaching rectangulate

vittate: striped, usually in reference to color patten of dorsal surface of abdomen (univittate-one, usually median stripe; bivittate-two usually dark longitudinal stripes; trivittate-three usually dark longitudinal stripes; quadrivittate-four usually dark longitudinal stripes)

Generic keys are provided for larvae, pupae and adults. Keys to species are provided only for the adults. Adult males and females are keyed separately for most genera. When this is not the case, the characters used are applicable to both sexes. Characters used in the keys and species descriptions are illustrated in Figures 3-6, or they are defined in text as necessary. Keys to species are not provided for the larvae and pupae. However, for those seeking descriptions and other information on the immature stages, Table 4 lists all species occurring or possibly occurring in Texas for which recent (post-1968) published descriptions are available and provides citations to the publications.

NOMENCLATRURAL CHANGES, DELETIONS, AND OTHER SPECIAL NOTES

Below are listed some previously published Texas records for which the names originally used are now treated as synonyms.

From Mcgregor and Schomberg (1952):

T. amplifrons Kröber = *T. colombensis* Macquart

T. giganteus DeGeer = *T. calens* Linnaeus

T. vittiger subsp. *schwardti* Philip = *T. subsimilis* Bellardi

From Stone (1938):

T. truquii Stone, not Bellardi = *T. subsimilis* Bellardi

McGregor and Schomberg (1952) listed *T. lineola* subsp. *scutellaris* Walker from Texas. This name is presently considered a synonym for *T. similis* Macquart, a northern species that reaches its known southern limits in central Kansas and Wyoming. We believe that the specimens available to McGregor and Schomberg were *T. subsimilis* as presently recognized. Thompson (1976) reported *T. aranti* Hays from Texas. An examination of specimens determined by Thompson housed in the Texas

A&M University Department of Entomology Collection revealed that they are *T. atripennis* Stone. Philip (1965) lists *T. nigrovittatus fulvilineis* Philip from Texas. *Tabanus fulvilineis* is now recognized as a distinct species known only from Florida to Louisiana. A re-examination of the single Texas specimen referenced by Philip (1965), a specimen collected by L. L. Pechuman 19 July 1960, revealed it to be a typical *T. nigrovittatus* Macquart.

Several specimens in the Florida State Collection of Arthropods with labels noting September, 1967, collections in extreme south Texas (Hidalgo, Hidalgo County; La Feria and Olmito, Cameron Co.) were examined. These specimens, all deer flies, were *Chrysops brimleyi* Hine, *C. fuliginosus* Wiedemann and *C. niger* Macquart, all of which are common spring and early summer species. Collections later than midsummer are unknown, hence September collections are most unlikely. The first is a salt marsh species, and the other two are more commonly found in or near forested areas. The first and third have been collected in east Texas, and the other is known from coastal states of the eastern U.S. as far west as Mississippi. Because of absence of typical adult habitat in the south Texas areas noted, plus the "out of season" dates of collection, there is a strong likelihood that these specimens are incorrectly labeled. Hence, *C. fuliginosus* is not included in the fauna of Texas at this time, and the south Texas data on the other two species is not reflected on distributional maps or in text.

PRESENTATION OF SPECIES AND COLLECTION INFORMATION

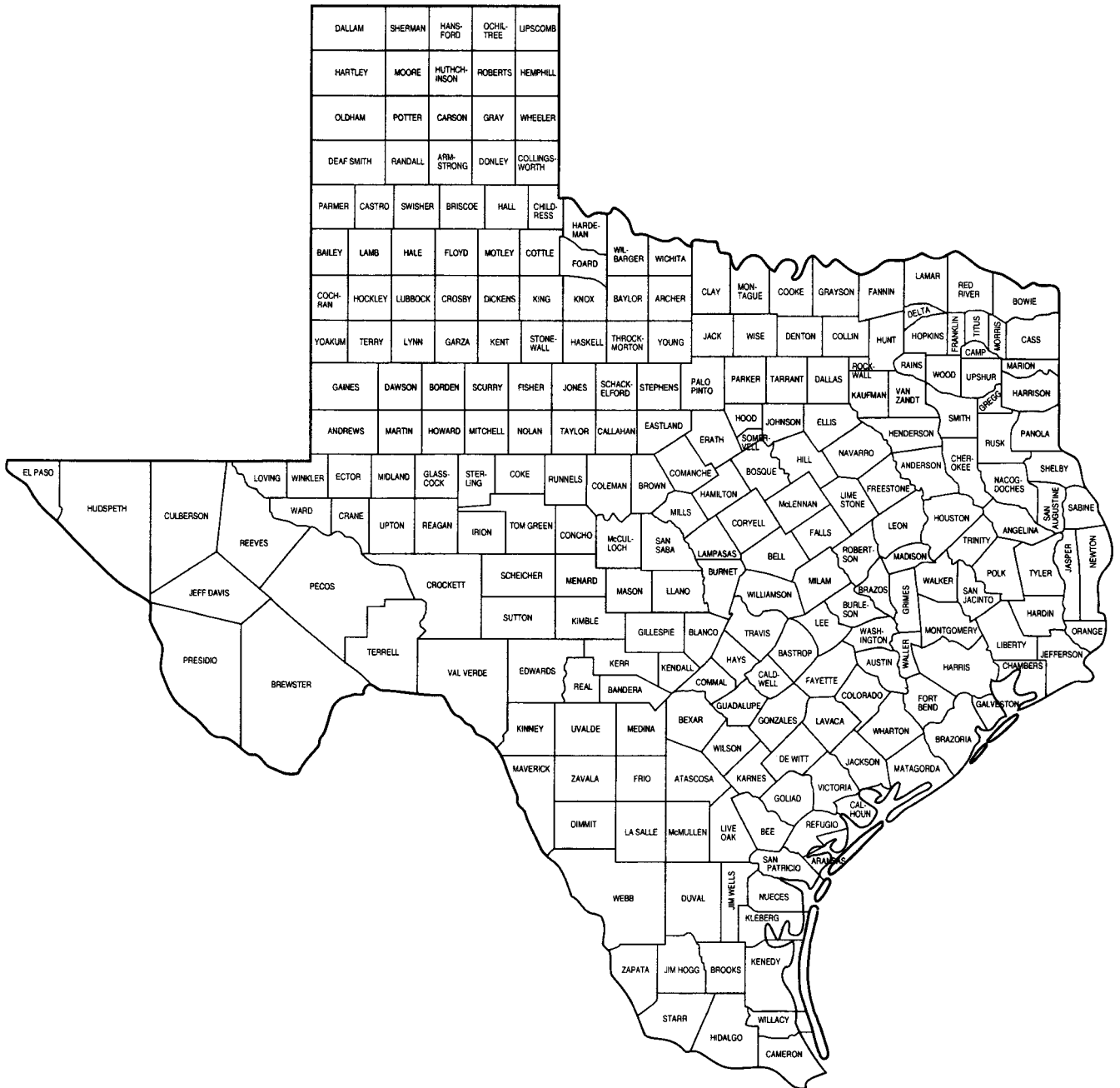
For each species covered in the taxonomic keys, we provide synonymy, a brief description to supplement the keys, brief comments, and distributional information. Distributional information includes a map for each species known to occur in Texas. County names are not included on these small maps, but names are shown on Map 2. In addition, under the subheading, Known Distribution, detailed collection information is presented alphabetically by counties. Each county name appears entirely in capital letters. Following a county name, collection information is presented in the following order, as available: (1) locality information; (2) date(s) of collection (the year of collection appears at the end of a list of multiple dates for that year); (3) name(s) of collector; (4) special information, if any; and (5) location of specimens (abbreviated) and/or literature source. All specimens from which unpublished data were accumulated were seen either by the authors or by L. L. Pechuman, G. B. Fairchild or John F. Burger, who provided information for this report. The abbreviations for locations of specimens used herein are presented alphabetically below (following Table 4 and Map 2):

TABLE 4. Species of Tabanidae Occurring or Possibly Occurring in Texas for which Descriptions of the Immature Stages are Available in Recent (post-1968) Literature

Species	References	Species	References
<i>Goniops</i>		<i>Tabanus</i>	
<i>chrysocoma</i>	15	<i>abactor</i>	11
<i>Merycomyia</i>		<i>americanus</i>	13
<i>whitneyi</i>	13, 15	<i>aranti</i>	5, 13
<i>Silvius</i>		<i>atratus</i>	13, 15
<i>quadrivittatus</i>	1	<i>atripennis</i>	10 ^b
<i>Chrysops</i>		<i>calens</i>	15
<i>aestuans</i>	15	<i>colombensis</i>	9
<i>atlanticus</i>	3 ^a , 15	<i>cymatophorus</i>	10
<i>brimleyi</i>	13, 15	<i>dorsifer</i>	1
<i>brunneus</i>	7	<i>fairchildi</i>	13, 15
<i>callidus</i>	13, 15	<i>fulvulus</i>	14
<i>carbonarius</i>	15	<i>fuscicostatus</i>	14
<i>celatus</i>	13, 15	<i>gilanus</i>	1
<i>cincticornis</i>	13, 15	<i>gladiator</i>	5
<i>dimmocki</i>	13, 15	<i>hinellus</i>	2, 10
<i>facialis</i>	1	<i>imitans</i>	8
<i>flavidus</i>	13, 15	<i>limbatinevris</i>	5 ^b , 13, 15 ^b
<i>fulvaster</i>	1, 16	<i>lineola</i>	13, 15
<i>geminatus</i>	15	<i>maculipennis</i>	13
<i>hinei</i>	7	<i>mogollon</i>	1
<i>macquarti</i>	15	<i>molestus</i>	13
<i>moechus</i>	15	<i>mularis</i>	11
<i>montanus</i>	15	<i>nigrescens</i>	5, 13
<i>niger</i>	13, 15	<i>nigripes</i>	13, 15
<i>nigribimbo</i>	13, 15	<i>nigrovittatus</i>	2, 15
<i>obsoletus</i>	10	<i>pallidescens</i>	14
<i>pachycerus</i>	1	<i>petiolatus</i>	13, 15
<i>parvulus</i>	15	<i>proximus</i>	13
<i>pikei</i>	15	<i>pruinosis</i>	1
<i>pudicus</i>	7 ^a	<i>pumilus</i>	13, 15
<i>reicherti</i>	3, 13	<i>punctifer</i>	1
<i>sequax</i>	17	<i>pungens</i>	12
<i>univittatus</i>	13, 15	<i>quinquevittatus</i>	15
<i>upsilon</i>	13	<i>reinwardtii</i>	13, 15
<i>virgulatus</i>	1	<i>sackeni</i>	9
<i>vittatus</i>	15	<i>sparus</i>	15
<i>Haematopota</i>		<i>stonei</i>	1
<i>americana</i>	16	<i>stygius</i>	13, 15
<i>Diachlorus</i>		<i>subsimilis</i>	1, 5
<i>ferrugatus</i>	4	<i>texanus</i>	11
<i>Chlorotabanus</i>		<i>trimaculatus</i>	5, 13
<i>crepuscularis</i>	4, 13	<i>venustus</i>	8, 10
<i>Stenotabanus</i>		<i>wilsoni</i>	14
<i>magnicallus</i>	6	<i>zythicolor</i>	8 ^a
<i>Leucotabanus</i>			
<i>annulatus</i>	4, 13		
<i>Whitneyomyia</i>			
<i>beatifica</i>	8		
<i>Hybomitra</i>			
<i>aatos</i>	1		
<i>fulvilateralis</i>	1		
<i>lasiophthalma</i>	15		
<i>phaenops</i>	1		

^a description covers pupa only

^b described under different name; see "Comments" in text under name appearing above [Reference Code: 1, Burger (1977); 2, Freeman (1987); 3, Goodwin (1972); 4, Goodwin (1973b); 5, Goodwin (1973c); 6, Goodwin (1974); 7, Goodwin (1976a); 8, Goodwin (1976b); 9, Goodwin (1986); 10, Goodwin (1987); 11, Goodwin (1994); 12, Goodwin and Murdoch (1974); 13, Tidwell (1973); 14, Tidwell and Tidwell (1973); 15, Teskey (1969); 16, Teskey (1985); 17, Teskey and Burger (1976)]



Map 2. Map of Texas showing county lines and names.

ACC = Agriculture Canada Collection, British Columbia
 AMNH = American Museum of Natural History
 ANSP = Academy of Natural Sciences, Philadelphia
 ASU = Angelo State University
 BC = B. Cutler collection
 BMD = B. M. Drees collection
 CAS = California Academy of Sciences
 CBP = C. B. Philip collection (now in the CAS)
 CC = C. Cutler collection
 CM = Carnegie Museum of Natural History
 CNC = Canadian National Collection, Ottawa
 CTM = C. T. Maier collection
 U = Cornell University
 FDF = F. D. Fee collection
 FSCA = Florida State Collection of Arthropods
 GBF = G. B. Fairchild collection (now in the FSCA)
 GSU = Georgia Southern University
 INHM = Illinois Natural History Museum
 JTG = J. T. Goodwin collection
 KSU = Kansas State University
 LACM = Los Angeles Co. Museum
 LB = Larry Bezark collection
 LD = L. Davis collection
 LLP = L. L. Pechuman collection (now in the CU collection)
 LSU = Louisiana State University
 MCZ = Museum of Comparative Zoology
 MH = M. Huybensz collection
 MISU = Midwestern State University
 MSU = Mississippi State University
 NMU = New Mexico University
 NSM = Nova Scotia Museum
 NYSM = New York State Museum, Albany
 ODH = Ohio Department of Health
 OHSU = Ohio State University
 ORSU = Oregon State University
 PMNH = Peabody Museum of Natural History, Yale University
 PU = Purdue University
 RB = R. Beard collection
 SFASU = Stephen F. Austin State University
 SJ = J. Gordon Edwards Museum of Entomology, San Jose State Univ.
 SRSU = Sul Ross State University
 SYR = State University of New York, Syracuse
 TAMU = Texas A&M University
 TTU = Texas Tech University
 TMM = Texas Memorial Museum, University of Texas at Austin
 UAL = University of Alberta
 UAR = University of Arkansas
 UB = University of Buffalo
 UC = University of California
 UCB = University of California at Brown
 UCBK = University of California at Berkeley
 UCD = University of California at Davis
 UCR = University of California at Riverside
 UG = University of Georgia
 UK = Univeristy of Kansas
 UM = University of Michigan
 UMO = University of Missouri
 UNH = University of New Hampshire
 UNT = University of North Texas
 USNM = U. S. National Museum (Smithsonian)
 USDA = U. S. Department of Agriculture, Kerrville, TX
 USU = Utah State University
 UTA = University of Texas at Arlington
 UTAU = University of Texas at Austin, Breckenridge Field Sta.
 UT = University of Tennessee
 UW = University of Wyoming
 WSU = Washington State University

WTAM = West Texas A&M University
 WWRC = Welder Wildlife Refuge

A number of other abbreviations are used in the collection data. This has been done both to conserve space and to ensure consistency in locality data as different collectors often use different abbreviations for the same word. Directions from named reference points are abbreviated in capital letters (e.g., N, S, E, W, NW, SE, SSE, ESE, etc. = north, south, east, west, northwest, southeast, south-southeast, east-southeast, etc.). Months are always shown using only the first three letters of the month. Other abbreviations used are noted below:

ca = approximately
 Conf = Conference
 Cons = Conservation
 Cpgd = Campground
 Cr = Creek
 Ctr = Center
 Cyn = Canyon
 Dr = Drive
 Elec = Electric(al)
 FM = Farm to Market Road (will be followed by road number)
 For = Forest
 Ft = Fort
 ft = feet
 Hw = Highway
 Is = Island
 Jct = Junction (usually of two roads and/or highways)
 km = kilometer
 Lk = Lake
 mi = mile
 Mngt = Management
 Mt, Mts = Mountain(s)
 Nat = National
 nr = near
 OSR = Old San Antonio Road
 Pk = Park
 Prop = Property
 Pt = Point
 R = River
 Rec = Recreation
 Ref = Refuge
 Res = Research
 Resv = Reservoir
 Rd = Road
 Rt = Route
 Sanct = Sanctuary
 Spr = Spring
 St = State
 Sta = Station
 U = University
 Vterl (VTERL) = Veterinary Toxicology and Entomology Entomology Research Laboratory [now Food Animal Protection Research Laboratory (USDA) at Texas A&M University, College Station, Texas]

KEYS TO THE GENERA OF TABANIDAE OCCURRING OR POSSIBLY OCCURRING IN TEXAS

--Known Larvae--

- | | |
|--|---|
| <p>1. Respiratory siphon absent, posterior spiracle sessile on last segment 2
Respiratory siphon present, at least half as long as broad basally, the posterior spiracle a vertical slit at its tip 4</p> <p>2. Larva club-shaped, greatly swollen posteriorly; last segment with numerous fleshy protuberances <i>Goniops</i> Aldrich
Larva more cylindrical, diameter largest in region of meso- and metathorax; fleshy protuberances absent from last segment 3</p> <p>3. Pseudopodia present on abdominal segments VI-VII; mandibles recurved and serrate ventrally; cephalic brushes present; posterior spiracular area lacking adjacent large setae; cuticular ornamentation of prothorax and anal ridges spiculate; body short and stout <i>Apatolestes</i> Williston
Pseudopodia absent from abdominal segments VI-VII; mandibles nearly straight, not serrated ventrally; cephalic brushes absent; posterior spiracle encircled by 6 setae borne on cuticular plates; cuticular ornamentation of prothorax and anal ridges scale-like; body long and slender <i>Esenbeckia</i> Rondani</p> <p>4. Entire larva covered by pubescence; length never more than 35 mm 5
Pubescence usually confined to anterior and posterior margins of segments or to pseudopodial regions with occasional anterior and/or posterior projections; readily visible striations present laterally, or if striations entirely absent larva is almost devoid of pubescence, or if entirely pubescent, the color is dark brown to black and full grown larva greatly exceeds 35 mm 6</p> <p>5. Pubescence distinctly mottled, the dark areas green-black in life, brown in preserved specimens <i>Chlorotabanus</i> Lutz
Pubescence uniformly yellowish, a little lighter ventrally <i>Diachlorus</i> Osten Sacken</p> <p>6. Three pairs of pseudopodia (located dorsally, laterally and ventrally) on each of the first seven abdominal segments
. <i>Chrysops</i> Meigen
Four pairs of pseudopodia (the above, plus an</p> | <p>additional ventrolateral pair) on each of the first seven abdominal segments 7</p> <p>7. Respiratory siphon very short, ca. 1/2 as long as its basal diameter; striations present on all aspects of every segment and rather uniformly spaced; dorsal tracheae sinuous with more or less uniform taper from posterior to anterior 11
Respiratory siphon length ranges from slightly shorter to 2 or more times longer than its basal diameter; striations normally absent from dorsal and ventral surfaces of at least the prothorax, and more widely spaced dorsally and ventrally than laterally on other segments; typically, dorsal tracheae only slightly tapered from posterior to region of 1st abdominal segment, where a distinct constriction exists 8</p> <p>8. Respiratory siphon comprises the distal ends of two opposed sclerotized plates between which the tracheal trunks terminate in a stigmatal spine; spine in lateral view, broad basally, apically pointed, the dorsal and ventral edges convex <i>Merycomyia</i> Hine
Respiratory siphon membranous, lacking sclerotized plates except for spiracular lips; stigmatal spine, if present, narrow basally with dorsal and ventral edges concave or straight in lateral views, 9</p> <p>9. Integumentary striations absent; midlateral pubescence of anal segment an elongate oval patch usually united with posterior annulus but widely separated from pubescence of anal ridge; respiratory siphon about as wide as long; small larva, less than 22 mm long <i>Haematopota</i> Meigen
Integumentary striations present at least on lateral aspects of thoracic segments; disagreeing with at least one other of the above 10</p> <p>10. Median lateral surface of anal segment lacking a dorsally directed pubescent extension from anal ridge pubescence; larva usually light brown in color; striations typically present on dorsal and ventral surfaces of all abdominal segments; stigmatal spine absent
. <i>Hybomitra</i> Enderlein
Median lateral surface with a vertically directed extension of pubescence from anal ridge pubescence that at least attains middle of</p> |
|--|---|

segment; larva typically whitish, only rarely brownish; striations usually absent either dorsally or ventrally from some abdominal segments (or entire larva pubescent); exsertile spine present or absent

. . . . *Tabanus* Linnaeus, *Whitneyomyia* Bequaert

11. Relatively robust larva with little or no midlateral pubescence on anal segment, the pubescence of the anal ridge and posterior annulus widely separated; inhabit rotten logs and tree holes

. *Leucotabanus* Lutz

Very slender larva, either with extensive area of midlateral pubescence uniting posterior annulus of anal segment with pubescence of anal ridge or larval habitat exclusively marine beach sand near the tide line 12

12. Posterior annulus of anal segment not united with pubescence of anal ridges; larval habitat exclusively marine beach sand near high tide line *Stenotabanus* (*Aegialomyia* Philip)

Lutz

Extensive area of midlateral pubescence on anal segment unites posterior annulus with pubescence of anal ridges; larval habitat wet silty or sandy soil adjacent to freshwater streams *Silvius* Meigen

--Known Pupae--

1. Aster with a single pair of large acutely pointed tubercles. Abdominal fringes with relatively stout spines of widely variable length, the largest (three pairs on tergites, one on each pleuron, and a pair on sternites) uniformly positioned in fringes of each segment; spiracular prominences on thorax and abdominal segments globular

. *Goniops* Aldrich

Aster with two or three pairs of conspicuous tubercles; abdominal fringes and spiracular prominences otherwise 2

2. Three pairs of mesonotal setae dorsally

. *Apatolestes* Williston

Two pairs of mesonotal setae dorsally 3

3. Abdominal tergum I with a row of small tubercles or spines between paired setiferous sublateral tubercles *Chlorotabanus* Lutz

Abdominal tergum I lacking tubercles and spines between sublateral setae; sublateral setae may or may not arise from tubercles 4

4. Dorsal abdominal fringes uniseriate 5

Dorsal abdominal fringes biseriate 7

5. Abdominal fringe spines with broad bases and of varied and irregular sizes (resembling a saw blade with irregularly sized teeth); abdominal

cuticle exhibiting netlike (reticulate) appearance; dorsal, lateral and ventral or ventrolateral preanal combs present; dorsal tubercles of aster very short and arising from base of lateral tubercles

. *Diachlorus* Osten Sacken

Abdominal fringe spines slender, with uniform length on each segment, bases not broad; abdominal cuticle not reticulate; dorsal and lateral preanal combs present or absent; dorsal tubercles of aster well developed 6

6. Dorsal and lateral preanal combs absent; callus tubercles bisetose (unisetose in *brunneus*) *Chrysops* Meigen

Dorsal preanal combs present; callus tubercles unisetose *Haematopota* Meigen

7. Callus tubercles elevated 0.4 mm; globular or drop-shaped; front with prominent ridge crossing upper basal angles of antennal sheaths through bases of callus tubercles; thoracic spiracles ca. 2 mm long; length of dorsal, lateral, and ventral tubercles of aster 0.6, 0.8, and 0.4 mm, respectively

. *Merycomia* Hine

Not agreeing with the above 8

8. Callus tubercles bisetose *Stenotabanus* Lutz

Callus tubercles unisetose 9

9. Basal alar tubercles bisetose

. *Silvius* (*Griseosilvius* Philip) Meigen

Basal alar tubercles unisetose 10

10. At least the lateral and ventral pairs of tubercles of aster elongate and slender, tapering gradually to apices; all preanal combs present and distinct; setae of abdominal segment I arising from tubercles; posterior series of fringe spines continuous across abdominal tergite VII; thoracic respiratory prominences never exceeding the anterior margin by more than 0.1 mm *Leucotabanus* Lutz

Disagreeing with 2 or more of the preceding 11

11. Abdominal fringes biseriate, those of anterior series of approximately equal length dorsally on all segments and/or stouter than adjacent posterior spines *Hybomitra* Enderlein

Spines of anterior series increasing in length posteriorly and of same or smaller diameter than adjacent posterior spines

. *Tabanus* Linnaeus, *Whitneyomyia*

Bequaert

--Adults--

1. Hind tibia with a pair of apical spurs, sometimes small and hard to see; often with ocelli; no setae on basicosta 2

Hind tibia lacking apical spurs; never with ocelli;

- basicosta setose or not (Subfamily Tabaninae) 9
2. Third segment of antenna composed of 8 annuli, or composed of a basal plate and 2 or 3 annuli together with the frons being entirely pollinose and without a basal callus (Subfamily Pangoniinae) 3
- Third antennal segment composed of a distinct basal plate and 4 or fewer annuli and frons with a distinct basal callus (Subfamily Chrysopsinae) 6
3. Eye of the female with upper inner angle strongly acute; frons broader than width of eye and non-pollinose over middle third; wing darkly patterned over anterior half *Goniops* Aldrich
- Eye of female with upper inner angle much less acute (angle 80-90°); frons narrower than width of eye and uniformly pollinose; wing either hyaline (with possible exception of costal cell) or if darkly patterned third segment of antenna composed of basal plate and 2 or 3 annuli 4
4. Third antennal segment composed of a basal plate and 2 or 3 annuli; frons pollinose, without basal callus *Asaphomyia* Stone
- Third antennal segment composed of 7 or 8 annuli 5
5. Cell r_5 of wing closed at or before margin *Esenbeckia* Rondani
- Cell r_5 of wing open *Apatolestes* Williston
6. Basal plate of third antennal segment with 2 or 3 terminal annuli; large species, 17 - 23 mm in length, with abdomen dorsally bearing a large white patch indented above on 4th tergite and two white spots on both 5th and 6th tergites; hind tibial spurs very small *Merycomyia* Hine
- Basal plate of third antennal segment with 4 terminal annuli; smaller species (under 12 mm) with distinct contrasting pattern on one or more of thorax, abdomen or wings; hind tibial spurs large 7
7. Wing with evident spots on crossveins and elsewhere, never entirely hyaline and always lacking a crossband near middle; eye in life irregularly spotted *Silvius* Meigen
- Wing never spotted, either with evident, but sometimes very pale crossband near middle, or evenly fumose, or hyaline; eye in life with characteristic pattern of spots and bands 8
8. Wing evenly fumose; abdomen globose, yellow with two rows of dark spots *Neochrysops* Walton
- Wing with distinct crossband or remnants thereof, or if crossband absent (i.e., wing hyaline), abdomen is entirely black, or yellow and black, the black not forming two rows of spots *Chrysops* Meigen
9. Scape considerably longer than broad; frons of female widened below, broader than high, with a velvety black spot on each side at angle made by eye and subcallus; third antennal segment with three annuli; wing (Figure 56, p. 74) with lacelike color pattern (Tribe Haematopotini) *Haematopota* Meigen
- Scape about as broad as long; frons of female not broader than high and without velvety black spots; third antennal segment with four annuli; wing pattern, if any, otherwise . . . 10
10. Basicosta bare or nearly so (Tribe Diachlorini) 11
- Basicosta setose, setae as numerous as on adjacent area of costa (Tribe Tabanini) 14
11. Callosity absent from frons of female; body compact, almost uniformly greenish-yellow *Chlorotabanus* Lutz
- Callosity present; body not greenish-yellow . . 12
12. Frons narrow, more than 6 times as high as wide basally; basal callus small, more or less oval, higher than wide; median callus a narrow line; wing (Figure 55, p. 71) dark apically; fore tibia swollen *Diachlorus* Osten Sacken
- Frons rather broad, distinctly less than 6 times as high as wide basally; basal callus rather large, wider than high, usually quadrate; median callus variable; wings hyaline, without apical pattern; fore tibiae not swollen 13
13. Spur vein usually at bifurcation of vein R_{4+5} ; annuli of third antennal segment not noticeably hairy; median callus either a weakly developed narrow line or spot, or a distinct but very irregularly shaped area *Stenotabanus* Lutz
- Wing venation normal, no spur vein at bifurcation of vein R_{4+5} ; annuli of third antennal segment usually decidedly hairy; median callus well-developed, cleanly demarcated, lanceolate or elongate oval *Anacimas* Enderlein
14. Subcallus very swollen, protruding, shiny black; genae denuded and black; wings and body predominantly black; length less than 16 mm *Whitneyomyia* Bequaert
- Disagreeing with two or more of the first three characters, or length exceeds 19 mm (see *Tabanus atratus*) 15
15. Basal plate of third antennal segment with a dorsal, forward projecting, hook-like process above the annuli; eyes pilose; bifurcation of vein R_{4+5} and crossveins margined with brown;

- abdomen above pale laterally, with a distinct median longitudinal black stripe, paler to sides ***Agkistrocerus Philip***
- Basal plate of third antennal segment without such a process, or, if such a process is present, eyes non-pilose and one or both of the other characters disagree **16**
16. Vertex with a distinct ocellar tubercle in female, male with vertex usually raised and non-pollinose; eyes generally pilose if tubercle indistinct **17**
- Vertex lacking ocellar tubercle (except *Tabanus pungens* which differs from all Texas *Hybomitra* and *Leucotabanus* by having a middorsal pale stripe of narrow, connected triangles in the center of a distinct median dark blackish stripe on each side of which is a pale midlateral stripe); if vertex raised in male it is pollinose **18**
17. Eye bare; frons narrow, callosity long and narrow, widely separated from eyes; scutellum pale grayish to yellowish-white; male with thorax and abdomen covered by dense white hairs ***Leucotabanus Lutz***
- Eye usually distinctly pilose; frons of variable width; frontal callosity with its basal portion distinctly set off from the median portion and as wide or nearly as wide as frons basally; male not as above . . . ***Hybomitra Enderlein***
18. Eyes pilose, in life with a single diagonal purple to bluish band; frons at least partially denuded and shiny at vertex, but lacking an ocellar tubercle; basal plate of third antennal segment with an evident dorsal tooth that may extend forward to near the first annulus; abdomen dorsally with both median and sublateral pale spots on most segments
- ***Hamatabanus Philip***
- Small to large species species with bare or pilose eyes, but, if pilose, disagreeing with at least one of the other characters; small to large species ***Tabanus Linnaeus***

SUBFAMILY PANGONIINAE

Only two tribes of the subfamily Pangoniinae, Pangoniini and Scionini, are represented in the Nearctic fauna. Three genera of the Pangoniini are known to occur in Texas, and the single Nearctic species of Scionini may be present in Texas as it is known to occur in western Arkansas.

TRIBE PANGONIINI

Seven species of Pangoniini are known from Texas, including two species of *Apatolestes* Williston, one species of *Asaphomyia* Philip, and four species of *Esenbeckia* Rondani. These species have neither been frequently collected in Texas, nor taken in large numbers. None is considered to be a pest species, and it is possible that the females of one or more do not feed on blood.

GENUS APATOLESTES WILLISTON

Apatolestes Williston 1885: 12. Type-species, *comastes* Williston (monotypic)

The genus *Apatolestes* is restricted to the southwestern United States and northwestern Mexico. Its known eastern distributional limit is in western Texas where specimens of two species have been collected.

KEY TO THE SPECIES OF APATOLESTES OCCURRING IN TEXAS

1. Females (frons present) 2
Males (frons absent; eyes contiguous) 3
2. Genae with denuded shiny area; lower margin of basal callus lacking a median vertical encroachment of pollinosity from the subcallus *philipi* Pechuman
Genae lacking shiny areas; lower margin of basal callus with a median vertical pollinose encroachment from the subcallus
. *aitkeni* Philip
3. Genae with denuded area; frontal triangle shiny, denuded, non-pollinose
. *philipi* Pechuman
Genae without denuded area; frontal triangle pollinose, not denuded and shiny
. *aitkeni* Philip

Apatolestes aitkeni Philip

Apatolestes aitkeni Philip 1941a: 191.

Medium size (10.5 mm); frons broad, the basal callus shiny brown to black and protuberant, encroached upon medially by vertical extension of pollinosity from subcallus; scape and pedicel of antenna grayish pollinose, flagellum black; wings hyaline. Male with frontal triangle pollinose; otherwise similar to female.

Comments. This species is known from New Mexico, Texas and Arizona. The immature stages are not known.



Map 3. Counties of Collection: *Apatolestes aitkeni*.

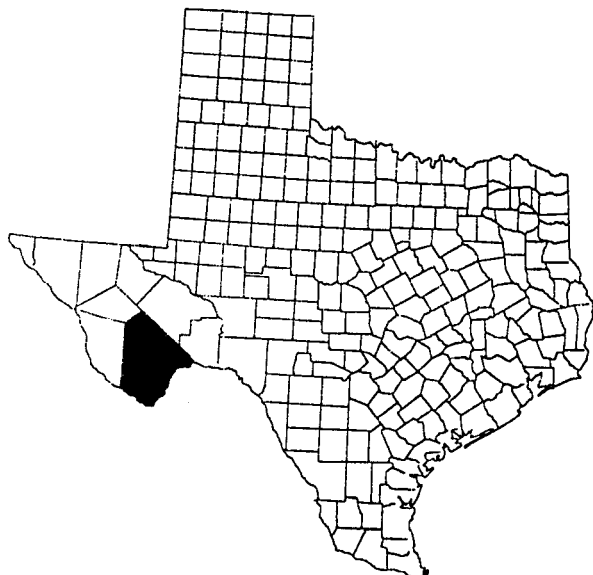
Known distribution (Map 3): BREWSTER: Big Bend Nat Pk, Green Gulch; 17 Apr 1970; 5300 ft; LLP. 6.5 mi. SW Grapevine Hills Ranch; LLP.

Apatolestes philipi Pechuman

Apatolestes philipi Pechuman 1985: 361.

Medium size (10 mm); frons a little more than twice as high as wide at base, narrowed above to half basal width; basal callus protuberant, shining dark brown, reaching eye margin, broadly connected to a similarly colored wide median callus; wing tinted brown, more heavily in costal cell and along veins. Male with denuded frontal triangle; otherwise similar to female.

Comments: The original description was based on Texas specimens. It is also known from New Mexico and northern Mexico. The immature stages are not known.



Map 4. Counties of Collection: *Apatolestes philipi*.

Known Distribution (Map 4): BREWSTER: Santa Elena Canyon, Big Bend Nat Pk, 2100 ft; 5 May 1959; J.C. McAlpine; CNC. Oak Spring, Big Bend Nat Pk, 4000 ft; 8 May 1959; Howard & Buhr; CNC. Dugout Wells, Big Bend Nat Pk, 3000 ft; 13 May 1959, J.C. McAlpine (**holotype** and **allotype**); CNC. Panther Junction, Big Bend Nat Pk, 3500-4000 ft; 16 May 1959; W.R. Mason; CNC. **PRESIDEO:** Presideo; 4 May 1979; W.F. Chamberlain; TAMU.

GENUS ASAPHOMYIA STONE

Asaphomyia Stone 1953a: 256. Type-species, *texensis* Stone (type by original designation)

Two species of this Nearctic genus, one from Texas and one from Florida, are recognized. Nothing is known of the biology of either. The Florida species is known from a single locality. The Texas species is known from four counties, all in southern Texas. It has not been collected since 1970.

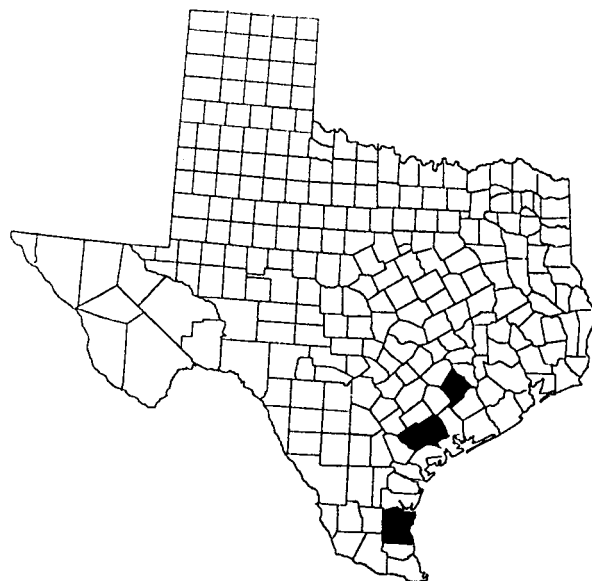
Asaphomyia texensis Stone

Asaphomyia texensis Stone 1953a: 256.

Small (8 mm); more or less uniformly dark brown with some tinges of gray on thorax and abdomen; frons about 1½ times as high as wide basally, somewhat

convergent above; three prominent ocelli present; scape and pedicel of antenna short, third segment with three subdivisions, the first short and stout, second and third slender with latter much longer than former; wings brown, a little darker along anterior border, spur vein present at bifurcation of vein R_{4+5} . Male with distinctly differentiated areas of large and small facets; ocelli on an evident tubercle; abdomen tapered; coloration essentially as in female.

Comments: This species is known only from Texas and has apparently been collected only once since being described. The immature stages are not known.



Map 5. Counties of Collection: *Asaphomyia texensis*

Known Distribution (Map 5): COLORADO: Columbus; female **holotype**; USNM. **GOLIAD:** Weser; 11 May 1952; Cazier, Gertschs & Schrammel; 2 male, 2 female **paratypes**; 1 CU, 3 AMNH. **KENEDY:** 2 mi. S Armstrong; 8 Jun 1970; V.V. Board; FSCA. **VICTORIA:** Victoria, 3 May 1913; Mitchell & Coad; male **paratype**; USNM.

GENUS ESENBECKIA RONDANI

Esenbeckia Rondani 1863: 83, 95 (as *Esenbeckia*, p. 83)(1864: 83). Type-species, *Silvius vulpes* Wiedemann (type by original designation)

Esenbeckia, a New World genus, is primarily found in the Neotropical Region where more than 60 species in several subgenera are recognized. The ranges of four species extend northward into the United States, including Texas. Little is known of the biology of this genus,

especially in regard to the juvenile stages.

**KEY TO THE SPECIES OF
ESENBECKIA OCCURRING IN TEXAS**

1. Second and following abdominal tergites blackish with contrasting pale hind margins
 *tinkhami* Philip
 Abdominal tergites otherwise, either not blackish or those of the anterior half of abdomen decidedly paler than those of the posterior half 2
2. Posterior tergites blackish with contrasting pale hind margins; anterior 2 to 3 tergites paler, at least laterally, than posterior tergites; head of normal proportions, about as wide as thorax
 *incisuralis* (Say)
 Tergites not blackish, generally grayish brown, without sharply contrasting pale hind margins; head appears unusually small, evidently narrower than thorax 3
3. Antennae and palpi reddish; femora dark chocolate brownish, the two hind pairs with predominantly pale hairs; mesonotum, scutellum, base of the first tergite and an inverted median triangle on tergites 2-4 dull bluish gray *micheneri* Philip
 Antennae and palpi bright orange yellow; femora reddish, the hairs blackish; thorax, scutellum and abdomen concolorous . . . *delta* (Hine)

***Esenbeckia delta* (Hine)**

Pangonia delta Hine 1920: 313

Medium size (15 mm); frons and genae grayish white pollinose; antennae orange yellow; thorax pale grayish brown with whitish hairs; abdomen nearly uniformly grayish brown; wings faintly tinted, more obvious anteriorly; legs uniformly reddish brown with dark hairs.

Comments: This species has been infrequently collected from New Mexico, Arizona, Texas (Philip 1947, 1965) and northern Mexico. Burger (1977) discussed larvae thought to be this species. The larvae were terrestrial, collected from forest loam on a steep, well-drained hillside beneath an oak forest canopy. They were 3-6 inches below the surface.

Known Distribution (Map 6): CULBERSON: 3 Sep 1986; LLP.



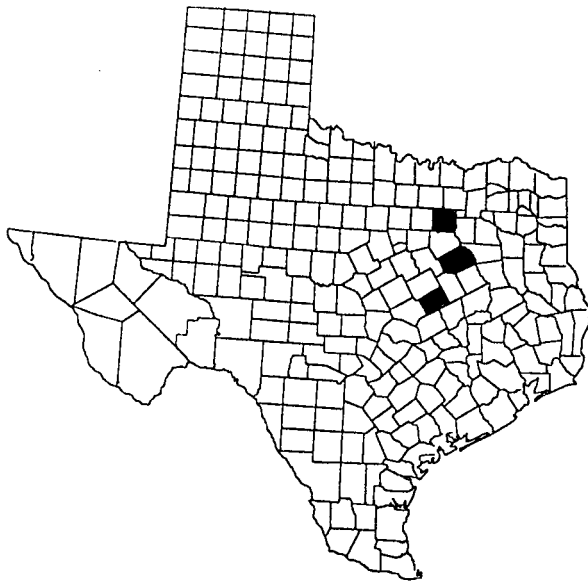
Map 6. Counties of Collection: *Esenbeckia delta*.

***Esenbeckia incisuralis* (Say)**

Pangonia incisuralis Say 1823: 31 (1859: 53)
Pangonia incisa Wiedemann 1828: 90
Ricardoia latiflagrum Enderlein 1925a: 291

Medium size (13 mm); frons about 5½ times as high as wide, narrower above, with a darker median area but no shiny basal callus, although there is a median shiny ridge on upper third to half; frons and face grayish pollinose; antennae and palpi yellowish; thorax dark brown, densely golden haired; legs predominantly yellowish, scarcely any brown on femora and tibiae; tergites brownish basally, more blackish posteriorly, with contrasting pale bands on posterior margins; first and second tergites with lateral fourths to thirds obviously yellowish; wing generally tinted yellowish brown throughout. Male generally like female, except abdomen of lighter color and legs almost entirely yellowish.

Comments: This species has been reported northward into Kansas and Oklahoma and southwesterly from Arizona, New Mexico and Texas (Brennan 1935; Philip 1947, 1965) into northern Mexico. Jones (1956) reported collecting larvae presumed to be this species from terrestrial locations in Oklahoma. None of the specimens were successfully reared to adults. Larvae were found in both loose and sandy soil and very compact clay in rolling, wooded terrain adjacent to gullies. The soil was covered by a thin coat of decaying leaves and other material. Only limited descriptive comments were provided. In addition to the distribution noted below, Brennan (1935) reports a collection at Gurley, Texas, 28 May 1905. Gurley is not shown on current state maps.



Map 7. Counties of Collection: *Esenbeckia incisuralis*.

Known Distribution (Map 7): DALLAS: Dallas; 13 June 1938; TAMU. FALLS: specific locality illegible; 28 May 1905; H. C. Morgan, male, CU. NAVARRO: Corsicana; 4 June 1935; TAMU.

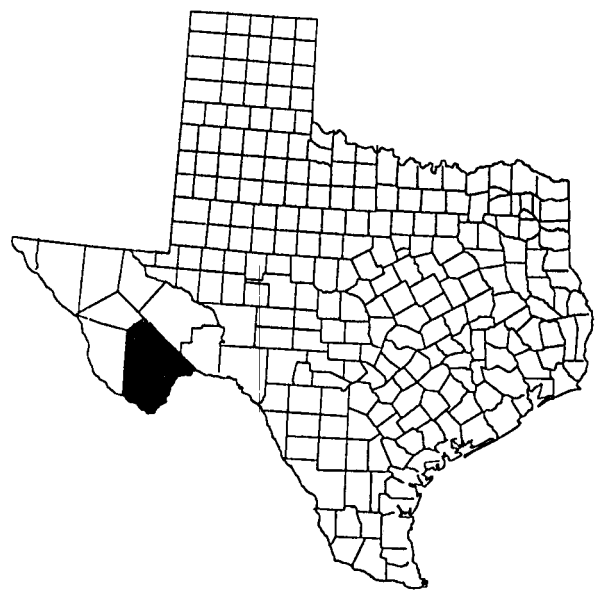
***Esenbeckia micheneri* Philip**

Esenbeckia micheneri Philip 1954: 48

Medium size (15 mm); frons grayish pollinose, genae more whitish pollinose; antennae and palpi dull reddish; thorax, first tergite and median areas of tergites 2 to 4 bluish gray, remainder of abdominal dorsum grayish brown; femora dark chocolate brown, remainder of legs reddish; wings very faintly tinted pale brown, costal cell pale yellow.

Comments: This species is known from northern Mexico and extreme southwest Texas (Philip 1954). The immature stages are not known.

Known Distribution (Map 8): BREWSTER: Big Bend Nat Pk; 30 Jul 1956; E. G. Matthews; CU. Chisos Mts; 30 Jun 1957; Knull; OHSU. Green Gulch, Big Bend Nat Pk, 5,700 ft; 4 Aug 1968; J.E. Hafernik; TAMU. South Trail, Chisos Mts, Big Bend Nat Pk, 6,700-7,200 ft; 16 Aug 1968; J.E. Hafernik; TAMU. Green Gulch, Big Bend Nat Pk; 14 Aug 1969; Board & Hafernik; TAMU. Lost Mine Trail, Big Bend Nat Pk; 4 Jul 1972; R. L. Berry; ODH.



Map 8. Counties of Collection: *Esenbeckia micheneri*.

***Esenbeckia tinkhami* Philip**

Esenbeckia tinkhami Philip 1954: 50 (as subsp. of *incisuralis*)

This species is superficially very similar to *E. incisuralis* treated earlier. In addition to differences noted in the keys to species, it differs from *E. incisuralis* as follows: hairs of thorax more grayish than grayish yellow or golden; femora and tibiae predominantly brownish; abdominal tergites predominantly blackish with sharply contrasting pale posterior bands and virtually no indications of yellowish laterally on basal tergites; wing with tinting obvious only in anterior third of wing. Male with much paler abdomen, second and third tergites yellowish brown, second and sometimes third tergites with median inverted dark brown triangle arising from anterior margin, these not reaching posterior margins; otherwise similar to female.

Comments: This species has been reported from Colorado southward into Texas (Philip 1954, 1960, 1965) and New Mexico. The immatures are not known.

Known Distribution (Map 9): BREWSTER: 6 mi NW Boquillas; 20 Oct 1946; E.R. Tinkham; CBP. JEFF DAVIS: Davis Mts; 20 Sep 1938; Knull; female **topotype**; LLP. Frager; Apr; LLP. 15 mi W Ft Davis; 23 Aug 1969; Board & Hafernik; TAMU. 15 mi NW Ft Davis on Hwy 17, 4700 ft; 11 Sep 1971; K. W. Brown; PMNH.



Map 9. Counties of Collection: *Esenbeckia tinkhami*.

length ranges from 10 to 15 mm, but reared specimens are sometimes no more than 8 mm in length. Although, this species has not been collected in Texas, records from western Arkansas suggest that it may eventually be found in at least the extreme northeastern counties of Texas.

TRIBE SCIONINI

GENUS *GONIOPS* ALDRICH

Goniops Aldrich, 1892: 236. Type-species, *hippoboscoides* Aldrich (monotypic) = *chrysocoma* Osten Sacken.

The genus *Goniops* is monotypic. In addition to the characters used in the generic key, the eyes are holoptic in male and dichoptic in female, the vertex is broad and divergent toward antennae, the palpi are about three-fourths or more of the length of proboscis and the first posterior cell of the wing is broadly open.

Goniops chrysocoma (Osten Sacken)

Pangonia chrysocoma Osten Sacken 1875: 368
Goniops hippoboscoides Aldrich, 1892: 237.

Stout species (8 to 15 mm); body predominantly yellowish to rather dark brown, in darker forms hind margins of abdominal tergites decidedly yellowish; wings with dark pattern, more pronounced on anterior half; males typically brownish with yellowish hind margins on abdominal tergites.

Comments: The stout body and strong infuscation of the anterior one-half of the wings together with the key characters should prevent confusion of this species with any other found in Texas. In field-collected adults the

SUBFAMILY CHRYSOPSINAE

Only two tribes of the subfamily Chrysopsinae are represented in the Nearctic fauna. One, Chrysopsini, is very well represented in Texas, whereas the other, Bouvieromyiini, includes only two Nearctic species, one of which may occur in Texas. Species of two genera, *Silvius* Meigen and *Chrysops* Meigen, of the Chrysopsini are known to occur in Texas, and species of two additional genera, *Assipala* Philip and *Neochrysops* Walton, may occur.

TRIBE BOUVIEROMYIINI

GENUS *MERYCOMYIA* HINE

Merycomyia Hine, 1912: 515. Type-species, *geminata* Hine (type by original designation) = *whitneyi* (Johnson).

In addition to the characters used in the generic key, the eyes are holoptic in the male and dichoptic in the female, ocelli are present and the adults have a distinct *Tabanus*-like appearance. The females are not known to feed on blood. Only two species are currently recognized. One, *M. microcera* (Walker), known only from Florida and southern Georgia, is not considered further herein.

Merycomyia whitneyi (Johnson)

Tabanus whitneyi Johnson 1904: 15

Merycomyia geminata Hine 1912: 515

Merycomyia mixta Hine 1912: 516

Large (17 to 23 mm); brownish; abdomen with a large white middorsal patch indented anteriorly on fourth tergite, and two white spots on fifth and often sixth tergites, whole white area resembling letter "H"; wing with considerable brown infuscation, sometimes darker anteriorly, at base and alongside wing veins, but often involving entire wing except for paler streaks in posterior cells (r_5 , m_1 - m_3 , cua_1), cell r_{2+3} and apical portion of cell r_4 ; costal cell yellowish brown. Male, except for sexual differences, similar to female.

Comments: This species has not been collected in Texas, nor in any adjacent state. However, probably fewer than 30 adult specimens have been collected in the field. Adults have been captured from Florida to Ontario, and from several east coast states and the western one-third of Tennessee. Never has more than one adult been

captured on a single day. Larvae have been collected at several locations, usually only one to a few specimens at a particular site. In Florida, however, the larvae are collected commercially and sold as bass bait. The senior author, and others (Philip *et al.* 1973), have seen between 600 and 1,000 more or less fully grown larvae in Florida bait shops on various occasions. The wide range of the species and the infrequency of its collection in the adult stage preclude its elimination as a possible component of the Texas fauna.

TRIBE CHRYSOPSINI

Species of Chrysopsini occurring or possibly occurring in Texas are all small (less than 12 mm in length) in comparison to most other Tabanidae. However, in the brief descriptions of the species which follow, species of Chrysopsini are described as small if 7 mm or less in length, moderate if averaging between 7 and 9 mm, and large if averaging over 9 mm in length.

GENUS *SILVIUS* MEIGEN

Silvius Meigen 1826: 27. Type-species, *Tabanus vituli* Fabricius (monotypic)

This genus is mainly Holarctic in distribution. It is represented in the Nearctic fauna by one or more species in each of four subgenera. Five species are known to occur in Texas, and one other is thought to possibly occur here. These taxa represent two of the Nearctic subgenera. The characters used in the generic key are sufficient to distinguish the genus from others of the Texas fauna.

KEY TO THE SPECIES OF *SILVIUS* MEIGEN OCCURRING OR POSSIBLY OCCURRING IN TEXAS

1. Third antennal segment shorter than either of the two basal segments (Subgenus *Assipala*) *ceras* (Townsend)
Third antennal segment longer than two basal segments combined (Subgenus *Griseosilvius*) 2
2. Three to five veins (R_{2+3} , R_4 and one or more of the following: R_5 and M_1 and M_2) with subapical spots 3

Subgenus *Griseosilvius* Philip

- Vein R_{2+3} with an apical spot; remainder of above veins lacking subapical and apical spots **4**
3. Vein CuA_1 with a distinct dark spot in basal $\frac{1}{3}$, or entire basal $\frac{1}{3}$ of this vein infuscated; median $\frac{1}{2}$ of vein R_{4+5} before bifurcation of R_{4+5} covered by elongate spot ***gibsoni* Philip**
- Vein CuA_1 lacking an isolated spot and never infuscated over more than basal $\frac{1}{4}$; spot near middle of vein R_{4+5} only about $\frac{1}{4}$ length of vein before bifurcation of R_{4+5} ***quadrivittatus* (Say)**
4. Entire anterior margin of wing, including costal and subcostal cells, deeply infuscated to wing tip; wing spots large, extending along longitudinal veins away from crossveins, especially along anterior border of discal cell ***sayi* Brennan**
- Costal cell not infuscated; wing spots small and limited to crossveins and tip of vein R_{2+3} **5**
5. Frontal callus one-half or more width of frons; body grayish with obscure dark spots ***pollinosus* Williston**
- Frontal callus distinctly less than one-half width of frons; body yellowish . . . ***jeanae* Pechuman**

Subgenus *Assipala* Philip

Assipala Philip 1941b: 4, 9 (as genus). Type-species, *Chrysops tanycerus* Osten Sacken (type by original designation)

***Silvius (Assipala) ceras* (Townsend)**

Silvius (Assipala) ceras (Townsend) 1897: 38

Moderate to large (9 mm); frontal callus brown, diamond-shaped but with sides outwardly rounded, wider than high; frontoclypeus yellowish, somewhat grayish pollinose, sides yellow to brown and non-pollinose; thorax pale brown with a median pair of widely separated yellowish lines which do not reach scutellum; abdomen dark brown, tergites with yellowish hind margins which expand on midline to form pale triangles which do not attain anterior margins of tergites; wings with normal venation, hyaline, with brownish spots at bifurcation of vein R_{4+5} and on crossveins and a little brownish tinge in vicinity of stigma. Male similar to female.

Comments: This species has not yet been collected in Texas. It has been collected in northern Mexico and southern New Mexico in habitat similar to that found in southwestern Texas. Nothing is known of its biology.

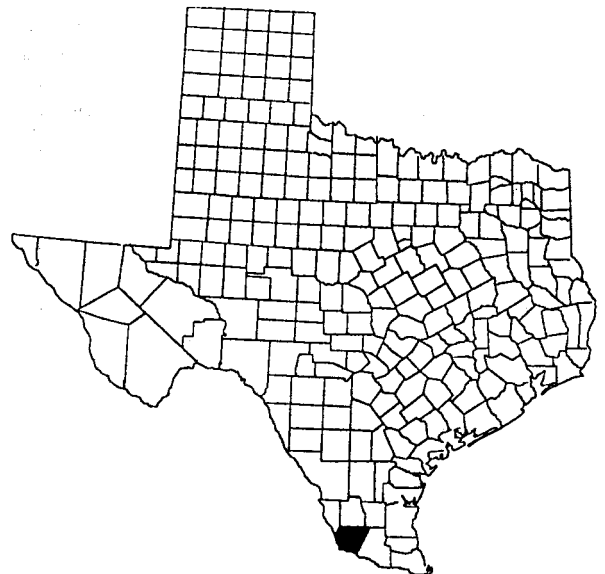
Silvius, subgenus *Griseosilvius* Philip 1961b: 235.
Type-species, *Chrysops quadrivittatus* Say (type by original designation)

***Silvius (Griseosilvius) gibsoni* Philip**

Silvius (Griseosilvius) gibsoni Philip 1958: 182

Moderate (8 mm); slender, grayish; frons higher than wide, brown, pollinose on area between and around ocelli; frontal callus blackish, a little taller than broad, shield-shaped with upper end pointed; thorax grayish with four dull, darker lines; abdomen with four rows of large blackish dashes or spots on tergites, except tergite 2 where sublateral spots are not present; wing (Figure 7, p. 37) smoky, especially beyond and below stigma; spots along veins prominent, sometimes without submarginal spots on veins R_5 and M_2 ; mesal spot on vein R_{4+5} nearly as long as stigma; a large spot present on basal $\frac{1}{3}$ of vein CuA_1 , or basal $\frac{1}{3}$ of this vein entirely infuscated. Male similar to female.

Comments: Various authors in the past have separated this species from *S. quadrivittatus* based on absence of subapical spots from some of the longitudinal veins. However, we have seen specimens of both species with one or more subapical spots absent requiring us to rely on the characters noted in the key to separate the two species. The immature stages are not known.



Map 10. Counties of Collection: *Silvius gibsoni*

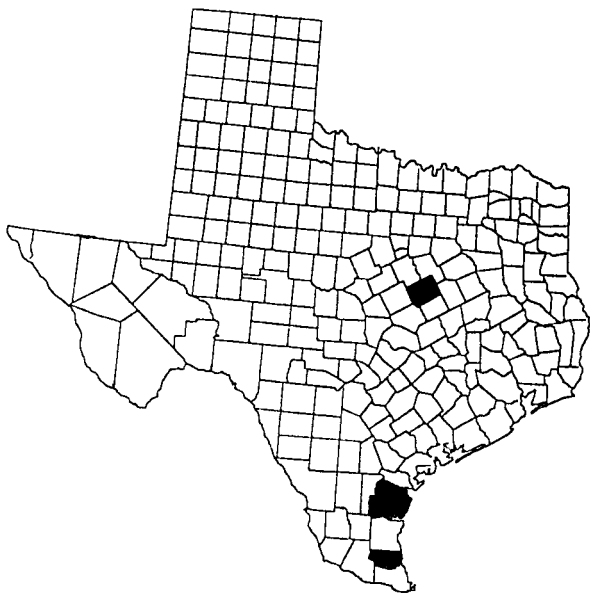
Known Distribution (Map 10): STARR: Los Almos Cr at El Sauz; 11 Jun 1975; R. Turnbow; UGA. Arroyo Minita at Rt 83; 11 Jun 1975; R. Turnbow; UGA. 4-15 mi N Roma; 12 Jun 1975; C.L. Smith; UGA.

Silvius (Griseosilvius) jeanae Pechuman

Silvius (Griseosilvius) jeanae Pechuman 1960: 793

Moderate to large (9.5 mm); yellowish with obscure to moderately distinct dark markings; frontal callus black, distinctly less than half width of frons at vertex; thorax and abdomen yellowish, the latter with obscure to moderately distinct dark spots often evident dorsally; wing (Figure 8, p. 37) hyaline, except for pale marginal infuscation and large brown spots at bifurcation of vein R₄₊₅ and on crossveins; no submarginal spots on veins R₄, R₅, M₁ and M₂. Male similar to female.

Comments: Although described as a subspecies of *S. pollinosus*, the two forms have overlapping ranges and do not meet the criteria for subspecies. Because the differences used to separate the two forms have proved consistent throughout their ranges, the authors have elected to treat each as separate species. *Silvius jeanae* has been reported from the southwestern United States from Texas (Pechuman 1960, Philip 1965) to California. The immature stages are not known.



Map 10. Counties of Collection: *Silvius jeanae*.

Known Distribution (Map 11): KLEBERG: Malaquite Beach; 19 Aug 1971; L.L. Pechuman; LLP. Drum Pt N of Loyola Beach; 18 Aug 1971; P.H. Thompson; TAMU. MCCLENNAN: Waco; 14 Jul 1949; TAMU. NUECES: 4 May 1945; F. R. Duckmore; **Topotype**; USNM. WILLACY: Pt Mansfield; 10 Oct 1970; C.G. Gaumer & R.R. Murray; TAMU.

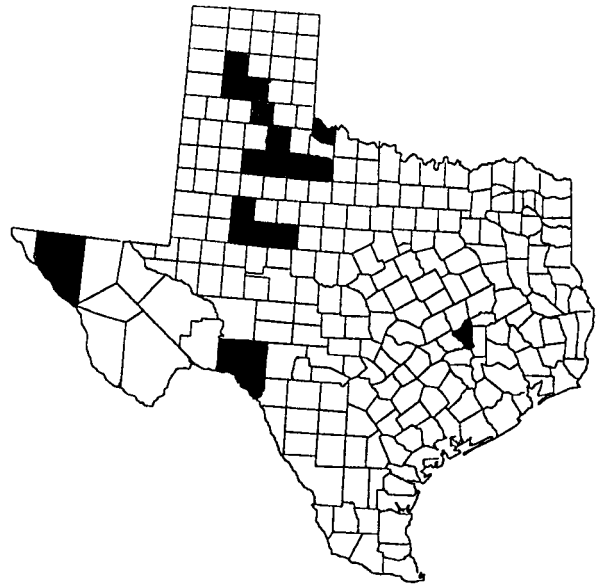
Silvius (Griseosilvius) pollinosus Williston

Silvius (Griseosilvius) pollinosus Williston 1880:
244

Moderate to large (9.5 mm); gray with obscure dark

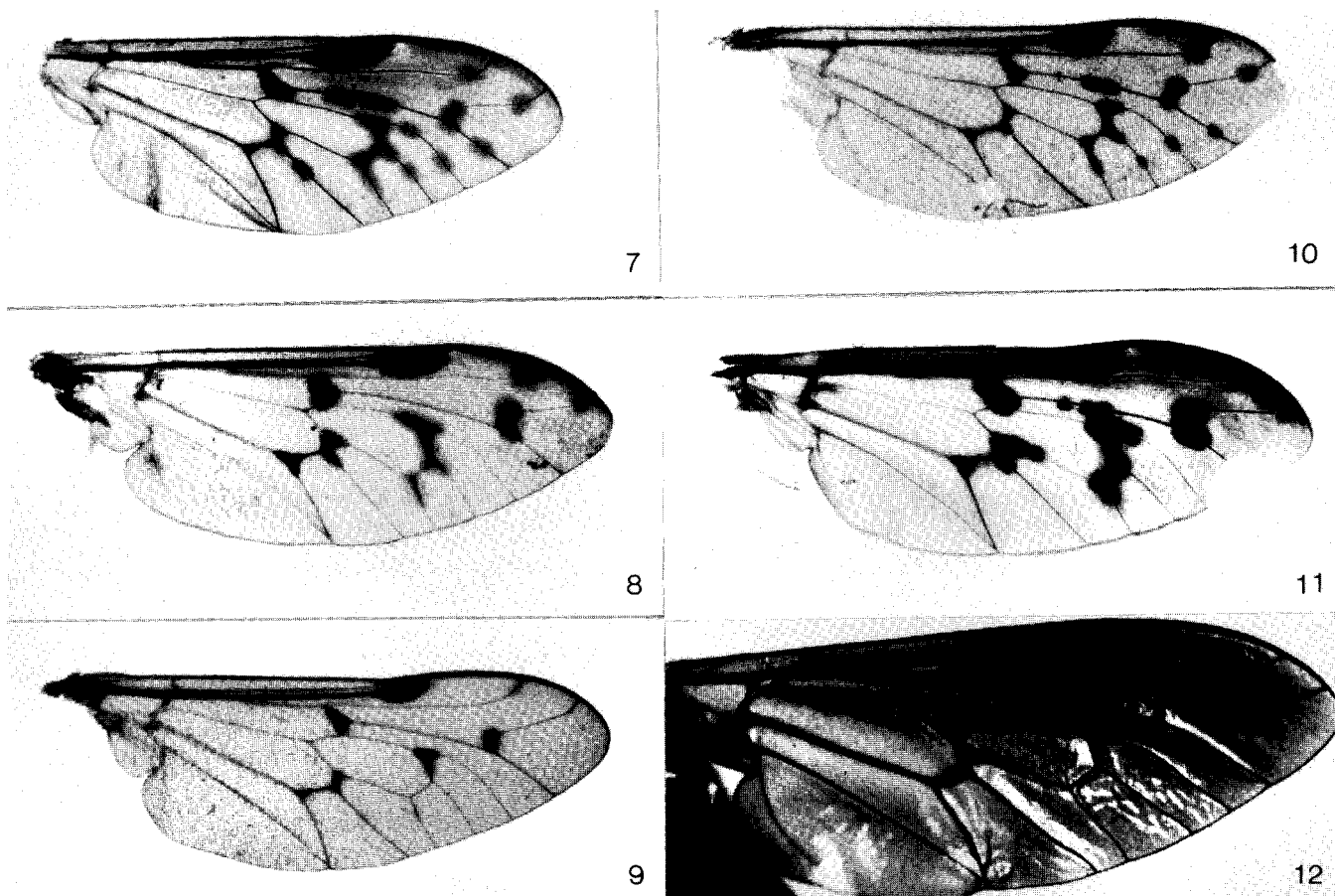
spots; frontal callus black, oval, about half width of frons at vertex; thorax and abdomen gray, the latter with obscure dark spots sometimes evident; wing (Figure 9, p. 37) hyaline, stigma brown, with brown spots at bifurcation of vein R₄₊₅ and crossveins but submarginal spots absent from veins R₄, R₅, M₁ and M₂. Male darker, abdominal spots more distinct; base of abdomen yellowish laterally; wing like female.

Comments: This species has been collected as far north as South Dakota and southward to Texas (Philip 1965) and westward to California (see also comments on *S. jeanae* above). The immature stages are not known.



Map 11. Counties of collection: *Silvius pollinosus*.

Known Distribution (Map 11): ARMSTRONG: Palo Duro; 28 May 1969; J. & J. Tenorio; TTU. Palo Duro Canyon; 1-2 Jul 93; A.W. Hook; UTAU. 2 mi N Tx 285; 28 Jun 1979; D. Sanders; TTU. 1 mi N Wayside; 24 Jul 1986; F.E. French; GSU. BORDEN: 27 Jun 1979; D. Sanders; TTU. BRAZOS: College Station; 7 May 1947; H.J. Reinhard; TAMU. BRISCOE: 18 Jun 1979; C.W. O'Brien; TTU. CROSBY: 8, 27, 29 Jun, 6 Jul 1979; D. Sanders; TTU. DICKENS: Pitchfork Ranch; 25 May 1978; S.G. Davis; TTU. 9, 15, 21, 23 Jun 1978; S.G. Davis; TTU. 8, 20, 25, 29 May 1979; D. Sanders; TTU. FLOYD: 20 Jun 1979; D. Sanders; TTU. HALL: 10 Jun 1966; D.D. Collins; TTU. 20 Jun 1979; D. Sanders; TTU. HARDEMAN: Sites 1, 2, 5, 7, 8, 9, & 10, Medicine Mounds Ranch; 14, 15 May 1995, 23, 24 Jun 1995; W.D. Sissom; ASU. HOWARD: Big Spr; 7 May 1975; D.E. Foster; TTU. HUDSPETH: 7 mi NE Dell City; 31 Jul 1950; AMNH. KING: 16 Jun 1978; J.K. Wangberg; TTU. J.Y. Ranch; 8 Jun 1979; D. Sanders; TTU. 13, 15, 22 Jun 1979; D. Sanders; TTU. YJ Ranch, Guthrie; 22 Jul 1982; S.R. Kingston; TTU. KNOX: Knox City; 19 May 1947; J.F. Varnell; TAMU. KENDALL: Boerne; 16 Jun 1987; N.E. Strenth; ASU. MITCHELL: Colorado City; 31 May 1964; C.R. Ward; TTU. MOTLEY: 20 Jun 1979; D. Sanders; TTU. NOLAN: Wright Ranch; 2, 23 Aug 1982; S.K. Kingston; TTU. POTTER: 1 Jun 1971; C.W. O'Brien; TTU. PRESIDEO: 25 mi SE Marfa, 18 Jul 1977; D. Bryant; ASU. RANDALL: Palo Duro Canyon St Pk; 14 May 1961; L.M. Morton; LACM. Palo Duro St Pk; 11 Aug 1965; J.C. Schaffner; TAMU. Canyon; 1 Jul 1967; F. Newton; GSU & WTAM. Palo Duro Canyon; 22 Sep 1968; C. D. Schmidt; TTU. Palo Duro St Pk; 22 Jun 1976;



Figures 7-12. Wings of *Silvius* and *Neochrysopterus*: 7 - *S. gibsoni*; 8 - *S. jeanae*; 9 - *S. pollinosus*; 10 - *S. quadrivittatus*; 11 - *S. sayi*; 12 - *N. globosus*.

B.O'Conner; CU (alcohol collection). Palo Duro St Pk; 3 Jun 1980; M. O'Brien; SYR. VAL VERDE: Comstock; 20 Sep 1969; K. Pitts; TTU.

Silvius (Griseosilvius) quadrivittatus (Say)

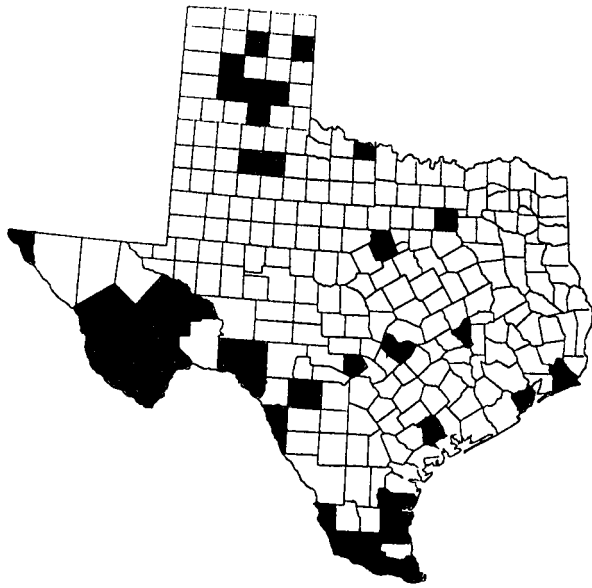
Chrysopterus quadrivittatus Say 1823: 33 (1859: 54)

Moderate (8.5 mm); yellowish gray to gray with dark spots; frontal callus black, about half width of frons at vertex; thorax yellowish gray pollinose with brown stripes; abdomen yellowish gray to gray pollinose with four rows of black spots in vittate pattern; wing (Figure 10, p. 37) hyaline, stigma brown, with distinct brown spots including submarginal ones on veins R_{2+3} , R_4 , R_5 , M_1 and M_2 and a large spot at apex of discal cell which crosses into base of cell r_5 . Male a little more yellow than female but with essentially same pattern.

Comments: Two forms of this species (*texanus* and *quadrivittatus*) have been recognized. The former differs from the latter as follows: costal cell and apical margin of wing faintly to moderately infuscated; mesal clouds of infuscation in r_{2+3} and r_5 ; wing membrane with yellowish tint. The latter form has been collected from

northern Mexico and in the U. S. from southern California eastward into western Mississippi and in narrowing distribution into eastern Montana and western North Dakota. The *texanus* form has been collected from throughout the western three-fourths or more of the range of the *quadrivittatus* form. Published reports of Texas collections have been made by Brennan (1935), Philip (1947, 1965), Thompson (1974a, 1977), and Thompson *et al.* (1977). Burger (1977) reported collecting larvae of the *quadrivittatus* form from damp sandy and silty substrate at the margins of permanent streams. The senior author has collected larvae in similar areas. The extent of overlap in the ranges of the two forms precludes recognition as subspecies. Hence, they are treated herein as a single species. However, the Texas distributions of the two forms are presented separately because it is possible that the two forms represent separate species. Discovery of the immature stages and larval habitats of the *texanus* form may help resolve the matter.

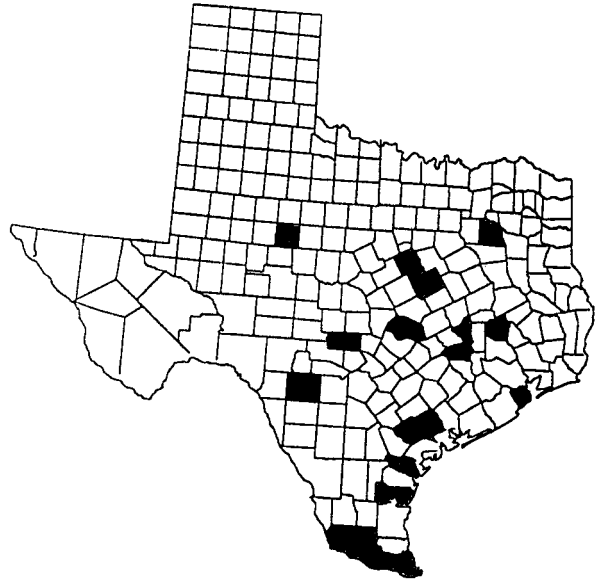
Known Distribution (Map 12): *Silvius quadrivittatus* (*quadrivittatus* form) ARMSTRONG: 28 May 1969; J. & J. Tenorio; TTU. BRAZOS: College Station; 24 Apr 1931, Jul 1932, 4 May 1934,



Map 12. Counties of collection: *Silvius quadrivittatus* (*quadrivittatus* form)

7, 16, 25 May 1935; H.J. Reinhard; **Paratypes**; TAMU. Mile Dr, S College Station; 19 Sep 1970, 20 May 1973, 5 Jul 1973, 15 Aug 1975, 28 Jun 1978; P.H. Thompson; TAMU. College Station; 29 May 1973, 9 Jun 1973, 16 May 1974, 21 Aug 1974; R.R. Blume; TAMU. Jones Rd 1.6 mi N HW 60; 1 Jun 1975; S.J. Merritt; TAMU. **BREWSTER**: 1 mi W Lajitas; 23-30 Apr 1963; H.E. Evans; CU. **BRISCOE**: 18 Jun 1970; C.W. O'Brien; TTU. **CAMERON**: Santa Rosa; 3 June; E.A. Schwarz; USNM. Brownsville; 16 Jul 1921; R.H. Painter; USNM. Padre Is; 4-7 May 1964; L.L. Pechuman; CU. **CROSBY**: 5 mi E Crosbyton; 2 Jul 1974; D.J. Shetler; FDF. **DALLAS**: Farmers Branch; 3 Jul 1938; F.C. Bishopp; USNM. **DICKENS**: 9 Jul 1970; C.W. O'Brien; at light; TTU. **DONLEY**: Lake McClellan; 28 Jul 1972; G. Eichwort; CU. **EL PASO**: El Paso; 24 Jul 1935; USNM. 18 Jul 1933; J.W. Brennan; TAMU. **ERATH**: 3 mi W Bluffdale, bank of Paluxy R; 29 Jul - 4 Aug 1976; malaise trap; R.L. Sams; TAMU. **GALVESTON**: Galveston Is; 8 Sep; F.M. Hull; TAMU. May; F.H. Snow; 10 Jun 1917; J.M. Aldernik; USNM. Galveston; 1961; A.L. Melandy; USNM. Galveston; 22 Apr 1967; J.L.M. III; UNT. **HEMPHILL**: 25 Jul 1969; D. Ashdown, Tenorios, Oakes & Richardson; TTU. 23 Jun 1970; C.W. O'Brien; TTU. 24 Jun 1970; L. & C.W. O'Brien and D. Ashdown; TTU. **HIDALGO**: Donna; 6 Oct. 1967; Florida. **HUTCHINSON**: Borger; 17 Jul 1967; M. Sweigest; GSU. **JEFF DAVIS**: 21 Jun 1967; J.W. Tilder; S.J. **JEFFERSON**: Port Arthur; 12 Oct 1957; USNM. **KENDALL**: Boerne; 2 Aug 1987; N.E. Strenth; ASU. **KENEDY**: 4 mi S Armstrong; 11 Jun 1969; Board & Hafernik; TAMU. **KLEBERG**: Kingsville; C.T. Reed; CU. Malaquite Beach; 19 Aug 1971; P.H. Thompson; TAMU. **MAVERICK**: Eagle Pass; 9 Sep 1916; A.L. Melander; USNM. **PECOS**: 16 May 1958; Painter; KSU. **POTTER**: Amarillo; 20 Jun 1967; M. Nelson; WTAM. **POTTER-RANDALL**: Amarillo; 20 Jun 1967; M. Nelson; GSU & WTAM. Girl Scout Camp, Amarillo; 4 Jul 1974; R. Milton; WTAM. **PRESIDIO**: Alamito Ck 5 mi SE Presidio; 5 Jun 1969; J.E. Hafernik; TAMU. Big Bend St Ranch Nature Area, Colorado Cyn Riv Acc; 5 Jun 1992; E.G. Riley & C. W. Wolfe; TAMU. **RANDALL**: Canyon; 30 Jul 1966; M. Rucker; GSU & WTAM. Palo Duro St Pk; 22 Jun 1976; B.O'Conner; CU (alcohol collection). Palo Duro St Pk; 10 Aug 1978; C. B. Barr; LSU. **STARR**: Rio Grande City; Oct.; FSCA. **TRAVIS**: Austin; 21 Jun 39; Breland; UTAU. Austin; 1961; F.C. Bishopp. USNM. **UVALDE**: Uvalde; 10 Jun 1939; C.C. Dernier; FSCA. **VAL VERDE**: 21 mi W Del Rio; 2 Jun 1965; R.R. Blume; TAMU.

VICTORIA: Victoria; 1903; W.E. Hinds; USNM. 12 mi NE. Victoria; 29 May 1974; R.R. Blume & P.H. Thompson; TAMU. **WICHITA**: Burkburnett; 29 Jun 1972; R.L. Berry; ODH. **ZAPATA**: Zapata; 7 Oct. 1967; P.C. Harmston; FSCA.



Map 13. Counties of collection: *Silvius quadrivittatus* (*texanus* form)

Known Distribution (Map 13): *Silvius quadrivittatus* (*texanus* form) **BOSQUE**: Corpus Christi Naval Air Sta; 10 Oct, 29 Sep 1942; USNM. Corpus Christi; Oct 1951; A.B. Gurney; USNM. Rio Grande City; Oct. 1967; P.C. Harmston; FSCA. **BRAZOS**: College Station; 17 Jun 1933; H.J. Reinhard; USNM. College Station; 12 May 1957; **Topotype**; TAMU. **CAMERON**: Padre Island; early May; L.L. Pechuman; CU. **GALVESTON**: Galveston; May; male; ANSP. Galveston; May; F.H. Snow; FSCA. **GILLESPIE**: 14 mi N Kerrville; 30 Jun 1964; R.R. Blume; TAMU. **GOLIAD**: Goliad; 11 May 1952; AMNH. **HIDALGO**: Edinberg; AMNH. Donna; 3 Apr 1933; J.W. Monk; TAMU. **KLEBERG**: Malaquite Ranch; 19 Aug 1971; P.H. Thompson; TAMU. Loyola Beach; 10 Oct 1971; P. H. Thompson; TAMU. **MCLENNAN**: Waco; 16 Jun 1948, 7 Jul 1949; P.A. Glick; USNM. Waco; 7 Jun 1968; W.P. Tysar; CU. **NOLAN**: Wright Ranch; 20 Jul 1982; S.R. Kingston; TTU. **NUECES**: Corpus Christi, Mustang Island; 28 Sep 1942; UM. Corpus Christi Naval Air Station; 10 Oct, 29 Sep 1942; USNM. Corpus Christi; Oct 1951; A.B. Gurney; USNM. Bishop; 1 Oct 1973; Gillaspay & party; TAMU. 23 Oct 1977; G. Valle; TAMU. **SAN PATRICIO**: Welder Wildlife Ref, Hackberry Motte; 28 Jun 1984; J. Schaffner; TAMU. **STARR**: Rio Grande City; Oct 1967; P.C. Harmston; FSCA. **UVALDE**: Uvalde; 19 May 1918; J.C. Broady; CU. **VAN ZANDT**: 1 mi S Grand Saline; 12 Aug 1971; R.E. Acciavitti; in salt marsh; CU. **VICTORIA**: 12 mi NE Victoria; 19 May 1974; R. R. Blume & P. H. Thompson; TAMU. **WALKER**: Huntsville; 18 Jun 1953; F.A. Cowan; TAMU. **WASHINGTON**: Brazos R; 10 May 1952; AMNH. **WICHITA**: 5 mi E Burkburnett; 9 Jun, 15 Sep 1982; TTU. **WILLIAMSON**: Taylor; 24 Jun; UA.

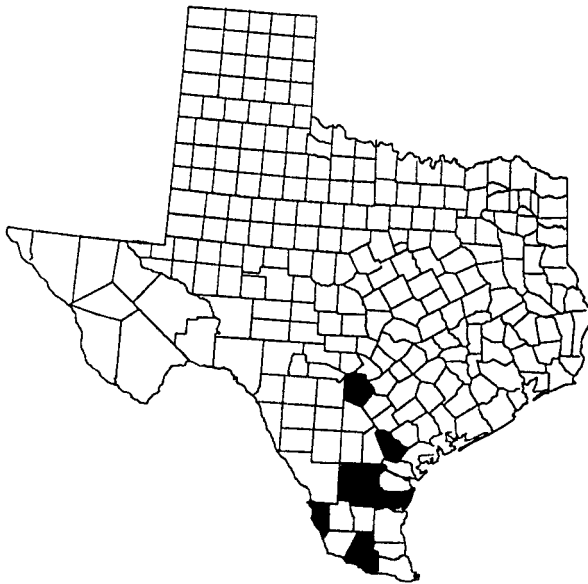
Silvius (Griseosilvius) sayi Brennan

Silvius (Griseosilvius) sayi Brennan 1935: 357

Moderate (8 mm); grayish to grayish yellow with

black markings; frontal callus distinctly separated from eyes, shiny black, often with a median line extending upward from it to vertex; thorax blackish-gray pollinose with pale gray stripes; abdomen dorsally grayish to grayish yellow, a black spot beneath the scutellum, tergites 2 to 5 with a median row of black geminate spots; wing (Figure 11, p. 37) with entire anterior border to tip, including costal cell, heavily infuscated as are the large maculations at the crossveins; area between anterior border of discal cell and vein R_{4+5} entirely or almost entirely infuscated. Male similar to female.

Comments: This species has so far been reported only from Texas (Brennan 1935, Philip 1965). The immature stages are not known.



Map 14. Counties of collection: *Silvius sayi*.

Known Distribution (Map 14): **BEE:** Beeville; 9 Sept. 1960; E.L. Smith; USNM. **BEXAR:** Mitchell Lk, 2 mi S San Antonio; 6 Jun 1982; S.J. Hanselmann; TAMU. **DUVAL:** San Diego; 29 Jun 1930; H.M. Smith; USNM. 8.5 mi NW San Diego; 18 Oct 1993; E.G. Riley; TAMU. **HIDALGO:** Donna; 10 Apr 1953; J.W. Morek; TAMU. **JIM WELLS:** La Copita Res Sta., 8 mi W Ben Bolt; 20-21 May 1987; J.C. Schaffner; TAMU. **KLEBERG:** Baffin Bay; 28 Sep 1963; B. McDaniel; LLP. 21 Sep 1973; Gillaspay & Party; TAMU. **ZAPATA:** Falcon St Rec Area; 5 Jun 1983; D.A. Rider & C.B. Barr; LSU.

GENUS *NEOCHRYSOPS* WALTON

Neochrysops Walton, in McAtee and Walton, 1918: 191. Type-species, *globosus* Walton (monotypic)

The genus *Neochrysops* is monotypic. In addition to the characters used in the generic key, a frontal callus is present in the female, and the abdomen is globose and

considerably broader than the thorax. Although treated herein as a distinct genus, further study may result in the placement of this species in the genus *Silvius* Meigen.

Neochrysops globosus Walton

Neochrysops globosus Walton, in McAtee and Walton 1918: 192

Large (9.5 mm); head and thorax *Chrysops*-like, slender; abdomen globose, considerably wider than thorax; thorax bright yellow with three black longitudinal stripes, none attaining anterior or posterior margins; abdomen orange-yellow with paired black sublateral spots on first five abdominal tergites, those of tergites 1 and 2 confluent and those on remaining segments isolated; wing (Figure 12, p. 37) fumose, darker on anterior third, apical half and posterior edge; costal cell yellow-brown. Male in color similar to female; abdomen less globose, scarcely wider than thorax.

Comments: This species has not been collected in Texas nor any adjacent state. However, it is known from fewer than 20 specimens, including a single male. It has been reported from Maryland, Illinois, Delaware, Alabama, Mississippi and Tennessee. Nothing is known of its biology. The paucity of collections, lack of biological data, and wide distribution in the eastern preclude its exclusion as a possible component of the Texas fauna.

GENUS *CHRYSOPS* MEIGEN

Chrysops Meigen 1800: 23. Type-species, *Tabanus caecutiens* Linnaeus (monotypic subgenus, Meigen, 1803: 267). Suppressed by I.C.Z.N. 1963: 339

Chrysops Meigen 1803: 267. Type-species, *Tabanus caecutiens* Linnaeus (monotypic)

Chrysops, subgenus *Heterochrysops* Kröber 1920: 50. Type-species, *flavipes* Meigen (Bequaert, 1924: 31)

Chrysops, subgenus *Liochrysops* Philip, 1955: 87. Type-species, *hyalinus* Shannon (type by original designation)

The genus *Chrysops* includes the species commonly referred to as deer flies. The genus is worldwide in distribution and is one of the largest in number of species. They are distinctive as a result of the bright green and gold eyes with reddish spots, the wings with the typically distinct crossband near middle, and the typically black and yellow or solid black abdominal color. These flies are often annoying pests of man and animals, especially in wooded areas and in close proximity to water. The

earliest records for Texas species are in March, but one or more species may appear earlier.

Because the number of species of *Chrysops* known or possibly occurring in Texas is large, the key provided for the identification of females departs from the traditional approach of a single key for all species. Instead a key to species groups, followed by a separate keys to species in each group, are provided. It is hoped that the use of species groups will aid those unfamiliar with Tabanidae to identify most specimens that are in reasonably good condition. The groups are taxonomic tools only, and should not be viewed as indicative of relationships. As males are still poorly represented in collections, only a single key for all known males is provided.

**KEYS TO THE SPECIES GROUPS OF
CHRYSOPS OCCURRING OR POSSIBLY
OCCURRING IN TEXAS**

(FEMALES ONLY)

1. Abdomen dorsally black, without yellow integumental areas, at most with gray pollinose pattern **2**
Abdomen dorsally with at least second tergite partly yellow **4**
2. Wings largely hyaline, at most with costal cell darkened and/or crossband barely indicated by faint yellowish shadow **Group 1**
Wings with distinct crossband **3**
3. Wings hyaline distal to stigma, no apical spot or marginal darkening, at most a small cloud at bifurcation of R₄₊₅ **Group 2**
Wings with an apical spot which may be no more than a thin, dark strip along the costa narrower than cell r₁ **Group 3**
4. Antennae (especially scape) markedly swollen; wing pattern of sharply contrasting dark and hyaline areas; frontoclypeus with a median pollinose stripe **Group 4**
Antennae not markedly swollen; if scape somewhat swollen, wing pattern diffuse (i.e. hyaline areas reduced to row of small spots by invasion of apical spot into most posterior cells) and frontoclypeus lacking median pollinose stripe **5**
5. Abdomen with a median yellow stripe nearly its whole length, sometimes with sublateral and/or lateral yellow stripes; median stripe always defined by a submedian pair of continuous or broken dark stripes which may be so broad that the abdomen may be almost entirely black with only a vestigial short median yellow stripe **Group 5**
Abdomen without such a median stripe **6**

6. First and second abdominal tergites entirely yellow **Group 6**
First and second abdominal tergites with evident median or submedian dark markings **7**
7. Third and remaining tergites dark, lacking median pale posterior triangles; dark marking of second abdominal tergite covering at least posterior ½ of tergite in middle, or comprised of two parallel dashes that cross nearly ⅔ of tergite and are usually at least narrowly joined along posterior border of tergite **Group 7**
Third and most remaining tergites with a median pale pollinose triangle with its base on the posterior margin of the tergite; second tergite either with similar posterior pale median triangle surrounded by dark area or the dark pattern of this tergite may be limited to a pair of short diagonal black marks often joined anteriorly to form an inverted "V" or "U" **Group 8**

***Chrysops*, GROUP 1**

1. Body, legs, frontoclypeus and genae shiny black to dark brown, except for dull yellowish haltere knobs and basitarsi of middle and hind legs; no pale pollinosity except mid-frons between callus and ocellar tubercle, though scattered yellowish hairs present on mesonotum, legs and abdomen; wings entirely hyaline with no trace of crossband, or at most with faint trace of infuscation along anterior margin
 ***hyalinus* Shannon**
Body and legs largely shiny dark brown to black; frontoclypeus and genae yellow with small white pollinose areas; pronotal lobes and a latero-ventral pleural stripe pale gray pollinose; legs with fore- and mid-tibiae, mid-femora, mid- and hind basitarsi pale brown to yellowish; haltere knobs brown; wings usually with faint vestiges of yellowish crossband, sometimes entirely clear
 ***nigribimbo* Whitney**

***Chrysops*, GROUP 2**

1. Midfacial gray, yellow or orange pollinose stripe beneath antennae extending ½ to ¾ distance to oral margin **2**
Midfacial pollinose stripe on frontoclypeus absent ***niger* Macquart**
2. Cell cua₁ with distinctly hyaline basally, hairs of pleurae grayish to yellowish
 ***carbonarius* Walker**
Cell cua₁ entirely infuscated basally, hairs of

pleurae orange *cincticornis* Walker

Chrysops, GROUP 3

1. Apical spot evidently separated from crossband by anterior extension of hyaline triangle; moderate size species *separatus* Hine
Apical spot distinctly united with crossband; small or large species 2
2. Large species with densely orange pilose pleura and evident median pollinose stripe on frontoclypeus *amazon* Philip
Small slender species without orange pilosity on pleura and lacking pollinose stripe on frontoclypeus 3
3. Wing with a small spot at bifurcation of vein R_{4+5} ; pleura without prominent pale pollinose stripes; abdomen usually with at least vestiges of pattern in form of paler dorsolateral pale spots *brimleyi* Hine
Wing without a spot at bifurcation of vein R_{4+5} ; pleura with at least one prominent pale pollinose stripe; abdomen shiny black to brown with at most vestiges of a median and/or dorsolateral stripes anteriorly 4
4. Hyaline triangle extending to R_{2+3} , sometimes crossing it and approaching costa; thorax with 3 pale pollinose stripes, one above wing base, 2 below; abdomen occasionally with vestiges of median dorsal and dorsolateral pale stripes *obsoletus* Wiedemann
Hyaline triangle barely reaching beyond bifurcation of vein R_{4+5} ; thorax lacking pale stripe above wing base, the 2 stripes below wing base not prominent; abdomen rarely with any indication of pale stripes *parvulus* Daecke

Chrysops, GROUP 4

1. Wing with infuscation of apical spot continuing around apex to unite with the crossband posteriorly; discal cell fenestrate *fulvaster* Osten Sacken
Wing with infuscation of apical spot ending at or before middle of cell R_4 ; discal cell usually not fenestrate 2
2. Apex of hyaline triangle attaining or nearly attaining vein R_1 ; apical spot appearing almost separated from crossband *facialis* Townsend
Apex of hyaline triangle attaining vein R_{2+3} or slightly beyond, not attaining vein R_1 ; apical spot always obviously joined to crossband 3
3. Basal plate of third antennal segment distinctly

longer than annulate portion

- *virgulatus* Bellardi
Basal plate of third antennal segment not longer than annulate portion
. *pachycerus* Brennan

Chrysops, GROUP 5

1. Both cells br and bm entirely hyaline 2
Cell br completely or nearly completely infuscated, cell bm hyaline or basally infuscated 3
2. Frontoclypeus usually with a median pollinose T-shaped mark; costal cell with infuscation lighter than rest of crossband
. *upsilon* Philip
Frontoclypeus without such a mark, essentially nonpollinose; costal cell same color as crossband *univittatus* Macquart
3. Hyaline triangle reduced to an isolated circular clear area predominantly in cell r_{2+3} near bifurcation of vein R_{4+5}
. *bistellatus* Daecke
Hyaline triangle variable in size and shape but always open to hind margin of wing 4
4. Cell cua, infuscated except for a short hyaline area at base *vittatus* Wiedemann
Cell cua, largely hyaline, with some weak infuscation along vein CuA_2 5
5. Hyaline triangle small, its apex not reaching bifurcation of vein R_{4+5} 6
Hyaline triangle larger, its apex clearly lying anterior of bifurcation of vein R_{4+5} 7
6. Dark areas of wing intensely black, the small hyaline triangle sharply delineated; hind tibiae basally $\frac{1}{3}$ or more black; paired dorsal dark stripes of abdomen bend towards each other on second tergite, sometimes touching
. *moechus* Osten Sacken
Dark areas of wing slightly dilute, the apex of the hyaline triangle dissolves into fragments as it approaches bifurcation of vein R_{4+5} ; hind tibiae wholly yellow; paired abdominal stripes somewhat diffuse, not bent towards each other *macquarti* Philip
7. Abdomen dark brown with faint remnants of a middorsal yellow stripe; mesonotum dark, greenish gray pollinose, the scutellum reddish; frontal callus dark brown to black
. *dacne* Philip
Abdomen yellowish with 2 or 4 unbroken longitudinal dark stripes; mesonotum variable, scutellum brown, yellow or orange; frontal callus black or yellow 8
8. Scape of antennae distinctly more swollen than pedicel; hyaline triangle very wide open posteriorly as apical spot ends in anterior

- third of cell r_4 *dissimilis* Brennan
 Scape not noticeably more swollen than pedicel; hyaline triangle much narrower posteriorly as apical spot extends caudally at least to posterior tip of r_4 , often extending into, or even across cell r_5 9
9. Frontal callus black, sometimes yellowish at margins 10
 Frontal callus yellow 11
10. Abdomen dorsally with four more or less complete longitudinal dark stripes; hyaline triangle extends beyond vein R_{2+3} , apex pointed *sequax* Williston
 Median pair of longitudinal dark stripes complete, dorsolateral "stripes" usually represented by a row of black spots from tergite 3 rearward; hyaline triangle terminates bluntly at vein R_{2+3} , its apex broad and flat, or broadly rounded *pikei* Whitney
11. Abdomen dorsally with 4 black stripes, the middle pair complete, the laterals complete or broken; ventrally with 2 black stripes on each side and a broad median stripe beginning on 3rd sternite and widening to cover width of terminal segments *beameri* Brennan
 Abdomen generally as above, except lateral dark stripes often reduced to a series of spots or even absent and middorsal stripes sometimes appearing as a row of elongate black spots due to pale hind margins of tergites; ventrally only a single dark stripe on each side *hinei* Daecke

Chrysops, GROUP 6

Group 6 includes on a single Texas species, *Chrysops impunctus* Kröber.

Chrysops, GROUP 7

1. Fore coxae entirely yellow; middorsal dark stripe usually much broadened on posterior $\frac{1}{3}$ of tergite 2, sometimes much narrower on anterior $\frac{1}{3}$ of tergite 2 than on tergite 1; wing with crossband ranging from moderately dark to almost totally absent 2
 Fore coxae distinctly bicolored, yellow and black; middorsal dark stripe not noticeably widened on posterior $\frac{1}{3}$ of tergite 2; wing with crossband saturate *abatus* Philip
2. Dark pattern of second abdominal tergite a single median figure which usually rests on or very near the hind margin of tergite and extends anteriorly at least to the middle of the tergite *dorsopunctus* Fairchild
 Dark pattern of second abdominal tergite comprised

of a submedian pair of parallel dark dashes that cross $\frac{1}{2}$ or more of tergite and which usually expand medially to narrowly join along posterior border of tergite *fulvistigma* Fairchild

Chrysops, GROUP 8

1. Cell br at least $\frac{1}{2}$ basally infuscated; scape and pedicel of antennae moderately swollen; hyaline triangle usually reduced to a row of hyaline spots by invasion of most posterior cells by sometimes weak infuscation of enlarged apical spot 2
 Cell br rarely over $\frac{1}{3}$ basally infuscated; scape and pedicel rarely noticeably swollen; wings not as above 3
2. Whole insect pale brown; frontal callus nearly as high as wide; scape and pedicel rather strongly inflated, obviously together longer than strongly bicolored third segment; wings extensively brown, the hyaline triangle largely obscured by infuscation; abdomen brown with faint middorsal pale pollinose triangles on tergite 2 or 3 to 4 *brunneus* Hine
 Thorax generally with black integument and gray stripes; frontal callus clearly wider than high; wings generally as above; abdomen nearly always with dark blackish areas or diagonal dashes anterior to pale median triangles *atlanticus* Pechuman
3. Wing pattern reduced in extent and intensity, pale brown to yellow; abdomen yellow with paired median black integumental oblique spots on tergites 3 to 5 *cursor* Whitney
 Wing pattern normal, black to dark brown; abdomen otherwise 4
4. Hind legs usually all black as are frontal callus and scutellum; frontal callus round; mesonotum prominently striped, yellow pollinose with black shiny stripes; abdomen with first two tergites bright yellow, second with 2 small median black diagonal marks not touching hind margin and rarely joined together to form and inverted "V"; tergites 3 to 5 usually black with yellow hind margins and a narrow yellow median longitudinal stripe, sometimes also with yellow dorsolateral spots of variable size *geminatus* Wiedemann
 Hind legs nearly always partly or wholly yellow; frontal callus always wider than high, often yellow; abdomen otherwise 5
5. Frontal callus black; hind tibiae at least partly and scutellum wholly black 6
 Frontal callus yellow, rarely brown; hind tibiae and scutellum various 10

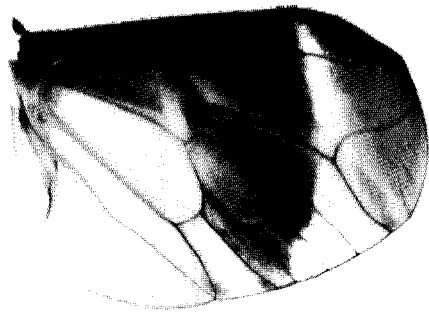
6. Apical spot narrow, entering only extreme anterior apex of cell r_4 **7**
 Apical spot drop-shaped, filling about $\frac{1}{2}$ of cell r_4 ; second abdominal tergite pale, with a median inverted black "V" **9**
7. Slender species; frontal callus only slightly wider than high; second abdominal tergite nearly filled by a broad V-shaped figure which leaves only anterior corners of tergite and median triangle yellow; tergites 3 to 5 black or dark brown with median triangles and hind borders yellow; thorax gray pollinose with slender black stripes; pleura not evidently striped ***puddicus* Osten Sacken**
 Stout species; frontal callus about twice as wide as high; second abdominal tergite yellow with a median inverted black V-shaped mark whose apex reaches anterior border of tergite and whose posterior arms may extend outwards along hind border; remaining tergites black with a median pale triangle and hind border, sometimes with lighter diffuse areas laterally; pleura striped **8**
8. Apical spot very narrow and more dilute than crossband; frons little convergent at vertex; pale markings of abdomen grayish or dull yellow; second abdominal tergite with dorsolateral black triangles, one on each side of the median dark markings; dorsolateral triangles may or may not be connected with median markings by dark band along hind margin ***aestuans* Wulp**
 Apical spot varies from one-half to full width of cell r_1 and is same intensity as crossband; frons somewhat convergent at vertex; pale markings of abdomen yellow, which sometimes is quite bright; dark median markings of second abdominal tergite may have projections along hind margin but they do not form lateral triangles
 ***callidus* Osten Sacken**
9. Third and following abdominal tergites black with a small median yellow triangle which does not reach anterior border of tergite; hind borders of all tergites yellow; posterior border of apical spot nearly always sharply marked ***dimmocki* Hine**
 Third and following tergites largely yellow with a median pair of dark marks enclosing a pale triangle which often reaches anterior border of tergite and with large pale spots forming a dorsolateral row which may extend posteriorly to tergite 5 or 6, these laterally bordered by a row of dark dashes separating pale spots from lateral borders of segments; hind border of apical spot often diffuse, sometimes apical spot including most of wing apex ***montanus* Osten Sacken**
10. Mesonotum largely pale gray, the dark stripes slender and inconspicuous; upper margin of frontal callus often infuscated; crossband with straight distal margin, the apical spot slender, not generally reaching middle of cell r_4 ; abdomen like *cursum* (see couplet 3), but markings blurred ***puddicus* Osten Sacken**
 Mesonotum strongly striped; frontal callus usually entirely yellow; crossband, apical spot and abdomen variable **11**
11. Abdomen yellow with an inverted V-shaped black figure enclosing a median yellow triangle on second tergite, third and fourth tergites similar, but with short black streaks close to lateral margins; remaining tergites largely black with reduced yellow median triangles and yellow hind margins; apical spot extending to or beyond middle of cell r_4 in reduced intensity
 ***montanus* Osten Sacken**
 Abdomen without clearly defined inverted black V-shaped figure on tergite 2, at most with blurred dark patches with indefinite outlines **12**
12. Mesonotal integument black or dark greenish brown, the pollinose stripes greenish to yellowish gray; abdominal integument yellowish to dark brown, nearly always with at least some irregular black markings
 ***celatus* Pechuman**
 Mesonotal integument orange, the pollinose stripes pale orange; scutellum orange; abdominal integument yellow to dark orange brown without black markings **13**
13. Outer border of crossband straight or slightly bowed; apical spot usually sharply defined, rarely slightly drop-shaped or extending much beyond wing apex; abdominal triangle of second tergite extending nearly to hind margin of first tergite
 ***flavidus* Wiedemann**
 Outer border of crossband usually strongly bowed outward; apical spot nearly always extends beyond apex of wing, often filling all or nearly all of wing apex, leaving a reduced crescentic hyaline triangle; abdominal triangle of second tergite confined to posterior $\frac{1}{2}$ of segment ***reicherti* Fairchild**

**KEYS TO THE KNOWN MALES OF
 CHRYSOPS OCCURRING OR
 POSSIBLY OCCURRING IN TEXAS**

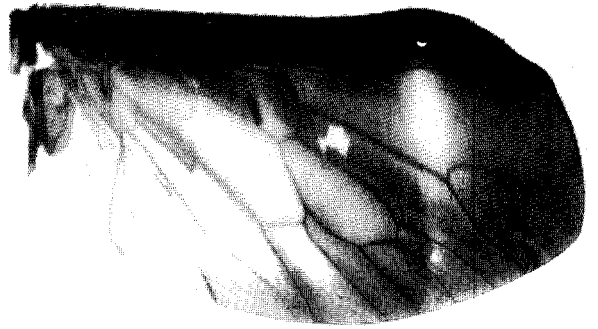
1. Wing entirely hyaline, or at most only a trace of

- infuscation along anterior margin
- *hyalinus* Shannon
- Wing with some evidence of a crossband near middle, the crossband usually distinct, and some infuscation in one or more basal cells or along anterior margin to tip, or both 2
2. Apex of wing beyond crossband hyaline, at most an occasional indefinite trace of infuscation along costa 3
- Apex of wing beyond crossband with evident infuscation at least in marginal cell, usually extending into cell. r_{2+3} or beyond (i.e., apical spot present) 8
3. Midface with gray, yellow or orange pollinosity at least as a stripe on upper $\frac{1}{2}$, usually more 4
- Midfacial pollinosity absent, or at most only an attenuated spur less than $\frac{1}{2}$ the distance to oral margin from base of antenna 5
4. Cell cua_1 with basal hyaline area
- *carbonarius* Walker
- Cell cua_1 infuscated basally
- *cincticornis* Walker
5. Wing picture saturate; frontoclypeus yellow with large black spot on each side
- *niger* Macquart
- Wing picture dilute; frontoclypeus dark 6
6. Abdomen and cell br entirely blackish
- *nigrimbimbo* Whitney
- Abdomen with a basal yellow pattern; cell br not infuscated 7
7. Second abdominal tergite with two small parallel submedian black dashes
- *fulvistigma* Hine
- Second abdominal tergite with a single median black figure *dorsopunctus* Fairchild
8. Entirely black; apical spot distinctly separated from crossband; both cells br and bm infuscated
- *separatus* Hine
- Not with above combination of characters 9
9. Abdomen black with no yellow markings; hind femora black 10
- Abdomen with yellow markings; hind femora variable 13
10. Apical spot not covering all of cell r_4 11
- Apical spot includes all of cell r_4 12
11. Frontoclypeus with a median pollinose stripe
- *amazon* Philip
- Frontoclypeus without such a stripe, essentially nonpollinose *brimleyi* Hine
12. Hyaline triangle clear, restricted to apices of cells r_5 and m_1 ; thorax usually with at least a trace of a pale stripe above wing base; facial area with considerable yellow
- *moechus* Osten Sacken
- Hyaline triangle dilutely infuscated; no trace of pale stripe above wing base; yellow of facial area restricted to narrow stripe in center of frontoclypeus *parvulus* Daecke
13. Black species; abdomen with yellowish median longitudinal stripe, occasionally with similar abbreviated stripe on each side; hyaline triangle crosses vein R_{2+3} ; apical spot rarely occupies more than half of cell r_4 14
- Not with above combination of characters 15
14. Frontoclypeus with a prominent median pollinose stripe *upsilon* Philip
- Frontoclypeus without such a stripe, essentially non-pollinose *univittatus* Macquart
15. Apical spot narrow, entering only extreme anterior apex of cell r_4 and covering less than apical $\frac{1}{4}$ of vein R_4 ; if apical spot appears widened beyond base, union of spot with crossband is only about $\frac{1}{2}$ width of marginal cell at that point and maximum width of spot rarely exceeds that of cell r_1 at any point 16
- Apical spot broader, covering at least apical $\frac{1}{3}$ of vein R_4 and at least $\frac{1}{3}$ of cell r_4 ; spot obviously broadened beyond base 18
16. Scape of antenna distinctly more swollen than pedicel; abdomen dorsally yellow with four longitudinal rows of isolated dark spots
- *dissimilis* Brennan
- Scape of antenna not more swollen than pedicel; abdomen without rows of dark spots 17
17. Second abdominal tergite with sublateral black triangles which join median figure along posterior border of tergite; cell m_3 usually hyaline at apex and cell cua_1 with considerable infuscation, especially basally; pale markings grayish yellow; apical spot narrow
- *aestuans* Wulp
- Second abdominal tergite without sublateral black triangles; cell m_3 usually entirely infuscated and cell cua_1 often mostly hyaline; pale markings yellow *callidus* Osten Sacken
18. Antenna incrassate (i.e., strongly swollen) 19
- Antenna not incrassate 24
19. Wing pattern dilute and indefinite, much of the usual hyaline areas with some infuscation; hyaline triangle often represented by narrow hyaline to very slightly tinted area not reaching hind margin of wing; abdomen brownish with pattern, if any, limited to faint pale median triangles or dark median patches on some tergites; first antennal segment moderately to strongly swollen 20
- Wing pattern clear cut, with no indications of infuscation; if hyaline triangle not open to hind margin of wing, abdomen has a distinct

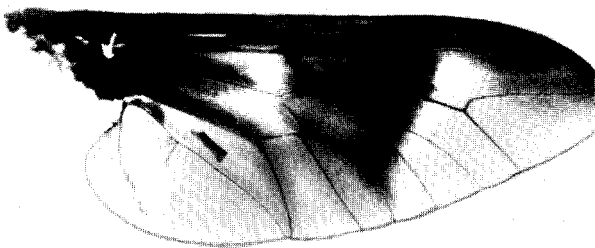
- pattern of light yellow to yellowish-white and black; antenna strongly swollen 21
20. Dull yellowish species with pattern of dark spots on each abdominal segment except first; wing pattern dilute and indefinite; first antennal segment moderately swollen
atlanticus Pechuman
 Brown species with no definite abdominal pattern, although dark markings may be indicated by dark shadows; hyaline triangle indicated by clear area along edge of crossband and not usually extended beyond center of cell m_2 ; first antennal segment considerably swollen
brunneus Hine
21. Wing with infuscation of apical spot continuing around apex to unite with the crossband posteriorly; discal cell fenestrate
fulvaster Osten Sacken
 Wing with infuscation of apical spot ending at or before middle of cell R_4 ; discal cell usually not fenestrate 22
22. Apex of hyaline triangle attaining or nearly attaining vein R_1 ; apical spot appearing almost separated from crossband
facialis Townsend
 Apex of hyaline triangle attaining vein R_{2+3} or slightly beyond, not attaining vein R_1 ; apical spot always obviously joined to crossband 23
23. Basal plate of third antennal segment distinctly longer than annulate portion
virgulatus Bellardi
 Basal plate of third antennal segment not longer than annulate portion
pachycerus Brennan
24. Hyaline triangle reduced to an isolated clear circular area predominantly restricted to cell r_{2+3} near bifurcation of vein R_{4+5}
bistellatus Daecke
 Hyaline triangle of variable size and shape but always open to hind margin of wing . . . 25
25. Abdomen bright yellow and black; large black figure on second abdominal tergite broadly joined to black figure of first tergite; median yellow triangles do not reach anterior border of tergites; apical spot occupying $\frac{1}{2}$ to $\frac{2}{3}$ of cell r_4 *montanus* Osten Sacken
 Not with above combination of characters . . . 20
26. Apical spot filling about half or less of cell r_4 27
 Apical spot filling all or nearly all of cell r_4 , sometimes extending into cell r_5 32
27. Cell br infuscated, except for nearly hyaline area near apex; cell bm at least $\frac{1}{2}$ infuscated; hind femora usually partly black
dimmocki Hine
- Cell br $\frac{1}{3}$ infuscated; hind femora often entirely yellow; dark markings on second abdominal tergite not reaching anterior margin . . . 28
28. Thorax yellow or brownish in ground color with brown stripes 29
 Thorax greenish gray with fuscous stripes . . . 30
29. Outer margin of crossband nearly straight; abdomen with uniformly yellowish ground color; legs yellow *flavidus* Wiedemann
 Outer margin of crossband sinuous; abdomen usually with greenish cast to base of second tergite; legs brownish
reicherti Fairchild
30. Crossband dilute, base of discal cell nearly hyaline; ground color of abdomen bright yellow; hind femora entirely yellow . . *cursim* Whitney
 Crossband saturate or nearly so; discal cell not paler at base; ground color of abdomen dull yellow; hind femora variable 31
31. Hind femora usually dark at base; black spot beneath scutellum; dark abdominal markings usually saturate . . . *pubicus* Osten Sacken
 Hind femora usually entirely yellow; black spot beneath scutellum very pale or absent; dark abdominal markings often faded
celatus Pechuman
32. Hyaline triangle very distinctly crosses vein R_{2+3} ; yellow species with black median abdominal spots which are usually joined on second tergite or second tergite entirely yellow; apical spot does not extend beyond cell r_4 33
 Not with above combination of characters . . . 35
33. Middle abdominal tergites with a longitudinal black stripe, sides yellow *abatus* Philip
 Second tergite entirely yellow or with a pair of submedian diagonal dashes which may touch; third and subsequent tergites black 34
34. Second tergite with a pair of submedian dark diagonal dashes which may touch
geminatus Wiedemann
 Second tergite entirely yellow
impunctus Kröber
35. Hyaline triangle reaches or nearly reaches vein R_{2+3} (if lightly infuscated beyond bifurcation of vein R_{4+5} , predominantly black species with pale abdominal markings) 36
 Hyaline triangle scarcely extends beyond bifurcation of vein R_{4+5} ; predominantly yellowish species with dark abdominal markings 41
36. Blackish species, with reduced pale abdominal markings 37
 Yellow species with black abdominal markings 38



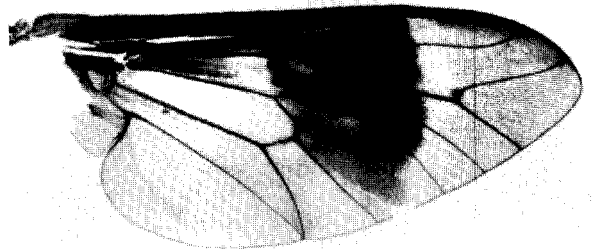
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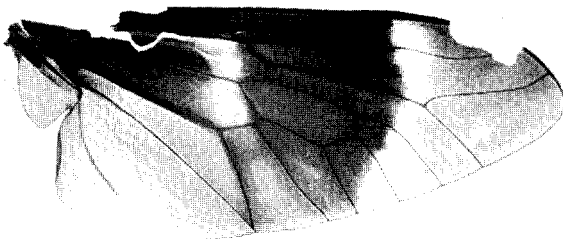
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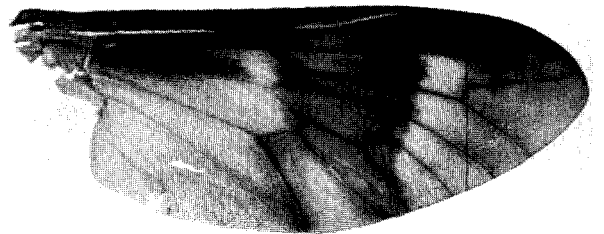
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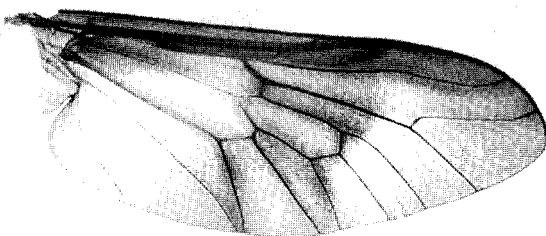
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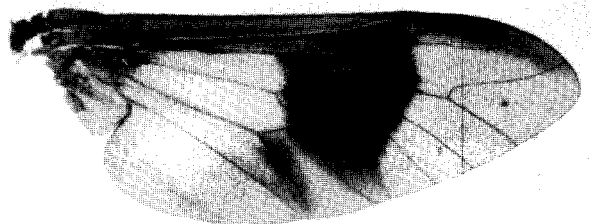
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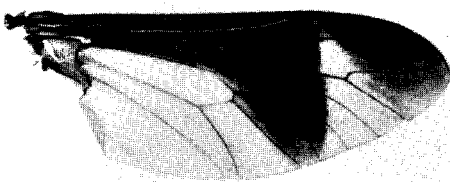
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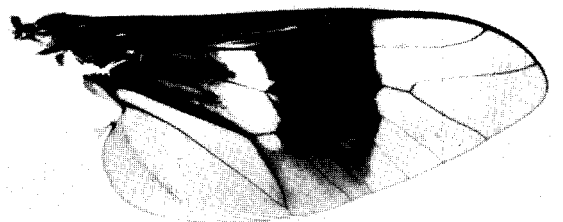
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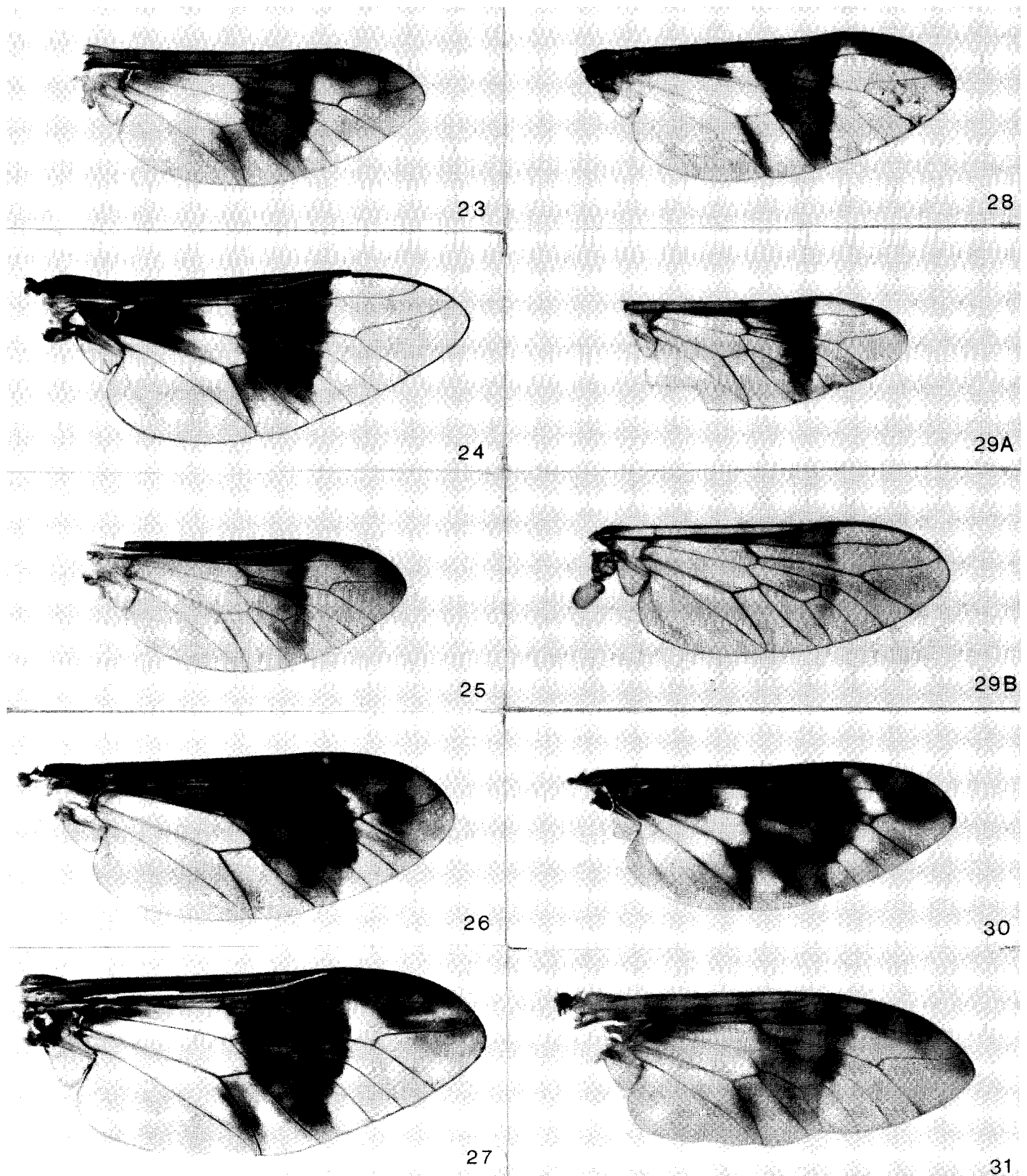


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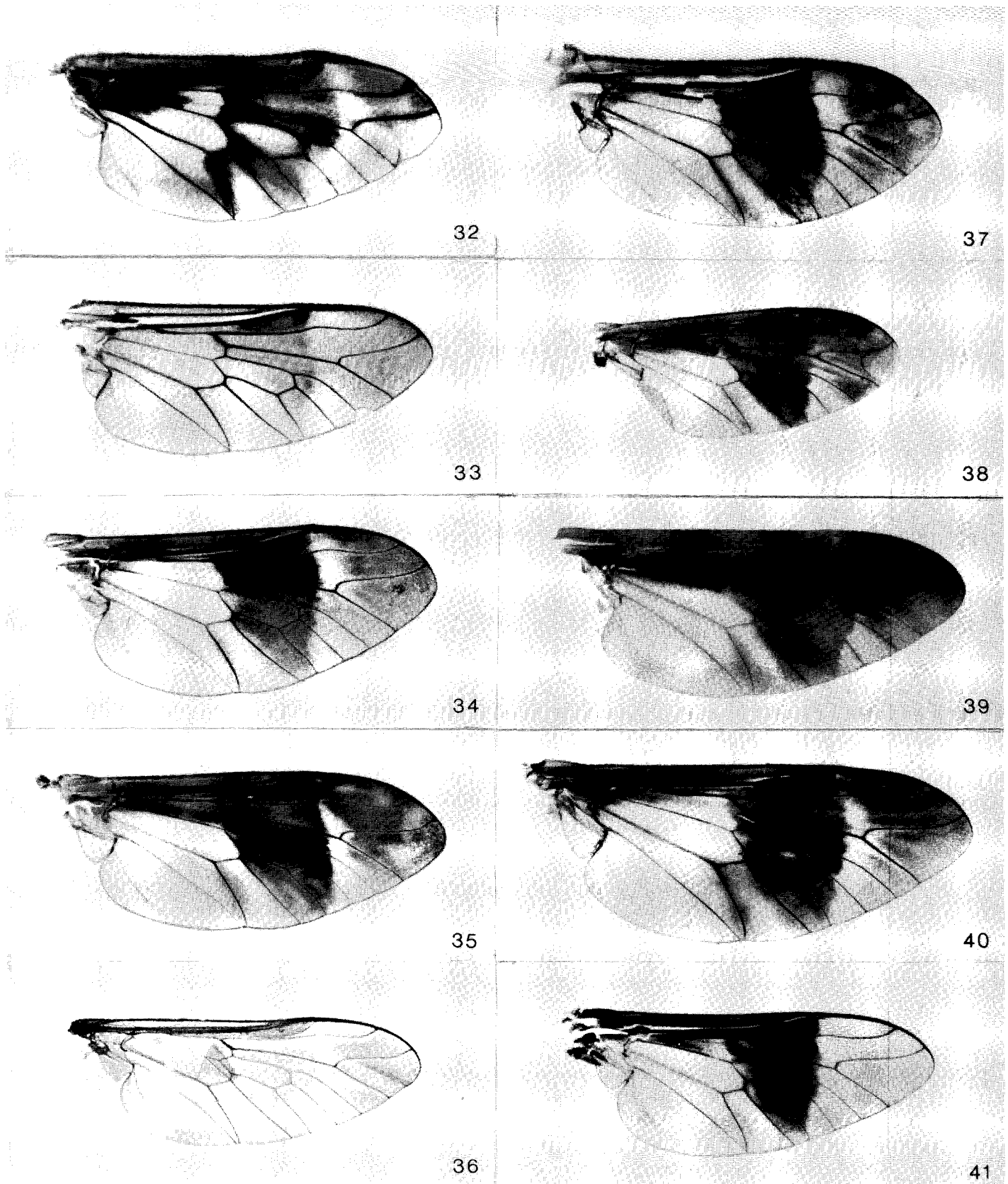


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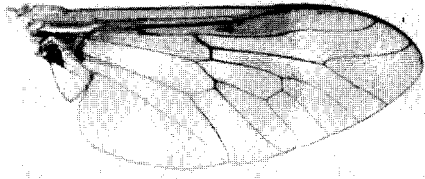
Figures 13-22. Wings of *Chrysops*: 13 - *C. abatus*; 14 - *C. aestuans*; 15 - *C. amazon*; 16 - *C. atlanticus*; 17 - *C. beameri*; 18 - *C. bistellatus*; 19 - *C. brimleyi*; 20 - *C. brunneus*; 21 - *C. callidus*; 22 - *C. carbonarius*.



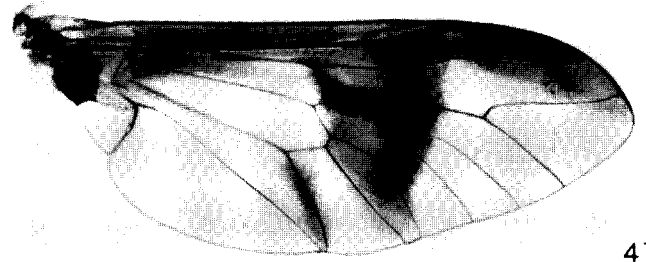
Figures 23-31. Wings of *Chrysops*: 23 - *C. celatus*; 24 - *C. cincticornis*; 25 - *C. cursim*; 26 - *C. dacne*; 27 - *C. dimmocki*; 28 - *C. dissimilis*; 29A - *C. dorsopunctus* (dark form); 29B - *C. dorsopunctatus* (pale form) 30 - *C. facialis*; 31 - *C. flavidus*.



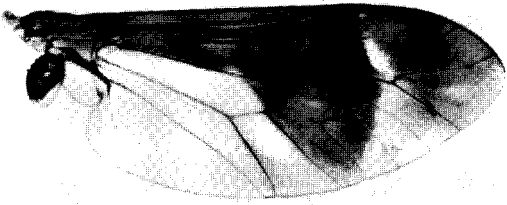
Figures 32-41. Wings of *Chrysops*: 32 - *C. fulvaster*; 33 - *C. fulvistigma*; 34 - *C. geminatus*; 35 - *C. hinei*; 36 - *C. hyalinus*; 37 - *C. impunctus*; 38 - *C. macquarti*; 39 - *C. moechus*; 40 - *C. montanus*; 41 - *C. niger*.



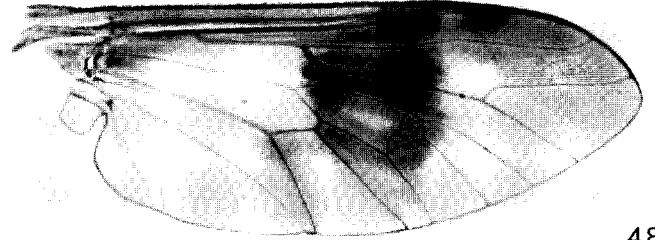
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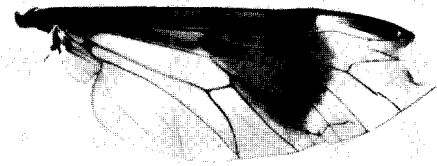
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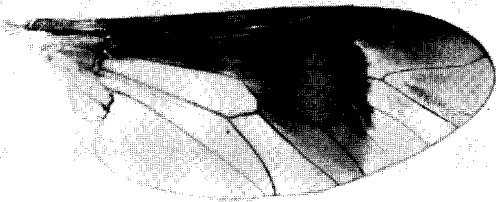
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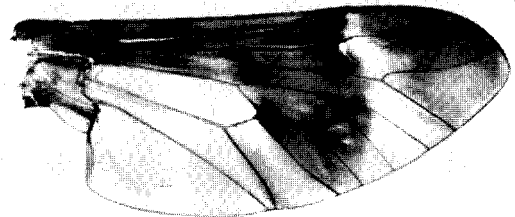
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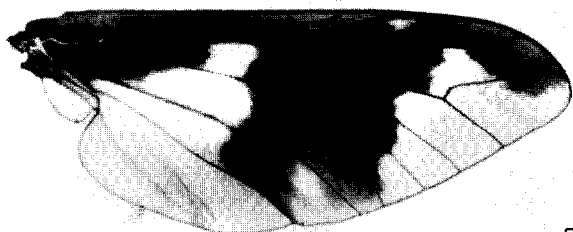


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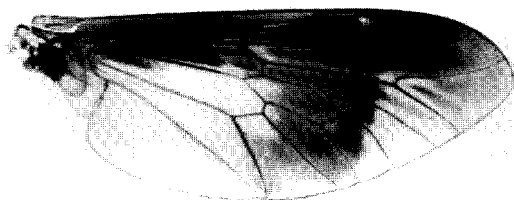
Figures 42-51. Wings of *Chrysops*: 42 - *C. nigribimbo*; 43 - *C. obsoletus*; 44 - *C. paxchycerus*; 45 - *C. parvulus*; 46 - *C. pikei*; 47 - *C. pudicus*; 48 - *C. riecherti*; 49 - *C. separatus*; 50 - *C. sequax*; 51 - *C. univittatus*.



52



53



54

Figures 52 -54. Wings of *Chrysops*: 52 - *C. epsilon*; 53 - *C. virgulatus*; 54 - *C. vittatus*.

37. Thorax with a yellow stripe on each side above wing base; lower border of cell bm infuscated
 *obsoletus* Wiedemann
 Thorax without yellow stripe above wing base;
 lower border of cell bm not more heavily
 infuscated than adjoining portion of cell . .
 *dacne* Philip
38. Frontoclypeus with a large dark spot on each side
 and cheeks with considerable black
 *pikei* Whitney
 Frontoclypeus and genae mostly yellow 39
39. Cell bm hyaline; thoracic stripes distinct, yellowish
 40
 Cell bm largely infuscated; thoracic stripes
 indistinct *sequax* Williston
40. Abdomen with four black lines equal in length and
 attaining tergite 1; hind tibia not swollen;
 cell bm and cell cua₁ predominantly hyaline
 *beameri* Brennan
 Abdomen with two submedian black lines and two
 shorter sublateral lines which do not attain

tergite I; hind tibia slightly expanded; cell bm
 and cell cua₁ considerably infuscated

- *hinei* Daecke
41. Abdomen with median yellow stripe with
 longitudinal black band on each side; lateral
 margins of tergites narrowly yellow
 *macquarti* Philip
 Abdomen yellow with four more or less complete
 rows of black spots . . *vittatus* Wiedemann

Chrysops abatus Philip

Chrysops abatus Philip 1941a: 120

Moderate (8 mm); abdomen yellowish, darker
 posteriorly, with a median middorsal black stripe; face
 with a median pollinose stripe; wing (Figure 13, p. 46)
 with apex of hyaline triangle extending beyond vein R₂₊₃,
 cell br infuscated. Male with both cells br and bm
 predominantly infuscated; otherwise relatively similar to
 female, except darker.

Comments: This species is not known from Texas,
 but it does occur in the Gulf coastal states from Louisiana
 to Florida and may be present in the eastern part of the
 State. The immature stages are not known.

Chrysops aestuans Wulp

Chrysops moerens Walker 1848: 201 (preoccupied
 Fabricius, 1787)

Chrysops aestuans Wulp 1867: 135

Chrysops confusus Kröber, 1926: 284 (as *moerens*
 variety)

Chrysops abaestuans Philip 1941d: 121 (as
 subspecies)

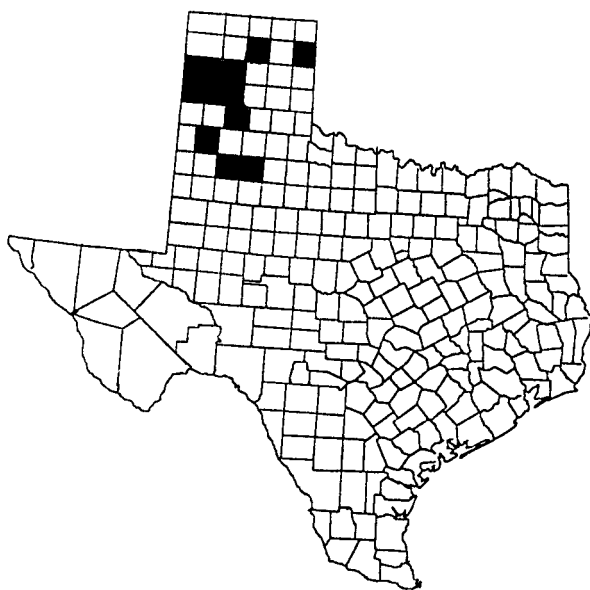
Chrysops pseudoconfusus Philip 1959: 200 (as
 variety)

Moderate (8.5 mm); black with grayish to yellowish
 markings; frontal callus black; frontoclypeus, genae and
 palpi orange-yellow; thorax gray to yellowish gray
 pollinose with dark stripes; abdomen yellowish or grayish
 in ground color with black markings, neither color forming
 longitudinal stripes; wing (Figure 14, p. 46) with cells br
 and bm hyaline, apical spot narrow, crossband not
 reaching hind margin. Male with yellowish areas reduced;
 cell bm infuscated.

Comments: This species is widespread across the
 central United States and Canada extending southward into
 Texas. Teskey (1969) described the immature stages.
 Larvae were collected along the borders of large lakes in
 cattail marsh and in areas where piles of rotting vegetation
 had washed on shore.

Known Distribution (Map 15, p. 51): CROSBY: L-7 Ranch;
 26 May, 6 Jul 1977; D. Sanders; TTU. 6 Jul 1979; D. Sanders; TTU.

DEAF SMITH: 23 km W Canyon; 14 Jun 1974; G. Wilhelm; WTAM.
HEMPHILL: Boys Ranch, Canadian R; 2 Sep 1984; J.M. Rodney; GSU.
HUTCHINSON: Borger; 24 Jun 1967; M. Sweigert; GSU & WTAM.
LAMB: 12 mi SW Littlefield; 21 Jun 1978; T. B. Hall & J. V. Moody; TTU.
LUBBOCK: Buffalo Spr Lake; 21 May, 1 Jul 1986; R. W. Sites; TTU.
OLDHAM: Canadian R Boys Ranch; 2 Sep 1984; J. Radney; WTAM.
POTTER: Amarillo; 23 Jun 1967; A. Jones; WTAM.
POTTER-RANDALL: Amarillo; 28 Jun 1967; M. Tones; GSU. 27 Jun 1974; J. Burrows; GSU. 25 Jul 1978; D. Ries; GSU.
RANDALL: Canyon; 12 Jun 1967; O. Nolan; GSU & WTAM. Canyon; 14 Jun 1967; C. West; WTAM. Canyon; 4 Sep 1973; Kitaxama, Bigart & Eberty; SJ.
SWISHER: 1 mi N Tx 86; 28 Jun 1979; D. Sanders; TTU.



Map 15. Counties of collection: *Chrysops aestuans*.

***Chrysops amazon* Daecke**

Chrysops amazon Daecke 1905: 250
Chrysops hubbelli Philip 1955: 88 (as subspecies)

Large (10.5 mm); black; face with a median pollinose stripe; pleura of female with dense orange pile; wing (Figure 15, p. 46) with apical spot distinctly reaching into at least one-half of cell R_4 , anal and cells br and bm infuscated, the cells with hyaline spots apically. Male lacks orange pleural pile and has the anal area of wing infuscated.

Comments: This species is not known from Texas. It is known from eastern and southern coastal states from New Hampshire into Louisiana and may extend into eastern Texas. The immature stages are not known.

***Chrysops atlanticus* Pechuman**

Chrysops canifrons Walker 1848: 107 (senior synonym of *atlanticus*; suppressed by I.C.Z.N. 1991, p. 225-6)
Chrysops atlanticus Pechuman 1949: 79

Moderate to large (9 mm); dull yellow and brown; thorax with longitudinal stripes but these not markedly contrasting; dark pattern of the abdomen distinctly demarcated but never in form of longitudinal lines or stripes; wing (Figure 16, p. 46) with membrane dilutely infuscated more or less throughout, crossband and apical spot evident as darker areas, cells br and bm infuscated, apical spot broad. Male usually darker but with abdominal pattern more distinct.

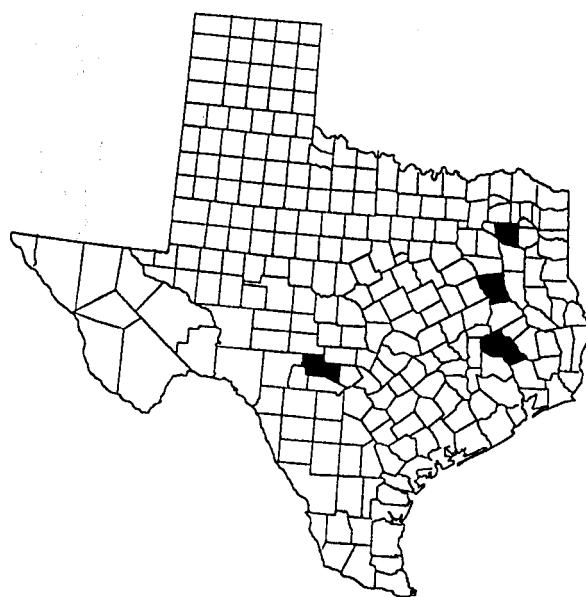
Comments: This species has not been collected in Texas. It is a coastal species associated with salt marsh and has been collected along the eastern and southern coasts west into Louisiana in habitat similar to areas along the Texas coast. Descriptions of the immature stages have been provided by Teskey (1969) and Goodwin (1972). Larvae have been collected from salt marsh and from a tidally influenced roadside borrow pit.

***Chrysops beameri* Brennan**

Chrysops beameri Brennan 1935: 265

Moderate (8 mm); yellow and black; frontoclypeus and frontal callus yellow; thorax yellow to greenish yellow with black stripes; abdomen dorsally with four longitudinal black stripes; wing (Figure 17, p. 46) with cell br infuscated, bm hyaline, apical spot wide, hyaline triangle exceeding vein R_{2+3} . Male similar to female.

Comments: This species has been widely collected in the eastern and southern United States extending westward into Texas, Kansas and Oklahoma. It is similar to *C. hinei* with which it is sometimes confused. The immature stages of this species are not known.



Map 16. Counties of collection: *Chrysops beameri*.

Known Distribution (Map 16): ANDERSON: 10 Aug 1963; W.W. Gibson; black light trap; SFASU. Salmon; 14-21 Jul 1974; H.R. Burke; TAMU. **KERR:** 29 Aug 1969; R.R. Blume; TAMU. **SAN JACINTO:** 3 Jun 1985; S. Dunkle; FSCA. **WALKER:** Huntsville St Pk; 10 Aug 1963; W.W. Gibson; at black light in wooded game preserve; SFASU. Huntsville St Pk; 26,30 Jun 1971; P.H. Thompson; TAMU. **WOOD:** Mineola; 19 Jul 1906; Bishopp & Jones; TAMU.

Chrysops bistellatus Daecke

Chrysops bistellatus Daecke 1905: 249

Moderate to large (9 mm); yellow and brown; dorsum of thorax greenish gray with dark brown stripes; abdomen yellow with two submedian dark stripes; wing (Figure 18, p. 46) with hyaline triangle represented by an isolated spot in cell r_{2+3} . Male with cells br and bm infuscated; otherwise similar to female.

Comments: This species has been rather widely collected in the Atlantic and Gulf coastal states from New Jersey to Texas. Collections from non-coastal states have been less frequent, but have been made (e.g., West Virginia). The immature stages are not known.



Map 17. Counties of collection: *Chrysops bistellatus*.

Known Distribution (Map 17): NACOGDOCHES: 9 May 1971; J.R. Boyett; black light trap; SFASU.

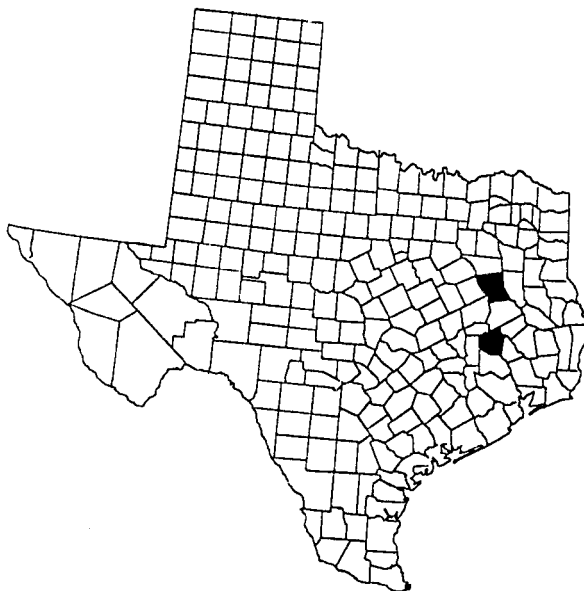
Chrysops brimleyi Hine

Chrysops brimleyi Hine, 1904a: 55.

Small (6 to 7 mm); dark, black with grayish pruinosity; frontal callus brown; frontoclypeus predominantly yellow, brown at sides; abdomen sometimes with traces of grayish pattern; wing (Figure 19, p. 46) with cell br partly infuscated, bm hyaline, apical spot

narrow. Male similar to female except cells br and bm partly infuscated and apical spot sometimes broader.

Comments: Like the previous species, *C. brimleyi* has been widely collected in Atlantic and Gulf coastal states from New Jersey to Texas (Thompson 1975b), but less frequently in non-coastal states (e.g., Tennessee, West Virginia). Larvae of this species have been taken from moss or sandy soil containing much organic material along the banks of streams in pine barrens, the margins of stagnant pools, in totally organic soils of a long abandoned cranberry bog (Teskey 1969) and from the margin of a lake in a long-leaf slash pine forest (Tidwell 1973).



Map 18. Counties of collection: *Chrysops brimleyi*.

Known Distribution (Map 18): ANDERSON: Salmon; 26-27 Apr 1975; malaise trap; H.R. Burke; TAMU. **WALKER:** Huntsville St Pk; 5, 10, 17 Apr 1972; P.H. Thompson; TAMU.

Chrysops brunneus Hine

Chrysops brunneus Hine 1903b: 34

Moderate to large (9 mm); brown; frontal callus and frontoclypeus yellow; thorax yellowish to greenish gray with brown stripes; abdominal pattern obsolete, some specimens with faint pale middorsal triangles; wing (Figure 20, p. 46) with cells br and bm partly infuscated, apical spot large, extending dilutely around wing margin to unite with crossband, thus isolating hyaline triangle; antennae swollen. Male similar to female.

Comments: This species has been collected from coastal states from New York to Texas (Brennan 1935; Philip 1947; Thompson 1973a) and also from most states bordering the Mississippi River northward to the states along the Great Lakes and westward into Nebraska, Kansas and Oklahoma. Goodwin (1976a) reported taking

a single larva from a clump of dead *Spartina* spp. in a salt marsh along the coast in South Carolina.



Map 19. Counties of collection: *Chrysops brunneus*.

Known Distribution (Map 19): **BRAZORIA:** 11 mi E Angleton; 18, 26 Aug, 2 Sep 1971; P.H. Thompson; TAMU. Haskins Mound; 25 Aug - 2 Sep 1971; P.H. Thompson; TAMU. **BRAZOS:** Carter Lk, Bryan; 1 May 1973; P.H. Thompson; TAMU. **CHAMBERS:** beach, 17 mi W Sabine Pass; 10-12 Jun 1965; H.E. Evans; CU. 8 Jul 1983; A.F. Beck; FSCA. **JEFFERSON:** Pleasure Is; 15 Jun 1972; D. McLead; TAMU. Port Arthur; 10, 20, 28 Aug 1983; L.J. Ogdin; USNM. Texas Pt Nat Wild Ref; 10 May 1993; J. T. Goodwin; JTG. **ORANGE:** San Nenito; 11 Aug 1983; A. Thomas; USNM. Orange; Sep 1984; Bishop; USNM.

Chrysops callidus Osten Sacken

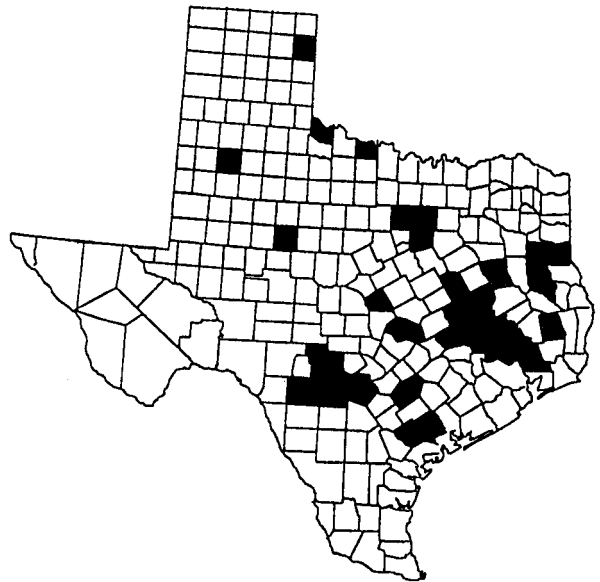
Chrysops callidus Osten Sacken 1875: 379

Chrysops callidula Philip, 1941d: 117 (unjustified new name for *callidus* Osten Sacken, not *calidus* Walker).

Moderate (8 mm); black and yellow; frontal callus and frontoclypeus yellow; thorax grayish to greenish yellow with black stripes; abdomen predominantly black with distinct pale middorsal triangles on tergites 2 to 4 or 5 and with lateral extremes of segments 1 and 2 pale; wing (Figure 21, p. 46) with cells br and bm hyaline, apical spot narrow. Male with cells br and bm partly infuscated and with pale markings of abdomen reduced.

Comments: This species has been widely collected over the entire eastern half of the United States. Published references to Texas collections include Blume *et al.* (1972), Brennan (1935), Philip (1947, 1965), Thompson (1973a, 1974 a and b, 1975b, 1977), and Thompson *et al.* (1977). Larvae have been taken commonly from the margins of ponds and less commonly

from the margins of streams (Teskey 1969, Tidwell 1973). Typically, larvae were in the upper few centimeters of mud very near the margins of the water, but Tidwell (1973) found larvae up to 10 m from the shore in the bottom mud of ponds during the colder months. The senior author has collected larvae of this species from numerous habitats similar to those noted above in several of the southern states including sites in Texas.



Map 20. Counties of collection: *Chrysops callidus*.

Known Distribution (Map 20): **ANDERSON:** Salmon; 26-27 Apr 1975; H. Burke; malaise trap; TAMU. Salmon; 27 Apr 1985; P.W. Kovarik; TAMU. **BANDERA:** Geronimo Creek; Feb, Mar 1975 (as larvae); J. T. Goodwin; FSCA. **BEXAR:** Ft Sam Houston; 11 Apr 1965; P.H. Thomas; FSCA. **BRAZORIA:** 27 Apr 1965; R. Thornton; CU. **BRAZOS:** College Station; 7, 24, 25, 30 Apr 1929; H.J. Reinhard; TAMU. 16 Apr 1930; R.K. Fletcher; TAMU. 26 Jun 1932; S. Bromley; TAMU. 10 Jun 1938; J.E. Gillaspay; TAMU. 8 Apr 1946; H.J. Reinhard; TAMU. College Station; 26 Apr 1964; J.C. Schaffner; TAMU. Navasota R, 11 mi E Bryan; 4, 12 Aug 1970; P.H. Thompson; TAMU. Mile Dr, S College Station; 2 Mar, 2-8, 4, 9, 10, 11, 12, 15, 18 Apr, 3, 4, 5, 7, 14, 19, 20, 21, 25, 29 May 1971, 25 Mar, 20 Apr. 1972, 1, 5, 6, 17, 20, 21, 22, 25, 27 Apr, 3, 4, 8, 11, 15, 19, 26 May, 1, 2, 5, 9, 23, 25, 26, 29, 30, 31 June, 1, 2, 3, 4, 8, 25, 26, 27, 29 July, 28, 29 Aug. 1973, 17 Mar, 14 Sep 1974, 1, 4, 6 Apr, 2, 3 May, 6 Aug 1975, 4 Apr, 11 mi SE of Bryan, HW 30; 12-15 Apr, 16 Apr - 2 May 1971; P.H. Thompson; TAMU. College Station; 17 Apr 1983; T.P. Friedlander; TAMU. HW 6 & 30; 29 Apr 1971; P.H. Thompson; TAMU. 1 May 1978; P.H. Thompson; TAMU. 7 mi S HW 6; 7 May 1971; TAMU. 24 Apr 1973; T.P. Friedlander; TAMU. 16 May 1978; P.H. Thompson; TAMU. **BURLESON:** 3 mi E Somerville; 1 Apr 1973; J.C. Schaffner; TAMU. **GOLIAD:** 2 mi N Weser; 14 Mar 1976 (as larvae); J. T. Goodwin; FSCA. **GONZALES:** Palmetto St Pk; 18,19 Apr 1970; J.C. Schaffner; TAMU. Palmetto St Pk; 4 May 1970; Board & Schaffner; TAMU. Palmetto St Pk; 19 Apr 1963; Roberts & Neumann; UK. **GRIMES:** Navasota R & FM 2038; 22 Jun, 1 Sep 1971, 27 Mar, 5, 10 Apr, 19 Jun, 1 Aug 1972, 5 May 1974, 6 Aug 1975; P.H. Thompson; TAMU. **HARDEMAN:** Site 9, Medicine Mounds Ranch; 24 Jun 1995; W.D. Sissom; ASU. **HEMPHILL:** 14 mi NE Canadian L, Marvin; 24 Jun 1970; C.W. O'Brien; TTU. **JOHNSON:** 3 mi S Alvarado; 21 May 1972; R.E. Acciavitti; CU. **KERR:** Kerrville; 12 Apr 1965; J.C. Schaffner;

TAMU. LAMPASAS: 26 May 1968; J. Williamson; TTU. LEON: 3 mi N Lima; 19 Jun 1980; Lisowski; INHM. LIBERTY: 1/2 mi E Hull; 29 Mar, 23, 29 May 1972, 12, 26 Apr 1973; P.H. Thompson; TAMU, 16 mi, ESE Cleveland; 29 Mar, 19 Apr 1972; P.H. Thompson; TAMU. LIMESTONE: Mexia; 26 Apr 1968; J.C. Schaffner; TAMU. LUBBOCK: 6 Jun 1954; J.C. Homsley; TTU. MEDINA: 17 Apr 1965; D.G. Young; FSCA. MONTGOMERY: 16 mi SE Magnolia; 4 Sep 1976; K.L. Koplan; TAMU. NACOGDOCHES: 10 Apr 1960; Nacogdoches; SFASU. 23, 26 Apr 1961; N. Nichols; SFASU. 19 Apr 1965; A.D. Cook; at light; SFASU. 5 Jul 1966; D. Monroe; SFASU. 21 Apr 1971; Terry Nins; SFASU. 17 Apr 1982; W.W. Gibson; SFASU. NOLAN: Wright Ranch; 20 Jul 1982; S.R. Kingston; TTU. PANOLA: 2.5 mi W of Sabine R. at TX43; 22 May 1993; J. T. Goodwin; JTG. PARKER: 2.5 mi SW Aledo; 31 May 1970, 3 Apr 1971; Acciavatti; CU. ROBERTSON: 3 mi S Camp Ck Lk; 17 May 1970; J.C. Schaffner; TAMU. RUSK: Minden; 12 Jun 1969; N. Nichols; SFASU. SAN JACINTO: Sam Houston Nat For; 1 May 1905; P. Wagner; TAMU. Sam Houston St Pk; 1 May 1965; P. Wagner; TAMU. Sam Houston Nat For, Double Lake Cpgd.; 12 May 1985; R. Brown & S. Cho; MSU. TARRANT: Haltom City; 15 May 1971; Acciavatti; CU. 5.5 mi NW Crowley; 16-17 Jun 1980; Lisowski; INHM. TRAVIS: 7.5 mi NNW Austin; 11 May 1969; B. Vogel; TMM. Bull Cr, 7.5 mi NNW Austin; 11 May 1960; B. Vogel. TYLER: 2 mi W Fred; 19 Apr 1972; P.H. Thompson; TAMU. UVALDE: Speir Ranch, 3 mi NW Uvalde; 1, 2, 3, 4 May 1977; Fishlin & Warbauer; LB. VICTORIA: 10 May 1971; G. Underwood; TAMU. WALKER: Huntsville St Pk; 22, 27 Jul 1950, 2 Apr 1951, 5 May 1951; 18 Jun 1953; F.A. Cowan; TAMU. 8 mi W New Waverly; 3 May 1970; V.V. Board; TAMU. Huntsville St Pk; 12, 14, 15 Apr 1971; 10, 17 Apr 1972; 1, 5, 9, 14, 29 May 1973; P.H. Thompson; TAMU. WICHITA: 5 mi E Burkburnett; 30 Jul 1982; S.R. Kingston; TTU. WILLIAMSON: San Gabriel 5-6 mi NW Taylor; 22 Jul 1967; 18-20 Apr 1968; J.E. Hafernik; TAMU.

Chrysops celatus Pechuman

Chrysops celatus Pechuman 1949: 82 (as *flavidus* subspecies)

Moderate (8.5 mm); yellowish brown; frontal callus and frontoclypeus yellow; thorax greenish gray with brown stripes; abdomen yellowish with brown geminate spots on second tergite; remaining tergites brown bordered by yellow that expands into middorsal triangles; wing (Figure 23, p. 47) with cell br infuscated over most of basal half, cell bm only at base, outer margin of crossband usually sinuous. Male similar to female.

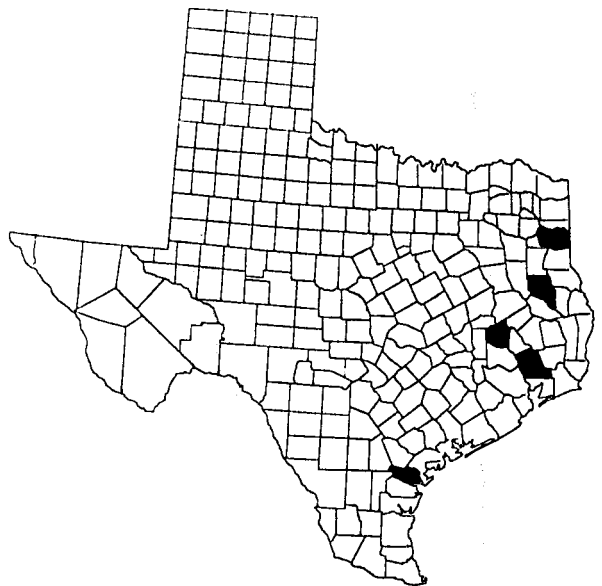
Comments: This species has been collected throughout most of the eastern third of the United States as far west as Texas in the south and northeastern Wisconsin in the north, but it has not been reported from Illinois and Indiana nor the adjacent areas of neighboring states to the east and south. Teskey (1969) reported collecting larvae of this species along streams, at the margins of ponds, from around roots of aquatic vegetation at the base of cypress trees and from an abandoned cranberry bog. Habitats varied from almost pure wet sand to totally organic soil. Tidwell (1973) found larvae in a lake margin in a long-leaf slash pine area. The senior author has collected larvae from similar habitats in Alabama and Tennessee.

Chrysops carbonarius Walker

Chrysops carbonarius Walker 1848: 203
Chrysops fugax Osten Sacken 1875: 375
Chrysops niger Macquart of Walker 1848: 202

Moderate (8.5 mm); black; frontal callus and frontoclypeus brown to shining black, the latter with a yellow pollinose streak on midline; thorax with grayish to whitish pruinosity; abdomen sometimes with traces of gray middorsal triangles; wing (Figure 22, p. 46) with cells br and bm infuscated at least one-half their length, apical spot absent, outer margin of crossband straight, distinct hyaline area at base of cell cua_1 . Male with cells br and bm at least three-fourths infuscated.

Comments: This species has been collected from much of the eastern third of the North America from northern Florida into southeastern Canada, extending westward around much of the Great Lakes region and in the south into south-central Louisiana. It has not been reported from Texas. Teskey (1969) reported collecting larvae from the banks of generally swift streams with sand and gravel banks and little silty material, except for a single collection from a slower, larger stream with silty-clay banks.



Map 21. Counties of collection: *Chrysops celatus*.

Known Distribution (Map 21): HARRISON: 1 mi E Kamak; 19 May 1971; R.E. Acciavatti; CU. LIBERTY: 16 mi ESE Cleveland FM 162; 29 May 1973; P.H. Thompson; TAMU. NACOGDOCHES: 10 May 1961; N. Nichols; SFASU. SAN PATRICIO: Welder Wildlife Ref, 8 mi NE Sinton; 13-15 May 1985; N. Bedwell & R. Brown; MSU. WALKER: Huntsville St Pk; 3 Apr, 6, 21 May 1971, 13, 19 Jun 1972; P.H. Thompson; TAMU.

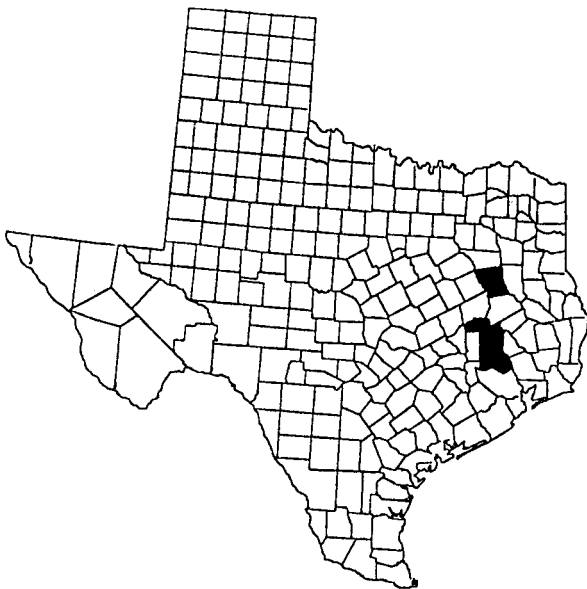
Chrysops cinciticornis Walker

Chrysops cinciticornis Walker 1848: 201

Chrysops celer Osten Sacken 1875: 376

Moderate to large (9 mm); black; frontal callus and frontoclypeus black, the latter with a broad longitudinal pollinose stripe on midline; thorax with white pubescence and faint gray stripes; pleurae with dense yellow to orange-red pile; abdomen with white pubescence and indistinct gray middorsal triangles on segments 2 and 3; wing (Figure 24, p. 47) with cells br and bm infuscated over more than half their length, apical spot absent, cell cua, infuscated at base. Male lacking yellow or orange pile; anal area of wing dilutely infuscated.

Comments: This species has been widely collected from the eastern half of the United States and southeastern Canada. Thompson (1973b) reported collecting this species in Texas. Larvae have been taken from moss, silt, muck, mud and almost pure sand on the margins of stagnant and freshwater ponds and lakes and along slow-moving streams (Teskey 1969, Tidwell 1973).



Map 22. Counties of collection: *Chrysops cinciticornis*.

Known Distribution (Map 22): ANDERSON: Salmon; 26-27 Apr 1975; H.R. Burke; TAMU. Salmon; 27 Apr 1985; P.W. Kovarik; TAMU. GRIMES: Navasota R & FM 2038; 11 Apr 1977; P.H. Thompson; TAMU. MONTGOMERY: Sam Houston Nat For; 16 Apr 1965; J.C. Schaffner; TAMU. Sam Houston Nat For; 10 Apr 1968; C. Schaffner; CBP. WALKER: Huntsville St Pk; 12 Apr 1971; P.H. Thompson; TAMU.

Chrysops cursim Whitney

Chrysops cursim Whitney 1879: 36

Moderate (7.5 mm); yellow and black, the former

predominant; frontal callus and frontoclypeus yellow; thorax grayish yellow with brown stripes; black of abdomen forms an isolated inverted V-shaped spot on second tergite, that of succeeding tergites forming more band-like areas along anterior margins; wing (Figure 25, p. 47) with cells br and bm hyaline, crossband dilute, part of discal cell with reduced infuscation, apical spot moderately broad. Male with cells br and bm partly infuscated; crossband less dilute.

Comments: This species has not been collected in Texas. It has been collected from most of the eastern third of the United States from Louisiana to New Hampshire, the western limit approaching the Mississippi River in Tennessee and then angling eastward through New York to New Hampshire. Although the immature stages of this species have not been described, Jones and Anthony (1964) reported rearing adults from larvae taken from the wet grassy margin of a pond in a low pineland pasture.

Chrysops dacne Philip

Chrysops dacne Philip 1955: 99

Moderate (7.5 mm); dark brown; frontal callus dark brown; frontoclypeus predominantly brownish yellow, darker at sides; thorax brown with grayish stripes but lacking pale stripe above wing base; abdomen with yellow typically forming narrow median stripe and rarely obsolete lateral stripes; wing (Figure 26, p. 47) with cell br infuscated, bm hyaline, apical spot very broad, hyaline triangle narrow. Male with hyaline areas of wing faintly tinted.

Comments: This species has been collected from the southern half of the United States from eastern Texas and Oklahoma to the Atlantic Coast and northward in the eastern third into northeastern Ohio and New York. The immature stages of this species are not known.

Known Distribution (Map 23, p. 56): ANGELINA: Boykin Springs Rec Area nr. microwave tower on forest road 313A; 15 May 1993; C.T. Maier; CTM. WALKER: Huntsville; 22 Jul 1950; F.A. Cowan; TAMU.

Chrysops dimmocki Hine

Chrysops dimmocki Hine 1905: 393

Moderate (8 mm); black and yellow; frontal callus black to yellow; frontoclypeus yellow; thorax greenish-gray pollinose with brown stripes; abdomen with black quadrate spot beneath scutellum and an inverted black V-shaped (occasionally geminate) spot on second segment; remaining segments predominantly black with yellow middorsal triangles; wing (Figure 27, p. 47) with cells br and bm hyaline, apical spot broad. Male with cells br and bm partly infuscated.



Map 23. Counties of collection: *Chrysops dacne*.

Comments: This species has been previously collected from Atlantic and Gulf coastal states from New Hampshire to Texas (Thompson 1974b). Populations from non-coastal states have been reported from western Tennessee to southern Illinois and southern Ohio and Pennsylvania. Larvae have been taken from almost pure wet sand at the margin of a small stagnant pond (Teskey 1969) and from moist organic muck at the bases of gum trees in a tupelo gum-cypress swamp and from mud of a rice field levee (Tidwell 1973). The senior author has collected larvae from saturated mud at the margins of cypress-bordered lakes in pine forests in Florida.



Map 24. Counties of collection: *Chrysops dimmocki*.

Known Distribution (Map 24): ANGELINA: Bouton Lk,

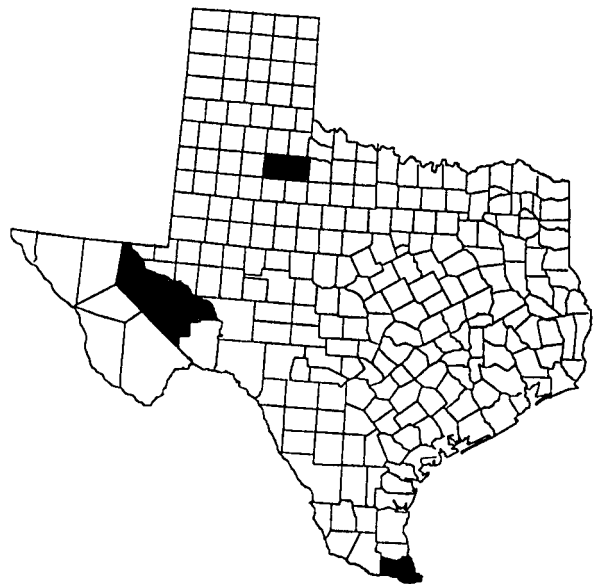
Angelina Nat For; 15 May 1993; J. T. Goodwin; JTG. **HARDIN:** 3 mi NE Kountz FM 418; 23 May 1973; P.H. Thompson; TAMU. **LIBERTY:** 0.5 mi E Hull; 7, 14 Jun 1972; P.H. Thompson; TAMU. **SAN JACINTO:** Sam Houston Nat For, Double Lk Cpgd; 12 May 1985; N. Bedwell; MSU.

***Chrysops dissimilis* Brennan**

Chrysops dissimilis Brennan 1935: 288

Moderate (7.5 mm); yellow and black; frontal callus brown-yellow, broadly bordered dark brownish black frontoclypeus, genae and palpi predominantly yellow; thorax yellowish-gray pollinose with obscure dark stripes; abdomen predominantly yellow, tergite 2 variable, either with a pair of median parallel or anteriorly converging black spots or a single median geminate spot; tergites 3 to 5 each with a pair of submedian black spots and sometimes smaller sublateral black spots; wing (Figure 28, p. 47) with cell br of wing partly infuscated, apical spot narrow, crossband only narrowly reaching hind margin of wing. Male similar to female.

Comments: This southwestern species has been collected in New Mexico and Texas (Philip (1965). The immature stages are not known.



Map 25. Counties of collection: *Chrysops dissimilis*.

Known Distribution (Map 25): CAMERON: Brownsville; 18 Apr 1948; C.R. Joyce; USNM. **DICKENS:** 16, 21 Jun 1978; S.G. Davis; TTU. **KING:** J.Y. Ranch; 21 Jun 1978; S.G. Davis; TTU. YJ Ranch, Guthrie; 18, 21 Aug 1982; S. R. Kingston; TTU. **PECOS:** 23 Jul 1970; C.W. O'Brien; TTU. **REEVES:** Pecos; 9 Jul 1943; F.C. Baker; CU.

***Chrysops dorsopunctus* Fairchild**

Chrysops dorsopunctus Fairchild 1937: 59 (as variety of *fulvistigma*)

Small (7 mm); black with yellow markings; frontoclypeus and frontal callus black, the former sometimes with an abbreviated pollinose midstripe; thorax fuscous with grayish pollinosity and indistinct brownish stripes; abdomen black and yellow, the yellow confined to the first two tergites where the black is reduced to a median spot under the scutellum and a large median figure on the second tergite, these often joined; wing (Figures 29A & 29B, p. 47) highly variable, ranging from only faint indications of a crossband to a fully saturate crossband and from virtually no apical spot to a distinct, but narrow apical spot that is scarcely, if at all, united to crossband. Male essentially like female.

Comments: This southeastern species has been collected in Gulf coastal states from Texas to Florida. Originally described as a variety of *C. fulvistigma* Hine, specimens matching the above description have been treated as a distinct species, but Tidwell (1973) chose to treat them as part of the overall variability of *C. fulvistigma*. Although further study is definitely needed, we have chosen to treat the two entities as separate species. The immature stages are not known.



Map 26. Counties of collection: *Chrysops dorsopunctus*.

Known Distribution (Map 26): ANDERSON: Salmon; 22 Jun, 14-21 Jul 1974; H.R. Burke; TAMU. WALKER: Huntsville St Pk; 3, 23, 30 Jun, 7, 22 Jul 1971; P.H. Thompson; TAMU.

Chrysops facialis Townsend

Chrysops facialis Townsend 1897: 39

Moderate (8 mm); black and yellow; frontal callus fuscous to black; frontoclypeus and palpi predominantly reddish to brown, the former with a row of black spots; oral margins of genae black; thorax black with faint

indications of grayish yellow stripes; abdomen yellow and black, the black comprising median triangular figures on tergites 2 and 3 and more or less double geminate spots on 4 and 5, remaining tergites black; wing (Figure 30, p. 47) with cells br and bm partly infuscated, apical spot only slightly broadened, covering about one fourth of cell r_4 , crossband broadly attaining hind margin of wing. Male similar to female.

Comments: This southwestern species has been collected in New Mexico, Arizona, and northern Mexico, but not from Texas. Burger (1977) reported collecting larvae from a variety of habitats including mud or sod along the banks of permanent streams and ponds, occasionally in cienaga habitat, in fine sandy silt in a large creek and in mineral soil, sod and occasionally moss; they were most abundant in lentic habitats in oak woodland to ponderosa pine forest.

Chrysops flavidus Wiedemann

Chrysops flavidus Wiedemann 1821b: 55 (1821b: 105)

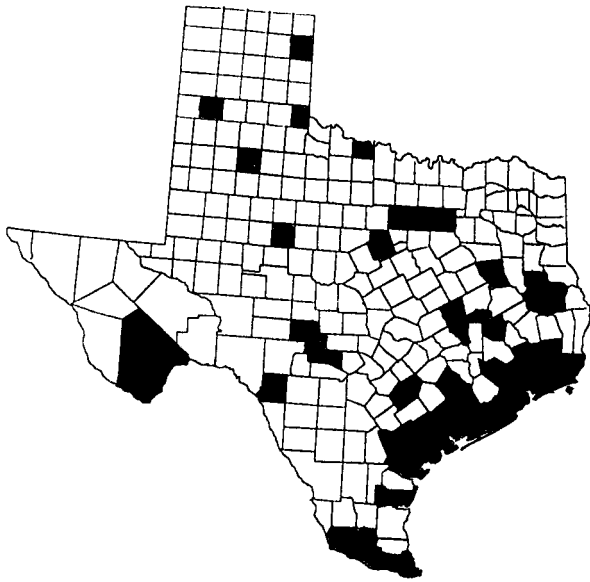
Chrysops pallida Macquart 1838a: 166 (1838a: 162)

Chrysops pallidus Bellardi 1859: 73 (1861: 273)(preoccupied Macquart, 1838a)

Moderate (8.5 mm); yellow and brown; frontal callus and frontoclypeus yellow; thorax yellowish with brown stripes; abdomen yellowish basally with a low inverted brown V-shaped spot on second tergite, remaining tergites predominately brown with yellow borders and middorsal triangles; wing (Figure 31, p. 47) with cells br and bm with infuscation in basal halves, apical spot broad, outer margin of crossband more or less straight. Male similar to female.

Comments: This species has been collected from most of the eastern half of the United States northward to the southern edge of the Great Lakes and collections are known from eastern Mexico at least as far south as Tampico. Texas collections have been reported by Blume *et al.* (1972), Brennan (1935), Easton *et al.* (1968), Philip (1947, 1965), Thompson (1973a and b, 1974a and b, 1975b, 1977), and Thompson *et al.* (1977). Larvae have been collected from the bank of a freshwater pond (Teskey 1969) and at the margins of ponds and waterways in mixed bottomland hardwood forests (Tidwell 1973). Jones and Anthony (1964) reported collecting a single larva from the bottom of a small brook. The senior author has collected many larvae of this species from wet organic mud at the margins of ponds and lakes in several southeastern states and from the mud of a stream bed in Goliad Co., Texas.

Known Distribution (Map 27, p. 58): ANDERSON: Palestine at wooded game preserve; 10 Aug 1963; W.W. Gibson; black light trap;



Map 27. Counties of Collection: *Chrysops flavidus*.

SFASU. 10 mi SW Elkhart; 28 May 1967; H.R. Burke; TAMU. **ANGELINA**: Lufkin; 7 Jun 1963; D. Hudson; on bark of tree; SFASU. Graham Creek, Angelina Nat For; 17 May 1993; J. T. Goodwin; JTG. **ARANSAS**: Goose Is St Pk; 26 Jun 1969; Board & Hafernik; TAMU. **BEE**: Medio Cr @ FM 2441; 13 Apr 1996 (as larva); J.T. Goodwin; JTG. **BRAZORIA**: Alvin; 10 May 1963; A.D. Bratt; CU. Haskins Mound; 29 July, 2, 4, 7, 9, 16, 18, 23, 25, 30 Aug, 11, 13, 19 Sep, 5, 17 Oct 1967, 26 Apr, 6, 8, 10 May, 17, 26 Jun, 5, 12, 21 Aug, 11 Oct, 10, 12, 19, 21, 23 Jul 1968, 14 May, 4, 13 Jun, 2, 21 Jul, 5, 6, 14 Aug, 2, 10, 12, 22, 24, 29 Sep, 10 Oct 1969; P. H. Thompson; malaise trap; TAMU. West Bay, 12 mi S Danbury; 13-15 Aug 1970; P.H. Thompson; TAMU. 11 mi E Angleton; 7, 26 May, 8, 15, 22, 29 Jul, 11, 12, 18, 26 Aug, 2, 9 Sep 1971; P.H. Thompson; TAMU. **BRAZOS**: 23 Aug 1920; H.J. Reinhard; TAMU. College Station; 23 Apr 1930; S.E. Jones; TAMU. 24 Apr 1930; R.K. Fletcher; TAMU. 24 May 1931; H.J. Reinhard; TAMU. 6 mi E of Bryan; 2 May 1965; J.C. Schaffner; TAMU. College Station; 26 Aug 1970; P.H. Thompson; TAMU. Mile Dr, S College Station; 12 May 1972, 15 Sep 1974, 18, 18, 22, 23 Apr, 1, 8, 16 May 1975; ; P.H. Thompson; TAMU. Bryan; 29-30 May 1976; malaise trap; H.R. Burke; TAMU. **BREWSTER**: Rio Grande St Pk; 18 Apr 1974; C.C. Porter and G.H. Nelson; FSCA. **CALHOUN**: Goff Bayou HW 35; 19 Aug 1971; P.H. Thompson; TAMU. **CAMERON**: Brownsville; 10, 12, 14 Jul; Beimler, LLP. Brownsville; 25 May 1934; J.N. Knoll; USNM. Olmito; 14 Apr 1942; FSCA. June 1942; R.B. Eads; USNM. Laguna Madre, 25 mi W of Harlingen; 37 Mar 1946; D.E. Hardy, N.L. Wooley; USNM. Brownsville; 4 Aug 1967; H.R. Burke & J. Hafernik; TAMU. La Feria: 10 Oct 1968; TAMU. Brownsville; 20-22 Jun 1969; P.L. Glick; TAMU. Brownsville; 25, 26 Jun 1969; Board & Hafernik; TAMU. Brownsville; 11 Jul 1971; W.E. Clark; TAMU. 11 Aug 1971; W.E. Clark; TAMU. Brownsville; 23 Aug 1972; J. Tucker; TAMU. 29 May 1973; P.T. Reinherd; TAMU. Boca Chica; Jan 1974; FSCA. Brownsville; 23 Oct 1976; F.D. Fee; FDF. Brownsville; 20 Nov 1979; D.G. Young; FSCA. Sabal Palm Grove Sanct; 16,17 May 1981; blacklight trap; R. Turnbow & E. Oritz; TAMU. Brownsville; 29 Jun 1982; FSCA. Sabal Palm Grove Sanct; 5 Apr 1987; E. Riley & D. Rider; LSU. **CASTRO**: Dimmitt; 31 May 1945; TAES light trap; TAMU. **CHAMBERS- JEFFERSON**: beach, 17 mi W Sabine Pass; H.E. Evans & Flint; CU. **CHILDRESS**: 5.5 mi NE Childress; 29 Jul 1982; S.R. Kingston; TTU. **COLORADO**: 29 Jun, 11, 27, 9 Jul 1959; C.F. Bailey; FSCA. 30 Jun, 3, 15, 29 Jul, 5 Aug 1959; C.F. Bailey; TAMU. **CROSBY**: 9 Sep 1977; S.G. Davis; TTU. **DALLAS**: Dallas; 11 Apr 67; collector unknown; UTAU. **ERATH**: FM 1188 3 mi W Bluffdale; 16-23

Jul 1976; malaise trap; R.L. Sams; TAMU. **GALVESTON**: Galveston; May; F.H. Snow; NYSM. **GOLIAD**: 2 mi N Weser; 24 Mar 1976 (as larva); J.T. Goodwin; FSCA. **GONZALES**: Palmetto St Pk; 7 June 1969; Board & Hafernik; TAMU. **GRIMES**: Navasota R & FM 2038; 24 Apr, 24 Jun 1974, 23 Apr, 5 May 1975; P.H. Thompson; TAMU. **HARDIN**: Sour Lake; 8 Aug 1970; Gaumer; dry salt lake bed; CU. **HARRIS**: Houston; 7 May 1958; FSCA. Cypress; 4 Oct 1974; A. Dean; TAMU. **HEMPHILL**: Canadian; 26 Jul 1966; D. Brooks; GSU. 4 mi NE Canadian Lake, Marvin; 23 Jun 1970; L. & C.W. O'Brien; TTU. 2 Jul 1978; E.C. Knudson; FSCA. **HIDALGO**: Donna; 15 Oct 1933; J.W. Monk; TAMU. 24 Jun 1948; S.S. Robacsk; INHM. 26 Mar 1953, 8 Jun 1958, 3, 5 Apr 1967; Krisswell; OHSU. Bentsen-Rio Grande St Pk; 4 Jul 1967; J.W. Tilden; SJ. Santa Anna; 12 Jul 1967; J.W. Tilden; UGA. Mission; 12, 25 Nov 1970; P.T. Reinherd; TAMU. Rio Grande St Pk, Benson; 10 Jun 1975; C.L. Smith; UGA. Santa Anna Wildlife Preserve, 7 mi. SE Alamo; 25 May 1980; D. W. Webb; INHM. 25 Sep 1973; A. Dean; TAMU. Benson-Rio Grande St Pk; 6,7 Jun 1983; C. B. Barr & D. Rider; LSU. **JACKSON**: Edna; 10 Oct 1969; D. McKay; TAMU. **JEFFERSON**: 29 Jun 1901; A. Wordert; USNM. Beaumont; 10 Aug 1917; E.L. Davis; CU. 9 mi NE Hampshire; 24 Aug 1971; J.B. Tucker; TAMU. 10 mi W Beaumont; Karl J. Kuntz; TAMU. **KERR**: Center Pt; 14-20 May 1987; malaise trap; Wharton and Praetorius; TAMU. **KIMBLE**: Junction; 15-25 Jul 1974; N. Nichols; TTU. **KINNEY**: 5 mi NW Brackettville; 11, 14, 15 Jul 1966; E.R. Easton; TAMU. **KLEBERG**: Riviera; 7 May 1958; H.E. Evans & Flint; CU. Riviera; 10 Jun 1969; Board & Hafernik; TAMU. **LIBERTY**: 14 Aug 1935; T.H. and G.G. Hubbell; FSCA. 1 mi S Hull; 3 Oct 1970; Gaumer & Murray; CU. Dayton; 16 Aug 1971; R.D. Parker; TAMU. 1/2 mi E. Hull; 19, 26 Apr, 10, 31 May, 7, 14 Jun, 8, 16, 23 Aug. 1972, 26 Apr 1973; P.H. Thompson; TAMU. 5 mi ESE Cleveland HW 32; 6-7 Jul 1972; P.H. Thompson; TAMU. **MATAGORDA**: Palacios; 4 Aug 1971; R.D. Walsh; TAMU. **NACOGDOCHES**: 21 May 1960, Jul 1963; W.W. Gibson; males at black light trap; SFASU. Jul 1965; M. Young; at light; SFASU. 1 Jul 1969; N Nichols; SFASU. 7 mi ESE Etoile; 3 Jun 1971; R.E. Acciavitti; CU. 8 Aug 1983; W.W. Gibson; black light trap; SFASU. **NOLAN**: Wright Ranch, 7 mi SE Sweetwater; 20 Jul, 2, 17, 23 Aug, 22 Sep 1982; S.R. Kingston; TTU. **ORANGE**: 17 Aug 1972; USDA. **PARKER**: 2.5 mi SW Alido; 31 May 1971; R.E. Acciavitti; CU. **REFUGIO**: Rockport; 22 May 1980 D.W. Webb; INHM. **ROBERTSON**: Calvert; A.W. Morrill; USNM. **SAN AUGUSTINE**: 15 mi ESE Broadus; 2 Jun 1971; R.E. Acciavitti; CU. **SAN PATRICIO**: 29, 30 May; G.B. Fairchild; FSCA. Welder Wildlife Ref, 8 mi NE Sinton; R. Brown & B. Farmer; MSU. Lake Corpus Christi St Pk; 9 Jun 1969; Board & Hafernik; TAMU. Welder Wildlife Ref; 27, 28 Jun 1969; Board & Hafernik; TAMU. Welder Preserve; 7 mi NE Sinton; 25 Apr 1977; Fishlin & Wasbauer; Byark. Welder Wildlife Ref; 30 May 1980; FSCA. **STARR**: Grulla; Oct 1967; P.C. Harmston; FSCA. **TARRANT**: Hamilton City; 15 May 1971; R.E. Acciavitti; CU. 6 mi S Azle; 17 Jul 1971; R.E. Acciavitti; CU. 5.5 mi NW Crowley; 16-17 Jun 1980; E.A. Lisowski; INHM. **VICTORIA**: Victoria; 24 Jul 1915; Bishopp; USNM. Victoria; 29 Jul 1915; FSCA. **WALKER**: Huntsville St Pk; 15 Apr, 3, 16, 23, 30 Jun 1971, 13, 26 Jun, 3, 28 Jul 1972; P.H. Thompson; TAMU. Ellis Prison; modified malaise trap; 13, 14 Aug 1977; W.L. Sterling; TAMU. **WHARTON**: 26 May 1959; FSCA. Wharton; 2 Jul 1969; USDA. El Campo; 8 Jun 1975; C.L. Smith; at light; UG. Pierce; 19 Jul 1991; Bishopp; USNM. **WICHITA**: 24 Jul 69; G. Thornton; MISU. 14 mi N Wichita Falls, HW 281 at Red R; 21 May 1971; Murray & Gaumer; TAMU. 25 Jun 1971; MISU. 4 Oct 1975; L.D. Fagg; MISU. Lk Wichita; 12 sep 1976; J.F. Parrish; MISU. 5 mi E Burkburnett; 28 Jul 1982; S.R. Kingston; TTU.

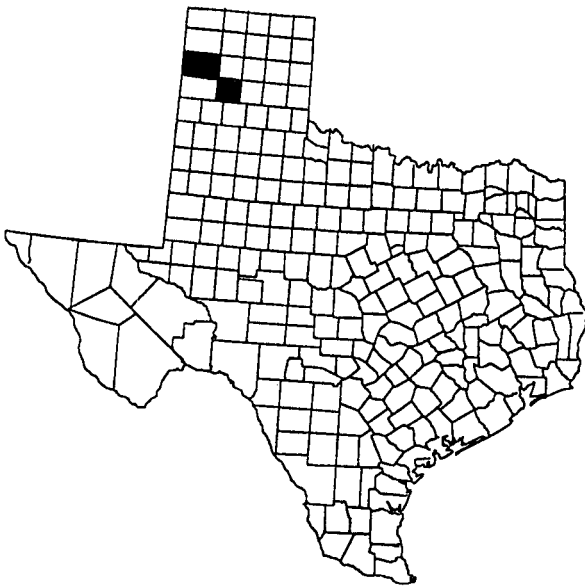
Chrysops fulvaster Osten Sacken

Chrysops fulvaster Osten Sacken 1877: 221

Small (7 mm); yellow and brown; frontal callus

yellow with fuscous upper margin; frontoclypeus, genae and palpi predominantly yellow, the first two with some fuscous; thorax brown to yellow brown with fuscous stripes; abdomen yellow or grayish yellow and black, second tergite predominantly yellow with a median pair of oblique black spots which may almost unite, posterior tergites with yellow confined to posterior bands which widen laterally and medially; wing (Figure 32, p. 48) with cells br and bm partly infuscated, apical spot broad, crossband not uniformly intense, paler in discal cell, entire posterior border faintly infuscated. Male with wing more infuscated; body and legs darker, the yellow of abdomen greatly reduced.

Comments: This species has been collected from much of the western one-third or more of the United States and southern Canada from Minnesota and Alberta southward to Texas, New Mexico, Arizona and California. Teskey (1985) reported rearing larvae of this species collected from the margins of an irrigation impoundment and from a small, shallow, marshy pond in association with cattail.



Map 28. Counties of collection: *Chrysops fulvaster*.

Known Distribution (Map 28): OLDHAM: Boys Ranch; 7 Jun 1974; T. Alvarez; GSU. & WTAM. RANDALL: Canyon; 30 Apr 1969; P. Davis; GSU.

***Chrysops fulvistigma* Hine**

Chrysops fulvistigma Hine 1904a: 55

Small (6.5 mm); brown to black and yellow; frontal callus and frontoclypeus black; thorax brownish with grayish pruinosity, faintly striped; abdomen with first tergite yellow laterally, black in middle beneath scutellum; second tergite yellow with black posterior margin, with

two submedian anterior black linear projections which nearly reach anterior margin, third tergite black with small median and two smaller lateral yellow spots at anterior margin; remaining tergites black; wing (Figure 33, p. 48) with

cells br and bm hyaline, apical spot absent, crossband dilute. Male similar to female.

Comments: This species has been collected from New Jersey southward and westward to Texas (Thompson 1973b), but no collections are known from the eastern third to half of North Carolina, South Carolina and Georgia, nor from Florida except for the panhandle. The known northern limit follows a more or less diagonal path from New Jersey to northeast Texas. The immature stages of this species are not known.



Map 29. Counties of collection: *Chrysops fulvistigma*.

Known Distribution (Map 29): WALKER: Huntsville St Pk, 3, 23, 30 Jun, 7, 22 Jul 1971, 16 Jun-10 Jul 1972; P.H. Thompson; TAMU.

***Chrysops geminatus* Wiedemann**

Chrysops geminatus Wiedemann 1828: 205

Chrysops fallax Osten Sacken 1875: 392

Small to moderate (7 mm); black and yellow; frontal callus black; frontoclypeus predominantly yellow except for black of tentorial pits; thorax yellowish with dark brown stripes; abdomen with first tergite yellow except for black spot beneath scutellum; second tergite yellow except for pair of oblique, usually isolated black submedian spots; tergites 3 to 5 predominantly black with a narrow yellow median longitudinal stripe; remaining tergites black; wing (Figure 34, p. 48) with cells br and bm hyaline, apical spot broad, hyaline triangle crosses vein

R₂₊₃ to nearly isolate apical spot. Male essentially like female except that cells br and bm have some dilute infuscation.

Comments: This species has been collected from most of the eastern one-third of the United States and extends westward in the northern and southern parts of its range into Michigan and eastern Iowa and into eastern Texas and Oklahoma, respectively. Teskey (1969) reported taking larvae of this species from moss growing in springfed drainage beds and less commonly from moss on the margins of a bog lake, the silty banks of a stream and loamy soils at the margin of a flood pool. The senior author has taken numerous larvae from moss and leaf litter on the surface of a hillside seepage area in mixed hardwood forest in northern Florida.



Map 30. Counties of collection: *Chrysops geminatus*.

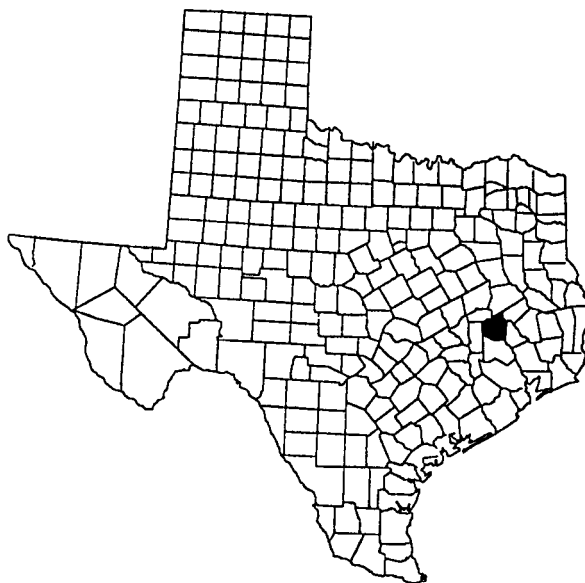
Known Distribution (Map 30): ANGELINA: Boykin Spr, Angelina Nat For; 16 May 1993; J. T. Goodwin; JTG. SAN JACINTO: Sam Houston Nat For, Double Lk Cpgd; 12 May 1985; N. Bedwell; MSU.

***Chrysops hinei* Daecke**

Chrysops hinei Daecke 1907: 143

Moderate (8 mm); yellow and black; frontal callus yellow, margined with brown; frontoclypeus, genae and palpi yellow; thorax greenish in ground color with dark stripes; abdomen with black longitudinal stripes on a yellowish ground color; wing (Figure 35, p. 48) with cell br infuscated, cell cua₁ usually partly infuscated, apical spot broad, reaching cell r₅ and sometimes cell m₁. Male with black abdominal stripes wider and sublateral ones more distinct than in female; cell br completely and cell bm largely infuscated; hyaline triangle often reduced to a narrow crescent.

Comments: This species has been collected from eastern and southern coastal states from New England to Texas (Thompson 1973b). Goodwin (1976a) reported taking larvae from roadside borrow pits in mud around grass roots in south Georgia and northern Florida.



Map 31. Counties of collection: *Chrysops hinei*.

Known Distribution (Map 31): WALKER: Huntsville St Pk; 21 May, 10 Jul 1971; P.H. Thompson; TAMU.

***Chrysops hyalinus* Shannon**

Chrysops vitripennis Shannon 1916: 69 (preoccupied Meigen, 1820)

Chrysops hyalinus Shannon 1924: 178 (new name for *vitripennis* Shannon)

Chrysops claripennis Kröber 1926: 230 (new name for *vitripennis* Shannon)

Small (5.5 mm); black; frontal callus black; antennae predominantly black; thorax and abdomen black, without pattern; wing (Figure 36, p. 48) hyaline except for yellowish costal area and stigma. Male similar to female.

Comments: This infrequently collected species has been collected at one or more locations in Texas, Georgia, Florida, North Carolina and Maryland. The immature stages are not known.

Known Distribution (Map 32, p. 61): ANDERSON: Salmon; 17 Apr 1975; H.R. Burke; FSCA.

***Chrysops impunctus* Kröber**

Chrysops impunctus Kröber 1926: 301

Small to moderate (7 mm); essentially identical to

species in sandy, silty and muck soils of small, usually slow flowing streams. The senior author has collected larvae from sandy soil of the bottom of shallow, slow-flowing stream in South Carolina.



Map 32. Counties of collection: *Chrysops hyalinus*.

C. geminatus except first two abdominal segments entirely yellow; wing (Figure 37, p. 48). Male similar to female.

Comments: This species has not been collected in Texas. It has been collected from the interior of the eastern one-third of the U.S. from central Louisiana in the south extending northward in a widening band through eastern Illinois on the west and western Virginia and Delaware on the east, with narrow extensions further northward into Michigan and Pennsylvania and New Jersey. The immature stages of this species are not known.

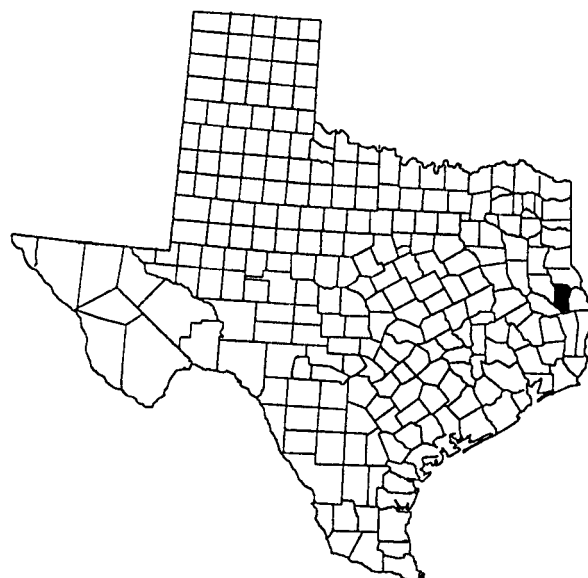
Chrysops macquarti Philip

Chrysops macquarti Philip 1961a: 161

Chrysops univittatus, authors, not Macquart

Moderate (7.5 mm); yellow and black; frontal callus dark brown to black; frontoclypeus predominantly yellow, darker at sides; thorax greenish gray with dark brown stripes; abdomen with yellow median stripe between two black stripes of variable width, sides yellow; wing (Figure 38, p. 48) with cell br infuscated, bm with some anterior infuscation in basal half, cell cua₁ mostly hyaline, apical spot broad, hyaline triangle small, typically crossed by narrow infuscated band in cell r₅ which unites crossband and apical spot. Male with abdominal black stripes broader and cell bm infuscated at least in basal half.

Comments: This species has been collected from throughout the United States east of the Mississippi River from northern Florida to southern Maine. West of the Mississippi River it has so far been reported from Louisiana and Arkansas, and herein for the first time from Texas. Teskey (1969) reported collecting larvae of this



Map 33. Counties of collection: *Chrysops macquarti*.

Known Distribution (Map 33): SAN AUGUSTINE: Turkey Hill Cons Area; 15 May 1993; J. T. Goodwin; JTG.

Chrysops moechus Osten Sacken

Chrysops moechus Osten Sacken 1875: 387

Moderate (7.5 mm); yellow and black; frontal callus black; frontoclypeus yellow; thorax greenish with brown stripes; abdomen typically with four black longitudinal stripes separated by yellow, the median stripes extend anteriorly to tergite 2 where they sometimes unite, the lateral stripes usually not extending as far forward and often irregular; wing (Figure 39, p. 48) with cell br infuscated, bm with infuscation anteriorly along vein, apical spot very broad, hyaline triangle small being confined to cells r₅ and m₁. Male black, wings almost entirely infuscated except for small hyaline triangle.

Comments: This species has been collected from most of the eastern one-half of the United States into southern Canada from western Louisiana and Arkansas in the south to central Minnesota in the north, excluding Florida east and south of the panhandle and herein for the first time from Texas. Teskey (1969) reported collecting two larvae of this species, one from silt that had accumulated among gravel in a river bed and the other from wet soil liberally mixed with leaf mold at the water's edge of a small creek.

S.S. Roback; INHM. TYLER: Town Bluff Res; 12-18 May 1975; S.J. Merritt; TAMU. WALKER: Huntsville St Pk; 6, 7, 21 May, 3, 9, 16, 23, 30 Jun, 7 Jul 1971; 21, 23 Jun 1972; P.H. Thompson; TAMU.



Map 34. Counties of collection: *Chrysops moechus*.

Known Distribution (Map 34): ANGELINA: Graham Cr, Angelina Nat For; 16 May 1993; Lloyd Davis; LD.

***Chrysops montanus* Osten Sacken**

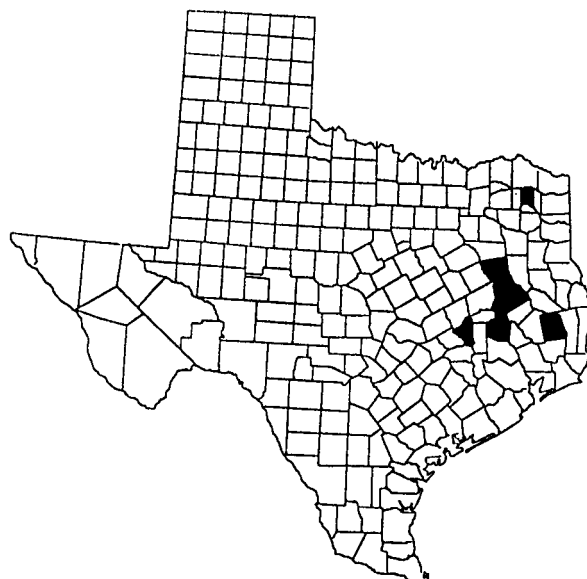
Chrysops montanus Osten Sacken 1875: 382

Chrysops perplexus Philip 1955: 111 (as subspecies)

Moderate (8 mm); black and yellow, frontal callus black; frontoclypeus yellow; thorax dark with grayish stripes; abdomen with median geminate spot on second tergite, sometimes with sublateral black spot on same tergite; tergites 3 to 5 with four rows of black spots; wing (Figure 40, p. 48) with cell br partly infuscated, bm with traces of infuscation at base, apical spot broad, hyaline triangle attaining or possibly exceeding vein R_{2+3} . Male with cells br and bm partly infuscated and yellow of body greatly reduced.

Comments: This species has been collected from the entire eastern one-half of the United States, except southern Florida, and from southern Canada. Texas collections have been reported by Brennan (1935) and Thompson (1973b, 1974a, 1975b, 1977). Teskey (1969) reported collecting larvae of this species from the muddy banks of a creek. The senior author has collected numerous larvae from organic mud at the margins of small ponds in mixed hardwood forests and the margins of large lakes in areas devoid of shoreline trees.

Known Distribution (Map 34): ANDERSON: Salmon; 1 Apr, 19 May 1974, 17 May - 6 Jun, 7-9 Jun, 20 Jul - 3 Aug 1975; malaise trap; H.R. Burke; TAMU. BRAZOS: Mile Dr, S College Station; 19, 24 Sep 1970, 12 May 1972, 18, 23 May, 1, 3, 5 Jun, 27 Aug 1973, 13, 28 Apr 1974; P.H. Thompson; TAMU. HOUSTON: 6 mi NE Crockett; 30 May 1975; P.H. Thompson; TAMU. TITUS: Mt Pleasant; 13 Jun 1948;



Map 35. Counties of collection: *Chrysops montanus*.

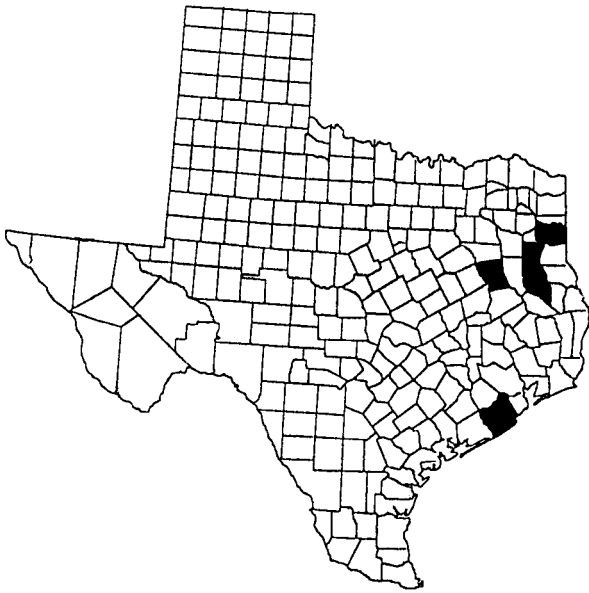
***Chrysops niger* Macquart**

Chrysops niger Macquart 1838: 165 (1838: 161)

Chrysops taylori Philip 1955: 112 (as subspecies)

Moderate (7.5 mm); black; frontal callus black; frontoclypeus predominantly yellow except for black at sides; a transverse pollinose area at the upper, posterior margin of head divides the vertex into anterior and posterior bare, shiny areas; thorax with sublateral stripes dull or obsolete; abdomen without pattern; wing (Figure 41) with cell br infuscated, bm hyaline, apical spot absent. Male with both cells br and bm predominantly infuscated.

Comments: This species has been collected throughout the eastern one-half of the United States, except southern Florida, and from southern Canada. Thompson (1973a) reported collection of this species in Texas. Larvae of this species have been found in wet silty mud on the banks of small ponds, slow-moving streams and small rivers and less frequently taken from a sphagnum bog, the margins of a relatively large lake and a swampy, spring-fed seepage bed (Teskey 1969). Tidwell (1973) reported taking larvae from the margins of a small stream and a pond. The senior author collected a single larva on two separate occasions, one in a flood-plain adjacent to a shallow lake and one near a small woodland stream.



Map 36. Counties of collection: *Chrysops niger*.

Known Distribution (Map 36): **ANDERSON:** Salmon; 28 Apr 1974, 26-27 Apr 1975; malaise trap; H.R. Burke; TAMU. **BRAZORIA:** Haskins Mound, Angleton; 25 Jun 1971; P.H. Thompson; TAMU. **HARRISON:** 3 mi E Karnack; 11 Apr 1972; R.E. Acciavitti; LLP. **NACOGDOCHES:** 29 Apr 1961, 6 Apr 1962; N. Nichols; SFASU. **RUSK:** Marville Cr nr Mt Enterprise; 2 May 1964; L.L. Pechuman; CU.

Chrysops nigribimbo Whitney

Chrysops nigribimbo Whitney 1879: 36

Small (6 mm); dark brown to black; frontal callus dark brown; frontoclypeus predominantly yellow, darker at sides; thorax and abdomen without pattern; wing (Figure 42, p. 49) pattern very pale, cell br infuscated, bm hyaline, apical spot absent or very faint. Male with postero-basal part of cell bm and anal area dilutely infuscated.

Comments: This species has not been collected in Texas. It has been collected from much of the eastern one-third of the United States from Louisiana in the west, north to Tennessee and easterly into New York and New Hampshire. Larvae have been collected in moss on the banks of streams (Teskey 1969) and from the margin of a lake (Tidwell 1973).

Chrysops obsoletus Wiedemann

Chrysops obsoletus Wiedemann 1821b: 58 (1821b: 108)

Chrysops lugens Wiedemann 1821b: 59 (1821b: 109)

Chrysops trinotata Macquart 1838: 165 (1838: 161)

Chrysops morosus Osten Sacken 1875: 389

Chrysops ultimus Whitney 1914: 345

Moderate (8 mm); dark brown to black; frontal callus fuscous; frontoclypeus, genae and palpi fuscous to yellow-brown; thorax yellowish gray pollinose with fuscous stripes; abdomen almost entirely black, sometimes just a hint of a median yellowish longitudinal stripe; pale stripe above wing base; wing (Figure 43, p. 49) with cell br infuscated, apical spot very broad; legs with considerable yellow. Male with part of cell bm and anal area of wing also infuscated.

Comments: This species has not been collected in Texas. It has been collected from coastal areas of the eastern United States from Louisiana to Connecticut. Although two forms of this species (*obsoletus obsoletus* and *obsoletus lugens*) have been recognized by various authors as varieties or subspecies, both are treated as a single species here. A "variety" has no taxonomic status, and subspecific recognition is not justified as the two forms occupy essentially the same range. Goodwin (1987) described the immatures (as *C. obsoletus lugens*) based on specimens reared from larvae collected from wet mud at the margin of a small lake in Florida.

Chrysops pachycerus Williston

Chrysops pachycerus Williston 1887: 134

Chrysops hungerfordi Brennan 1935: 306

Chrysops dilatus Rowe & Knowlton 1936: 256

Moderate (7.5 mm); yellow and black; frontal callus, frontoclypeus, genae and palpi yellow; thorax yellowish gray pollinose with dark stripes; abdomen yellow and black with black forming a spot beneath the scutellum, a black median geminate spot or pair of divergent spots on tergite 2, a pair of median black triangular spots on tergites 3 to 6 and sometimes with black sublateral spots on these same tergites, tergite 7 entirely black; wing (Figure 44, p. 49) with cells br and bm partly infuscated, apical spot broadened to include about a third of cell R₄, crossband rather narrowly attaining hind margin of wing. Male with both cells br and bm predominantly infuscated; body generally darker.

Comments: This species has been collected from Utah southward into northern Mexico, extending eastward into Texas (Easton *et al.* 1968; Philip 1947, 1965) and westward into California. Two forms of this species have been recognized, as varieties or subspecies or distinct species. Most workers currently believe that a single species is involved, but the immature stages of only the *hungerfordi* form have been described. Herein, we recognize only a single species, but we are presenting distribution separately for each of the forms which should facilitate re-examination should immatures of the *pachycerus* form differ from the *hungerfordi* form. Burger (1977) reported collecting larvae of the *hungerfordi* form along the margins of lakes, ponds, cienegas and

small streams, usually mixed with vegetable detritus, and in shaded mineral soil of a creek margin.



Map 37. Counties of collection: *Chrysops pachycerus* (*pachycerus* form).

Known Distribution (Map 37): *Chrysops pachycerus* (*pachycerus* form) **BRAZOS:** 29 Aug 1939; J.E. Gillaspay; TAMU. College Station; 7 May 1947; H.J. Reinhard; TAMU. **BREWSTER:** Big Bend Nat Pk, North Rosillos Mts, Butrill Spr & Lodge; 14-17 Jun 1991; R. Wharton; TAMU. **CULBERSON:** McKittrick Canyon, Guadalupe St Pk; 20 Aug 1969; Board & Hafernik; TAMU. Guadalupe Nat Pk, Choza Spr at Hwys 180/63, 1600 m; 22, 31 May 1992; Gelhaus, Nelson & Koenig; ANSP. **JEFF DAVIS:** Davis Mts, Limpia Spr, 19 km W of Ft Davis, 1945 m; 22, 31 May 1993; Gelhaus, Nelson & Koenig; ANSP. **PRESIDIO:** Almato Cr 5 mi SE Presidio; 5,13 Jun 1968; J.E. Hafernik; TAMU. Plata; 24 Aug 1969; Board & Hafernik; TAMU.



Map 38. Counties of collection: *Chrysops pachycerus* (*hungerfordi* form).

Known Distribution (Map 38): *Chrysops pachycerus* (*hungerfordi* form) **BREWSTER:** 5 mi S Marathon; 11 Jul 1961; J.E. Gillaspay; SRSU. Alpine; 9 Sep 1980; Lee Haik; SRSU. Calamity Cr, Woodward Ranch; 24 Jun 1986; McKensie; SRSU. Alpine; 14 Jun 1988; B. Jarreh; SRSU. 20 mi S. Alpine at TX 118; 4 Jul 1990; J. Adamson; SRSU. **CULBERSON:** Davis Mts; 2 Jun 1936; D.J. and J.N. Knull; USNM. McKittrick Canyon; 1 Jul 1961; SRSU. **PRESIDIO:** 6 mi SE Presidio; 15, 16, 18, 19, 22, 24 Aug 1966; E.R. Easton; TAMU. Cathedral Mt, 14 Aug 1986; collector unknown; SRSU. **VAL VERDE:** Del Rio; 27 May 1913; J.D. Mitchell; USNM.

Chrysops parvulus Daecke

Chrysops parvulus Daecke 1907: 142

Small (6.5 mm); very dark brown or black; frontal callus and frontoclypeus dark brown, the latter with a median yellowish pollinose stripe; thorax without pattern, lacking pale stripe above wing base; abdomen without pattern; wing (Figure 45, p. 49) with cell br infuscated, apical spot broad. Male with wing completely infuscated, but basic pattern is darker.

Comments: This species has been collected from the southeastern United States from Texas and Arkansas eastward and northward in the east to New Jersey and possibly New York. Teskey (1969) reported taking two larvae from moss, one along a drainage channel in an abandoned cranberry bog and one on the bank of a pool in a cedar swamp.



Map 39. Counties of collection: *Chrysops parvulus*

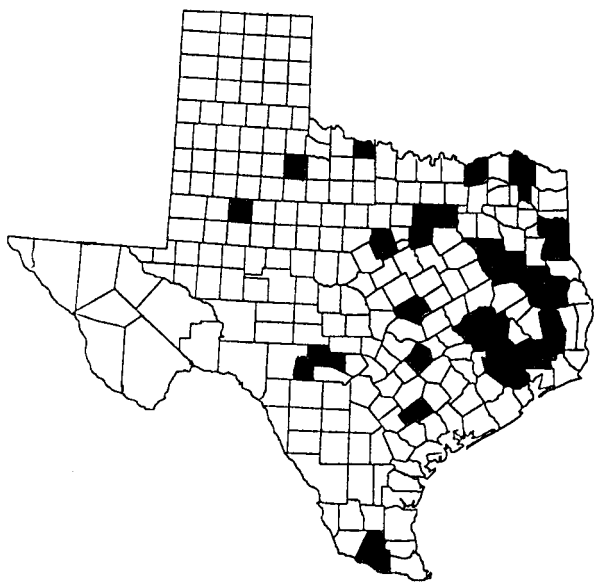
Known Distribution (Map 39): **ROBERTSON:** Southworth Bog; 17 May 1970; V.V. Board; TAMU.

Chrysops pikei Whitney

Chrysops pikei Whitney 1904: 205

Rather small (7 mm); yellow and black; frontal callus black; frontoclypeus yellow sometimes black at sides; thorax greenish yellow with dark stripes; abdomen with four longitudinal black stripes, the lateral ones usually shorter; wing (Figure 46, p. 49) with cell br infuscated, bm with small basal area of infuscation, apical spot very broad, inner margin irregular, hyaline triangle broadly attains vein R_{2+3} . Male with cell bm more obviously infuscated basally.

Comments: This species has been collected from most of the eastern half of the United States as far north as the mid-Great Lakes region. It has not been reported from the mountainous areas of the Appalachians, nor from Pennsylvania northward and eastward except western New York. It is also not reported from most of Florida south of Gainesville. Texas collections have been reported by Blume *et al.* (1972), Brennan (1935), Philip (1947, 1965), and Thompson (19773b, 1974a and b, 1975b, 1977). Larvae of this species have been taken from substrate of leaves mixed with silt on the bank of a creek (Teskey 1969), from debris in a narrow sandy-bottomed stream in a mixed pine-hardwood forest (Tidwell 1973) and from the muddy margin of a stagnant pool (Jones and Anthony 1964). The senior author has collected them from moss growing on wet sandy soil at the margin of a stream in a mixed hardwood forest. Tidwell (1973) described a related species, *C. harmoni*, from Louisiana. There is some indication that *harmoni* may be nothing more than a variant of *pikei*, but further study is needed to resolve the matter. We are not including *harmoni* as a species possibly occurring in Texas. If this darker form is encountered it would key to *pikei*.



Map 40. Counties of collection: *Chrysops pikei*.

Known Distribution (Map 40): ANDERSON: Salmon; 26-27 Apr 1973; malaise trap; H.R. Burke; TAMU. Burke Farm, Salmon.

ANGELINA: Boykin Spring Rec Area nr microwave tower on Forest Road 313A; 15 May 1993; Chris T. Maier; CTM. Bouton Lk, Angelina Nat For; 16 May 1993; J. T. Goodwin; JTG. Boykin Spr, Angelina Nat For; 16 May 1993; J. T. Goodwin; JTG. Graham Cr, 14 km S. of Zavalla; 16 May 1993; Chris T. Maier; CTM. Graham Cr, Angelina Nat For; 17 May 1993; J. T. Goodwin; JTG. **BASTROP:** Bastrop St Pk; 17 May 1964; 8 May 1966; J.C. Schaffner; TAMU. **BEE:** Medio Cr @ FM 2441; 13 Apr 1996 (as larvae); J.T. Goodwin; JTG. **BORDEN:** 1 mi S TX 180; TTU. 27 Jun 1969; S. R. Kingston; TTU. 27 Jun 1979; D. Sanders; TTU. **BRAZOS:** College Station; 30 Jun 1919; H.J. Reinhard; OHSU. College Station; 14 May 1943; H.J. Reinhard; TAMU. Bryan; 18 Apr 1965; J.C. Schaffner; TAMU. 19 Oct 1965, 20 Apr 1966; collector unknown; USDA. Vterl, College Station; 6 Sep 1970; P.H. Thompson; TAMU. College Station; 13 Sep 1970; Gaumer & Murray; CU. Mile Dr, S College Station; 17 Sep 1970, 9, 29, 30 Apr, 3-4, 7, 14 May, 7, 9 Jun 1971, 25, 28 Apr, 8, 11, 15, 17, 19 May, 1, 9, 12, 22, 23, 24, 25, 26, 28, 29, 30 Jun, 1, 2, 4, 9 Jul, 12 Aug 1973, 17, 19 Mar, 7 Apr, 22 May 1974, 10, 17, 18, 19, 22, 24 Apr, 17 Jun, 16 Aug 1975; 1 May 1978; P.H. Thompson; TAMU. 12, 15, 29 Apr 1971; P.H. Thompson; TAMU. Lake Placid; 1 May, 1-13 May 1971; P.H. Thompson; TAMU. Carter Lk, 27 May - 9 Jun 1971; P.H. Thompson; TAMU. 5 mi S College Station HW 6; 2-9 Jun 1971; P.H. Thompson; TAMU. College Station vicinity; 13 Aug 1976; P.H. Thompson; TAMU. **BELL:** Ft Hood; 21 May 1955; Mathews; CU. **CHEROKEE:** Rusk; 1906; USNM. **DALLAS:** 1 mi W Florence Hill; 22 Apr 1971; R.E. Acciavitti; CU. **ERATH:** 5 mi N Stephenville; 30 Aug 1973, 21-23, 27-30 May, 1-6 Jun 1980; P.T. Riherd; TAMU. **FANNIN:** Bonham; 20 Jun 1933; TAMU. **GRIMES:** Navasota R & FM 2038; 15 Apr, 28 May 1971, 31 May, 5, 24, 29 Jun 1974, 26 Mar, 7, 16, 23, 25 Apr, 7 May 1975; P.H. Thompson; TAMU. **HARDIN:** 3 mi NE Kountz FM 418; 28 Jun, 14 Jul 1972, 23 Jun 1973; P.H. Thompson; TAMU. **HARRIS:** G.B. Fairchild; **FSCA. HARRISON:** Karnack; 7 Jul 1949; Knoll; OHSU. 1 mi E Karnack; 9, 19 May 1971; R.E. Acciavitti; CU. **HENDERSON:** 20 Sep 1969; B.A. Davis; TAMU. **HIDALGO:** Donna; 1 May 1933; J.W. Monk; TAMU. **JOHNSON:** 9 mi WSW Rio Vista; 16 Jun 1980; Lisowski; INHM. **KERR:** Kerrville; 18, 26, 27, 28 Apr, 21 May 1968, 8, 24, 27 Apr 1969; R. R. Blume; USDA. Kerrville; 18 Jun 1995; J.T. Goodwin; TAMU. **KING:** YJ Ranch; 30 Jul 1976; D. Sanders; TTU. **LIBERTY:** 1/2 mi E Hull; 23 May 1972; 29 May 1973; P. H. Thompson; TAMU. 16 mi ESE Cleveland FM 162; 6 Sep 1972; P.H. Thompson; TAMU. **MADISON:** Navasota R at US79; 22 May 1993; J. T. Goodwin, JTG. **MONTGOMERY:** Willis; Apr 1903; J.C. Bridwell; OHSU. **NACOGDOCHES:** 3, 12 May 1960; N. Nichols; SFASU. 12 Apr 1963; W.W. Gibson; SFASU. 25 Apr 1965; N. Cook; SFASU. 19 May 1974; D. Gibson; on home; SFASU. 27 Apr 1971; all males, no females from digger wasp nest; C. Hunt; SFASU. 29 Apr 1971; C. Hurst; four males from digger wasp nest; SFASU. **PANOLA:** 1.5 mi W DeBerry; 17 May 1993; J.T. Goodwin; JTG. 2 mi S Bronson; 17 May 1993; J.T. Goodwin; JTG. US59, 0.5 mi S of Sabine R; 17 May 1993; J.T. Goodwin; JTG. 2.5 mi W of Sabine R; 22 May 1993; J.T. Goodwin; JTG. Sabine R at TX43; 4 Jul 1993; J.T. Goodwin; JTG. **RED RIVER:** Alvery; 1906; USNM. **SAN AUGUSTINE:** 5 mi S Chireno; 22 Apr 1971; R.E. Acciavitti; CU. 15 mi ESE Broadus; 2 Jun 1971; R.E. Acciavitti; CU. 30 Apr 1974; J. Lewis; JTG. Turkey Hill Cons Area; 15 May 1993; J.T. Goodwin; JTG. **TARRANT:** Arlington; 11 Jun 1971; R.E. Acciavitti; CU. 5.5 mi NW Crowley; 16-17 Jun 1980; Lisawski; INHM. **TITUS:** Mt Pleasant; 13 Jun 1948; S.S. Roback; INHM. **TYLER:** Fred; 23 Mar - 8 Sep 1972; P. H. Thompson; TAMU. **WALKER:** Huntsville St Pk; 6, 7, 9, 15, 21 May, 3, 15, 23, 30 Jun, 7 Jul, 25 Aug, 1 Sep 1971, 5, 10, 17, 18, 24 Apr, 30 May, 23, 26 Jun, 6 Sep 1972; 9, 23 May 1973; P.H. Thompson; TAMU. **WICHITA:** 5 mi E Burkburnett; 2-3, 9, 19 Jun, 1, 30 Jul, 4 Aug, 15 Sep 1982; S.R. Kingston; TTU.

Chrysops pudicus Osten Sacken

Chrysops pudicus Osten Sacken 1875: 381

Moderate (7.5 mm); black and yellow; frontal callus typically yellow, sometimes brown at borders; frontoclypeus yellow; thorax grayish with brown stripes; abdomen with median black spot beneath scutellum, an inverted black V-shaped spot on second tergite, remaining tergites black with yellow hind margins which expand to median triangles on third and fourth tergites; wing (Figure 47, p. 49) with cell br partly infuscated, bm with small anterobasal area of infuscation, apical spot relatively narrow, extending into cell r_4 . Male with both cells br and bm partly infuscated.

Comments: This is an eastern species having been collected from Texas (Thompson 1974b), Arkansas and Missouri eastward. Its range extends northward in the eastern coastal states to Massachusetts. Disjunct populations are reported from Nova Scotia and several areas in the Great Lakes region. The larvae of this species have not been described. Jones and Anthony (1964) reported taking larvae of this species from wet soil at the grassy margin of a roadside ditch. Goodwin (1976a) described the pupa but noted that no information on the habitat of the immature stages accompanied the specimen.



Map 41. Counties of collection: *Chrysops pudicus*.

Known Distribution (Map 41): LIBERTY: 1/2 mi E Hull; 8, 9, 16, 21, 23 Aug, 13 Sep 1972, 10, 29 May 1973; P.H. Thompson; TAMU. 5 mi ESE Cleveland; 21 Jun 1972; P.H. Thompson; TAMU.

***Chrysops reicherti* Fairchild**

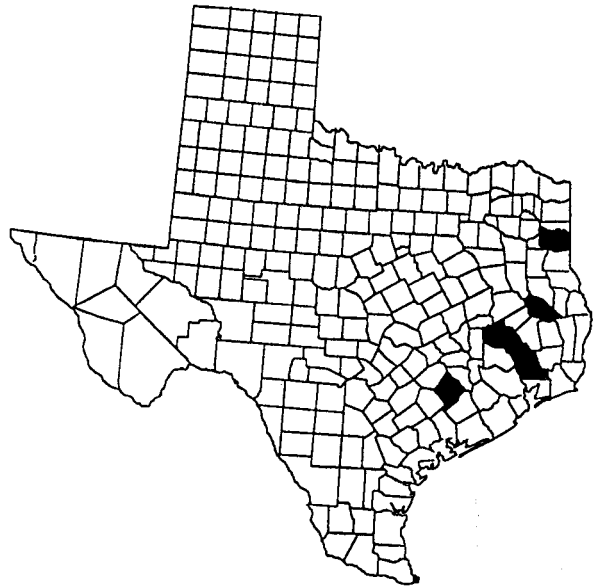
Chrysops reicherti Fairchild 1937: 60

Moderate (8.5 mm); yellow and dark brown; frontal callus and frontoclypeus yellow; thorax yellowish with brown stripes; abdomen greenish yellow basally, predominantly brown posterior to tergite 2; wing (Figure

48, p. 49) with cell br infuscated, bm with some infuscation at base, apical spot broad, outer margin of crossband sinuous. Male similar to female.

Comments: This is a southeastern species collected from Texas (Thompson 1973b, 1974b, 1975b), Arkansas and southern Missouri eastward, except for south Florida. Goodwin (1972) reported collecting many larvae of this species from wet mud and organic debris at the margin of a shallow lake in bottomland hardwood forest. Tidwell (1973) reported taking larvae at the margins of ponds in similar areas and at the margin of a cypress swamp.

Known Distribution (Map 42): ANGELINA: Graham Cr, ca 14 km S of Zavalla; 16 May 1993; Chris T. Maier; CTM. COLORADO: 18, 25 Apr 1959; TAMU. HARRISON: Karnack; 7 Jun; Knull; OHSU. LIBERTY: 16 mi ESE Cleveland FM 162; 6 Jul 1972, 29 May 1973; P.H. Thompson; TAMU. SAN JACINTO: Sam Houston Nat For, Double Lake Cpgd.; 12 May 1985; N. Bedwell; MSU. WALKER: Huntsville St Pk; 5, 13, 14, 19, 26 Jun 1972; P.H. Thompson; TAMU.



Map 42. Counties of collection: *Chrysops reicherti*

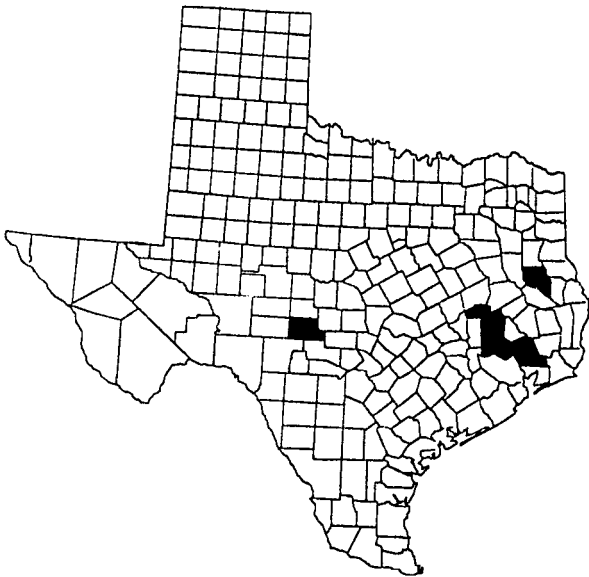
***Chrysops separatus* Hine**

Chrysops separatus Hine 1907: 228

Moderate (8 mm); black; frontal callus and frontoclypeus black, the latter with a grayish yellow pollinose streak along the midline; thorax and abdomen without pattern; wing (Figure 49) with cell br infuscated, bm hyaline, apical spot relatively narrow, not united with crossband basally. Male with wing almost entirely infuscated to outer side of crossband.

Comments: Two major areas of distribution are known for this species, one including eastern Texas (Thompson 1975b) and Oklahoma, southwestern Arkansas, Louisiana and southwestern Mississippi, and the second from west Tennessee, extending north and south into

bordering states, eastward into western South Carolina, mid-North Carolina and Virginia into Maryland. The immature stages of this species are not known.



Map 43. Counties of collection: *Chrysops separatus*.

Known Distribution (Map 43): GRIMES: Navasota R & FM 2038; 3 Apr 1978; P.H. Thompson; TAMU. KIMBLE: Roosevelt, Texas; 26 May; W.F. Chamberlain; TAMU. LIBERTY: ½ mi E Hull; 28 Mar 1973; P.H. Thompson; TAMU. 4 mi W Cleveland; 5 Apr 1973; P.H. Thompson; TAMU. MONTGOMERY: Jones St For, 8 mi S Conroe; 1-5 Apr 1987; Wharton, Wang and Praetorius; TAMU. NACOGDOCHES: 6 Apr 1959; Rhodes; SFASU. WALKER: Huntsville St Pk; 5 Apr 1972, 13 Mar 1974, 19-21 Mar 1975; P.H. Thompson; TAMU.

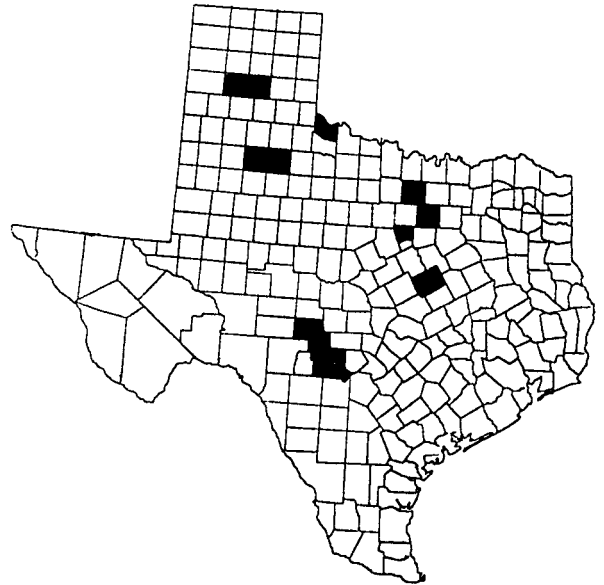
Chrysops sequax Williston

Chrysops sequax Williston 1887: 133

Moderate (8.5 mm); yellow and black; frontal callus black; mesonotum yellowish green with dark stripes; abdomen yellow with four complete longitudinal black stripes; wing (Figure 50, p. 49) with apical spot extensive, filling apex of cell r_5 and occasionally entering cell m_1 , apex of hyaline triangle extending above vein R_{2+3} , cell br infuscated. Male similar to female.

Comments: This species has been collected from a large part of the central U.S. from northeastern Texas and northwestern Louisiana, northward in an easterly and westerly expanding area to western Pennsylvania and western North Dakota. An apparently disjunct population has been reported from central Alabama and Georgia. Two subspecies are generally recognized, but there is considerable overlap in their known distributions. Further study may result in a change in taxonomic status. Only the nominal subspecies is known from Texas as the apparent southwestern limit of the distribution of *C. s. tau*

Philip lies in northern Arkansas. Teskey and Burger (1976) reported collecting larvae along the margin of a manmade stock pond in soft, slimy, muck soil.



Map 44. Counties of collection: *Chrysops sequax*.

Distribution (Map 44): ARMSTRONG: 1 mi N Wayside; 26 Jul 1986; F.E. French; GSU. BANDERA: Lost Maples St Pk, 4 mi NNW Vanderpool; 30 May 1980; E.A. Lisowski & Webb; INHM. HARDEMAN: Site 7, Medicine Mounds Ranch; 23 Jun 1995; W.D. Sissom; ASU. HOOD: 1.2 mi NW Palasy; 16 Jun 1980; E.A. Lisowski; INHM. KERR: Kerrville; 13 Jun 1951; O. Schomberg; USNM. Kerrville; 19 Jun 1953; L.J. Bottimer; USNM. Kerrville; 14 Jun 1964; R. R. Blume; USDA. Kerrville; 10 Jun 1968, 5 Jun 1969; USDA. KIMBLE: Roosevelt, 26 May 1963, W.F. Chamberlain, TAMU. MCCLENNAN: 6 mi NE McGregor; 17 Jun 1980; E.A. Lisowski; INHM. RANDALL: Ceta Cyn, 20 mi SE Canyon; 11 Sep 1984; L. Gilbreth; GSU. TARRANT: 5.5 mi NW Crowley; 16-17 Jun 1980; E.A. Lisowski; INHM. WISE: 8 mi E Decatur at Catlett Cr; 11 Jun 1972; R.E. Acciavitti; CU.

Chrysops univittatus Macquart

Chrysops univittatus Macquart 1855: 56 (1855: 36)

Chrysops wiedemanni Kröber 1926: 267

Chrysops fraternus Kröber 1926: 317

Rather small (7 mm); black or dark brown; frontal callus black; frontoclypeus predominantly yellow, black at sides; thorax grayish with brown stripes; abdomen with a median yellowish stripe; wing (Figure 51, p. 49) with cells br and bm hyaline, apical spot broad but almost completely separated from crossband basally. Male with cell br infuscated.

Comments: This species has not been collected in Texas. It has been collected from most of the eastern one-half of the United States, excluding eastern and southern Florida, from western Louisiana, Arkansas and northward to central Minnesota in the west and eastward

to the Atlantic. Teskey (1969) reported collecting a great many larvae of this species, most from the banks of slow-moving streams, once from the muddy shores of a lake and once from the bottom of a drainage ditch. Tidwell (1973) reported taking larvae from the margins of small streams draining longleaf-slash pine areas. The senior author found larvae in mud at the margins of streams and ponds at numerous locations in the southeastern states.

***Chrysops upsilon* Philip**

Chrysops upsilon Philip 1950a: 458

Moderate (8 mm); black and yellow; frontal callus black; frontoclypeus predominantly yellow except for black at sides and with a median pollinose stripe; thorax bluish green with brown stripes; abdomen with a median yellow stripe; wing (Figure 52, p. 50) with cells br and bm hyaline, apical spot very broad including all of cell r₄, hyaline triangle exceeds vein R₂₊₃. Male with cell br infuscated and abdomen with traces of submedian and lateral spots on tergites 1-4.

Comments: This is another southeastern species collected from eastern Texas (Thompson 1973b, 1975b), Arkansas and Missouri eastward. It extends northward into Illinois in the west and into Delaware in the east, but it has not been reported from the mountainous areas of the Appalachian Region or from Florida, except the panhandle region. Tidwell (1973) reported taking larvae of this species from the margins of a small stream draining a longleaf-slash pine region.



Map 45. Counties of collection: *Chrysops upsilon*.

Known Distribution (Map 45): ANDERSON: Palestine; 10 Aug 1963; W.W. Gibson; 2 specimens at black light in wooded area

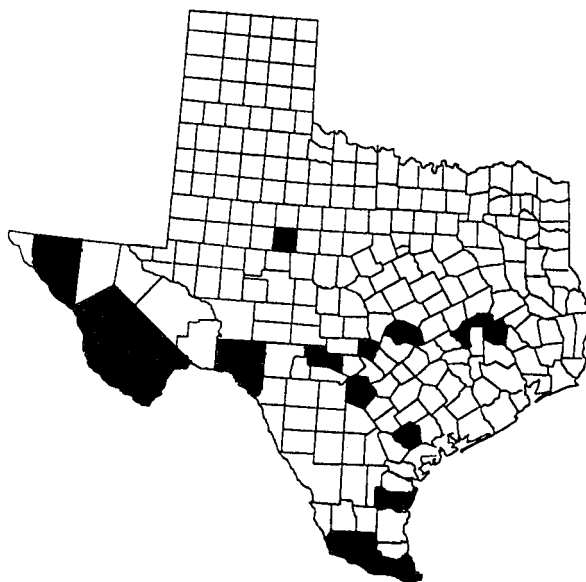
preserve; SFASU. WALKER: Huntsville St Pk, 6 May - 25 Aug; TAMU. Huntsville St Pk; 5 Apr 1972, 13 Mar 1974, 19-21 Mar 1975; P.H. Thompson; TAMU.

***Chrysops virgulatus* Bellardi**

Chrysops virgulatus Bellardi 1859: 71 (1861: 271)

Moderate (7.5 mm); yellow and black; frontal callus yellow except for fuscous upper margin; frontoclypeus, genae and palpi predominantly yellow, the first with a yellowish pollinose midstripe; thorax golden yellowish pollinose with faint brown stripes; abdomen golden yellowish and black, the black forming a spot beneath the scutellum, double geminate spots on tergites 2 to 4, more or less entirely covering tergites 5 to 7; wing (Figure 53, p. 50) with cells br and bm partly infuscated, apical spot somewhat broadened and covering about one-third of cell R₄, crossband distinctly reaches hind margin of wing. Male with cells br and bm more infuscated; body darker.

Comments: This southwestern species has been collected from Texas (Brennan 1935; Philip 1947, 1965; Thompson 1975b, 1977) to California and southward into Mexico. Burger (1977) reported collecting larvae at the margin of a large artificial lake and a large natural desert spring in wet soil mixed with decaying vegetation at or just below the water line. The senior author has collected larvae from silty mud of a pool which received the flow from a hillside seepage area and from organic mud from the bottoms of shallow streams.



Map 46. Counties of collection: *Chrysops virgulatus*.

Known Distribution (Map 46): BEXAR: Camp Bullis; 29 Aug 1967; R. R. Blume; USDA. Geronimo Cr nr TX16 & FR37; 23 Aug 1975 (as larva); J.T. Goodwin; FSCA. BLANCO: S Cypress Cr, Hwy 281, 10 mi N Johnson City; 18 Apr 90; Baumann & Nelson; UTAU. BRAZOS: 27 Oct 1935; H.J. Reinhard; TAMU. Mile Dr, S College

Station; 4, 23, Apr, 4 May 1975, 30 Apr, 1 May, 26 Jun 1978; P.H. Thompson; TAMU. Airport; 22 Jul 1976, 10 May 1978; P.H. Thompson; TAMU. **BREWSTER**: Marathon; 6 Aug 1980; L. Schneider; SRSU. **CAMERON**: Brownsville; 4 May 1944; C.R. Joyer; USNM. Boca Chica; 30 Jun 1967; P.C. Harmston; FSCA. Brownsville; 12, 14 Jul; Beimler; LLP. **GOLIAD**: 2 mi N Weser; 24 Mar 1976 (as larva); J. T. Goodwin; FSCA. **GRIMES**: Navasota R & FM 2038; 3 Jun 1974, 25 Aug 1976; P.H. Thompson; TAMU. **HIDALGO**: Donna; 11 Apr, 11 Jun, 15 Oct 1933; J.W. Monk; TAMU. Bentsen-Rio Grande St Pk; 7 Jun 1983; D. Rider; LSU. **HUDSPETH**: Ft Hancock; 13 Jul; W.F. Chamberlain; TAMU. **JEFF DAVIS**: Limpia Sp above Davis Mtns Resort, 1730 m; 22 May 93; C.R. Nelson, J.K. Gelhaus & D.P. Koenig; UTAU. **KERR**: Kerrville; 12 Jun 1969; collector unknown; USDA. **KLEBERG**: Kingsville; 8 Jun 1921; USNM. **NOLAN**: Wright Ranch; 20 Jul, 2, 23 Aug, 13 Oct 1982; S.R. Kingston; TTU. **PRESIDIO**: Alamito Cr at HW 170; 30 May 1970; Murray & Hafernck; TAMU. Big Bend Ranch St Nat Area, Cuevas Amerillas Sp, 24 km ENE Presideo, 1037 m; 30-31 May 92; C.R. Nelson, J.K. Gelhaus & D.P. Koenig; UTAU. **REAL**: 5-9 Jun 1982; G.B. Fairchild; FSCA. **STARR**: 15 mi NE Rio Grande City; 3 Jun 1954; H.F. Houston; UT. **VAL VERDE**: Del Rio; 27 May 1912 (Brennan 1935). 28 Jun 1964; male, light trap; CSU. Devils R, Dolan Falls area, 360m; 18 May 1993; Gelhaus, Nelson & Koenig; ANSP. Devils R, Dolan Falls; 18-19 Sep 93; D. Cheshine; UTAU. Devils R, Dolan Falls; 18, 19 Sep, 17-24 Oct 93; C.R. Nelson, S.M. Stringer & S. Thomas; UTAU. **WALKER**: Huntsville St Pk; 13 Jun 1972; P.H. Thompson; TAMU. **WILLIAMSON**: San Gabriel R; 6 Oct 1968; J.E. Hafernck; TAMU.

Chrysops vittatus Wiedemann

Chrysops vittatus Wiedemann 1821b: 56 (1821b: 106)

Chrysops areolatus Walker 1848: 197

Chrysops lineatus Jaenicke 1867: 334

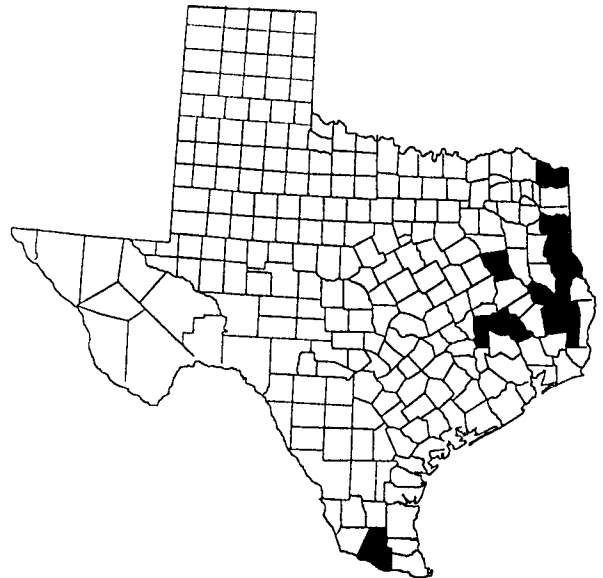
Chrysops ornatus Kröber 1926: 328

Moderate (8 mm); yellow and black; frontal callus and frontoclypeus yellow; thorax yellow with black stripes; abdomen with four longitudinal black stripes; wing (Figure 54, p. 50) with cell br infuscated, bm with anterior infuscation in basal half, apical spot broad, connected posteriorly to crossband by a faint band in cell r_5 . Male with cell bm predominantly infuscated and yellow areas of body reduced.

Comments: This species has been collected from the entire eastern half of the United States and southern Canada westward into eastern Texas (Philip 1947, 1965; Thompson 1973b, 1977) in the south and the eastern Dakotas in the north. Two subspecies are recognized, but only *C. v. vittatus* is known from Texas, the other (*C. v. floridanus* Johnson) being known only from east coastal areas from Florida to Virginia. Teskey (1969) reported collecting a great many larvae of this species and noted that they were present in almost all types of habitat except sphagnum bogs and other areas where concentrations of poorly decayed vegetation were present. Tidwell (1973) reported collecting larvae at the margins of a stream and a river.

Known Distribution (Map 47): **ANDERSON**: Salmon; 1-8 Jul 1974; 20-29 Jun, 14-20 Jul 1975; malaise trap; H.R. Burke; TAMU. 17 Apr 1994 & 14 Mar 1996 (as larvae); J.T. Goodwin; JTG. **ANGELINA**:

Bouton Lk, Angelina Nat For; 15 May 1993; J.T. Goodwin; JTG. **BOWIE**: 5 mi E New Boston; 13 Sep 1971; R.E. Acciavitti; CU. **HARRISON**: 1 mi E Karnack; 18 May 1971; R.E. Acciavitti; CU. **HIDALGO**: Donna; 10 Oct 1933; J.W. Monk; TAMU. **JASPER**: Jasper; 1 Jun 1971; R.E. Acciavitti; CU. **MADISON**: Navasota R at US79; 22 May 1993; J.T. Goodwin; JTG. **PANOLA**: US79, 2.5 mi W of Sabine R; 17 May 1993; J.T. Goodwin; JTG. **SAN AUGUSTINE**: 30 Apr 1974; J. Lewis; SFASU. **SAN JACINTO**: Double Lk Rec Area, Sam Houston Nat For; 4 Sep 1976; M. Turell; CU. Big Cr Scenic Area; 28 Jun 1980; P.V. Kovarik; TAMU. **SHELBY**: Center; 23, 24 Jun 1973; J.W. Monk; TAMU. **TYLER**: Town Bluff Res; 7-8 Jun 1975; S.J. Merritt; TAMU. **WALKER**: Huntsville St Pk; 3, 16, 23, 30 Jun, 28 Jul 1971, 23 Jun 1972; P.H. Thompson; TAMU.



Map 47. Counties of collection: *Chrysops vittatus*.

SUBFAMILY TABANINAE

All three tribes of the subfamily Tabaninae are represented in the Nearctic fauna. The known Texas fauna includes species of two of the tribes, Diachlorini and Tabanini, and at least one species of the third tribe, Haematopotini, may eventually be found in Texas. Adults can be readily separated into tribes by the characters noted in the generic keys.

Members of this subfamily range from small to large. In the descriptions which appear on subsequent pages, small refers to species averaging 10 mm or less in length, moderate to those averaging 13 to 17 mm, and large to those 19 mm or more in length.

TRIBE DIACHLORINI

GENUS ANACIMAS ENDERLEIN

Anacimas Enderlein 1923: 545. Type-species, *limbellatus* (type by original designation)

Two species are recognized in this genus, one currently known only from primarily coastal counties of the southeastern United States and the other known from Oklahoma, Kansas and Nebraska. Neither has been frequently collected, and nothing is known of the biology of either species. Although not known from Texas, the paucity of information on the two species prevents us from excluding them from the possible fauna of Texas.

KEY TO SPECIES OF ANACIMAS ENDERLEIN OCCURRING OR POSSIBLY OCCURRING IN TEXAS

1. Females (frons present) 2
Males (frons absent; eyes contiguous) 3
2. Wing veins not margined with brown; median callus of female narrow and not strongly convex; a pair of narrow, sublateral, gray stripes on mesoscutum and a broader pair on abdomen above *dodgei* (Whitney)
Wing veins margined with brown; median callus of female rather broad and decidedly convex; mesoscutum without gray stripes and those of the abdomen, if distinct, more yellowish-brown *limbellatus* Enderlein
3. Abdomen dorsally with a pair of gray sublateral stripes separated by median dark brown to black stripe; wing veins not margined with brown *dodgei* (Whitney)

If sublateral stripes are evident dorsally on abdomen, they are yellowish-brown; wing veins distinctly margined with brown
. *limbellatus* Enderlein

Anacimas dodgei (Whitney)

Tabanus dodgei Whitney 1879: 37

Moderate (14 mm); brown and gray; basal callus dark brown, wider than high, united with slender median callus; frons about 2½ times as high as wide basally; thorax and abdomen as noted in key; wing hyaline, costal cell yellow. Male with large and small facets of eye clearly differentiated, eyes densely pilose; coloration essentially like female.

Comments: This species has not yet been collected in Texas, but it is known from Oklahoma, Kansas and Nebraska. The immature stages are unknown.

Anacimas limbellatus Enderlein

Anacimas limbellatus Enderlein 1923: 545

Moderate (14.5 mm); brown with indistinct pattern or with a dark brown median stripe on abdomen; basal callus orange brown to black, slightly wider than high, at most only narrowly united with convex, brown to black, usually ellipsoid median callus; frons 3 to 3½ times as high as wide basally; thorax brown with at most only indications of pale lines; abdomen brown, darker in middle, the dark median area sometimes distinct enough to be termed a stripe; wing predominantly hyaline, costal cell brown and veins margined with brown. Male with large and small facets sharply differentiated, eyes pilose; coloration essentially like female.

Comments: This species is yet to be collected outside Florida, but it has been infrequently collected, only once in relative large numbers in coastal pine forest. It is included because so little is known about its biology. The immature stages are unknown.

GENUS DIACHLORUS OSTEN SACKEN

Diabasis Macquart, 1834: 207 (preoccupied Hoffmannsegg, 1819). Type-species, *Tabanus bicinctus* Fabricius (Coquillett, 1910: 532)

Diachlorus Osten Sacken, 1876: 475 (new name for *Diabasis* Macquart). Type-species, *Tabanus bicinctus* Fabricius

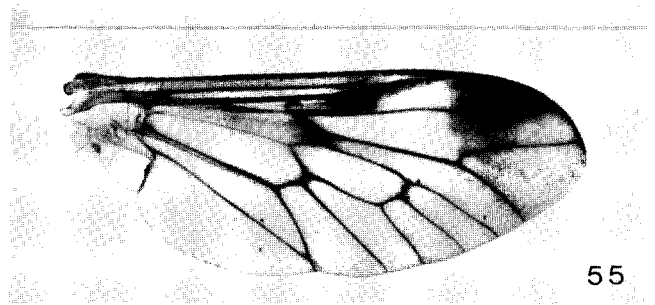
Of the 20 species of this predominantly Neotropical genus, only one, *D. ferrugatus*, sometimes called the "yellow fly", occurs in the United States. In some areas it is sufficiently abundant to be a serious pest, but there are no known reports of pest-level populations in Texas.

***Diachlorus ferrugatus* (Fabricius)**

- Chrysops ferrugatus* Fabricius 1805: 111
- Tabanus americanus* Palisot de Beauvois 1819: 222 (preoccupied Forster, 1771)
- Diabasis ataeana* Macquart 1838: 156 (1838: 152)
- Chrysops approximatus* Walker 1848: 198

Relatively small (7 to 9 mm); yellow; frons very narrow; basal callus small, brown, not touching eyes; median callus a slender line; thorax yellow without lines; abdomen with a median yellow longitudinal stripe bordered by black (more obvious in unrubbed specimens); fore tibiae swollen; wing (Figure 55, p. 69) with apex beyond bifurcation of vein R₄₊₅; darkened. Male similar to female.

Comments: This species has been reported from coastal states from New Jersey southward into Mexico and beyond. It extends inland at least to Tennessee. Thompson (1974b) reported collecting this species in Texas. Goodwin (1973a) reported collecting larvae in sphagnum moss at the margin of a lake and in wet mud around the roots of plants growing along the margin of the same lake.



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Figure 55. Wing of *Diachlorus ferrugatus*.

GENUS *CHLOROTABANUS* LUTZ

- Chlorotabanus* LUTZ 1909: 30. Type-species, *Tabanus mexicanus* Linnaeus (monotypic)

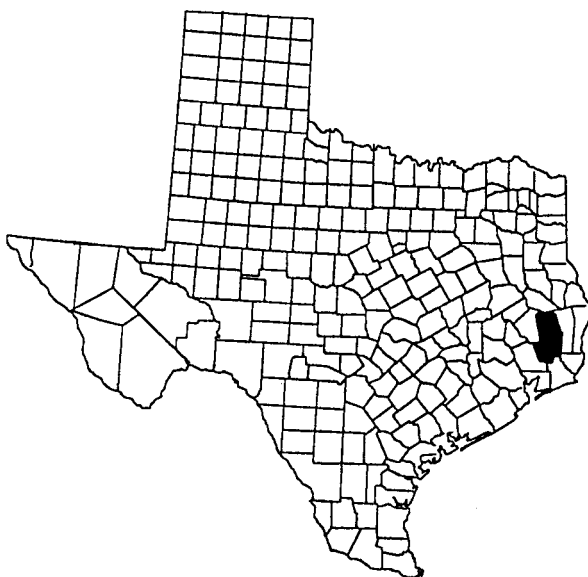
Only one of the six recognized species of this genus, *C. crepuscularis*, is found in the United States, the rest being entirely Neotropical in their distributions.

***Chlorotabanus crepuscularis* (Bequaert)**

- Tabanus flavus* Macquart 1834: 200 (preoccupied Wiedemann, 1828)
- Tabanus crepuscularis* Bequaert 1926: 234 (new name for *flavus* Macquart)
- Chlorotabanus mexicanus* authors, not Linnaeus
- Chlorotabanus sulphureus* authors, not Palisot de Beauvois

Moderate in length (13 to 15 mm); green to greenish yellow; frons narrow, without ocelli, wings hyaline, costal cell and veins yellowish; spur vein present on base of vein R₄. Male with eyes bare; large and small facets of eye distinctly differentiated, coloration like female.

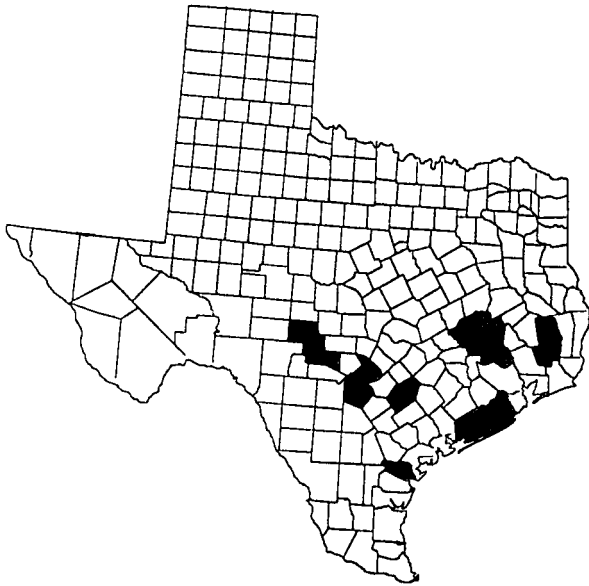
Comments: This species has been collected throughout the southeastern United States from Texas (McGregor and Schomberg 1952; Philip 1965; Thompson 1973a and b, 1974a, 1975b, 1977; Thompson *et al.* 1978) and Arkansas eastward and along the east coast northward to New Jersey. As its name implies, the adults are crepuscular, and the females readily attack man and livestock. Whether they are serious pests in Texas is not known. Larvae were taken from shallow water areas usually in association with algal mats or with submerged debris (Goodwin 1973a). The senior author also has found them in large numbers among the roots of aquatic vegetation growing on the surface of floating and partially submerged logs.



Map 48. Counties of Collection: *Diachlorus ferrugatus*.

Known Distribution (Map 48): HARDIN: 3 mi NE Kountz; 7, 14, 21 Jun, 7 Jul, 30 Aug. 1972; P.H. Thompson; TAMU. TYLER: Fred; 29 Jun 1952; McGregor; TAMU.

**KEY TO THE SPECIES OF *STENOTABANUS*
LUTZ OCCURRING OR POSSIBLY
OCCURRING IN TEXAS**



Map 49. Counties of Collection: *Chlorotabanus crepuscularis*.

Known Distribution (Map 49): BEXAR: San Antonio; 15 Jun 1976; J.T. Goodwin; FSCA. BRAZORIA: Haskins Mound; 14 Aug 1971; P.H. Thompson; TAMU. BRAZOS: Mile Dr, S College Station; 24, 27 May, 6 Jun 1974, 6-7 Jun 1975; P.H. Thompson; TAMU. JONES RD 0.5 MI N HWY 60; 30 May 1975; S.J. Merritt; TAMU. COMAL: Cypress Bend Pk, New Braunfels; 19 Jun 1978; E.A. Lisowski; INHM. GONZALES: Palmetto St Pk; Apr 1977 (as larva); J. T. Goodwin; FSCA. GRIMES: Navasota R & FM 2038; 18, 28, 29, 31 May, 2, 5, 7, 10, 14, 19, 21 Jun, 1, 5 Jul 1974, 2, 15 Jun 1975; P.H. Thompson; TAMU. HARDIN: near Kountz; U. S. Department of Agriculture (1973). KERR: Hunt; 23 Jul 1971; R. R. Blume; USDA. KIMBLE: Triple R Cottages, 10 mi S Junction; 17 Jun 1972; B. Wright; NSM. MADISON: 1 Jul 1931; Bibby & Tate; TAMU. MATAGORDA: undated; collector unknown; TAMU. MONTGOMERY: 15 Jul 1978; K.L. Kaplan; TAMU. 13-19 Apr 1987; 16 mi SE Magnolia; TAMU. SAN PATRICIO: Welder Wildlife Ref, 8 mi NE Sinton; 13-15 May 85; N. Bedwell & R. Brown; MSU. TYLER: Fred; 16-23 May 1956; McGregor and New; USNM. Fred, 29 Jun 1952; McGregor; TAMU. Town Bluff Res, 7-8 Jun 1975; S.J. Merritt; TAMU. WALKER: Huntsville St Pk; 30 Jun 1971, 29 May 1973; P.H. Thompson; TAMU.

GENUS *STENOTABANUS* LUTZ

Stenotabanus Lutz 1913: 487. Type-species, *Tabanus taeniotes* Wiedemann (monotypic subgenus, Lutz and Neiva, 1914: 73)

This genus is mainly Neotropical in distribution, but species of two subgenera are known to occur in the United States, including Texas. One of these subgenera is represented in Texas by at least two species, and one species of the other subgenus may possibly be present.

1. Females (frons present) 2
Males (frons absent; eyes contiguous) 4
2. Median callus absent; basal callus with little evidence of a median upper prolongation; frons relatively broad, distinctly narrowed toward antenna; abdomen whitish to brown, without significant pattern; adults found in proximity to salt water, usually along sandy beaches or in the sparsely vegetated areas immediately adjacent 3
Median callus present; frontal callus with a median upper prolongation which may unite with median callus; frons nearly parallel-sided; abdomen grayish to grayish-yellow pollinose, tergites 2-6 each with a transverse row of 4 brown spots; inland species not associated with a beaches or adjacent areas
. *guttatulus* Townsend
3. Basal callus distinctly separated from eyes; wing hyaline *magnicallus* (Stone)
Basal callus wide, touching or nearly touching eyes; wing with some darkening at crossveins
. *pechumani* Philip
4. Abdomen grayish to grayish-yellow, tergites 2 to 6 each with transverse row of 4 brown spots
. *guttatulus* Townsend
Abdomen whitish without distinct pattern 5
5. Area of small facets of eye includes a border of small facets along the occipital region
. *pechumani* Philip
No band of small facets along occipital border
. *magnicallus* (Stone)

Sub-genus *Stenotabanus* Lutz

***Stenotabanus* (*Stenotabanus*) *guttatulus* (Townsend)**

Diachlorus guttatulus Townsend 1893: 134
Stenotabanus cribellum authors, not Osten Sacken

Small (11.5 mm); grayish with dark brown pattern; frons about 3 times as high as wide basally, convergent below; frontal callus black, square, touching eyes, usually united with irregular median callus; thorax blackish with grayish longitudinal lines; abdomen with first tergite grayish anteriorly and narrowly so posteriorly, the two areas separated by a narrow transverse brown band; tergites 2 to 6 yellowish gray with narrow anterior brown transverse row of 4 spots; wing hyaline, spur vein present on bifurcation of vein R₄₊₅. Male with large and small facets differentiated; thorax and scutellum densely clothed with erect white hairs; otherwise similar to female.

Comments: This species has not been collected in

Texas. It is known from Arizona, California, New Mexico, Utah and Mexico. The immature stages are not known.

Sub-genus *Aegialomyia* Philip

Aegialomyia Philip 1941b: 10 (as genus). Type-species, *Tabanus psammophilus* Osten Sacken (type by original designation)

***Stenotabanus (Aegialomyia) magnicallus* (Stone)**

Tabanus nanus Macquart 1846: 170 (1846: 42) (preoccupied Wiedemann 1821c)

Tabanus maritimus Townsend 1898: 167 (preoccupied Scopoli 1763)

Tabanus magnicallus Stone 1935: 19 (new name for *nanus* Macquart)

Small (11 mm); gray to grayish white without distinct pattern; frons very wide, about 1¼ to 1½ times as high as wide basally, not markedly convergent below; basal callus black, rectangular, separated from eyes; thorax yellowish brown, abdomen cream colored, both without pattern; wing hyaline, distinct spur vein present on bifurcation of vein R₄₊₅. Male with large and small facets differentiated, the former more extensive, reaching to the occipital border; otherwise similar to female.

Comments: This is a coastal species restricted to sand beaches and the adjacent dunes. It is known from the Florida panhandle west and south into northeastern Mexico. Philip (1947, 1965) and Stone (1938) report Texas collections. It is possible that the population east of Louisiana represents a distinct and undescribed species, but further study of fresh material from Texas is needed.



Map 50. Counties of Collection: *Stenotabanus (A.) magnicallus*.

Goodwin (1974) reported taking larvae of this species from moist sand at the high tide line on the inland side of a narrow island along the Florida coast.

Known Distribution (Map 50): ARANSAS: Rockport; 4 Jul 50; TAMU. CAMERON: Del Mar Beach; 7 Sep 1949; F. Werner; **paratype**; CAS. Padre Is; 24 May 1950; TAMU. Boca Chica; 13 Jun 1954; A. Robinson; KS. Port Isabel; 10 May 1958; H.E. Evans & Flint; CU. 4 May 1964; R.E. Woodruff; FSCA. GALVESTON: Galveston Beach; 8 May 1938; C.B. Philip; FSCA. Galveston Beach, 10 May 1964; L.L. Pechuman, CU. KLEBERG: Padre Is; 19 May 1976; J.E. Gillaspay; TAMU. NUECES: Padre Is; 28 May 1950; TAMU. STARR: Rio Grande City; Oct 1967; P.C. Harmston; FSCA.

***Stenotabanus (Aegialomyia) pechumani* Philip**

Stenotabanus (Aegialomyia) pechumani Philip 1966: 522

Small (10 mm); grayish without distinct pattern; frons with sides convergent below, about 2 times as high as wide basally; frontal callus black, rectangular, wider than high, touching eyes; thorax and abdomen grayish without evident pattern; wing with indistinct clouds, some darkening at crossveins, spur vein at bifurcation of vein R₄₊₅. Male with large and small facets sharply differentiated, a band of small facets along occipital border; patterned and colored as in female.

Comments: This species is known only from Texas (Pechuman 1966) and northeastern Mexico. The immature stages are not known.



Map 51. Counties of collection: *Stenotabanus (A.) pechumani*.

Known Distribution (Map 51): CAMERON: "beach", Del Mar; 7 Sep 1949; Werner & Nutting; male **paratype**; CBP. 2 mi W Boca Chica Beach; 7 May 1991; T. Carlow & E. Riley; TAMU.

TRIBE HAEMATOPOTINI

The Haematopotini is primarily an Old World tribe represented by several hundred species in Africa, Europe, Asia and southward through China and on the larger islands of the Indian and Pacific Oceans at least into Indonesia. In the New World, only five species are recognized, all restricted to the United States and Canada, one rather widespread, three known only from east of the Mississippi River and one only from California. Burger and Pechuman (1986) provide the most recent review of this genus for North America.

GENUS HAEMATOPOTA MEIGEN

Chrysozona MEIGEN 1800: 23. Type-species, *Tabanus pluvialis* Linnaeus (Coquillett, 1910: 524). Suppressed by I.C.Z.N., 1963: 339.

Haematopota MEIGEN 1803: 267. Type-species, *Tabanus pluvialis* Linnaeus (monotypic)

Haematopota americana Osten Sacken

Haematopota americana Osten Sacken 1875: 395

Small (10 mm); eyes sparsely pilose; frons grayish with brownish tints dorsally, with relatively large black velvety black spots laterally near eyes and a single small median spot; basal callus shiny dark brown to black, 5 to 6 times as wide as high, indented at midpoint dorsally; subcallus with a median velvety brown patch just below basal callus; thorax dorsally brownish black with narrow median and sublateral pale gray stripes; wing as shown in Figure 56; abdomen dorsally dark brown to black, some or all of tergites 2 to 7 with small sublateral and median gray spots. Male with eyes more densely and evidently pilose; otherwise similar to female.



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Figure 56. Wing of *Haematopota americana*.

Comments: This species has not been collected in Texas. It has been reported from Alaska eastward through Canada to the Atlantic and southward along the Rocky Mountains westward into California and eastward in New Mexico. Teskey (1985) reported collecting larvae in wet mineral soils (silt, sand, gravelly-clay) on the margins of drainage ditches, small lakes, and alder swamp, and small, slow-flowing streams.

TRIBE TABANINI

GENUS LEUCOTABANUS LUTZ

Leucotabanus Lutz 1913: 487. Type-species, *Tabanus leucaspis* Wiedemann (monotypic subgenus, Lutz and Neiva 1914: 71) = *exaestuans* (Linnaeus)

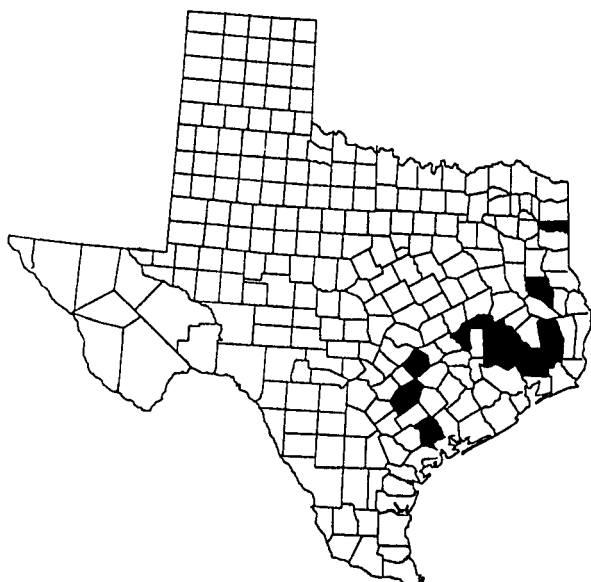
Of the 14 species recognized by Fairchild (1971), only two are found in the United States, the others being entirely Neotropical. One species, *L. ambiguus* Stone, is thus far known from the extreme southwestern Nearctic and is not considered further. The other, *L. annulatus*, is reported from almost all states from Delaware west to Kansas and southward.

Leucotabanus annulatus (Say)

Tabanus annulatus Say 1823: 32 (1859: 53)

Moderate in length (10-12 mm); orange or reddish brown and gray; frons relatively narrow, parallel sided; basal callus brown, oval, about 1/2 or less width of frons; median callus a slender line; thorax without pattern, orange or reddish brown with yellowish orange and white hair; abdomen reddish brown with pale hind margins; wing hyaline, venation normal. Male appears whitish due to dense covering of white hairs; large and small facets of eye sharply differentiated.

Comments: This species has been collected in the eastern one-half of the United States, except south Florida, as far north as mid-Illinois, southern Ohio and Delaware. Texas collections have been reported by McGregor and Schomberg (1952), Philip (1947, 1965), Stone (1938), Thompson (1973b, 1974a and b, 1975b, 1977), Thompson *et al.* (1978), and Goodwin (1973a) reported collecting larvae from damp decaying wood such as fallen trees and from the detritus in tree holes or cavities in the trunks of growing trees, typically at ground level.



Map 52. Counties of Collection: *Leucotabanus annulatus*.

Known Distribution (Map 52): **BASTROP:** BASTROP St Pk; 21 Jul 1989; E. Riley & C. Wolfe; TAMU. **BRAZOS:** College Station; 1 Aug 1964; S.G. Wellso; light trap; TAMU. 10 mi. SE. College Station; 25 May 1971; P.H. Thompson; TAMU. Lk Placid; 9-21 Jul 1971; P.H. Thompson; TAMU. Mile Dr, S College Station; 12 Aug 1973, 27 May, 1, 15 Jun, 2, 22 Jul 1975; 10 Jun 1976; P.H. Thompson; TAMU. College Station, 25 Jun 1979; L. Hull; TAMU. **GONZALES:** Palmetto St Pk; Apr 1977 (as larva); J. T. Goodwin; FSCA. **GRIMES:** Navasota R & FM 2038; 22 Jun 1971, 26 Jun 1972.; 15 Jun, 1 Jul, 19 Aug.1974, 26 May, 22 Jun, 6 Aug 1975; P.H. Thompson; TAMU. **HARDIN:** 3 mi NE Kountz, FM 418; 27 Jun 1973; P.H. Thompson; TAMU. **LIBERTY:** 5 mi ESE Cleveland, HW 321; 14, 28 Jun 1972; P.H. Thompson; TAMU. **MARION:** Daingerfield; 3 Aug 1937; TAES light trap; TAMU. **MONTGOMERY:** Jones St For, 8 mi S Conroe; 28 Jun to 13 Jul 1987; Wharton, Steck & Carroll; TAMU. **NACOGDOCHES:** 19 Jun 1965; Faroni; SFASU. 2 Jun 1969; F. Latta; at light; SFASU. 22 Jun 1969, 26 May 1971, 30 May 1968 (all males at black light trap); W.W. Gibson; SFASU. 21 Jul 1966; R.R. Murray; TAMU. **SAN JACINTO:** Sam Houston Nat For; 18 Mar 1978; A.B. Bosworth; TAMU. **TYLER:** Fred; 23 May 1951; McGregor and New; USNM. Fred; 22 Aug 1951; O. Schomberg; TAMU. Fred; 29 Jun 1952; McGregor; TAMU; 2 mi E Fred, FM 1943; 21 Jun 1972; P.H. Thompson; TAMU. **VICTORIA:** 2 Jul 1971; G. Underwood; TAMU. **WALKER:** Huntsville St Pk; 16 Jun, 7 Jul, 11, 25 Aug 1971, 3, 19, 26 Jun, 3, 24 Jul, 1, 7, 14, 15, 28 Aug 1972; P.H. Thompson; TAMU.

GENUS *WHITNEYOMYIA* BEQUAERT

Tabanus, subgenus *Whitneyomyia* Bequaert 1933: 85.
Type-species, *beatifica* Whitney (type by original designation)

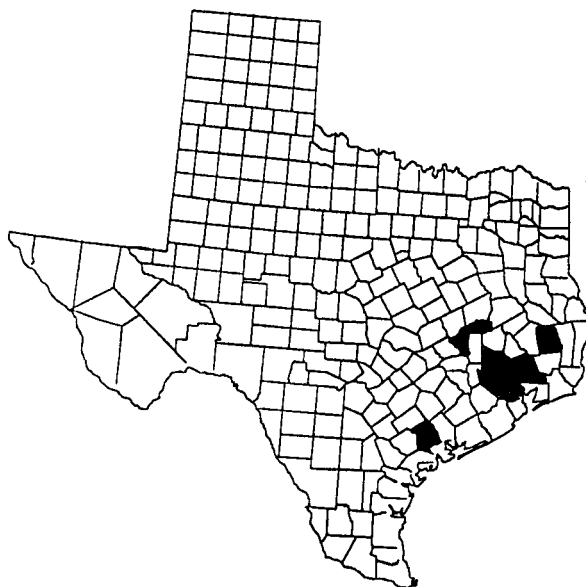
The genus *Whitneyomyia* is monotypic, but two forms (*atricorpa* and *beatifica*) have been recognized, and both have been collected in Texas.

Whitneyomyia beatifica (Whitney)

Tabanus beatifica Whitney 1914: 344.

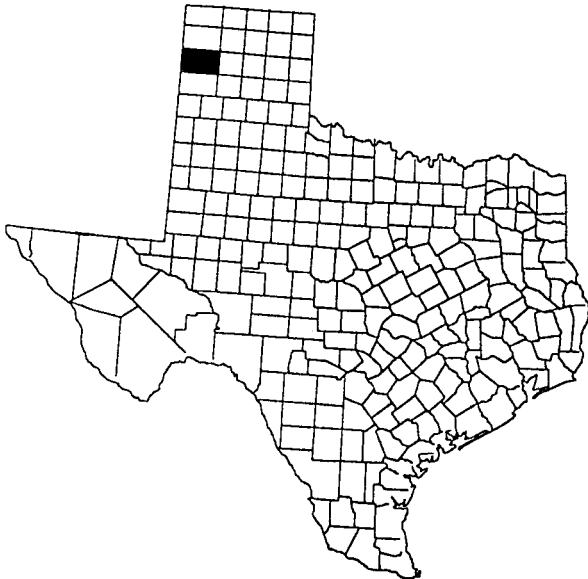
Moderate in length (13 to 15 mm); shiny black; frontal callus large, quadrate, shiny black, united with broad concolorous median callus; remainder of frons predominantly dull black except for paired grayish spots above basal callus and grayish area at upper end of median callus; subcallus swollen, protuberant, non-pollinose, shiny black; thorax and abdomen dark brown to black, the sides of abdomen appearing distinctly whitish due to abundant white hairs laterally on tergites 1 to 4 (the *atricorpus* form has the sides of the abdomen entirely black); wing more or less entirely black. Male with frontal triangle swollen, shiny black; eye bare, large and small facets distinctly differentiated.

Comments: This species has been collected from the coastal states of the southeastern United States from North Carolina to Texas (McGregor and Schomberg 1952; Philip 1947, 1965; Thompson 1974a and b, 1975b, 1977) and inland at least as far north as Auburn, Alabama. Two forms (*atricorpus* form and *beatifica* form) have been recognized by most recent workers, and both have been collected in Texas. Goodwin (1976b) reported collecting a larva of the *atricorpus* form from wet mud at the margin of a cattle pond. As both forms occupy essentially the same range, treatment as subspecies is not justified. Although the two forms likely represent a single species, as treated herein, discovery of the immatures of the second form may suggest that they are distinct species. Consequently, distributions for each form are provided below to facilitate reexamination should a second species be recognized.



Map 53. Counties of Collection: *Whitneyomyia beatifica* (*beatifica* form)

Known Distribution (Map 53) *Whitneyomyia beatifica* (*beatifica* form): BRAZOS: Mile Dr, S College Station; 18 Apr, 3, 13, 17 May 1974, 24, 26 Apr 1975, 1 May 1975; P.H. Thompson; TAMU. **GRIMES:** Navasota R & FM 2038; 28 May 1971, 30 May 1972, 28 Apr 1973, 17 Apr 1974, 18, 21, 23, 28 Apr 1975; P.H. Thompson; TAMU. **HARRIS:** Hockley; UB. **LIBERTY:** ½ mi E Hull; 19, 26 Apr, 3, 10 May 1972; P.H. Thompson; TAMU. **MONTGOMERY:** 16 mi SE Magnolia; 4 Sep 1978; K.L. Kaplan; TAMU. **TYLER:** Fred; 16-23 May 1950; McGregor and New; USNM. Fred; 1-7 Jun 1950; S.E. McGregor; TAMU. 17 Jun 1950, 16-23 May 1951; McGregor; LLP. Fred; 18 May 1951; O. Schomberg; TAMU. **VICTORIA:** Victoria; 10 May 1971; G. Underwood; TAMU.



Map 54. Counties of Collection: *Whitneyomyia beatifica* (*atricorpa* form).

Known Distribution (Map 54) *Whitneyomyia beatifica* (*atricorpa* form): OLDHAM: Boys Ranch; 7 Jun 1974; T. Alvarez; GSU.

GENUS *HAMATABANUS* PHILIP

Hamatabanus Philip 1941b: 13. Type-species, *Tabanus scitus* Walker (type by original designation) = *carolinensis* (Macquart).

Species of this genus should not be confused with other species of the Texas fauna except for members of the genus *Agkistrocerus* and a few large *Tabanus* which also have an elongate dorsal tooth on the basal plate of the third antennal segment. Most, if not all *Tabanus* found in Texas and possessing a distinct dorsal tooth will clearly exceed 16 mm in length and usually have a dark brown to black abdomen without pattern, or at least without pale sublateral spots. Species of *Agkistrocerus* can be separated as noted in the generic key. Only two species are currently recognized in this genus.

KEY TO SPECIES OF *HAMATABANUS* OCCURRING OR POSSIBLY OCCURRING IN TEXAS

1. Females (frons present) 2
Males (frons absent; eyes contiguous) 3
2. Abdomen above with three rows of pale spots, these distinct at least on tergites 2 to 6; lacking obvious pale hind margins on tergites
. *carolinensis* (Macquart)
Abdominal tergites with pale hind margins which widen a little laterally and also medially on tergite 2 only to form a slender median triangle that may attain the anterior margin
. *annularis* (Hine)
3. Eyes with areas of large and small facets sharply differentiated; abdomen dorsally without evidence of middorsal or lateral pale triangles or spots *annularis* (Hine)
Eyes with areas of large and small facets not sharply differentiated; at least tergite 2 with a pale middorsal triangle and suggestions of lateral pale spots *carolinensis* Macquart

Hamatabanus annularis (Hine)

Tabanus annularis Hine 1917: 269

Small to moderate in length (10 to 15 mm); brown, abdomen with pale posterior bands that may widen laterally and medially on some segments; basal callus brown to black, quadrate, as wide as frons, united or slightly separated from slender median callus; frons at vertex bare and shining, depressed, without ocellar tubercle; third segment of antenna with distinct forward-projecting dorsal tooth on basal plate; eyes sparsely pilose; abdomen dark reddish brown to brown, each tergite with a posterior transverse yellowish-gray band, the band widening to form a median triangle on second tergite, this band and possibly others widen less distinctly laterally; wing predominantly hyaline, costal cell brownish. Male with eye pilose, large and small facets distinctly differentiated; tooth of third segment usually reduced and abdomen darker.

Comments: This species has been collected from coastal states of the southeastern United States from South Carolina to Louisiana, but collections have been infrequent and never in large numbers. It has not been reported from Texas. The immature stages are not known.

Hamatabanus carolinensis (Macquart)

Tabanus carolinensis Macquart 1838: 149 (1838: 145)

Tabanus scitus Walker 1848: 181.

Tabanus hirtioculatus Macquart 1855: 53 (1855: 33)
Tabanus cerastes Osten Sacken 1876: 462
Tabanus frater Kröber 1934: 297 (new name for
fraterna Kröber)
Tabanus fraterna Kröber 1931b: 82 (preoccupied
Macquart 1846)

Moderate in length (13 to 16 mm); brownish with pale markings; frontal callus black, quadrate, touching eyes; median callus slender, usually isolated, frons at vertex bare and shiny but lacking ocellar tubercle; third segment of antenna with distinct forward projecting tooth; eyes pilose; thorax reddish brown with pale lines; abdomen reddish brown with three rows of pale whitish spots, these very large on first two tergites, much smaller on remaining tergites; wing hyaline, venation normal. Male with eye densely pilose, large and small facets not sharply differentiated, tooth of third segment of antenna smaller than female; pale spots of abdomen reduced.

Comments: This species has not been collected in Texas. It has been collected from most of the eastern United States east of Texas, northward into southern Illinois and eastward to southern Maryland, except for West Virginia and southern Florida. The immature stages are not known.

GENUS AGKISTROCERUS PHILIP

Dicladocera, subgenus *Agkistrocerus* Philip 1941b:
13. Type-species, *Tabanus megerlei*
Wiedemann (type by original designation)

Only two Nearctic species are recognized in this genus, and both have been reported from Texas. They are moderate to large flies (16 - 21 mm), rather brightly colored and on occasion very numerous. Both species often are taken at the same time. We are aware of no reports of these species being pests. Nothing is known of their biology. The characters in the generic key are sufficient to characterize the genus.

KEY TO SPECIES OF AGKISTROCERUS OCCURRING OR POSSIBLY OCCURRING IN TEXAS

1. Females (frons present) 2
Males (frons absent; eyes contiguous) 3
2. Median callus a slender line; hair on lateral margin of tergite 4 white; vein R_{4+5} not broadly margined with brown *finitimus* (Stone)
Median callus broadly joined to basal callus and gradually tapered over its length; hair on lateral margin of tergite 4 entirely black; vein R_{4+5} and other longitudinal veins at base of wing broadly

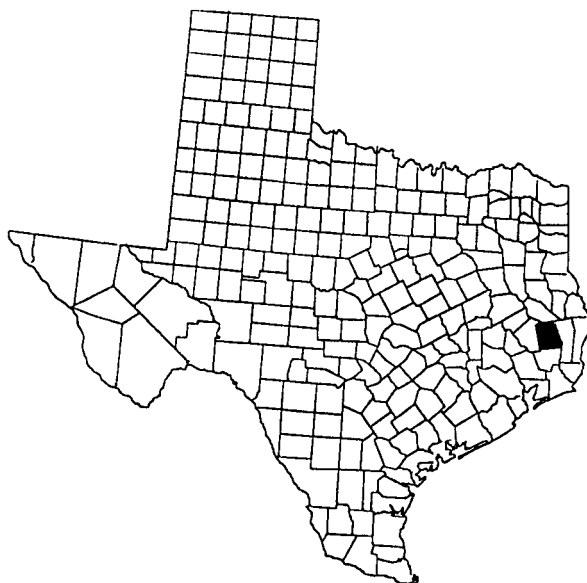
- marginated with brown
. *megerlei* (Wiedemann)
3. Hair on lateral margin of tergite 4 white; vein R_{4+5} not broadly margined with brown
. *finitimus* (Stone)
Hair on lateral margin of tergite 4 entirely black; vein R_{4+5} and other longitudinal veins at base of wing broadly margined with brown
. *megerlei* (Wiedemann)

Agkistrocerus finitimus (Stone)

Dicladocera finitimus Stone 1938: 15

Moderate (17.5 mm); dark reddish brown and black; basal callus shiny dark brown, about as high as wide, distinctly rounded above, continued dorsally in middle as a slender median line which represents the median callus; frons parallel-sided, a little less than 3 times as high as wide basally; abdomen above reddish brown with a median black stripe that widens posteriorly, covered with black hair except lateral corners of second tergite and lateral margins of tergites 3 to 6 which are white haired; wing more or less hyaline, bifurcation of vein R_{4+5} and crossveins margined with brown, costal cell pale yellowish, cell r_5 slightly narrowed apically. Male similar to female.

Comments: This species is known from the extreme southeastern United States from Georgia to Texas (McGregor and Schomberg 1952, Philip 1965). The immature stages are not known.



Map 55. Counties of collection: *Agkistrocerus finitimus*.

Known Distribution (Map 55): TYLER: Fred; Apr 1951; McGregor and New; USNM.

Agkistrocerus megerlei (Wiedemann)

Tabanus megerlei (Wiedemann) 1828: 132

Moderate (18 mm); reddish and black; basal callus shiny dark brown, protuberant, not touching eyes, a little higher than wide, broadly joined to concolorous tapering median callus; frons about 3 times as high as wide basally; abdomen pale reddish gray with a broad median black stripe on dorsum and a lateral fringe of entirely black hairs; wing hyaline, longitudinal veins basally, bifurcation of vein R₄₊₅ and crossveins margined with brown, costal cell, cells br and bm and area just behind stigma brownish. Male similar to female.

Comments: This species has been reported from the southeastern coastal states from North Carolina to Texas (McGregor and Schomberg 1952, Philip 1965). Although the immature stages have not been described, Jones and Anthony (1964) reported taking a single larva from soil near the edge of a lake in an area devoid of trees and shrubs.



Map 57. Counties of Collection: *Agkistrocerus finitimus*.

Known Distribution (Map 56): TYLER: Fred; 16-23 May 1950; McGregor; TAMU.

GENUS HYBOMITRA ENDERLEIN

Hybomitra Enderlein 1922: 347. Type-species, *solox* Enderlein (type by original designation) = *rhombica* (Osten Sacken)

Descemet Enderlein 1922: 346. Type-species, *Tabanus cinctus* Fabricius (type by original designation)

Tylostypia Enderlein 1922: 347. Type-species,

Tabanus astur Erichson (type by original designation)

Sziladynus Enderlein 1925: 181. Type-species, *Tabanus aterrimus* Meigen (type by original designation)

Theriopectes authors, not Zeller

In North America this genus is primarily northern in distribution. However, six species are known to occur in Texas, and at least three other species are possibly present. Whether any of these species is a pest in the state is not known at present, but species of the genus are important pests of domestic and wild ruminants and man in some areas of the world.

KEY TO SPECIES OF HYBOMITRA OCCURRING OR POSSIBLY OCCURRING IN TEXAS

--Females--

1. Subcallus predominantly pollinose, at most only a small non-pollinose area immediately below the basal callus 2
Subcallus predominantly to entirely denuded and shiny 6
2. Abdomen uniformly dark brown to black with a median row of conspicuous white triangles; wing more or less uniformly infuscated *trispila* (Wiedemann)
Abdomen with both median and sublateral pale triangles and/or spots at least on tergites 2 to 5, or if sublateral pale spots absent, abdomen is distinctly and broadly reddish orange laterally on tergites 1 to 4; wing predominantly hyaline 3
3. Abdomen above broadly reddish orange laterally 4
Abdomen above yellowish brown to blackish brown laterally 5
4. Wings usually with a spur vein at the bifurcation of vein R₄; antenna predominantly black except for some orange at extreme base of third segment; third antennal segment with obtuse dorsal angle and little or no dorsal excision *phaenops* (Osten Sacken)
Wing without spur vein at bifurcation of vein R₄; first two antennal segments yellowish brown, third basally orange; third antennal segment with acute dorsal angle and moderate dorsal excision *fulvilateralis* (Macquart)
5. Abdomen more or less uniformly blackish dorsally; spur vein absent from bifurcation of vein r₄₊₅ *aatos* Philip
Abdomen yellowish brown and black, the former obvious sublaterally on tergites 2 to 4; spur

- vein present at bifurcation of vein R_{4+5}
6. Abdomen reddish brown laterally; all crossveins and bifurcation of vein R_{4+5} distinctly infuscated *rubrilata* (Philip)
- Abdomen not extensively reddish brown laterally; wings not conspicuously patterned 7
7. Basal plate predominantly to entirely orange to reddish orange; abdomen with both median triangles and large sublateral spots, which may be rather indistinct; basal callus and femora brown to black 8
- Basal plate with orange restricted to basal third; abdomen black, without sublateral spots, but with pale posterior borders which expand laterally (and sometimes medially as triangles); basal callus black; femora black
8. Basal callus brown; femora reddish brown; abdomen above brownish, faintly reddish brown laterally, with indistinct median and sublateral pale triangles or spots
- Basal callus black; femora brownish black; abdomen above blackish with median and sublateral grayish to yellowish gray median and sublateral pale triangles and spots

- usually reaching anterior margin of tergite 1 6
- Abdomen above either predominantly blackish, or with paler yellowish brown areas sublaterally, the paler areas not reaching entirely across tergite 1 7
6. Spur vein typically present at bifurcation of vein R_{4+5} ; venter of abdomen orange brown to black
- Spur vein absent from bifurcation of vein R_{4+5} ; first sternite orange with median black spot, sternites 2 to 4 almost entirely orange, remainder of abdominal venter predominantly black
7. Abdomen above yellowish brown sublaterally, blackish medially; spur vein present at bifurcation of vein R_{4+5}
- Abdomen above more or less uniformly blackish; spur vein absent from bifurcation of vein R_{4+5} 8
8. Abdomen above with large flesh-colored sublateral pale spots on tergites 2 to 5; wings hyaline except for faint cloud at bifurcation of vein R_{4+5}
- Abdomen above with yellowish gray sublateral pale spots on tergites 2 to 3; wing hyaline except for light yellowish costal cell

--Males--

1. Stiff hairs along midline between eyes 2
- No stiff hairs along midline between eyes 3
2. Femora reddish brown; abdomen with indistinct sublateral spots; hind tibia with distinct black fringe
- Femora black; abdomen lacking isolated sublateral spots; hind tibial fringe only weakly developed
3. Crossveins and bifurcation of vein R_{4+5} with distinct dark spots; abdomen laterally broadly orange
- Wing hyaline to more or less entirely infuscated, but without isolated spots at bifurcation of vein R_{4+5} and crossveins; abdomen black to yellowish-brown and black 4
4. Abdomen dorsally with a row of conspicuous white triangles and no sublateral spots; wing more or less uniformly infuscated
- Abdomen dorsally otherwise; wing hyaline with at most faint infuscation in costal cell and at bifurcation of vein R_{4+5} 5
5. Abdomen above broadly and distinctly reddish orange to orange brown sublaterally on first 3 or 4 tergites, the reddish orange to orange brown

Hybomitra aatos Philip

Hybomitra aatos Philip 1941c: 148

Moderate (15 mm); grayish black; frons yellowish gray pollinose, widened above, with prominent ocellar tubercle; subcallus grayish pollinose except along upper margin adjacent to basal callus and narrowly along midline; basal callus subquadrate, dark brown to black, touching eyes, separated from irregular median callus; thorax black dorsally with indistinct grayish lines; wings hyaline except for faint cloud at bifurcation of vein R_{4+5} ; abdomen black dorsally with pale median triangles that do not cross tergites and pinkish, flesh-colored sublateral oblique dashes on tergites 2 to 4. Male with eyes densely pilose, areas of large and small facets not noticeably differentiated; a little darker and thorax more densely haired, but generally similar to female.

Comments: This species has not been reported from Texas. It has been reported from the more mountainous states of the western United States from Arizona northward to Wyoming. Burger (1977) reported taking larvae of this species from moss growing on partially submerged logs and stumps, and from submerged aquatic vegetation in a small pond, both locations in the mountains of Arizona.

Hybomitra difficilis (Wiedemann)

Tabanus difficilis Wiedemann 1828: 165
Tabanus carolinensis authors, not Macquart

Moderate (13 mm); dark brown; frons yellowish gray, nearly parallel-sided; basal callus brown, wider than high, usually touching eyes and separated from the rectangulate predominantly dull brown median callus; subcallus denuded; eyes sparsely pilose; thorax dark brown; abdomen broad, brown in middle and reddish laterally, with indistinct median triangles, and usually at least suggestions of indistinct lateral spots; wing hyaline, costal cell yellow; eye almost bare. Male with large and small facets hardly differentiated; eye almost bare; erect hairs on midline between eyes.

Comments: This species has not been reported from Texas. It has been collected throughout most of the eastern United States from Oklahoma, Arkansas, and Louisiana north and east to the Great Lakes region and into New York and Massachusetts, except for Florida east and south of the panhandle area. The immature stages are not known.

Hybomitra fulvilateralis (Macquart)

Tabanus fulvilateralis Macquart 1838: 137 (1838: 133).
Tabanus recedens Walker 1854: 201 (preoccupied Walker 1848)
Tabanus haemaphorus Marten 1882: 210

Moderate (16 mm); blackish, abdomen with orange markings laterally; frons grayish pollinose, distinctly widened above, with prominent ocellar tubercle; basal callus shining black, rounded above, separated from eyes and from spindle-shaped median callus; subcallus grayish pollinose; eyes densely pilose; thorax blackish dorsally, with gray longitudinal lines; wings very faintly tinted brownish, costal cell pale yellowish, some light brown around veins in basal half; abdomen dorsally predominantly black, but broadly orange laterally on tergites 1 to 4; pale median triangles over submedian bivittate black spots on tergites 2 to 5. Male with eyes densely pilose; large and small facets scarcely differentiated; wings with obvious infuscation and general body pattern darker; median triangles sometimes obsolete.

Comments: This species has not been reported from Texas. It is a western species which has been collected in Canada (British Columbia to Manitoba) southward to southern California and New Mexico. Burger (1977) reported collecting larvae of this species from clumps of wet moss in several cienegas in the White Mountains of Arizona and from floating clumps of pondweed in a small pond.

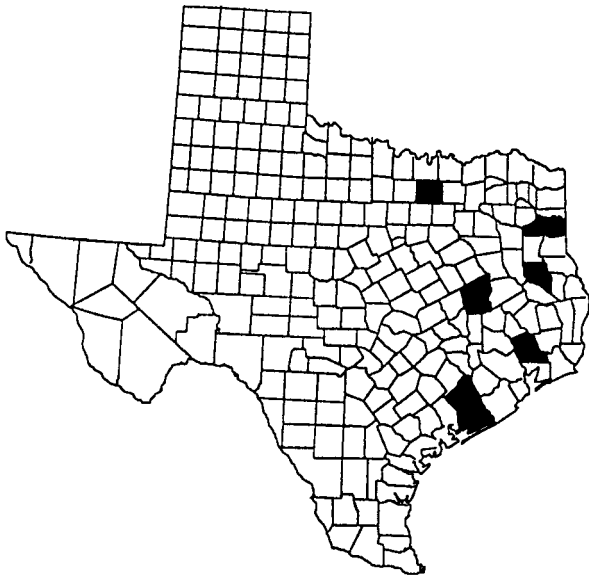
Hybomitra lasiophthalma (Macquart)

Tabanus lasiophthalma Macquart 1838a: 147 (1838a: 143)
Tabanus punctipennis Macquart 1847: 39 (1847: 23) (preoccupied Macquart 1838)
Tabanus notabilis Walker 1848: 166
Tabanus redactus Walker 1850: 639
Tabanus fretus Stone 1938: 154
Tabanus guttiferus Harris in Johnson 1925: 70, Nomen nudum

Moderate (14 mm); brownish and orange; frons yellowish gray, distinctly widened above; basal callus orange brown, oval, not touching eyes, not united with short black elongate oval median callus; subcallus partly denuded; eyes densely pilose; thorax predominantly blackish with yellowish gray lines; abdomen broadly yellowish orange laterally with a dark brown to black median stripe, narrowest on tergites 2 to 4; wing hyaline except for infuscations at bifurcation of vein R₄₊₅ and on all cross-veins, costal cell brownish. Male with eye facets of nearly uniform size; eye pilose; no erect hairs on midline between eyes.

Comments: This species has been collected from the eastern half of the United States, except for the extreme southeast (southern Alabama and Georgia, and Florida), from most of southern Canada westward nearly to British Columbia where a southward extension of the range enters the United States in Western Montana and Idaho southward into northern Utah. McGregor and Schomberg (1952), Philip (1965), and Thompson (1974b, 1975b, 1977) reported Texas collections. Teskey (1969) reported collecting larvae in a sphagnum bog, a bog-like backwater of a river, the margin of a woodland pool, a rotting log floating in a pond and shrub-sedge marsh. The senior author has found larvae of this species in very wet spongy decaying logs, usually well into the interior of the log. In addition to the distribution noted below, the authors are aware of a specimen from Val Verde County (El Paso; 10 Mar 1973; B. Gomez) in the Ohio State University collection, but we strongly question the locality as we are unaware of habitat suitable for this species anywhere in the southwest Texas area. Consequently, we have not included the locality on the distribution map, or in the recognized distribution below.

Known Distribution (Map 58, p. 81): DENTON: C & L Brown Nursery; 5 May 1969; L.S. Brown; UNT. Denton; 3 Apr 1970; M.D. Stroble; UNT. GREGG: 18 Apr 1965; D. Young; CU. GRIMES: Navasota R & FM 2038; 15, 20, 27 Mar, 5, 10 Apr 1972, 14, 17, 24, 26 Mar, 11, 14, 16, 18, 21, 23, 28 Apr, 7, 12 May 1975, 14, 15, 20, 22, 28, 29 Apr, 8 May 1978; P.H. Thompson; TAMU. HARRISON: 3 mi E Karnack; 3, 5 Oct 1972; R.E. Acciavitti; CU. LEON: 8 Apr 1950; TAMU. Oakwood, 18 Apr 1950; TAMU. LIBERTY: ½ mi E Hull; 29 Mar 1972, 21 Mar, 5, 6, 12, 16, 26 Apr 1973; P.H. Thompson; TAMU. MATAGORDA: Sargent; 15 Apr 1948; E.T. McGregor; USNM. NACOGDOCHES: 21 Jun 1966; D. Morris; SFASU. WHARTON: Wharton; 17 May 1967; USNM.



Map 58. Counties of collection: *Hybomitra lasiophthalma*.

Hybomitra nigricans (Wiedemann)

- Tabanus nigricans* Wiedemann 1828: 157
- Tabanus patulus* Walker 1848: 175
- Tabanus oklahomensis* Stone 1933: 76

Moderate (14 mm); brownish black; frons broad, yellowish brown pollinose, nearly parallel-sided, denuded dorsally over a triangular area in center of which is distinct ocellar tubercle; basal callus black, distinctly wider than high, usually touching eyes, isolated from broad median callus; subcallus denuded; eyes densely pilose; thorax black; abdomen blackish with indefinite pale posterior bands which expand laterally and sometimes medially to form faint triangles; wing hyaline, costal cell tinted; eyes hairy. Male

with facets nearly uniform in size, densely hairy; erect hairs on midline between eyes.

Comments: This species has been collected from many southeastern states from Oklahoma and Texas (Thompson 1974b) in the west to North Carolina in the east. The immature stages are not known.

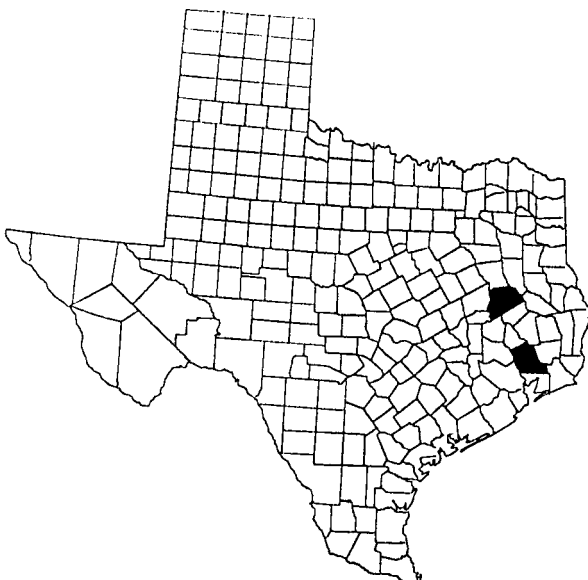
Known Distribution (Map 59): HOUSTON: 27 Apr 1962; M. Mather; JTG. 27 Mar 1966; C.M. Mather; SFASU. LIBERTY: ½ mi E Hull; 29 Mar 1972, 2, 4, 12, 26 Apr 1973; P.H. Thompson; TAMU.

Hybomitra phaenops (Osten Sacken)

Tabanus phaenops Osten Sacken 1877: 217

Moderate (14 mm); dark brown to black, sides of abdomen decidedly orange; frons gray, about 4 times as high as wide basally, distinctly widened above; basal callus black, touching eyes, subquadrate, usually narrowly joined to lanceolate concolorous median callus; ocellar tubercle prominent; eyes with short pile; thorax blackish brown; abdomen blackish brown above, sides of tergites 1 to 4 broadly orange, especially on tergites 2 and 3, sometimes with faint grayish dorsal triangles visible on black midstripe; wing hyaline, the costal cell, margin of some veins and bifurcation of vein R_{4+5} faintly brown; bifurcation usually with an evident spur. Male with eyes densely pilose, areas of large and small facets not markedly differentiated; generally darker, but otherwise patterned like female.

Comments: Only a single specimen of what appears to be this species has been seen from Texas. It is widely distributed in the northern ⅓ of the western U.S. Burger (1977) reported finding larvae in the mats of fallen and dead sedges in a boggy lake, in moss around snowmelt ponds and occasionally in moss along the margins of cienegas.



Map 59. Counties of Collection: *Hybomitra nigricans*.



Map 60. Counties of collection: *Hybomitra phaenops*.

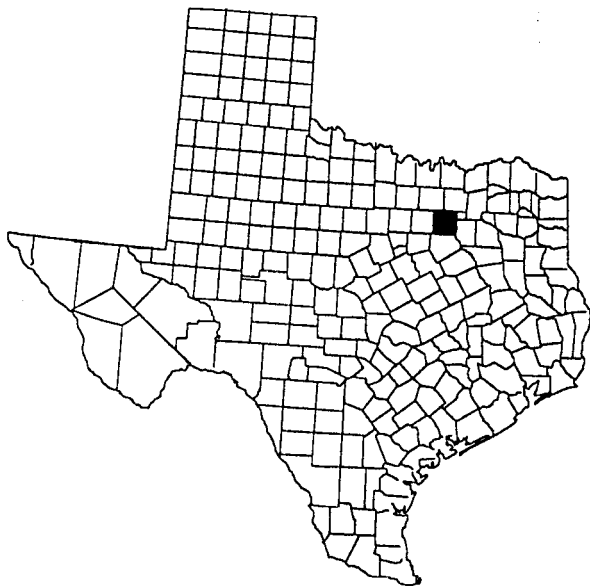
Known Distribution (Map 60, p. 81): WICHITA: 31 Jul 1981; L. Stroh; JTG.

***Hybomitra rhombica* (Osten Sacken)**

Tabanus rhombicus Osten Sacken 1876: 472
Tabanus centron Marten 1882: 211
Hybomitra solox Enderlein 1922: 347

Moderate (14.5 mm); black, with grayish abdominal markings; frons gray pollinose, slightly widened above; basal callus broad, shining black, touching eyes, subquadrate, narrowly joined or separated from spindle-shaped median callus; subcallus denuded, shining black; eyes moderately pilose; thorax dorsally blackish, with conspicuous grayish to yellowish gray lines; wings hyaline, costal cell faintly brownish; abdomen dorsally dull black, with median and sublateral grayish to yellowish gray triangles and spots on tergites 2 to 6. Male with eyes densely pilose, large and small facets scarcely differentiated; frontal triangle grayish pollinose; abdomen dorsally with some yellowish brown laterally; otherwise similar to female.

Comments: This species has been fairly widely collected in the western third of the United States and Canada from British Columbia southward to southern California and New Mexico. The immature stages are not known.



Map 61. Counties of collection: *Hybomitra rhombica*.

Known Distribution (Map 61): DALLAS: 8 Apr 1948; Kuehhe; TAMU.

***Hybomitra rubrilata* Philip**

Tabanus tetricus variety *rubrilata* Philip 1937: 64
Tylostypia laticornis Enderlein 1925a: 363
(preoccupied Hine 1904b)

Moderate (16 mm); grayish black, abdomen yellowish sublaterally; frons grayish pollinose, widened above, ocellar tubercle prominent, partly to completely denuded; basal callus dark brown to black, subquadrate, narrowly separated from eyes and from spindle-shaped median callus; subcallus yellowish gray pollinose except for small bare area just beneath basal callus; eyes densely pilose; thorax dorsally blackish, with gray pollinose lines; wings hyaline, spur vein present on bifurcation of vein R_{4+5} ; abdomen dorsally yellowish brown to black, the former color evident sublaterally on tergites 1 to 4; pale median triangles and sublateral spots present on tergites 2 to 5. Male with eyes densely pilose, large and small facets scarcely differentiated; wings with veins faintly tinted with brown; body more pilose and darker than female, the pale dorsal abdominal markings obscured or evanescent.

Comments: This is predominantly a western montane species which has been collected from Colorado and Utah southward to Arizona and New Mexico. The immatures are not known.



Map 62. Counties of collection: *Hybomitra rubrilata*.

Known Distribution (Map 62): MOTLEY: Flomot; 28 Sep 1969; CBP.

***Hybomitra trispila* (Wiedemann)**

Tabanus trispila Wiedemann 1828: 150

Moderate (14 mm); blackish, with white abdominal markings; frons grayish pollinose, nearly parallel-sided, ocellar tubercle distinct; basal callus black to brown, narrowly separated from eyes, usually narrowly united to concolorous median callus; eyes sparsely pilose; third antennal segment orange basally; thorax blackish, with grayish lines; abdomen black with a median row of

conspicuous grayish white triangles; wing more or less uniformly and darkly tinted. Male with large and small facets distinctly differentiated; abdomen orange brown laterally; eyes pilose.

Comments: This species has been collected throughout much of the eastern United States from Texas (McGregor and Schomberg 1952; Thompson 1973a) to New York. In the interior it may reach its northern limits in Kentucky. The immature stages are not known.



Map 63. Counties of Collection: *Hybomitra trispila*.

Known Distribution (Map 63): WALKER: Huntsville St Pk; 3, 16 Jun 1971; P.H. Thompson; TAMU.

GENUS *TABANUS* LINNAEUS

Tabanus Linnaeus 1758: 601. Type-species, *bovinus* Linnaeus (Latreille 1810: 443)

Neotabanus Lutz 1909: 20. Type-species, *Tabanus trilineatus* Latreille (Bequaert 1924: 29)

Taeniotabanus Kröber 1931b: 68. Type-species, *Tabanus dorsiger* Wiedemann (monotypic)

In species diversity, the genus *Tabanus* is the most abundant in Texas and includes, along with *Hybomitra*, the insects most commonly referred to as horse flies. Species of this genus range from small (7.5 mm) to very large (30 mm). In the brief descriptions provided later, species averaging 10 mm or less in length are termed small, those averaging 19 mm or more large, and those between moderate. Many of the species are major pests of domestic livestock, and some species frequently attack man. A total of 52 species have been reported to occur in Texas, and at least 12 other species are possibly present.

As with *Chrysops*, the large number of species of *Tabanus* occurring or possibly occurring in Texas has led us to present for the identification of females a key to species groups, followed by keys to the species in each group. For the males, which are much more poorly represented in collections, a single key covering all known species is provided. Of the species treated herein, only the male of *T. nefarius* is as yet unrecognized.

KEYS TO SPECIES GROUPS OF *TABANUS* LINNAEUS OCCURRING OR POSSIBLY OCCURRING IN TEXAS (FEMALES ONLY)

1. Abdomen wholly black to dark brown, often bluish pruinose, but without pale hairs above or below; wings black to brown, with or without darker clouds around crossveins . . . **Group 1**
Abdomen with dorsal and/or lateral pale pilose and/or pollinose markings; wings various 2
2. Abdomen with a middorsal pale stripe that is either smooth-sided or serrated; if the latter, stripe comprised of a row of contiguous, occasionally narrow, triangles that clearly and broadly cross the tergites; at least indications of sublateral pale stripes or rows of pale spots also present; wings without strong spots or clouds around crossveins or bifurcation vein R_{4+5} 3
Abdomen otherwise, if both median and sublateral pale spots or triangles present, the former at most only very narrowly cross the tergites so that there is no impression of a stripe; middorsal triangles often cross no more than posterior 2/3 and often arise from pale hind margins, or wings with strong spots around crossveins and bifurcation vein R_{4+5} , or both 4
3. Abdomen with a uniform continuous middorsal pale pollinose and pilose stripe and at least indications of sublateral pale stripes on the anterior tergites; tergites without pale hind margins; wings usually hyaline, at most lightly tinted, and without definite dark clouds around crossveins or bifurcation of vein R_{4+5} ; costal cell clear or colored **Group 2**
Abdomen with a median row of broadly contiguous, occasionally slender, triangles that are widened at the hind border of each tergite, and with a dorsolateral row of pale pilose spots on each side; wings unspotted, at most with costal cell yellowish, or membrane smoky . . **Group 3**
4. Wings hyaline, unspotted, at most with costal cell darkened and veins brown margined (except *abactor* Philip which has a faint cloud of infuscation at the bifurcation of vein R_{4+5} but no clouds on crossveins) 5

- Wings with definite dark clouds around bifurcation of vein R_{4+5} and usually around crossveins . . . **7**
5. Abdomen dorsally dark brown to nearly black, beneath with white hairs and/or pollinosity on some or all sternites; wings without spots, hyaline or tinted, the costal cell darkened; some specimens with small dorsal median triangles on abdominal tergites and no pale dorsolateral spots; very large species, wing length over 15 mm **Group 4**
- Abdomen otherwise, either with very distinct median pale abdominal triangles or with both dorsolateral and median pale markings; smaller species, wing length never greater than 14 mm **6**
6. Abdominal tergites each with a pair of small white pilose and pollinose dorsolateral spots, and often indistinct median white triangles, and narrow white hind borders; wings entirely glass clear; very small species, wing length less than 10 mm (exceptionally small specimens of *quaesitus* Stone might be confused here, but the eyes of *quaesitus* are pilose under magnification whereas the eyes of Group 5 species are bare; *quaesitus* is treated in Group 6) . . **Group 5**
- Either abdomen grayish, black or dark brown with a median row of distinct dorsal white pilose triangles of about the same size on tergites 2 to 5 or 6, with or without pale dorsolateral spots, or with distinct pale median triangles only on tergites 3 and 4, being absent or very small on 2 and/or 5, usually with dorsolateral pale spots of each side of tergites 2 to 4; scutellum not conspicuously white pollinose; wings unspotted, hyaline or with darkened costal cell; larger species, wing length only rarely as short as 10 mm **Group 6**
7. Abdomen largely yellow to yellowish brown, with or without a generally obscure row of paler median triangles or median pale stripe; legs nearly unicolorous light to dark brown, none sharply bicolored; wings lightly to heavily fumose, the crossveins with slight to moderate clouds **Group 7**
- Abdomen dark brown to black; legs rarely unicolorous, the fore tibiae at least obscurely bicolored, usually distinctly so, often all or some tibiae markedly paler than femora; if wings somewhat fumose throughout, 3 or more abdominal tergites have very distinct median pale triangles **6**
8. Wings with very large black clouds surrounding all crossveins and bifurcation of vein R_{4+5} , and lighter clouds filling basal cells and a dark band along entire wing margin; abdomen blackish with a median row of pale triangles and diffuse dorsolateral spots **Group 8**
- Wings not as above, dark spots around crossveins and bifurcation of vein R_{4+5} not enlarged and dark spots absent from basal cells; abdomen various **9**
9. Scutellum strikingly white pollinose and pilose; abdomen blackish with 3 or more median white pilose triangles; wings with veins dark margined, with weak spots at crossveins, and more or less brown fumose **Group 9**
- Scutellum not as above, not strongly contrasting with abdomen, though often extensively white pilose; wings various, but usually with distinct dark spots at crossveins and/or bifurcation of vein R_{4+5} **10**
10. Black, rarely brown, and white species; wings with small but sharp dark clouds at all crossveins and bifurcation of vein R_{4+5} ; costal cell at most slightly yellowish; abdomen with large white middorsal triangles and generally with dorsolateral pale pilose patches; third antennal segment usually black, at least style always so **Group 10**
- Brown species; wings with all crossveins and bifurcation of vein R_{4+5} strongly spotted, often with veins brown margined; costal cell dark yellow to brown **11**
11. Frons broad, not over 4 times as high as wide basally; abdomen with a middorsal row of small pale pilose and pollinose triangles, evanescent and obsolete in some specimens; legs unicolorous, light to dark brown **Group 11**
- Frons narrower, rarely less than $4\frac{1}{2}$ as high as wide basally; abdomen generally with larger middorsal triangles, rarely are these small or obsolete; tergites often with pale hind and lateral margins; legs often bicolored, with tibiae lighter than femora and fore tibiae bicolored **Group 12**

Tabanus, Group 1

1. Mesonotum and scutellum predominantly densely cream-colored or white pollinose and pilose, in sharp contrast to dark black or brown of abdomen **2**
- Mesonotum and scutellum black to dark brown, not markedly in contrast with dark abdomen . . **3**
2. Fore tibiae sharply bicolored *punctifer* Osten Sacken
- Fore tibiae uniformly brownish *stygius* Say
3. Frontal callus distinctly wider than high; subcallus and genae predominantly to entirely denuded and shiny; wings deep black to reddish brown

- without distinct darker spot at bifurcation of vein R_{4+5} ; very large species, wing length usually 20 to 25 mm *atratus* Fabricius
- Frontal callus at least as high as wide; subcallus usually pollinose, genae always so; wings black to nearly clear, often with distinct darker spot at bifurcation of vein R_{4+5} ; smaller species, wing length rarely exceeds 20 mm 4
4. Antennae wholly orange; frons over 6 times as high as wide basally, nearly twice as wide at vertex as at base; abdomen bluish pruinose, black to dark brown; wings yellowish brown, crossveins and bifurcation of vein R_{4+5} with diffuse dark spots *proximus* Walker
- Antennae with at least style and scape blackish, sometimes wholly black; frons less than 6, usually 5 or less times as high as wide basally; abdomen bluish pruinose or not; wings basally brownish but predominantly hyaline, or entirely infuscated 5
5. Antennae wholly black; abdomen bluish pruinose; wings predominantly infuscated
- *aranti* Hays
- Antennae not wholly black, at least basal plate brown or orange; abdomen not bluish pruinose; wings basally brownish but predominantly hyaline, or entirely infuscated 6
6. Wings evenly brown to nearly black; basal plate of antennae nearly as broad as long, orange, the style dusky *atripennis* Stone
- Wings nearly clear on distal half; costal, basal, and anal cells brownish tinted; antennae more slender, basal plate nearly twice as long as broad, basally brown, apically darker as is style *nigrescens* Palisot

Tabanus, Group 2

1. Vertex with a small discrete raised tubercle; frons less than 4 times as high as wide basally; abdomen with a narrow even or irregular pale median stripe overlying a broad black integumental stripe; dorsolateral stripes of broad pale oblique contiguous patches; all femora pale, wings clear *pungens* Wiedemann
- Vertex without tubercle; frons ranges from $2\frac{1}{2}$ to over 6 times as high as wide basally; middorsal pale stripe usually even; dorsolateral stripe and femora various 2
2. Costal cell entirely hyaline, no darker than rest of wing 3
- Costal cell light yellow to brown 6
3. Integument of scutellum entirely black 4
- Integument of scutellum with at least apex reddish *subsimplis* Bellardi
4. Mid and hind femora entirely pale, rarely slightly

- dusky basally; frontal callus usually yellow to reddish, at least in part, and round or slightly pointed above; middorsal pale stripe even and parallel-sided, dorsolateral stripes uneven, step-like, all chalky white; mesonotum without evident stripes *colombensis* Fairchild
- Mid and hind femora basally $\frac{1}{2}$ or more sharply black; frontal callus almost always black, higher than wide, rarely pointed above; middorsal pale stripe variable, wide to narrow, even or irregular; mesonotum usually clearly striped in undenuded specimens 5
5. Frons usually 6 or more times as high as wide basally, almost always distinctly convergent below; middorsal pale abdominal stripe usually slender, narrower than dark intervals between it and dorsolateral stripes; all coxae and femora with black integument, the tibiae at least pale basally with white pilosity; primarily inland in distribution *lineola* Fabricius
- Frons generally less than 5 times as high as wide basally, usually nearly parallel-sided; middorsal pale abdominal stripe broader, as broad as the intervals between it and dorsolateral stripes; legs paler, apical third of femora pale and mid and hind tibiae white; predominantly coastal *hinellus* Philip
6. Integument of coxae and femora largely black, at most distal third of mid and hind femora pale, yellowish; scutellum black 7
- Integument of coxae and femora largely pale, at most mid and hind femora slightly infuscated basally; scutellum often brown . . . *fuscicostatus* Hine
7. Dorsolateral pale stripes on abdomen usually reduced to a row of vague paler spots, often absent; abdomen orange brown to nearly black; beard white, pleura gray pilose *mularis* Stone
- Dorsolateral pale stripes on abdomen usually broad and complete to at least tergite 5; except for middorsal abdominal pale stripe, area between dorsolateral stripes dark brown to blackish, darker than lateral margins of tergites 8
8. Pollinosity and pilosity of face and pleura gray to white; a strictly coastal species
- *nigrovittatus* Macquart
- Pollinosity and pilosity of face and pleura distinctly yellow; coastal or inland in distribution . . . 9
9. Coastal species; frons usually $3\frac{1}{2}$ or less times as high as wide basally *eadsi* Philip
- Inland species, rarely taken on the coast; frons usually more than $3\frac{1}{2}$ times as high as wide basally *quinquevittatus* Wiedemann

Tabanus, Group 3

1. Scutellar integument brown, concolorous or paler

- than mesonotum and abdomen; legs pale brown, fore tibiae not obviously bicolored . **2**
- Scutellum and mesonotum with black integument, usually darker than adjoining abdomen; legs various **4**
2. Wings, especially costal cell, yellowish tinted; frontal callus yellow; antennae and legs pale yellow, except for brown tarsi and slightly darker apical half of fore tibiae; pale dorsolateral spots of abdomen oval, generally contacting hind margins of respective tergites; frons parallel-sided **zythicolor Philip**
- Wings glass clear, costal cell not tinted; frontal callus yellowish to brown; antennae bicolored, orange yellow with annuli black; legs as above, except tarsi darker and fore tibiae obscurely bicolored; dorsolateral pale spots on abdomen more circular, not touching at least hind margin of respective tergites; frons parallel-sided or convergent below **3**
3. Frons relatively narrow, convergent below, about 4½ or more times as high as wide basally; basal callus evidently higher than wide **sackeni Fairchild**
- Frons nearly parallel-sided, usually 4 or less times as high as wide basally; basal callus about as wide as high **longus Osten Sacken**
4. Pollinosity and pilosity of most of the body and legs bright yellow; abdomen above predominantly yellow, the dark markings reduced to a pair of dorsolateral stripes formed of black pilose comma-shaped marks and marginal rows of black dashes **5**
- Pollinosity and pilosity not yellow; abdomen with dark areas predominating; antennae sharply bicolored, third segment yellow with black annuli **6**
5. Whole body and legs covered with thick yellow pollinosity; beard, pleura and venter of abdomen yellow pilose; antennae bicolored, yellow with black annuli; coxae and basal halves or more of femora with black integument; fore tibiae prominently bicolored; abdomen yellow below **fulvulus Wiedemann**
- Dorsum as above, but pleura and venter white pilose and pollinose; antennae wholly yellow, rarely the annuli brownish; coxae and femora yellow, white pollinose **pallidescens Philip**
6. Frons broad, usually about 3 times as high as wide basally; callus round, as wide or wider than high, black; legs bicolored, femora largely black, but coxae and tibiae pale, the fore tibiae prominently bicolored; wings with costal cell dark brown; median abdominal pattern a continuous row of yellowish-white pollinose and pilose concave sided triangles and dorsolateral rows of oblique pale dashes separated by intensely black pilose areas; laterally tergites pale with black oblique patches separating lateral margins from dorsolateral pale markings **texanus Hine**
- Frons narrower, usually 4 to 7 times as high as wide basally; callus square or higher than wide; wings with costal cell at most slightly yellowish; abdomen with middorsal row of pale pollinose inverted T-shaped markings, and pale isolated dorsolateral spots, the markings usually somewhat blurred **7**
7. Frons very narrow, about 6 to 7 times as high as wide basally; basal callus higher than wide, black; coxae and at least basal ⅔ of femora with black integument; fore tibiae bicolored; first and second abdominal tergites with a vague black more or less distinct integumental triangle, the abdominal dorsolateral pale spots not sharply defined; costal cell hyaline **wilsoni Pechuman**
- Frons broader, 3½ to 4⅓ times as high as wide basally; callus square, round or somewhat higher than wide; coxae pale, femora at most brown; tibiae pale, or weakly bicolored due to dark pilosity on apical half; costal cell strongly to weakly yellow tinted **8**
8. Abdomen dark brown to nearly black, the narrow pale median stripe formed of white pilose inverted T-shaped contiguous marks; dorsolateral pale spots small, white pilose, hardly ever touching either border of the tergites in which they lie; costal cell dark yellow; abdomen beneath whitish pollinose and pilose **longiusculus Hine**
- Abdomen light brown, the median stripe yellowish, not strongly contrasting with background; dorsolateral pale spots large, nearly filling the spaces between the midstripe, lateral borders and pale hind margins of the tergites; costal cell faintly yellowish; abdomen beneath yellowish pollinose and pilose **sublongus Stone**

Tabanus, Group 4

1. Wings glass clear with dark brown costal cell; face and frons orange pilose and pollinose; dorsal surface of mesonotum and abdomen purplish brown, with contrasting yellowish hair tufts before and after wing bases; abdomen darker than scutellum, purplish brown, with weak gray pilose middorsal low triangles on tergites 1 to 5, and strong lateral pilose patches on tergites 1 to 4; usually 25 to 30 mm **americanus Forster**

Wings yellowish brown throughout, costal cell only slightly darker; face grayish white, frons brownish; mesonotum and abdomen reddish brown to nearly black, without contrasting yellowish hair tufts; abdomen sometimes with indistinct grayish median triangles, but lacking pale lateral patches; smaller species, 20 to 25 mm *calens* Linnaeus

Tabanus, Group 5

1. Median frontal callus broad, somewhat irregular, usually surrounded by a dark stained or dark pollinose area, very rarely joined to the square black basal callus; frons parallel-sided to narrowed below, but seldom as much as twice as wide at vertex as at base; eyes in life with 2 median parallel blue to green transverse bands usually narrower than dark interval between them *pumilus* Macquart
- Median frontal callus thread-like to narrowly spindle-shaped, often joined to basal callus and not surrounded by a dark stained area; frons strongly convergent below, often more than twice as wide at vertex as at base; eyes in life, with or without a slender thread-like reddish transverse band *sparus* Whitney

Tabanus, Group 6

1. Eyes sparsely pilose; second palpal segment very slender; basal callus usually wider than high, touching eyes; third antennal segment slender; body length 10 to 14 mm; abdomen brownish black with median triangles and rounded sublateral pale spots; wings hyaline; eye in life with a single diagonal purple band *quaesitus* Stone
- If eyes pilose, second palpal segment not unusually slender and/or basal callus narrower than high or third antennal segment not slender; disagreeing with one or more of other characters 2
2. Blackish species with abdominal pattern including a small white median spot on tergite 1 beneath scutellum, very distinct white median triangles on tergites 3 and 4 and sometimes small less distinct triangles on tergites 2 and/or 5; sometimes paired dorsolateral whitish spots on tergites 2 to 4, those on 2 the most distinct *dorsifer* Walker
- In addition to pale spot beneath scutellum, abdominal pattern includes pale median triangles on tergites 2 to 5 or 6, those on 2 and 5 or 6 as distinct and about same size as those on 3 and 4, with or without dorsolateral pale spots on

3. Subcallus at least partly bare and shiny; wings with all cells but anal broadly open, hyaline, at most bifurcation of vein R_{4+5} and crossveins with barely perceptible clouds; mesonotum striped, abdomen black, rarely brown, with middorsal row of white pollinose and pilose, generally contiguous and equal sized triangles; coxae and femora black, tibiae bicolored or basally white *nigripes* Wiedemann
- Subcallus pollinose, except for some specimens of *gilanus* which show varying degrees of denuded and shiny surface; in addition, wings with some posterior cells narrowed toward margin, or costal cell brownish, or legs brownish, or legs unicolorous (also, in *gilanus*, eyes usually are somewhat pilose and there is no white pile or pollinosity basally on tibiae) 4
4. Wings with cell r_5 narrowed towards margin or closed at margin or petiolate; fore tibiae sharply bicolored 5
- Wings with all cells but anal widely open; fore tibiae bicolored or not 6
5. Cell r_5 closed at margin, or petiolate; rarely a short spur vein at base of vein R_4 ; abdomen usually with white middorsal mark on tergite 2 joined to white spot on tergite 1, yielding a dumbbell shaped figure, rarely otherwise; basal one or two sternites with some yellow in ground color laterally *petiolatus* Hine
- Cell r_5 narrowed at wing margin, occasionally closed but rarely petiolate; white middorsal triangle on tergite 2 very rarely joined to white spot on tergite 1; basal sternites almost always entirely blackish brown in ground color *melanocerus* Wiedemann
6. Scape of antenna strongly swollen dorsally so that in vertical dimension it is as large or larger than broadest part of third segment; scape, pedicel and at least base of third segment pale yellowish to orange brown *erythraeus* (Bigot)
- Scape of antenna either not noticeably swollen dorsally, or antenna is more or less entirely black 7
7. Bifurcation of vein R_{4+5} with a faint cloud of infuscation; costal cell hyaline or nearly so *abactor* Philip
- Bifurcation of vein R_{4+5} without any evidence of infuscation; costal cell usually distinctly infuscated 8
8. Eyes distinctly and densely pilose; subcallus pollinose; sides of tergite 1 decidedly orange over entire length; basal plate of third antennal segment orange, about as wide as long *laticornis* Hine

- Eyes bare, or if pilose (*gilanus*) subcallus usually partly denuded and shining; also, sides of tergite 1 not decidedly orange, or basal plate not more than half orange or evidently longer than wide **9**
9. Thorax and abdomen obviously reddish and grayish pruinose over brown ground color **pruinusosus** **Bigot**
Thorax and abdomen not pruinose; gray, brown or black in ground color **10**
10. Abdomen brown, the middorsal abdominal triangles large and prominent on tergites 1 to 6, gray pilose; sublateral abdominal pale spots absent; legs brown, largely white pilose, the femora slightly darker than tibiae, the fore tibiae slightly paler basally; scutellum with sides white pilose, middle dark pilose and united with a patch of dark pilosity on the posterior of mesonotum **rufofrater** **Walker**
Abdomen grayish to black with distinct median and sublateral pale pollinose and/or pilose triangles or spots; legs various; scutellum not evidently white pilose at sides and without evident darker midbasal dark patch **11**
11. Third segment of antenna entirely black; first segment distinctly swollen, nearly covering second segment dorsally . . . **fairchildi** **Stone**
Third segment of antenna pale reddish to yellowish orange basally; first segment not noticeably swollen and not hiding second dorsally . . . **12**
12. Basal plate of third antennal segment elongate and slender, about twice as long as wide; antennae with basal segment reddish gray, third segment brownish gray basally, black apical from dorsal angle **stonei** **Philip**
Basal plate shorter, less than 1½ times as long as wide; antennae predominantly yellowish to orange to dorsal angle, black beyond . . . **13**
13. Hairs on ventral surface of antennal scape mostly black; abdominal sternites 2 to 4 with black hairs medially **gilanus** **Townsend**
Hairs on ventral surface of antennal scape mostly white; abdominal sternites 2 to 4 with white hairs, or at most, a few scattered black hairs medially **mogollon** **Burger**

Tabanus, Group 7

1. Frons notably convergent below, 1½ to 2 times as high as wide basally; basal callus brown, taller than wide, the median callus nearly as wide and broadly attached to basal callus, also brown; wings smoky gray, the veins broadly margined with infuscations and small clouds at crossveins and bifurcation of vein R₄₊₅; abdomen light to dark brown, rarely with faint vestiges of pale

- small pollinose median triangles or pale lateral hair tufts on some tergites; cell r₅ widely open **aar** **Philip**
Frons parallel-sided, 3 or more times as high as wide basally; median callus slender and linear, joined to basal callus; wings lightly tinted, spots very pale and indistinct except spot at bifurcation of vein R₄₊₅ which is small and inconspicuous; abdomen with a prominent middorsal pale pollinose and pilose stripe from base to apex, without dorsolateral pale markings; cell r₅ slightly or not at all narrowed toward margin, never seen closed **acutus** (**Bigot**)

Tabanus, Group 8

Group 8 includes a single Texas species, *Tabanus venustus* **Osten Sacken**.

Tabanus, Group 9

1. Slender brown species; ground color of abdominal venter light brown and pale brown pollinose, white pilose, bases of sternites not noticeably darker (i.e. not banded); legs unicolorous light brown, pale pilose; fore tibiae obscurely bicolored due to black pilosity on distal ⅓ to ½; wings clear, with small infuscated clouds at bifurcation of vein R₄₊₅ and apex of discal cell; dorsum of abdomen with a contiguous row of pale pilose median triangles, of equal size on tergites 2 to 4, smaller on 1, 5 and 6 **coarctatus** **Stone**
Stouter black species, the abdomen not as above, often banded beneath due to darker color basally on sternites; legs black or strongly bicolored **2**
2. Abdomen black with white pilose median triangles on only tergites 3 to 5; sometimes with a pair of dorsolateral pale spots on tergite 2; cell r₅ usually slightly narrowed towards wing margin **trimaculatus** **Palisot**
Abdomen usually brown with white pilose median spots or triangles on tergites 1 to 6, those on 3 and 4 often the larger **3**
3. Integument of mid and hind tibiae white except extreme apex, fore tibiae white only at extreme base; veins R₁ and R₂₊₃ (and often R₄₊₅) usually broadly margined with pale brown, the clouds at bifurcation of vein R₄₊₅ and crossveins dark but ill-defined; frons narrow, 6 or more times as high as wide basally, convergent below **moderator** **Stone**
Integument of all legs light to dark brown, at most the tibiae slightly paler; pilosity usually paler on tibiae than on femora; veins R₁ and R₂₊₃

- rarely brown margined, the clouds at bifurcation of vein R_{4+5} and crossveins small, usually not prominent, rarely not evident; frons broader, $3\frac{2}{3}$ to $4\frac{1}{2}$ times as high as wide basally **4**
4. Pilosity and pollinosity of pleura white to gray; pilosity of tibiae often white, contrasting with that of femora; abdomen beneath largely or wholly white pollinose *molestus* Say
- Pilosity and pollinosity of pleura brown to black; pilosity of legs largely brown to black, that of tibiae not contrasting; abdomen beneath banded, the apical margins of sternites pale pollinose and pilose, at least the basal halves of sternites dark pollinose *mixis* Philip

Tabanus, Group 10

1. Abdomen beneath unicolorous white pollinose; femora of fore legs light brown, of last 2 pairs white or very pale brown, tibiae all white, their apices more or less blackish; wing spots small but distinct, on all crossveins and bifurcation of vein R_{4+5} ; cell r_5 narrowed apically; frontal callus as wide as high, median callus spindle shaped, with a black pilose transverse mark across it *reinwardtii* Wiedemann
- Abdomen beneath banded, with posterior margins of most sternites white pollinose, at least the anterior borders dark pollinose; femora all black, tibiae bicolored, the basal half white and distal half black; wings heavily spotted, cell r_5 strongly narrowed apically; frontal callus higher than wide, median callus of same general shape as above but lacking dark transverse mark *cymatophorus* Osten Sacken

Tabanus, Group 11

1. Dorsal angle at base of third antennal segment produced into a long tooth or spine, longer than its width at base; abdomen without median triangular pale hair tufts; wing spots small but prominent, but no dark clouds at distal ends of any veins except A_1+CuA_2 at end of anal cell *imitans* Walker
- Dorsal angle at base of third antennal segment not so produced; abdomen with pale median triangular hair tufts; wing spots large, dark and prominent, often with small clouds at distal ends of some or all longitudinal veins *maculipennis* Wiedemann

Tabanus, Group 12

1. Wing with cell r_5 closed and usually petiolate, rarely

- narrowly open **2**
- Wing with cell r_5 at most narrowed towards wing margin **4**
2. Legs brown, including coxae; fore femora black pilose, bases of all femora darker, tibiae paler, but difference slight; hind tibial fringe red; median pale pilose dorsal triangles of abdomen prominent; mesonotal integument brown, scutellum reddish *nefarius* Hine
- Legs bicolored, the femora largely black, the tibiae at least basally yellow; pale median triangles not prominent, sometimes absent; integument of mesonotum and scutellum black **3**
3. Hind tibial fringe black; abdominal integument orange brown, with at most a small median black streak on tergite 2; pale median triangles slender, not prominent; thorax obscurely striped *limbatinevris* Macquart
- Hind tibial fringe pale, yellow; abdominal integument with a variable, but prominent, middorsal black stripe or series of spots, sometimes entirely absent; pale median pollinose triangles usually absent; thorax prominently striped *abdominalis* Fabricius
4. Frons broad, about 2 times as high as wide basally, parallel-sided; basal callus as wide as high, yellow to brown; third antennal segment short, generally less than twice width of frons in length, the basal plate generally less than twice as long as annulate portion, yellow to orange, with terminal 2 or 3 annuli blackish; wings with veins often very strongly infuscated around bifurcation of vein R_{4+5} and crossveins; integument of legs uniformly yellowish to pale brown, the fore femora sometimes dark and fore tibiae not obviously bicolored *cheliopterus* Rondani
- Frons narrower, $3\frac{1}{2}$ to over 6 times as high as wide basally, often narrowed below; antennae longer, the basal plate sometimes equaling annulate portion; legs and wings various **5**
5. Basal plate and annuli of third antennal segment subequal; frons narrow, 5 to 6 or more times as high as wide basally, convergent below, nearly twice as wide at vertex as at base; wings heavily marked, the veins broadly dark margined, especially the basal crossveins; abdominal tergites with large median pale pilose triangles; cell r_5 of wing broadly open **6**
- Annuli of third antennal segment much shorter than basal plate; frons broader or less convergent below; wings uniformly fumose, rarely darkened along veins, the clouds at bifurcation of vein R_{4+5} and crossveins small, discrete; abdominal tergites with small, less conspicuous

- pale pilose triangles, or none; cell r_5 of wing narrowed towards margin, rarely closed . . . 7
6. Antennae with third segment entirely black, rarely brown at extreme base, scape and pedicel light brown; wing veins generally not brown margined *equalis* Hine
Antennae yellow to orange, sometimes terminal annuli darkened; wing veins nearly always broadly brown margined *turbidus* Wiedemann
7. Frons narrower, 5 to 6 or more times as high as wide basally; abdomen usually without median pale pilose triangles *gladiator* Stone
Frons broader, $3\frac{1}{2}$ to $4\frac{1}{3}$ times as high as wide basally; abdomen nearly always with at least narrow pale pollinose median triangles *sulcifrons* Macquart

**KEYS TO KNOWN MALES OF *TABANUS*
LINNAEUS OCCURRING OR POSSIBLY
OCCURRING IN TEXAS**

1. Abdomen dorsally with both median and sublateral pale spots or triangles, or sublateral spots only; median pale markings may form a parallel-sided stripe (sublateral spots very faint but median stripe pronounced in *acutus*, a coastal species) 2
Abdomen dorsally unicolorous, or with a median row of pale spots or triangles which sometimes arise from pale apical bands (these bands may widen laterally but do not form distinct sublateral spots or triangles) or with a median row of black markings on an otherwise uniform reddish or orange brown ground color (rarely pale sublateral spots present on tergite 2 only) 35
2. Abdomen dorsally with a distinct median pale stripe, this stripe either parallel-sided or slightly serrated due to widening near posterior borders of some tergites; in the latter case, large facets of eyes distinctly demarked from small facets and eyes distinctly pilose 25
Abdomen dorsally with a median row of pale triangles or spots which do not form a median pale stripe although these median spots sometimes narrowly contiguous along anterior borders of tergites (if more obviously contiguous, the eyes are not pilose, having at most a few short scattered setae visible at higher magnification, or eyes distinctly pilose but with facets of eyes of nearly uniform size) 3
3. Wings mottled with brown, the spots not confined to crossveins and bifurcation of vein R_{4+5} ; tergites 2 to 4 with posterior white bands nearly

- obliterating the median and sublateral spots, but the spots distinct on tergite 4
. *venustus* Osten Sacken
Not with above combination of characters 4
4. Eyes pilose 5
Eyes bare 12
5. Bifurcation of vein R_{4+5} and crossveins margined with brown *reinwardtii* Wiedemann
Bifurcation of vein R_{4+5} and crossveins not margined with brown 6
6. First antennal segment considerably swollen above 7
First antennal segment not very swollen above . . 8
7. Antennae more or less entirely black
. *fairchildi* Stone
Scape, pedicel and at least base of third antennal segment pale yellowish to orange brown
. *erythraeus* (Bigot)
8. Thorax dark chocolate brown dorsally, abundantly clothed in long, predominantly gray to whitish hairs *quaesitus* Stone
If thorax dark in ground color, hairs also dark . . 9
9. Basal plate predominantly to entirely orange, annuli black; abdomen evidently paler laterally than medially *laticornis* Hine
Basal plate reddish, not orange, only on basal $\frac{1}{2}$ or less; abdomen not much paler laterally than medially 10
10. Thorax black dorsally, densely clothed with erect black hairs *gilanus* Townsend
Thorax grayish pollinose dorsally, clothed with erect white hairs 11
11. Basal plate slender, elongate, noticeably longer than annulate portion, dorsal angle weak; frontal triangle not noticeably inflated; thorax clothed with erect white hairs dorsally
. *stonei* Philip
Basal plate moderately stout basally, shorter than annulate portion, dorsal angle well developed; frontal triangle inflated; thorax densely clothed with mixed black and white hairs
. *mogollon* Burger
12. Bifurcation of vein R_{4+5} and crossveins margined with brown *cymatophorus* Osten Sacken
Wings entirely hyaline or with a faint spot at bifurcation of vein R_{4+5} only, or all veins faintly margined with brown 13
13. No median white spot on tergite 2, but spots on tergites 3 and 4 very conspicuous; sublateral spots oblique and those on tergites 4 to 6 indistinct; first antennal segment with a well developed dorsal angle . . . *dorsifer* Walker
Not with this combination of characters 14
14. Length 11 mm or less; small dark gray to brownish species; costal cell hyaline; median abdominal triangles faint or absent; sublateral spots

- rounded 15
 Length 11 mm or more; if less, costal cell infuscated 16
15. Femora mostly brownish, concolorous with tibiae or nearly so; eye in life or relaxed specimens with two narrow green bands, the upper partially covered by large facets . *pumilus* Macquart
 Femora mostly black; basal portion of tibiae light tan; eye in life or relaxed specimens with a single purple band *sparus* Whitney
16. Costal cell dark brown or deep yellow 17
 Costal cell hyaline or faintly tinged with yellow 19
17. Antennae entirely light orange
 *zythicolor* Philip
 Antennae with basal plate orange, annulate portion black 18
18. Sublateral abdominal spots angular, usually touching both margins of tergites *texanus* Hine
 Sublateral abdominal spots rounded and not touching hind margins of tergites . . . *longiusculus* Hine
19. Hair and pollen of pleura yellow; areas of large and small facets of eye weakly differentiated
 *fulvulus* Wiedemann
 Hair and pollen of pleura grayish; areas of large and small facets rather distinctly differentiated 20
20. Sublateral abdominal spots large, yellow; hair of thoracic dorsum yellow 21
 Sublateral abdominal spots smaller, rarely reaching anterior margins of tergites, pale brownish gray; hair of mesonotum not yellow 22
21. Antenna entirely orange *pallidescens* Philip
 Annulate portion of third antennal segment black
 *sublongus* Stone
22. Third antennal segment slender; first antennal segment not enlarged; annulate portion of third antennal segment black, basal plate orange 24
 Third antennal segment not slender; first antennal segment somewhat enlarged; color of third antennal segment otherwise 23
23. Blackish, the antenna entirely black; no spot at bifurcation of vein R_{4+5} ; palp very stout
 *pruinus* Bigot
 Brown, the antenna largely orange; a faint spot at bifurcation of vein R_{4+5} ; palp rather slender
 *abactor* Philip
24. Areas of large and small facets of eye sharply differentiated *sackeni* Fairchild
 Areas of large and small facets not sharply differentiated *wilsoni* Pechuman
25. Bifurcation of vein R_{4+5} with a small dark spot
 *acutus* (Bigot)
 Bifurcation of vein R_{4+5} without a dark spot . . . 26
26. Annulate portion of third antennal segment as long or longer than basal plate; costal cell usually infuscated 27
 Annulate portion of third antennal segment shorter than basal plate; costal cell hyaline 31
27. Palp, pleura and costal cell yellowish; thorax and yellowish stripe of abdomen golden pollinose 28
 Palp white or creamy white; pleura grayish; dorsum usually grayish to grayish black; costal cell variable 29
28. Costal cell brownish; genae, pleural pile light yellow (coastal species) *eadsi* Philip
 Costal cell yellow; genae, pleural pile darker yellow *quinquevittatus* Wiedemann
29. Eyes in live or relaxed specimens with single reddish purple band readily visible just beneath upper large facets; abdomen predominantly yellowish laterally; costal cell yellowish to clear (coastal species) *nigrovittatus* Macquart
 Not with this combination of characters 30
30. Legs predominantly yellowish brown; abdomen extensively yellowish-brown
 *fuscicostatus* Hine
 Femora, apical portions of tibiae and tarsi black; abdomen predominantly dark brown to black, at least apically *mularis* Stone
31. Scutellum reddish at posterior margin 32
 Scutellum and thorax concolorous, dark 33
32. At least area of large facets of eye distinctly pilose
 *subsimilis* Bellardi
 Eyes entirely bare, or at most with only scattered short hairs *pungens* Wiedemann
33. At least area of large facets of eye distinctly pilose
 *colombensis* Fairchild
 Eye entirely bare, or at most with only scattered short hairs 34
34. Palpi usually pale yellow; median pale abdominal stripe broad (coastal species)
 *hinellus* Philip
 Palpi creamy white; median pale abdominal stripe narrow *lineola* Fabricius
35. Abdomen reddish or orange brown with a median row of black spots and no evidence of pale median or sublateral spots; wing faintly tinged with brown, crossveins and bifurcation of vein R_{4+5} margined with brown
 *abdominalis* Fabricius
 Abdomen otherwise, if dark spots present medially then distinct median and/or sublateral pale triangles or spots present; wing variable 36
36. Abdomen unicolorous 37
 Abdomen bicolorous; faint to distinct median triangles or spots, with or without apical bands, or bands only present 48
37. Bifurcation of vein R_{4+5} without dark spot although

- whole wing may be infuscated **38**
 Bifurcation of vein R_{4+5} with a distinct dark spot **40**
38. Entirely black species **39**
 Otherwise colored **51**
39. Frontal triangle and genae shiny brown to black
 *atratus* **Fabricius**
 Frontal triangle and genae pollinose *aranti* **Hays**
40. Deep reddish brown to brownish purple species; tufts of prominent hair around wing base; wing hyaline to subhyaline with dark infuscation at bifurcation of vein R_{4+5} and on crossveins; antennae, palpi, legs orange brown; frontoclypeus, genae yellowish to grayish yellow; upper eye facets distinctly enlarged, sharply differentiated from lower facets **65**
 Not with above combination of characters **41**
41. Genae light to dark gray *proximus* **Walker**
 Genae dark brown or yellow; if genae gray, then abdomen reddish-orange **42**
42. Abdomen black, first tergite with bluish pruinosity; third antennal segment entirely black
 *aranti* **Hays**
 First abdominal segment lacking bluish pruinosity; antenna variable, not entirely dark **43**
43. Wings almost uniformly dark *atripennis* **Stone**
 Wings subhyaline or at least lighter apically **44**
44. Lateral margins of thorax with a band of pale white hairs *punctifer* **Osten Sacken**
 Thoracic dorsum lacking pale white lateral bands **45**
45. Antenna mostly orange; entirely dark chocolate brown species, dorsum of thorax with lighter hair and ground color *stygius* **Say**
 Not agreeing entirely with above; if entirely dark, thorax concolorous with rest of body, antenna usually with annulate portion brown **46**
46. Antenna blackish brown; entirely chocolate brown species *nigrescens* **Palisot**
 Abdomen orange to reddish-brown **47**
47. Cell r_5 not narrowed apically *aar* **Philip**
 Cell r_5 narrowed or closed apically **48**
48. Wings mottled with brown, the spots not confined to bifurcation of vein R_{4+5} and crossveins; first tergite black, second with narrow, sometimes incomplete posterior pale band of nearly uniform width *venustus* **Osten Sacken**
 Not with above combination of characters **49**
49. Bifurcation of vein R_{4+5} without infuscation **50**
 Bifurcation of vein R_{4+5} with infuscation, either distinct spot or extension of vein margin infuscation (faint in some *aar*, *equalis*, *turbidus* and *coarctatus*) **56**
50. Median abdominal spots, if present, not contrasting sharply with remainder of tergites **51**
 Median abdominal triangles present dorsally and contrasting with dark brown to black abdomen; if faint, frontal triangle shiny, denuded **53**
51. Medium sized fly; costal cell hyaline
 *rufofrater* **Walker**
52. Large fly; costal cell yellow or brown **52**
 Wings hyaline, costal cell dark brown; abdomen usually with apical bands
 *americanus* **Forster**
 Wings uniformly dilute brown *calens* **Linnaeus**
53. Scutellum with distinct white pollen and pile, thorax darker with brown stripes **59**
 Scutellum without white pollen and pile except around margin; or if present, not contrasting sharply with that of thorax **54**
54. Frontal triangle denuded, shiny, swollen; brownish species with a single median row of triangles on abdomen arising from pale posterior bands *nigripes* **Wiedemann**
 Not with above combination of characters **55**
55. Enlarged eye facets occupying about $\frac{1}{2}$ of total eye area; cell r_5 usually petiolate
 *petiolatus* **Hine**
 Enlarged eye facets occupying about $\frac{2}{3}$ of total eye area; cell r_5 usually narrowed but not petiolate *melanocerus* **Wiedemann**
56. Abdomen with contrasting pale median triangles or spots **57**
 Abdomen with indistinct median triangles or spots **65**
57. No median spot on tergite 2; fore tibia usually bicolored; areas of large and small eye facets distinctly differentiated; dorsum of abdomen blackish with three median white triangles; venter of abdomen with distinct median black stripe; bifurcation of vein R_{4+5} and crossveins margined with brown *trimaculatus* **Palisot**
 Not with above combination of characters **58**
58. Median spot on tergite 2, if present, distinctly smaller than those on tergites 3 and 4; scutellum with distinct pale pile; fore tibia nearly uniform in color (some *moderator* with extreme base pale) **59**
 Not with above combination of characters **61**
59. Middle and hind tibiae pale to dark reddish brown, apices not markedly darker **60**
 Middle and hind tibiae creamy white, extreme apices dark brown to black *moderator* **Stone**
60. Frontoclypeus and genae gray pollinose; abdominal spots arise from pale bands which may cover basal $\frac{1}{2}$ of third and fourth tergites; venter with wide gray bands *molestus* **Say**
 Frontoclypeus and genae mostly brown pollinose; abdominal bands, if present, very narrow on dorsum and venter *mixis* **Philip**
61. Basal plate of third antennal segment mostly orange with prominent dorsal excision, annulate

- portion black; palpi and fore femora dark brown to black; upper eye facets distinctly enlarged, sharply differentiated from lower; abdomen orange brown **62**
- Not with above combination of characters **63**
62. Wing membrane lightly tinted; middle femora often brownish; median triangles very conspicuous *sulcifrons* **Macquart**
- Wing membrane heavily tinted, especially anteriorly; all femora deep black; median triangles only moderately distinct . *limbatinevris* **Macquart**
63. Abdomen dorsally orange brown or grayish brown with rather large triangles **64**
- Abdomen dark reddish purple to nearly black with small median white spots that may be longer than broad **66**
64. Antennae wholly orange; enlarged facets of eye occupying $\frac{3}{4}$ of total eye area; cell r_5 narrowed apically *chelipterus* **Rondani**
- Not with above combination of characters **65**
65. Deep reddish brown to reddish purple species; tufts of prominent hair around wing base; wing hyaline to subhyaline with dark infuscation at bifurcation of vein R_{4+5} and on crossveins; antennae, palpi, legs orange brown; frontoclypeus, genae yellowish to grayish yellow; upper eye facets distinctly enlarged, sharply differentiated from lower facets . . . **66**
- Not with above combination of characters **67**
66. Basal plate of third antennal segment dorsally with prominent forward-projecting process *imitans* **Walker**
- Basal plate without forward-projecting tooth-like process *maculipennis* **Wiedemann**
67. Cell r_5 narrowed or closed apically **68**
- Cell r_5 not narrowed apically **70**
68. Legs predominantly orange brown *chelipterus* **Rondani**
- Legs, at least femora, predominantly black **69**
69. Mesonotum with lavender tone, with narrow gray lines; eye facets not noticeably differentiated *gladiator* **Stone**
- Mesonotum yellowish with dark lines; upper eye facets moderately enlarged, differentiated from lower facets *abdominalis* **Fabricius**
70. Legs, especially fore femora, dark brown to black; hair on fore femora black, tibial fringes mostly black; black or mixed black and white hair on rest of legs; pale abdomen contrasting with dark brown thorax; posterior pale bands of tergites wide, nearly obscuring median pale triangles *rufifrater* **Walker**
- Without above combination of characters; legs uniformly reddish to reddish brown with white or concolorous hair **71**
71. Frontoclypeus, genae and pleura brown with

concolorous hair; abdomen orange brown with at most only faint suggestions of middorsal triangles; occasionally lateral margins dark .

- *aar* **Philip**
- Frontoclypeus, genae and pleura gray to grayish brown with pale hair; abdomen with or without faint middorsal triangles, usually with lateral pale areas arising from the pale posterior margins of each segment **72**
72. Third antennal segment black except at extreme base; annulate portion shorter than basal plate, latter with only slight dorsal excision; costal cell distinctly infuscated; upper eye facets moderately enlarged, but areas of large and small facets not sharply differentiated *coarctatus* **Stone**
- Not with above combination of characters **73**
73. Wing veins distinctly margined with brown; third antennal segment mostly orange; upper facets of eye distinctly enlarged, differentiated from lower facets *turbidus* **Wiedemann**
- Wing veins usually not margined with brown, at most only faint trace of infuscation; third antennal segment mostly dark; upper eye facets only moderately enlarged, line of demarcation between large and small facets not distinct *equalis* **Hine**

Tabanus aar **Philip**

Tabanus aar Philip 1941c: 105

Large (22 mm); brown with pale grayish pattern; basal callus brown, higher than wide, a little rounded above, narrowly united with relatively slender median callus; frons narrow, a little widened above; abdomen brown with a median row of small indistinct grayish triangles; wing faintly infuscated, darker along veins. Male with large and small facets of eyes sharply differentiated; fore tibiae unicolorous; otherwise similar to female.

Comments: This species has not been collected in Texas. It has been collected from southern coastal states from Louisiana to Florida and as far north as Tennessee. It has not been frequently collected. Reported collections have been primarily late in the day into the evening, and some have been in light traps. The immature stages are not known.

Tabanus abactor **Philip**

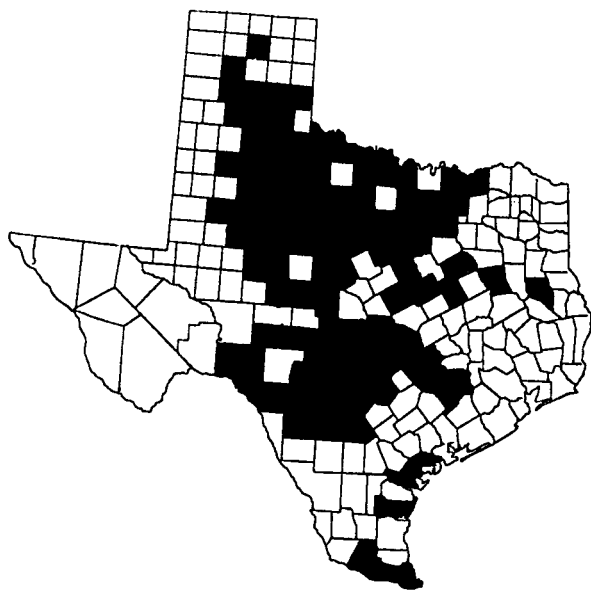
Tabanus abactor Philip 1936c: 153

Tabanus rubescens authors, in part, not Bellardi

Moderate (14 mm); brown with grayish pattern; basal callus brown, usually touching eyes and higher than wide, united to slender median callus of same color; frons about

4 times as high as wide basally, slightly widened above; thorax brown with faint pale longitudinal stripes; abdomen dull orange brown with median pale triangles which usually attain the anterior margins of tergites and oblique sublateral pale spots which touch hind margins of tergites; wing hyaline but for faint brown spot a bifurcating vein R_{4+5} ; eyes bare. Male with large and small facets of eyes sharply differentiated; color much like female but a little darker.

Comments: This is a southwestern species ranging from Kansas southward to Texas and New Mexico and on into Mexico. It has been reported from Texas (Easton *et al.* 1968; McGregor and Schomberg 1952; Philip 1936c, 1947, 1965). Lack of a collection record in a given county probably reflects the absence of collectors rather than the absence of this species which is reported to be a serious pest of cattle in many parts of the state. Goodwin (1994) described the immature stages based on specimens collected and reared by Montandon *et al.* (1993) who found larvae in terrestrial habitat beneath redberry juniper trees. Larger larvae found in the last few weeks before adult activity were between the soil and leaf litter. Smaller larvae found at other times of the year were entirely within the soil layer.



Map 64. Counties of collection: *Tabanus abactor*.

Known Distribution (Map 64): **ANDERSON:** Salmon; 27 Apr 1985; P.W. Kovarik, TAMU. **ARCHER:** 16 Sep 1976; M. Boyd; MISU. 26 Aug 1978; S.G. Davis; TTU. 4 km N Archer City; 18 Aug 1995; J.T. Goodwin; TAMU. **ARMSTRONG:** 28, 29 Jul 1979; D. Sanders; TTU. 1 mi N Wayside; 26 Jul 1986; F.E. French; GSU & WTAM. **ATASCOSA:** 2 mi NW Potect; 26 Jun 1983; S.J. Hanselmann; TAMU. **AUSTIN:** Philip(1936c). **BANDERA:** Lost Maples St Pk; 21 Sep 1980; S.J. Hanselmann; TAMU. Lost Maples St Pk; 1 Aug 1987; C. B. & J. E. Barr; LSU. **BASTROP:** Bastrop; 30 Jul 1953; H.E. Evans, Lin & Yoskimeta; CU. Bastrop St Pk; 19 Jun 1956; H.E. Evans; CU. **BAYLOR:** 27 Aug 1978; S.G. Davis; TTU. **BEXAR:** 15 Jun 1927; San Antonio; CU. Leon Creek; 12 Aug 1952; B. Adelson; UCD. Salado Cr. area; 15 Aug 1957; B.F. Eldridge; PU. 28 Jul, 8 Sep 1968; W.H. Tyson; CU. Friedrich City Pk, San Antonio; 2 Aug 1979; S.J. Hanselmann; TAMU. 2 mi E Helotes; 12

Sep 1979; S.J. Hanselmann; TAMU. **BLANCO:** Round Mt; AMSC. Pedernales Falls St Pk; 24 May 1985; John E. Rawlins; CM. Pedernales Falls St Pk; 9 Oct 1985; R. Davidson & J. Rawlins; CM. **BORDEN:** 27 June 1979; D. Sanders; TTU. **BOSQUE:** Meridian St Pk; 3 Jul 1956; H.E. Evans; CU. 2 mi W Tredell; 7 Jun 1968; J.C. Schaffner; TAMU. 2 mi S Walnut Springs; 20 Jun 1973; J.C. Schaffner; TAMU. **BRAZOS:** College Station; 20 Aug 1975; B. Cutler; BC. **BRISCOE:** 20 Jun 1979; D. Sanders; TTU. **BROWN:** 16 Jun 1979; D. Sanders; TTU. **BURNET:** 7 Jun 1954; Knull; OHSU. Longhorn Cavern St Pk; 29 Jun 1956; H.E. Evans; CU. Longhorn Cavern St Pk, Marble Falls; 16 Aug 1958; T.J. Cohn; 1200 ft.; UM. Inks Lk St Pk; 21 Jun 1972; at light; J.S. Ashe; TAMU. **CALLAHAN:** 26 Aug 1978; S.G. Davis; TTU. Brownwood; Philip (1936c). **CAMERON:** La Feria; 31 Mar 1978; P.T. Riherd; TAMU. **CLAY:** Lk Arrowhead; 12 Sep 1972; D. Rankin; MISU. 21 Jun 1979; D. Sanders; TTU. Lk Arrowhead; 24 Sep 1979; E. Peterson; MISU. 17 Sep 1983; D. McAninch; MISU. **COKE:** 25 Aug 1978; S.G. Davis; TTU. **COLEMAN:** 25 Aug 1978; S.G. Davis; TTU. **COLLIN:** 3 Jul 1984; student collection; specimen destroyed. **COLLINGSWORTH:** 10 Jul 1979; D. Sanders; TTU. COMAL: Canyon L; 8-14 Jul 1985; J. T. Goodwin; FSCA. **COLORADO:** Eagle Lake; 20 May 1973; J. Weise; TTU. **CONCHO:** 25 Aug 1978; S.G. Davis; TTU. **CORYELL:** 11 Aug 1983; student collection; specimen destroyed. **COTTLE:** 31 Aug 1978; S.G. Davis; TTU. **CROSBY:** 1 Jul 1977; 9 Sep 1978; 22 Jun, 6, 20, 27 Jul, 3 Aug 1979; D. Sanders; TTU. 9, 15, 21, 22, 23, 30 Jun, 7, 15, 21 Jul, 9, 11, 18, 19, 26, 27 Aug, 1, 2, 9, 15, 23, 29 Sep 1978; S.G. Davis; L7 Ranch; TTU. **DALLAS:** Dallas; male; TAMU. 22, 30 Jul 1969; UTA. Garland; 24 Jul 1971; G. Ryan; SFASU. Dallas; Philip (1936c). **DALLAS-COLLIN:** Richardson; 13 Jul 1935; TAMU. **DAWSON:** 27 Jun 1979; D. Sanders; TTU. **DENTON:** Denton; 13, 14, 18, 19, 21, 23 Jul 1965; D.L. Revill; UNT. **DICKENS:** 22 Jul, 5, 19, 26 Aug, 23 Sep 1977; 25 May; 1, 3, 7 Jun; 7, 15, 28 Jul, 18, 26, 27 Aug, 2, 9, 16, 23 Sep 1978; S.G. Davis; TTU. 27 Jul, 3 Aug 1979; D. Sanders; TTU. Pitchfork Ranch; 1 Jul 1977; 9 Sep 1978, 22 Jun 1979; S.G. Davis & D. Sanders; TTU. **DONLEY:** Lelia Lk; 10 Jul 1979; D. Sanders; TTU. **EASTLAND:** 27 May 1921; Grace O. Wiley; **Holotype;** CBP. **ERATH:** Stephenville; 8 Jun 1972; C.W. Agnew; TAMU. 3 mi W Bluffdale, bank of Paluxy R; 8-15, 16-23, 22-29 Jul, 29 Jul - 4 Aug 1976; malaise trap; R.L. Sams; TAMU. 5 mi N Stephenville; 16-17, 18-19, 20, 21-23, 27-30 May, 1-6, 14-19, 20-27 Jun, 3, 4 Jul 1980; malaise trap; P.T. Riherd; TAMU. 8 Jun 1987; C.W. Agnew; TAMU. **FANNIN:** 27 Jun 1979; D. Sanders; TTU. **FAYETTE:** 1 mi E Ledbetter; 10 Sep 1970; Gaumer & Murry; CU. **FISCHER:** 27 Jun 1979; D. Sanders; TTU. **FLOYD:** 28 Jun 1979; D. Sanders; TTU. **FOARD:** 31 Aug 1978; S.G. Davis; TTU. **FRIO:** Pearsall; 9 Oct 1934; **Paratype male;** TAMU. Pearsall; 25-26 Jun 1970; A.R. Hardy; UCR. **GARZA:** 2 mi N Justiceburg; 4 Aug 1976; D.E. Foster; TTU. 26 Jul 1978; S.G. Davis; TTU. Justiceburg, Hwy 84, Double Mt, Fork of Brazos R; UTAU. **GILLESPIE:** 11, 14 Jun 1934; Knull; OHSU. Harper; 21 Jun 1949; C. Condrin; LLP. **GRAYSON:** Denison; 9 Jul 1935; TAMU. Gordonville; 12 Sep 1970; R.E. Acciavitti; CU. **GUADELUPE:** Seguin; 2, 3 Aug 1986; F.E. French; 1 female, 1 male; GSU. **HALL:** 20 Jun 1979; D. Sanders; TTU. **HARDEMAN:** 31 Aug 1978; S.G. Davis; TTU. Sites 2, 6, 8, 11, 13, 15, Medicine Mounds Ranch; 18, 19, 20, 21, 23 Jul 1995; W.D. Sissom; ASU. **HASKELL:** 31 Aug 1978; S.G. Davis; TTU. **HAYS:** 10, 11 Jun 1985; G.C. Young; TAMU. **HIDALGO:** Progreso; 9 Oct 1971; P.T. Riherd; TAMU. **HOOD:** 8 mi S Granbury; 21, 22 Jun 1975; J.W. Holmes, Jr; TAMU. **HOWARD:** 27 Jun 1979; D. Sanders; TTU. **HUTCHINSON:** Borger; 22 Jul 1966; male; GSU and WTAM. **JOHNSON:** 10 Jun, 1 Jul 1934; **Paratypes;** TAMU. 12 mi SW Cleburn at St Pk; 6 Sep 1971; R.E. Acciavitti; CU. **JONES:** Stratford; before 12 Jul 1972; D.C. Ballard; TAMU. 30 Aug 1978; S.G. Davis; TTU. **KENDALL:** Cibolo CR, nr Boerne; Jul, 1963; student collection; specimen destroyed. **KENT:** 30 Aug 1978; S.G. Davis; TTU. Boerne; N.E. Strenth; ASU. **KERR:** 19 Jun 1928; **Allotype;** OHSU (Philip 1936c). Kerrville; 1, 4 Aug; ACC. 2, 3 Aug 1944; C. Condrin; LLP. Kerrville; 17 Jun 1951; W.W. Bryle; CU. Kerrville; 17 Jul, 18, 25 Aug 1952; McGregor; TAMU. Mt Home; 30 Jul 1958; W.F. Chamberlain; TAMU. Kerrville; 31 May 1965, 30 May, 5 Jun 1968, May 1971, 24 Jul 1981, 31 Jul 1983, Jul-Aug 1987; R.R. Blume; TAMU. 5 mi W Kerrville;

20, 22, 23, 24, 25, 26, 27, 28, 29 Jun 1966; malaise trap; E.R. Easton; TAMU. 3 mi S Brackettville; 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 17, 18, 19, 20 Jul 1966; E.R. Easton; TAMU. 6 mi N Brackettville; 11 Jul 1966; E. R. Easton; TAMU. Kerrville St Pk; 6 Jun 1968; M.E. & P.L. Dakin; TAMU. Kerrville; 10 Sep 1968; male; P.H. Thompson; TAMU. 21 Aug 1981; N. Nichols; TTU. Kerrville; 24 Jun 1981; 31 Jul 1983; 9 Aug 1988; at light; W.F. Chamberlain; TAMU. Kerrville St Pk; 16 May 1985; R. & B. Brown; MSU. Center Pt; 31 Jul - 6 Aug 1987; malaise trap; Wharton & Praetorius; TAMU. Kerrville; Philip (1936c). **KIMBLE**: Triple R Cottages, 10 mi S Junction; B. Wright; NSM. Fred Coleman Ranch, 12 mi S Junction; 15 Jun 1972; TTU. 21 Jul 1973; D. Lucky; TTU. 6-17 Aug 1973, 20 May, 15-25 July 1974; N. Nichols; TTU. Junction; 27 May 1975; S.G. Davis; TTU. 25 Jul 1975; D.E. Foster; TTU. 22 May 1979; M. Moten; JTG. **KING**: JJ Ranch; 11 Jun, 21, 23, 28 Jul, 2, 3, 6, 9, 13, 15 Aug, 3, 10, 17, 30 Sep, 8 Oct 1976; collector unknown; TTU. YJ Ranch Guthrie; 3 Aug 1976; TTU. JY Ranch; 27 May, 3, 10, 17 Jun, 1, 8, 12, 15, 22, 28, 29 Jul, 4, 12, 19, 26 Aug, 2, 9, 30 Sep 1977; 9 Sep 1978; 8, 15, 16, 23, 30 Jun, 7, 15, 28 Jul, 4 Aug, 1 Sep 1978; 8 Jun 1979; S.G. Davis; TTU. H. Ranch; 3, 14, 28, 30 Jun, 9, 11, 16, 18, 22, 31 Jul, 20, 21 Aug, 12, 25 Sep 1982; S.R. Kingston; TTU. 8, 14, 15, 29 Jun, 2, 6, 13, 20 Jul, 3 Aug 1979; D. Sanders; TTU. **KINNEY**: 5 mi NW Brackettville; 3-23 Jul 1966; E. R. Easton; Easton, *et al* (1968). **KLEBERG**: Baffin Bay; 18 Jun 1963; B. McDaniel; CU. **KNOX**: 27 km NW Benjamin; 24 Aug 1972; D. Brooks; GSU. 16 Aug 1978; S.G. Davis; TTU. **LEE**: Giddings; 5 Aug 1931; TAMU. Giddings; 6 Jul 1946; H.E. Evans; CU. **LIMESTONE**: "creekbed" E of Kosse; 22 Jul 1968; G.C. Gaumer; 2 males; SYR. **LLANO**: 10 Jun 1941; J. E. Gillaspay; UC. **LUBBOCK**: 6 Jul 1979; D. Sanders; TTU. **MASON**: Mason; Philip (1936c). **MCCULLUOGH**: 25 Aug 1978; S.G. Davis; TTU. **MCCLENNAN**: 3 mi W Eddy; 11 Jul 1963; Byers, *et. al*; "at light"; UK. **MEDINA**: Castroville; 26 Aug 1960; Triplehorn; OHSU. 1 mi W Castroville; 18 Aug 1961; Cantrall & Cohn; UM. **MITCHELL**: 26, 27 Aug 1978; S.G. Davis; TTU. **MONTEAGUE**: 15 Sep 1972; Hicks; MISU. **MOTLEY**: 20 Jul 1979; D. Sanders; TTU. **NACOGDOCHES**: 31 Jul 1959; J.F. Allison, N. Nichols; SFASU. **NAVARRO**: Purdon; 25 Sep 1964; W. Ivie; TAMU. **NOLAN**: 26 Aug 1978; S.G. Davis; TTU. Wright Ranch; 22, 28 Jun, 5, 13, 20 Jul, 2, 17, 23, 31 Aug, 22, 29 Sep; 2 Oct 1982; S.R. Kingston; TTU. **PALO PINTO**: Palo Pinto; 13 Jul 1957; Astell; LLP. **PARKER**: L. Weatherford Dam; 17 Jun 1972; R.E. Acciavitti; CU. **POTTER-RANDALL**: Amarillo; 23 Jun, 30 Jul 1978; D. Ries; GSU. **RANDALL**: Palo Duro Canyon St Pk; 9 Aug 1965; at light; J.C. Schaffner; TAMU. Canyon; 15 Jul 1966, 6 Jul 1978; D. Brooks; WTAM & GSU. Palo Duro St Pk; 28 Jun 1967; Westcotts; LACM. Canyon; 29 Jun 1967; M. Gist; WTAM. Palo Duro St Pk; 10 Aug 1978; C. B. Barr; LSU. Palo Duro St Pk; 28 Jun 1979; D. Sanders; TTU. Canyon; 19 Jun 1982; B. Botsonis; WTAM. **REAL**: Lesky; 8 Jul 1936; R.H. Beamer; CU. Camp HEB, 8 mi N Lesky; 30-31 Aug 1975; J.T. Goodwin; FSCA. **REFUGIO**: 8 mi SW Woodsburo; 14 Jun 1972; E.E. Grissell; male; TAMU. **SAN PATRICIO**: Lk Corpus Christi St Pk; 8 Jun 1969; Board & Hafernik; male; TAMU. Lk Corpus Christi St Pk; 18 Jun 1971; G. H. Nelson; FSCA. Welder Wildlife Ref; 14-16 May 1974; M. Turrell; male; CU. Welder Wildlife Ref; 25-29 Jun 1984; J.C. Schaffner; TAMU. **SCURRY**: 30 Aug 1978; S.G. Davis; TTU. **SHACKLEFORD**: 26 Aug 1978; S.G. Davis; TTU. **SOMERVELL**: Comanche Peak Elec Sta, 6 mi N of Glen Rose; 15, 16-17 Jun 1979; malaise trap; J.P. Cuda; TAMU. **STEPHENS**: 26 Aug 1978; S.G. Davis; TTU. **STERLING**: 26 Aug 1978; S.G. Davis; TTU. **STONEWALL**: 17 Aug 1978; S.G. Davis; TTU. **SUTTON**: Sonora; 13 Jun 1965; O.G. Babcock; ASU. Sonora; 4 May; Stone, 1938. Sonora; Philip (1936c). **SWISHER**: 28 Jun 1979; D. Sanders; TTU. **TARRANT**: 3 Oct 1970; UTA. 2 mi S Benbrook; 31 Jul 1971; R.E. Acciavitti; CU. Grapevine; 28 Aug 1975; B.M. Drees; BMD. **TAYLOR**: 30 mi W Abilene; 4 Jul 1943; ORSU. Abilene St Pk; 6 Aug 1961; H.R. Burke; TAMU. **THROCKMORTEN**: 26 Aug 1978; S.G. Davis; TTU. **TOM GREEN**: Christoval; 21 Jun 1981; N.E. Strenth; ASU. **TRAVIS**: Austin; 15 Jun 1948; S.S. Roback; male and female; INHM. Heep Farm, 11 mi S Austin; 2 Aug 1972; E.E. Grissell; TAMU. Breckenridge Laboratory, Austin; 23 Jun 1972; B. Vogel; TMM. Lk Travis; 30 Sep 1984; B.M. Drees; BMD. Austin; Philip (1936c). **UVALDE**: Uvalde; 16 Sep 1940; Jellison; INHM.

13 mi N Uvalde; 11 Jul 1965; O'Brien; UCD. 7 mi SE Concan; UCD. 11 Jul 1965; O'Brien; UCD. Camp Lajita; 27 Jul 1975; B.A. Funk; TAMU. Concan; Aug 1976; TAMU. **VAL VERDE**: 26 May 1974; D.E. Foster; TTU. 22 May 1975; J.V. Moody; TTU. Dolan Ck Camp Ground; 29°54' N x 100° W; 4,14 Jun 1975; at light; J.S. Ashe; TAMU. Devils R, Dolan Falls area, 360m; 19,20 May 1993; Gelhaus, Nelson & Koenig; ANSP. Devils R, Dolan Falls; 14 Aug 93; C.R. Nelson; UTAU. Devils R, Dolan Falls; 14 Jul 93; C.R. Nelson, S.M. Stringer & J.E. Gillaspay; UTAU. Devils R, Dolan Falls; 17, 18, 19 Sep 93; C.R. Nelson, S.M. Stringer & S. Thomas; UTAU. Devils R, Dolan Falls; 17, 24 Oct 93; C.R. Nelson, S.M. Stringer, S.B. Thomas & K.D. Alexander; UTAU. Devils R, Dolan Falls; 19 Sep 93; M.J. Prier; UTAU. **WICHITA**: 10 Sep 1976; D. Johnson; MISU. 27 Aug 1978; S.G. Davis; TTU. 5 mi E Burkburnett; 9, 19 Jun, 1, 28, 30 Jul, 4, 13 Aug, 15 Sep 1982; S.R. Kingston; TTU. **WILBARGER**: 21 Jun 1979; D. Sanders; TTU. 10 km S Vernon; 18 Aug 1995; J.T. Goodwin; TAMU. **WILLIAMSON**: Gabriel R, ca 2.5 mi NE Georgetown; 12 Aug 1983; student collection. **WISE**: 1.6 mi NE Cottondale at Salt Cr; 3 Jul 1971; R.E. Acciavitti; CU. **YOUNG**: 26 Aug 1978; S.G. Davis; TTU. **ZAVALA**: Batesville; Philip (1936c).

Tabanus abdominalis Fabricius

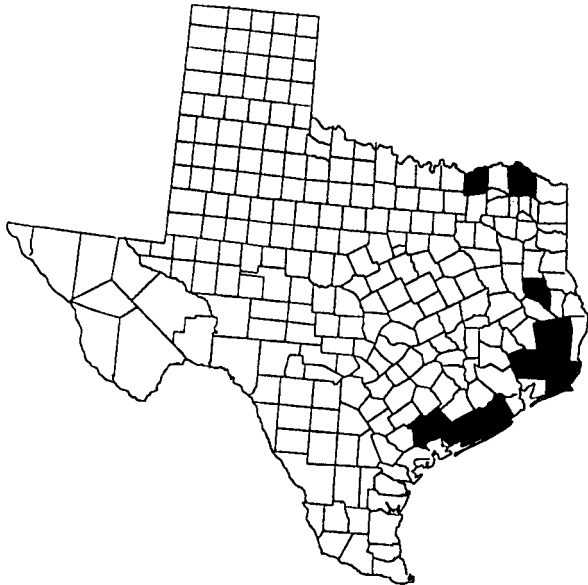
Tabanus abdominalis Fabricius 1805: 96

Relatively large (21 mm); orange to reddish brown; basal callus dark brown, narrowly united with slender median callus; frons narrow, at least 5 times as high as wide basally, widened above; abdomen yellowish to reddish brown with a median row or dark spots, these wider posteriorly, at most with only indefinite indications of pale median triangles; fore tibiae pale at base; femora black; wing heavily tinted with dark spots at bifurcation of vein R₄₊₅ and crossveins, costal cell dark yellow; eyes bare. Male with large and small eye facets but these not sharply differentiated; eyes bare.

Comments: This species has been widely collected from the eastern ½ of the United States from eastern Texas (McGregor and Schomberg 1952; Philip 1947, 1965; Stone 1938; Thompson 1973a, 1974b; Thompson *et al.* 1977), Oklahoma, and Kansas eastward and as far north as mid-Missouri to mid-Virginia, except for south Florida. The immature stages are not known. Larvae and pupae described as *T. abdominalis* by Goodwin (1973b) are now known to be *T. limbatinevris*, a species not recognized at the time of the descriptions of the immatures.

Known Distribution (Map 65, p. 96): BRAZORIA: Chocolate Bayou nr Alvin; 13 Jun 1956; H.E. Evans; CU. 11 mi E Angleton; 18, 24 Jun, 8 Aug 1971; P.H. Thompson; TAMU. Haskins Mound; 15 Jun - 5 Jul 1971; P.H. Thompson; TAMU. 12 mi NE Victoria; 19 Jun, 3, 10, 17, 24 Jul 1974; P.H. Thompson; TAMU. **FANNIN**: ca 14 mi NW Honeygrove; 1 Aug 1989; T. W. Miller; TTU. **HARDIN**: Saratoga; orange form; GRF. **JACKSON**: Francitas; 20 Jul 1914; Bishopp; USNM. **JASPER**: Buna; 10 Jun 1956; H.E. Evans; CU. **JEFFERSON**: Sabine Pass; 1 Jun 1901; A.L. Melander; OHSU. Beaumont; 13 Jun 1963; D.R. Whitehead; UAR. Beaumont; 15 June (Stone 1938). **LIBERTY**: ½ mi E Hull; 21 Jun 1972; P.H. Thompson; TAMU. **MATAGORDA**: 4 Jul 1959; Roberts; SFASU. Palacios; 9 Jul 1966; B. Noble; SFASU. 4 Jul 1969; R.H. Rokute; FSCA. **NACOGDOCHES**: 24 Jun 1969; SFASU. **ORANGE**: Beaumont; 15 Jun (Stone, 1938). **RED RIVER**: Clarksville; 5, 30 Jun 1957; M. Miesch; orange form; PU. **TYLER**: Fred; 1-7 Jun 1950; McGregor and New;

USNM. Fred; 29 Jun 1952; TAMU. **VICTORIA**: 12 mi NE Victoria; 19, 26 Jun 1974; R.R. Blume & P.H. Thompson; TAMU.



Map 65. Counties of collection: *Tabanus abdominalis*.

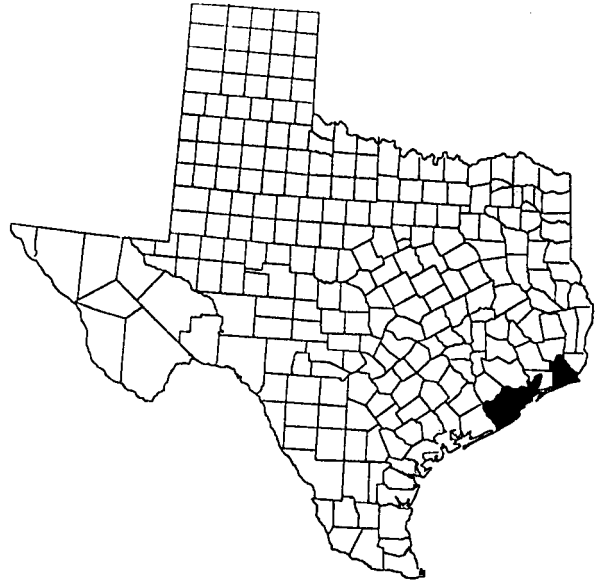
***Tabanus acutus* (Bigot)**

Atylotus acutus Bigot 1892: 660

Moderate (17.5 mm); yellowish brown with pale yellowish pattern; frons about 3½ times as high as wide basally, very slightly widened above; basal callus brown, higher than wide, not touching eyes and tapering to a slender median callus of same color and length; thorax yellowish brown with faint pale longitudinal stripes; abdomen orange brown, a little darker near apex, with a parallel-sided median pale yellowish stripe running almost entire length; wing pale brownish, the costal cell and a spot at the bifurcation of vein R₄₊₅ darker than rest; cell r₅ somewhat narrowed apically; eyes bare. Male with areas of large and small facets of eyes sharply differentiated; color essentially like female.

Comments: This species has been collected from the southern coastal states from Texas (Thompson 1973a; Thompson and Krauter 1978) to Florida. The immature stages are not known.

Known Distribution (Map 66): **BRAZORIA:** 31 May, 17 Jun, 2, 12 Aug 1968, 30 Jun, 9, 16, 21, 23 Jul, 13, 23, 25 Aug 1969; malaise trap; P.H. Thompson; TAMU. Haskins Mound; 18 Jun - 25 Aug 1971; P.H. Thompson; TAMU. 11 mi E Angleton; 24, 25 Jun, 1, 8, 15, 22 Jul, 11, 15, 18, 26 Aug 1971; P.H. Thompson; TAMU. 16 mi E Angleton; 20 Jun 1978; P.H. Thompson; TAMU. **GALVESTON:** Galveston; 11 Aug 1971; L. Meek; TAMU. **JEFFERSON:** Sabine Pass; 1 Jun 1961; A.L. Melander; USNM.



Map 66. Counties of Collection: *Tabanus acutus*.

***Tabanus americanus* Forster**

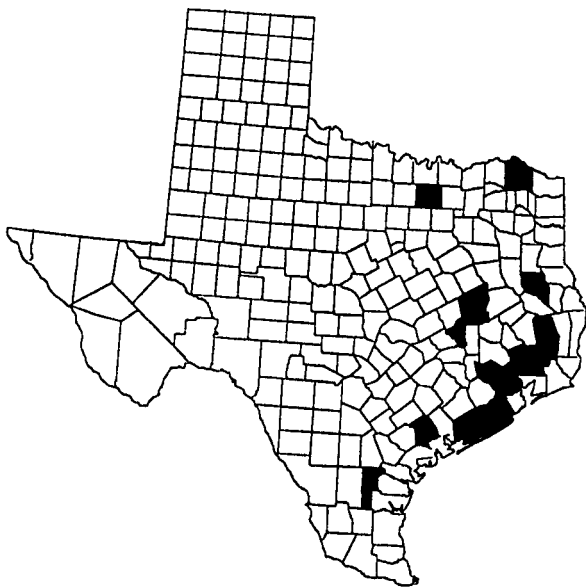
Tabanus americanus Forster 1771: 100

Tabanus plumbeus Drury 1773: 2, of index (1770: 104, unnamed description)(preoccupied Forster 1771)

Tabanus limbatus Palisot de Beauvois 1806: 54

Large (27 mm); reddish brown; basal callus orange brown to dark brown, narrowly joined to slender median callus; frons rather narrow, 4 to 5 times as high as wide basally, parallel-sided to slightly narrowed above; abdomen with narrow pale hind margins of segments; wing hyaline, costal cell dark brown; eyes bare. Male with large and small eye facets sharply differentiated; eyes bare.

Comments: This species has been collected from the eastern ½ of the southern United States from eastern Texas (McGregor and Schomberg 1952; Philip 1965; Stone 1938; Thompson 1973a, 1974a and b, 1975b, 1977; Thompson *et al.* 1977), Oklahoma and Kansas eastward to the Atlantic coast, including all of Florida, where its distribution extends northward to New Hampshire, primarily in the coastal states. An apparent disjunct population is known from southern Ontario and Michigan (Pechuman *et al.* 1983). It has also been reported from the Bahamas. Tidwell (1973) reported collecting larvae of this species from decaying logs in bottomland mixed hardwood forest in areas subject to annual flooding. Jones and Anthony (1964) reported taking larvae from the muddy margin of a shallow pool. The senior author found a single larva on two occasions in habitat similar to that reported by Tidwell.



Map 67. Counties of Collection: *Tabanus americanus*.

Known Distribution (Map 67): **BRAZORIA:** 6 mi W Columbia; 28 Jun 1961; R.L. Westcott; LACM. Haskins Mound; 18 Jun 1971; P.H. Thompson; TAMU. 11 mi E Angleton; 18 Jun 1971; P.H. Thompson; TAMU. Danbury; 18 May 1973; L. Meeks; TAMU. **BRAZOS:** 7 mi S College Station HW 6; 9 Sep 1971; P.H. Thompson; TAMU. **DENTON:** Mike Ranch; 20 Oct 1967; D.H.O.; UNT. **GRIMES:** Navasota R & FM 2038; 15 Jun 1971, 13 Jun 1972, 20 May, 5, 7, 10, 14 Jun 1974, 7 May, 18, 23 Jun 1975; P.H. Thompson; TAMU. **HARDIN:** 3 mi NE Kountz FM 418; 5, 7, 20, 27, 29 Jun 1973; P.H. Thompson; TAMU. **HARRIS:** Karnack; 22 May 1951; Knull; OHSU. 2 May 1963; J. Clay; SFASU. **JIM WELLS:** 4 Jul 1969; J. Snelgrove; TTU. **LEON:** 6 Jun 1924; M. Price; TAMU. **LIBERTY:** ½ mi E Hull; 10, 31 May, 7, 12, 21 Jun 1972, 29 May 1973; P.H. Thompson; TAMU. **MATAGORDA:** Palacios; 5 Jun 1924; TAMU. **NACOGDOCHES:** 25 Oct 1954; D. Lindsey; SFASU. 10 May 1958; J. Darial; SFASU. 21 Jun 1966; R.R. Blume; on jeep hood; SFASU. 20 Jun 1969; R.V. Dormer; on cow; SFASU. **RED RIVER:** Clarksville; 5, 30 Jul 1957; M. Miesch; PU. **TYLER:** Fred; 4 Jul 1952; McGregor; TAMU. 2 mi W Fred, FM 1943; 14 Jun 1972; P.H. Thompson; TAMU. Town Bluff Resv; 7-8 Jun 1975; S.J. Merritt; TAMU. **VICTORIA:** Inez; 14 Jun 1972; R.R. Blume; TAMU.

Tabanus aranti Hays

Tabanus aranti Hays 1961: 127

Large (21 mm); nearly black; basal callus brown, higher than wide, rounded above, united with slender median callus; frons narrow, usually about 4 times as high as wide basally, a little widened above; abdomen black, without pattern, but more or less entirely covered by a bluish-white pollinosity or bloom; wing heavily infuscated brown: at a minimum including costal cell and broad margins along all veins, sometimes including entire wing; cell r_5 somewhat narrowed. Male with areas of large and small eye facets sharply differentiated; otherwise like female except abdominal bloom reduced to traces.

Comments: This species has not been collected in Texas. Although Thompson (1975b) reported Texas

collections, an examination of specimens in the Texas A&M University Collection determined by Thompson proved to be *T. atripennis*. It has been collected from most of the southeastern states from Arkansas and Louisiana eastward to the Atlantic coast. If present in Texas it probably reaches its western limit in eastern Texas. Goodwin (1973b) reported taking larvae from stream habitats where they were associated with aquatic vegetation such as watercress, cattail and water lilies. Tidwell (1973) reported taking larvae from the margins of a shallow beaver pond in a hardwood forest.

Tabanus atratus Fabricius

Tabanus atratus Fabricius 1775: 789

Tabanus americanus Drury 1773: 2, of index (1770: 104, unnamed description)(preoccupied Forster 1771)

Tabanus niger Palisot de Beauvois 1806: 54

Tabanus validus Wiedemann 1828: 113

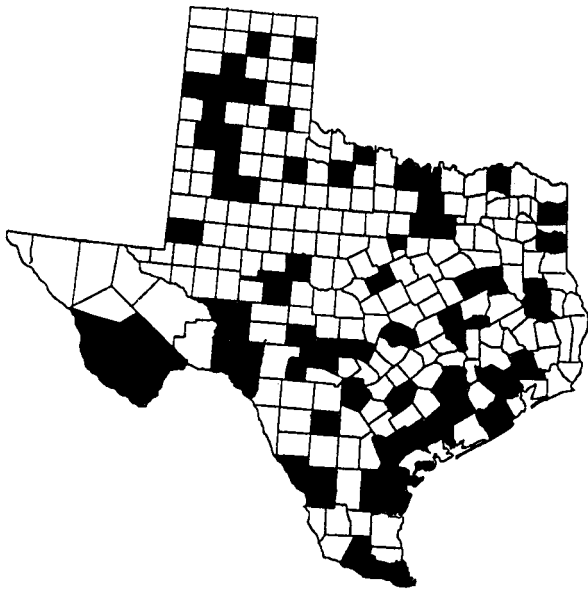
Tabanus nantuckensis Hine 1917: 271

Tabanus atratus var. *fulvopilosus* Johnson 1919: 164

Large (24 mm); black; basal callus black, wider than high, the median callus a black attenuated projection; frons relatively broad, 2 to 2½ times as high as wide basally, parallel-sided; subcallus denuded, shiny black; wings dark brown to black; eyes bare. Male with large and small facets sharply differentiated; eyes bare.

Comments: This species has been collected from the entire eastern one-half of the United States and extreme southern Canada as far westward as the western parts of the Dakotas southward through western Texas (Gingrich and Hoffman 1967; McGregor and Schomberg 1952; Philip 1947; Thompson 1973a, 1974b, 1975b, 1977; Thompson *et al.* 1977; Thompson *et al.* 1978; Townsend 1898) and into northern Mexico. Larval habitats have been reported by numerous authors including Teskey (1969) who summarized earlier records and Tidwell (1973). Habitats of the larvae have included a wide variety of areas such as mud at the margins of streams, ponds and lakes, crevices in decaying logs, spaces beneath the bark and wood of decaying logs, accumulations of silt and vegetation at the margins of all types of freshwater areas, mud in roadside ditches and borrow pits where inundation is seasonal. Drees (1987) reported the construction of mud cylinders as sites for pupation in drying substrates for larvae of this species. The senior author has found larvae in all of the above types of habitats throughout the southeastern United States.

Known Distribution (Map 68, p. 98): **ANDERSON:** Palestine; Jul 1962; N. Nichols; SFASU. Burke Farm, Salmon; 19 Mar, 17 Apr 1994 (as larvae); J.T. Goodwin; JTG. **ANDREWS:** Shafter Lk; 8 Jul 1961; R. Ross; SRSU. **ANGELINA:** Lufkin; 17 May 1969; D.J. Kuyper; SFASU. **ARANSAS:** Goose Is St Pk; 26 Jun 1969; Board & Hafernik; TAMU. Rockport; 27 Nov 1971; R.E. Acciavitti; CU. **ARMSTRONG:** Wayside; 25 Aug 1966; D. Brooks; WTAM. **AUSTIN:** W Austin St Pk near Sealy; 14-15 Jun 1956; H.E. Evans; CU. **BAYLOR:** 20 Sep 1991; MISU. **BEE:**



Map 68. Counties of Collection: *Tabanus atratus*.

Medio Cr @ FM 2441; 13 Apr 1996 (as larva); J.T. Goodwin; JTG. **BEXAR**: Ft. Sam Houston; 30 Jun 1952; B. Adelson; UCB. San Antonio; 29 Jun 1957; H.E. Evans; CU. Salado Cr area; 15 Aug 1957; B.F. Eldridge; PU. San Antonio; 28 Jul, 28 Sep 1968; W.H. Tyson; CU. Camp Bullis Rd; 25 Sep 1977; W. & N. McGuire; FDF. **BLANCO**: Pedernales St Pk; 6 May 1980; R.S. Peigler; TAMU. **BRAZORIA**: 23 Aug, 16 Sep, 14 Oct 1967, 19 Apr, 3 Jun, 2, 10, 17, 29, Jul, 23 Aug, 6 Sep, 21, 25 Oct 1968, 20 Aug, 22 Sep, 1 Oct 1969; malaise trap; P.H. Thompson; TAMU. West Bay 12 mi S Danbury; 13-15 Aug 1970; P.H. Thompson; TAMU. 11 mi E Angleton; 18 Jun, 2, 22, 29 Sep 1971, 14 Jun 1972; L. Meeks; TAMU. Hoskins Mound; 18 Jun - 29 Sep. 1971; P.H. Thompson; TAMU. Angleton; 1-10 May 1972; J.K. Olson; TAMU. **BRAZOS**: College Station; 2 Sep 1919, 28 Apr, 12 Jun, 22 Sep 1920, 1 Oct 1921; 18 Apr 1930, 1 Jun 1931, 30 May 1938, 24 Aug 1939, 3 May 1946, 3 Jul 1955; H.J. Reinhard; TAMU. Vterl. College Station; 8, 21 Aug 1970, 21 Jul, 9 Aug 1971, 4 Jun 1972; P.H. Thompson; TAMU. Vterl. College Station; 11 Sep 1970; B. Wright; TAMU. Mile Dr, S College Station; 29 Apr, 8 Nov 1971, 16 May, 5, 9 Jun, 15 Jul, 3, 29 Aug 1973, 28 Apr, 7, 12, 15 May, 4 Jun, 12 Jul, 26 Aug 1974. 16, 20, 29 Apr, 4, 7, 17 May, 18, 20, 22 Jun 1975, 3 Sep 1976, 26 Aug 1977; P.H. Thompson; TAMU. College Station; 10 Aug 1971, 22 Aug 1972, 23 June 1975; P.H. Thompson; TAMU. Vterl. College Station; 24 Aug 1972; B.J. Gregy; TAMU. Thompson Cr, Bryan; 27 Oct 1972; H.H. Harris; CU. Bryan; 9 Apr 1974; J.C. Schaffner; TAMU. College Station; 26 Apr 1975; A. Dean; TAMU. College Station; 30 Jun 1975; B. Cutler; BC. College Station; 21 Jun 1976; P.H. Thompson; TAMU. Mile Dr. S. College Station; 12 Oct 1978; J.A. Jackman; TAMU. 8 Jun, 27 Aug 1979; C.W. Agnew; TAMU. **BREWSTER**: Marathon; 25 Jul 1978; G. Wedin; SRSU. **CAMERON**: Brownsville; 16 Apr, 11 Jul; Townsend (1898b). Brownsville; 8, 22, 23 Aug; Beimer; LLP. Brownsville; 26 Nov 1910; INHM. Harlingen; 27 Oct 1976; M. Huybensy; MH. nr Southmost Sabal Palm Grove Sanct; 1 Aug 1981; ex blacklight trap; R. Turnbow & E. Ortiz; TAMU. 11 Aug 1981, R. Turnbow and E. Ortiz, TAMU. **CASS**: Atlanta; 13 Jun 1938; M. Sanderson; CU. Sabal Palm Grove Sanct; 2 Apr 1994 (as larva); J.T. Goodwin; JTG. **CASTRO**: Dimmitt; 16 Jul 1969; J. Martin; WTAM. 6 mi N Dimmitt; 28 Sep 1975; B. Smith; WTAM. 18 mi W Dimmitt; 24 May 1981; J. Armstrong; TTU. **CLAY**: Henrietta; 6 Jul 1971; MISU. 11 Oct 1975; T. Tomlinson; MISU. 8 mi W Petrolia; 6 Sep 1977; F.D. White; MISU. 14 Sep 1979; MISU. **COLORADO**: 23 Jun 1954; C.F. Bailey; TAMU. **COOKE**: Moss L; 11 Sep 1991; T.J. Stewart; UNT. **CROCKETT**: 13 Aug 1982; Thompson; TTU. **DALLAS**: Dallas; 7 May 1920; INHM. Dallas; 8 Jun 1938; TAMU. 1968; UTA. **DEAF SMITH**: 23 km W Canyon; 14 Jun 1974; G. Wilhelm; WTAM. 3 mi S

Dawn; 10 Sep 1984; S. Carter; WTAM. **DENTON**: Aubry Pond; 14 Sep 1970; F.G.G.; UNT. Salmon Pond off Crawford Rd; 4 Oct 1973; R.V.O.; UNT. Hickory Cr; 23 Oct 1973, 30 Jul 1974; B.J.J.; UNT. **FREESTONE**: Hwy 164, 5 mi W Buffalo; 1 Oct 1977; W. & N. McGuire; FDF. **FRIO**: Dilley; 6 May 1920; H.J. Reinhard; TAMU. **GARZA**: City Pk, Post; 16 Jun 1965; Reffenipower (?); CU. 17 Aug 1973; F.E. Byrd; TTU. Post; 6 Aug 1975; P.H. Thompson; TAMU. **GILLESPIE**: Fredricksburg; 15 Sep 1959; C. Coulsen; LLP. 22 Jun 1968; C.D. Schmidt; TTU. 17 Aug 1965 (as larva); Gingrich and Hoffman (1967). **GOLIAD**: 2 mi N Weser; 24 Mar 1976 (as larva); J. T. Goodwin; FSCA. **GONZALES**: Palmetto St Pk; 19 Jan 1975 (as larva); J. T. Goodwin; FSCA. **GRIMES**: Navasota R & FM 2038; 22 Jun 1971, 27 Jun, 23, 30 Jul, 28 Aug, 20 Sep, 30 Oct 1972, 7 Mar, 12, 15, 16 Apr, 6, 8, 15, 17, 22, 24 May, 3, 7, 10, 12, 15, 18, 19, 28 Jun, 5, 8, 12 Jul, 12 Aug 1974, 26 Mar, 14, 15, 16, 25, 28 May, 1, 6, 7, 11, 16, 18, 23, 27, 30 Jun, 7, 11, 16 Aug 1975; P.H. Thompson; TAMU. **HALE**: Plainview; 18 Jun, 4 Sep 1954; F.C. Hamistar; CU. 28 Sep 1968; J. Rice; TTU. 18 Oct 1968; B.W. Robertson; TTU. **HALL**: 15 Jul 1966; D.D. Collins; TTU. 5 mi W Childress; 26 Sep 1970; R. Rhume; UNT. **HAMILTON**: Hamilton; 30 Jul 1975; D. Ring; JTG. **HARRIS**: Houston; 4 Jul 1958; E.P. Meinour; UM. 3 mi W Houston; 26 Jun 1961; R.L. Westcott; LACM. 14 Jun 1969; Alsobrook; SFASU. **HARRISON**: Marshall; 14 Jun 1969; SFASU. 3 mi E Karnack; 11 Apr 1972; R.E. Acciavitti; CU. **HEMPHILL**: 15 Sep 1973; D.M. Gruman; TTU. **HIDALGO**: 31 Oct 1931; T.W. Musik (?); UCB. Bentsen-Rio Grande St Pk; 25 Jun 1948; S.S. Roback; INHM. Sep 1966; UTA. Weslaco; 12 Nov 1973; A. Dean; TAMU. Bentsen-Rio Grande St Pk; 20-21 May 1974; A.E. & O.S. Lewis; CU. **HILL**: 30 Oct 1982; J. Gerix; TTU. **HOOD**: Glen Rose; 7 Jun 1975; P.D. Holmes; TAMU. **HUTCHINSON**: Lk Meredith, 2 mi S of Dam; 3 Jul 1967; R. L. Nunn; WTAM. **JACKSON**: Pt Comfort; 24 Jun 1961; R.L. Westcott; LACM. **JIM WELLS**: 28 Jun 1969; J. Snelgrove; TTU. **KERR**: Kerrville; 26 Aug 1952; McGregor; TAMU. Kerrville; 30 Mar 1961; R.H. Roberts; ASU. 21 May 1968; R.R. Blume; TAMU. **KIMBLE**: Roosevelt; 10 Sep 1979; P.H. Thompson; TAMU. 4 Sep 1982; B. Glover; TTU. **KING**: 9, 20 Aug 1976; D. Sanders; TTU. **KLEBERG**: Kingsville; 31 Mar, 25 Apr, 1 May 1964; student collection; CU. undated specimen; C.T. Reed; CU. **LAMAR**: Paris; 6 Aug 1958; R. Beard; RB. **LAMB**: 12 Mar 1966; J. Diersing; ENMU. 11 Sep 1968; H. Melton; TTU. 20 Sep 1970; J. Katimer; TTU. 7 mi SW Littlefield; 12 Aug 1972; D. Brooks; WTAM. 14 Sep 1976; K. Ahrens; TTU. **LIBERTY**: Hull; 20 Sep 1972; P. H. Thompson; TAMU. **LUBBOCK**: R.A. Pudney; 26 May, TTU. 5 Jul; B. McNabb; TTU. 20 Oct 1960; R. Fultier; TTU. 9 Oct 1964; TTU. 28 Sep 1965; R.W. Fleming; TTU. 11 May 1968; R.E. Dilbeck; TTU. 30 Aug 1968; C.R. Ward; TTU. 12 Sep 1968; K. Pitts; TTU. 15 Oct 1968; V. Clifford; TTU. Blagg; 18 Oct 1968; TTU. 20 Oct 1968; J.D. Cox; TTU. 6 Jun 1969; J.A. Tenerio; TTU. 25 Jun 1969; R. Kirby; TTU. 8 Jul 1969; K. Pitts; TTU. May 1973; G.K. Moore; TTU. 1 Jun 1977; S.G. Davis; TTU. 28 Jul 1981; B. Lance; TTU. 15 Oct 1981; M. Foster; TTU. Sep 1982; M. Arnold; TTU. **LYNN**: 1 Oct 1968; C.M. Reid; TTU. **MONTEAGUE**: 5 Sep 1981; J. Major; MISU. 15 Sep 1992; Hicks; MISU. **NACOGDOCHES**: 5 Sep 1959; D. Alford; SFASU. 23 Sep 1959; W. Stephens; SFASU. 3 Oct 1959; Strong; SFASU. 28 Sep 1960; A. Valentine; SFASU. 10 Jun 1964; J. Knott; SFASU. 25 Sep 1964; J. Rogers; SFASU. 2 Jul 1969; N. Nichols; SFASU. 7 Jul 1969; Sjolender; SFASU. 1 Oct 1969; L.S. Brummett; SFASU. **NUECES**: Corpus Christi Naval Air Sta; 20 Sep 1942; UM. **POTTER**: Amarillo; 18 Jul 1966; R. Boyd; WTAM. 3 mi W Amarillo; 18 Jun 1974; R. Miller; WTAM. Amarillo; 28 Feb 1982; B. Lowder; WTAM. Amarillo; 11 Sep 1982; T. James; WTAM. **PRESIDIO**: Love Ranch, Marfa; 27 Jul 1993; SRSU. **RANDALL**: Umbarger; 14 Aug 1955; R.R.D.; WTAM. Canyon, 24 Jul 1966; A. Hevoman; WTAM. Canyon; 3 Aug 1966; B. Goodlow; WTAM. Canyon; 15 Aug 1966; C. Wright; WTAM. Canyon; 8 Jun 1967; W. A. Detram; WTAM. Canyon; 12 Jun 1967; A. Scott; WTAM. Canyon; 15 Jun 1967; collector unknown; WTAM. Canyon; 22 Jul 1967; D. Brooks; WTAM. Canyon; 3 Aug 1969; Bill Cox; WTAM. Canyon; 13 Sep 1970; collector unknown; WTAM. 4 km W Canyon; 3 Jul 1974; B. Stevens; GSU. 4 Ki W Canyon; 13 Jul 1974; B. Stevens; WTAM. Canyon; 11 Oct 1975; S. Christiansen; WTAM. Canyon; 2 Jul 1978; K. Whitley; WTAM. Canyon;

13 Aug 1978; S. Jones; WTAM. Canyon; 4 Oct 1978; J. Mitchell; WTAM. Canyon; 23 Oct 1978; J. Bertl; WTAM. Canyon; 17 Aug 1979; W. Fournier; TTU. Canyon; 16 Jun 1980, 11 Jul 1980; B. Hays; WTAM. Ceta Canyon; 8 Sep 1982; B. Dylestar; WTAM. Ceta Cyn; 8 Sep 1983; B. Dylertan; WTAM. **REAL**: 2 mi N Leakey; 27 Nov 1959; O. Cox; SRSU. **ROBERTSON**: Franklin; 14 Apr 1968; P. Sandifer; SFASU. **RUNNELS**: 26 Sep 1982; R.M. Pritchard; TTU. **SAN PATRICIO**: 3 Apr 1965; R. Greenwood; CU. 3.6 mi NE Sintou; 18 Oct 1978; R. Turnbow; UG. 5 mi W Rockport, Aransas; 17 Apr 1981; J. Cruses; TTU. **TARRANT**: 1968; UTA. Arlington; 13 Aug 1970; W. Sheppard; SFASU. Haltom City; 29 Aug 1971; R.E. Acciavitti; CU. **TOM GREEN**: 13 Apr 1968; T. Cypert; TTU. San Angelo; 8 Aug 1978; W.D. Sisson, O.F. Franke, T.B. Hall, J.V. Moody; TTU. **VAL VERDE**: Devils R, Dolan Falls area, 360m; 18 May 1993; Gelhaus, Nelson & Koenig; ANSP. **VICTORIA**: 12 mi NE Victoria; 1 May, 5, 19 Jun 1974; R.R. Blume & P.H. Thompson; TAMU. **WEBB**: Callaghan; 20 Aug 1968; R. Crow; TTU. **WHARTON**: 1 Jul 1942; C. Boetcher; TAMU. 26 May 1959; C.F. Bailey; TAMU. **WICHITA**: Iowa City; 5 Jul 1954; TAMU. Iowa Pk; 17 Jun 1971; MISU. Wichita Falls; 29 Jun 1971; MISU; 26 Aug 1972; L. Dippsey; MISU. 30 Aug 1974; F. Stangl; MISU. 20 Sep 1974; R. Walterschied; MISU. 3 Nov 1974; M. Millander; MISU. 20 Oct 1975; T. Tomlinson; MISU. 7 Sep 1977 N.D. Hodson; MISU. Sep 1974; MISU. Wichita Falls; 20 Sep 1977; R. Grandy; MISU. 8 Sep 1979; P. Graham; MISU. 20 Jul 1983; L. Bush; MISU. 24 Jul 1985; R. Tinema; MISU. 9 Sep 1985; E. Bousquat; MISU. 2 Oct 1985; T.S. Schafer; MISU. 18 Oct 1985; MISU. 17 Jul 1987; R. Tinema; MISU. 27 Jun 1991; P. Palquet; MISU. **WILLIAMSON**: Georgetown; 17 Jul 1975; B. Culter; specimen destroyed.

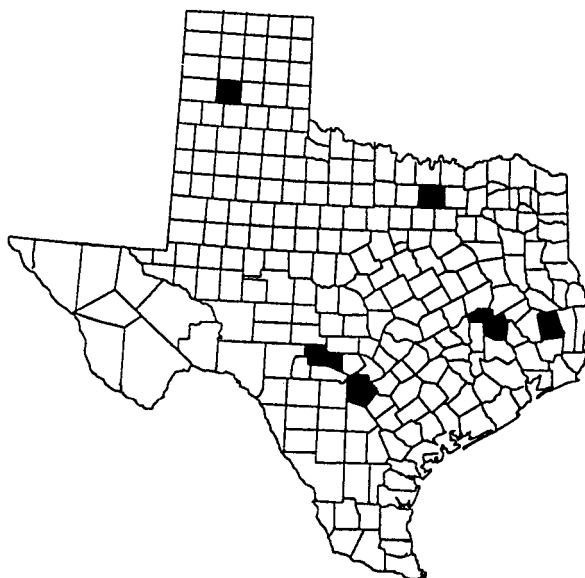
Tabanus atripennis Stone

Tabanus nigrescens subspecies *atripennis* Stone
1935: 15

Large (23 mm); dark brown to black without abdominal pattern; frons about 3.8 times as high as wide basally, slightly widened above; frontal callus black, touching eyes at base, higher than wide, united with black lanceolate median callus; thorax and abdomen both nearly black, without evident pattern or pale markings; wing uniformly smoky with a darker spot at bifurcation of vein R₄₊₅. Male with large and small facets sharply differentiated; coloration and pattern essentially like female.

Comments: Considerable confusion has existed for many years relative to the status of *T. atripennis*, *colon* Thunberg, and *nigrescens*. This was especially true when Teskey and Burger (1976) described larvae of *colon* collected in the eastern United States and Goodwin (1987) described quite different larvae as *colon* based on specimens from west of the Mississippi. General agreement has been reached that three distinct species are represented. Of these, *colon* is entirely eastern in distribution, and the immature stages described by Teskey and Burger (1976) are *colon*. *Tabanus nigrescens*, discussed in more detail later, is also a predominantly eastern species that may eventually be found in Texas. *Tabanus atripennis* is a western species widespread in Texas (McGregor and Schomberg 1952; Philip 1947, 1965; Thompson 1973a; Goodwin 1987). The immature stages described under the name *colon* by Goodwin (1987) are the immature stages of *atripennis*. The larvae involved were found in wet mud at the margins of

small permanent streams and rivers.



Map 69. Counties of collection: *Tabanus atripennis*.

Known Distribution (Map 69): **BEXAR**: Geronimo Cr., nr TX16 & FR37; Feb, Apr 1975 (as larvae); J. T. Goodwin; FSCA. **DENTON**: Mike Ranch; 20 Oct 1970; D.H.O.; UNT. **GRIMES**: Navasota R & FM2038; 28 May, 3, 10 Jun 1974, 2 Jun 1977; P.H. Thompson; TAMU. **KERR**: Kerrville; 15 May 1968; R.R. Blume & P.H. Thompson; TAMU. **RANDALL**: Ceta Canyon; 8 Sep 1982; V. Brannigan; WTAM. **TYLER**: Town Bluff Res; 7-8 Jun 1975; S.J. Merritt; TAMU. **WALKER**: Huntsville St Pk; 26 Jun 1971, 16 Jun 197; P.H. Thompson; TAMU.

Tabanus calens Linnaeus

Tabanus calens Linnaeus 1758: 601
Tabanus giganteus DeGeer 1776: 226
Tabanus lineatus Fabricius 1781: 455
Tabanus pallidus Palisot de Beauvois 1809: 100
Tabanus bicolor Macquart 1847: 37 (1847: 21)(preoccupied Wiedemann 1821b)
Tabanus coesiofasciatus Macquart 1855: 52 (1855: 32)

Large (24 mm); basal callus dark reddish, tapering to an elongate slender median callus; frons narrow, about 4½-5½ times as high as wide basally, parallel-sided; thorax brown with indistinct reddish lines; abdomen blackish, sometimes with faint pale median triangles; wings tinted yellowish brown, costal cell darker; eyes bare. Male with little differentiation into large and small eye facets; eyes bare.

Comments: This species has been collected from most of the eastern one-half of the United States from eastern Texas (McGregor and Schomberg 1952; Philip 1947, 1965), Oklahoma, Kansas and Iowa into southern Wisconsin, Michigan and eastward to the Atlantic where it reaches apparent northern limits in New Hampshire and

Vermont and southern limits in southern Louisiana, Mississippi, Alabama and Georgia. Teskey (1969) reported a single larvae identified as *T. calens* on the basis of comparisons with preserved larvae reared from eggs; this larva was found in damp, lowland pasture sod.

(1952), and Philip (1947, 1965), but these authors did not provide locality information. There are four specimens determined as this species by C. B. Philip in the collection of the California Academy of Sciences. They are old specimens from the M. C. Van Dusee collection, and the labels bear only the notation, Tex (Ribardo, personal communication). The species has been reported from the southern coastal states from Texas to Florida. The immature stages are not known.

***Tabanus coarctatus* Stone**

Tabanus coarctatus Stone 1935: 13

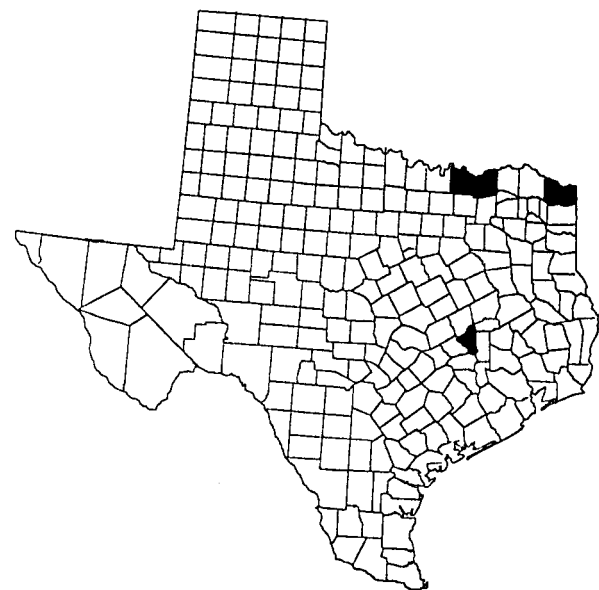
Moderate (15.5 mm); brown with paler brown to tan pattern; frons narrow, 5 to over 6 times as high as wide basally, widened above; basal callus dark brown, rectangulate, higher than wide, touching eyes, united to slender concolorous median callus of somewhat greater length; thorax brown with paler pollinose stripes; scutellum a little paler in color; abdomen brown with a median row of tan triangles arising from posterior bands which widen laterally to form sublateral triangles; wing nearly hyaline, the costal cell yellowish brown, the longitudinal veins basally faintly margined with brown and with rather distinct infuscations at bifurcation of vein R_{4+5} and base of cell m_1 ; eyes bare. Male with large and small facets of eyes sharply differentiated; a little paler, but basically similar to female.

Comments: This species has not been collected in Texas. It has been reported from the southern coastal states from Louisiana to Florida. The immature stages are not known.

***Tabanus colombensis* Macquart**

Tabanus colombensis Macquart 1846: 165 (1846: 37)
Tabanus truquii Bellardi 1859: 64
Tabanus amplifrons Kröber 1933: 354

Moderate (13 mm); brown to blackish with grayish white pattern; frons about 4½ times as high as wide basally, only a little widened above; basal callus brown, usually slightly higher than wide, rounded above, separated from eyes, separated or only narrowly united with slender linear median callus; thorax and scutellum concolorous, dark brown to black, except for cream-colored humeral lobes; abdomen brown to brownish black with a rather narrow more or less parallel-sided median grayish white stripe and less distinct sublateral grayish white spots, those of tergites 1 and 2 more or less united, the rest progressively smaller posteriorly and not attaining margins of tergites; wing hyaline, venation normal. Male with both large and small facets but these not sharply differentiated, the former distinctly pilose and sometimes paler in color in dried specimens.



Map 70. Counties of Collection: *Tabanus calens*.

Known Distribution (Map 70): **BOWIE:** 8.5 mi N New Boston at Red R; 13 Sep 1971; R.E. Acciavitti; CU. **BRAZOS:** College Station; 23 May 1937; student collection; TAMU. College Station; 1 Sep 1938; student collection; TAMU. **FANNIN:** ca 14 mi NW Honeygrove; 1 Aug 1989; T. W. Miller; TTU. **GRAYSON:** Whitesboro, Lk Texana; 25 Sep 1982; T. James; GSU.

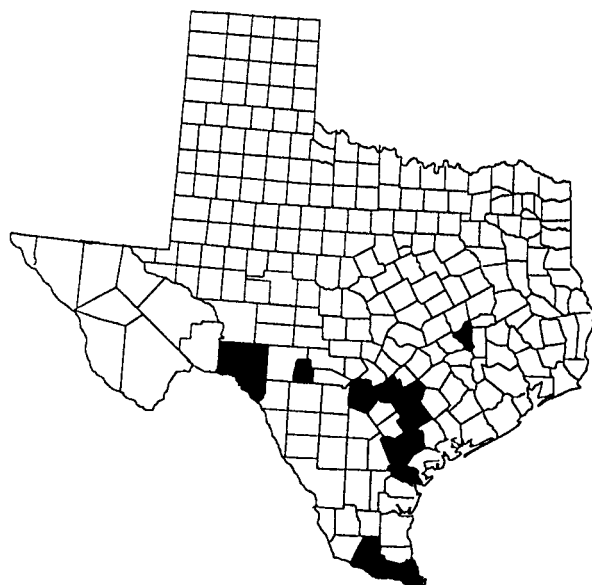
***Tabanus chelipterus* Rondani**

Tabanus chelipterus Rondani 1850: 192
Tabanus subfronto Philip 1936b: 100

Moderate (17.5 mm); orange brown with pale yellow pattern; frons 3 to 3.5 times as high as wide basally, parallel-sided to very slightly widened above; basal callus yellowish brown, shiny, flat, slightly higher than wide prolonged into a median callus of the same color but of variable length; thorax reddish brown with pale brown lines; abdomen orange brown, darker apically with hind margins of tergites paler and bearing a rather uniform row of yellowish median triangles, the one on tergite 2 at least preceded by a black spot; wing hyaline, the costal cell, bifurcation of vein R_{4+5} , crossveins and longitudinal veins all narrowly tinged with brown, the brown less distinct along the longitudinal veins; cell r_5 distinctly narrowed apically; eye bare. Male with areas of large and small facets distinctly differentiated; coloration essentially like female.

Comments: Although no specimens of this species from Texas have been seen by us, it was previously reported from Texas by Stone (1938), McGregor and Schomberg

Comments: This is a predominantly neotropical species known from throughout Central America and southward into Colombia, Ecuador and Peru and from some Caribbean islands. It reaches its apparent northern limits in Texas. It has been previously reported from Texas (Goodwin 1986; McGregor and Schomberg 1952; Philip 1947, 1965; Thompson 1977). Goodwin (1986) reported collecting larvae of this species from wet mud along the margin of a small stream. Goodwin and Murdoch (1974) reported the collection of larvae from moist soil, usually in the vicinity of roots of grass and/or water lettuce.



Map 71. Counties of Collection: *Tabanus colombensis*.

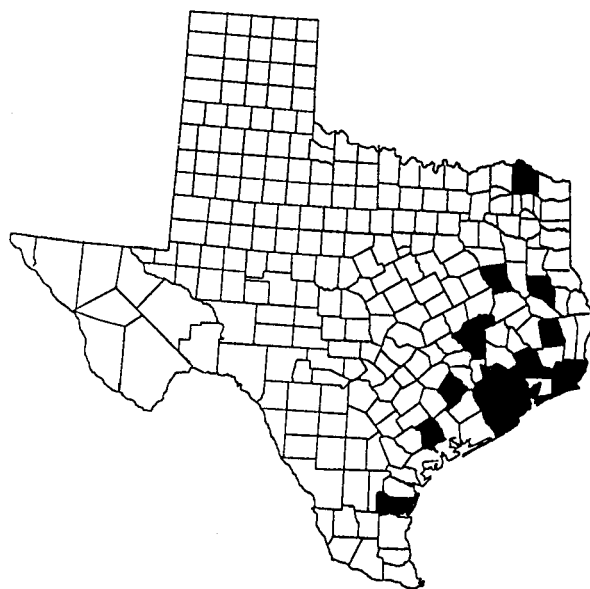
Known Distribution (Map 71): **BEE:** Medio Cr @ FM 2441; 13 Apr 1996 (as larva); J.T. Goodwin; JTG. **BEXAR:** Ft Sam Houston; 4 Oct 1952; UC. Salado Cr area; 15 Aug 1967; B.F. Eldridge; PU. Geronimo Cr nr. TX16 & FR37; Feb 1975 (as larva); J.T. Goodwin; FSCA. Brooks AFB, TX; 18 Sep 1994 (as Larva); J.T. Goodwin; JTG. **BRAZOS:** Mile Dr, S College Station; 6 Apr 1975, 7 Sep 1977; P.H. Thompson; TAMU. **CAMERON:** Thayer (unknown locality; probably Cameron Co as collector made other collections there on previous & same day); 15 Apr 1942; W.C. Reeves; FSCA. Olmito; 8 May 1942; W.C. Reeves; FSCA. **DEWITT:** 3 mi S Cuero; March 1975 (as larva); J.T. Goodwin; FSCA. **GOLIAD:** creek, 2 mi N Wesar; 24 Mar 1976 (as larva); J.T. Goodwin; FSCA. **GONZALES:** Palmetto St Pk; 13 Oct 1985; J. Rawlins & R. Davidson; CM. **GUADELUPE:** Seguin; 3 Aug 1986; F.E. French; GSU. **HIDALGO:** 20 Mar 1952, 26 Mar 1953, 24 Mar 1954, 30 Mar 1960, 5, 7 Apr 1967; Knull; FSCA. 5 Apr 1967; OHSU. Santa Anna; 8 Jul 1967; J.W. Tilden; SJ. 1 Jun 1976; C.C. Porter; FSCA. **REAL:** Camp HEB, 8 mi N Leaku; 30-31 Aug 1975; J.T. Goodwin; FSCA. **SAN PATRICIO:** Lk Corpus Christi St Pk; 1 Jun 1976; G.H. Nelson; FSCA. Welder Wildlife Ref, 8 mi NE Sinton; 13-15 May 1985; N. Bedwell & R. Brown; MSU. **VAL VERDE:** Devils R, Dolan Falls area, 360m; 18, 19, 20 May 1993; Gelhaus, Nelson & Koenig; ANSP.

Tabanus cymatophorus Osten Sacken

Tabanus cymatophorus Osten Sacken 1876: 444

Moderate to large (19 mm); brown with pronounced grayish white pattern; basal callus brown, higher than wide, narrowly united with slender median callus; frons narrow, about 4½ times as high as wide basally, slightly widened above; abdomen with three rows of large grayish white triangles, these rather broadly united at posterior border of tergites; wings nearly hyaline, with spots at bifurcation of vein R₄₊₅ and crossveins, costal cell not darkened; eyes bare. Male with large and small eye facets sharply differentiated; eyes bare.

Comments: This species is known from the south central United States from eastern Texas (McGregor and Schomberg 1952; Philip 1947, 1965; Stone 1938; Thompson 1973a, 1974a and b, 1977; Thompson *et al.* 1977; Thompson *et al.* 1978) north to southern Missouri and eastward in a narrowing zone to central Georgia where the distribution extends northeasterly through the central Carolinas, Virginia and Delaware to southern New Jersey. Thompson *et al.* (1978) reported taking a single larva from the marginal mud of a woodland pond. This specimen was described by Goodwin (1987).



Map 72. Counties of collection: *Tabanus cymatophorus*.

Known Distribution (Map 72): **ANDERSON:** Salmon; 14-20 Jul 1975; H.R. Burke; TAMU. **BRAZORIA:** Haskens Mound; 31 Jul, 30 Aug, 6 Sep 1968, 14, 28 Jul 1969; malaise trap; TAMU. 11 mi E Angleton; 24, 25 Jun, 15, 21, 22 July 1971; P.H. Thompson; TAMU. **BRAZOS:** 14 Oct 1935; J.H. Robinson; TAMU. College Station; 30 May 1937; student collection; TAMU. Mile Dr, S College Station; 6 Aug 1973, 19, 21, 29 Jun, 3, 4, 8, 10, 13, 14, 19, 22-30 Jul, 6 Aug 1975; P.H. Thompson; TAMU. College Station; 13 Aug 1976; P.H. Thompson; TAMU. **COLORADO:** 1959; C.F. Bailey; TAMU. **FORT BEND:** 10 Sep 1938; J.E. Gillespy; TAMU. **GALVESTON:** Dickinson; 9 Aug 1931; J.N. Roney; TAMU. Dickinson; 31 Aug; J.N. Rooney; TAMU. **GRIMES:** Navasota R & FM 2038; 15 Apr, 19, 24, 28 Jun, 1, 6, 8, 10, 15, 22, 24, 26 Jul, 2, 10, 19 Aug 1974, 25 Jun, 1, 2, 4, 7, 9, 11, 14, 15, 16, 18, 21, 22-30 Jul, 1, 11 Aug 1975; P.H. Thompson; TAMU. **HARRIS:** Hockley; UB. Seabrook; 19 Aug 1970; W.W. Gibson; male "at electric light"; SFASU. **JEFFERSON:**

Beaumont; 5 Jun (Stone 1938). **KLEBERG**: Kingsville; 15 Mar 1951; TAMU. **LIBERTY**: ½ mi E Hull; 19-25 Jul, 8 Aug 1972; P.H. Thompson; TAMU. **MADISON**: 17 Jul 1932; H.J. Reinhard; TAMU. **NACOGDOCHES**: Jul 1965; M. King; "at light"; SFASU. **ORANGE**: Beaumont; 5 Jun (Stone, 1938). **RED RIVER**: Clarksville; Jul 1965; M. Meisch; PU. **SAN PATRICIO**: Welder Wildlife Ref; 22 Jun 1990; I.W. Johnson; WWRC. **TYLER**: Fred; 15 May 1950; TAMU. 16 May 1950, Aug 1952; McGregor; TAMU. **VICTORIA**: 12 mi NE Victoria; 10, 17, 19, 24, 31 July 1974; R.R. Blume & P.H. Thompson; TAMU.

Tabanus dorsifer Walker

Tabanus dorsifer Walker 1850: 273

Tabanus intensivus Townsend 1897: 93

Tabanus hyalinipennis Hine 1903a: 244

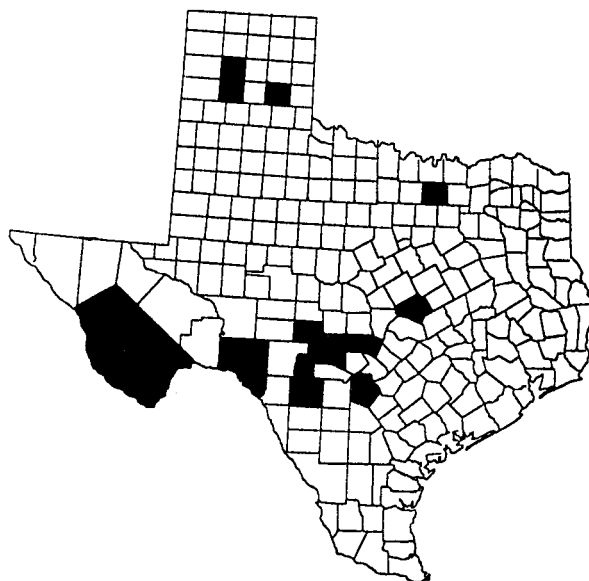
Tabanus monilus Philip 1968: 382

Moderate (14 mm); blackish brown with white pattern; frons about 4-4½ times as high as wide basally, widened above; basal callus square, dull reddish brown to black, united with spindle-shaped black median callus; thorax dark with pale reddish longitudinal stripes; scutellum dark along edges, reddish basally; abdomen black with a white spot beneath the scutellum, small paired sublateral white spots on tergites 2 - 4, those on second tergite prominent, a white median triangle on tergite 3 and a larger white median triangle on tergite 4; wing entirely hyaline, venation normal. Male with large and small facets of eye markedly distinct; coloration essentially like female.

Comments: This species is known from the northern neotropics from Belize northward into the southwestern United States from Arizona to Texas (McGregor and Schomberg 1952; Philip 1947, 1965; Stone 1938). It has been collected from numerous but scattered locations in Texas. The scattered collections may reflect a lack of collecting rather than an accurate distributional picture. The larval habitat may also be a factor. Burger (1977) reported collecting larvae from beneath coarse gravel in stream beds, more commonly in areas where stream flow is rapid. The senior author has collected larvae in similar areas at several sites in Texas.

Known Distribution (Map 73): **BELL**: Belton; 23 Apr 1972; collector unknown; TAMU. **BEXAR**: Geronimo Cr nr TX16 & FR37; Jan-Mar 1975 (as larvae); J. T. Goodwin; FSCA. **BLANCO**: Pedernales Falls St Pk. 5, 24 May 1985; John E. Rawlins; CM. **BREWSTER**: Oak Spring, Big Bend Nat Pk; Feb 1975 (as larvae); J. T. Goodwin; FSCA. Independence Cr; 30 May 1980; Brent Waver; SRSU. Elephant Mt St Game Mngt Area, 48 km S Alpine, 1220m, along Calamity Cr; 21 May 1993; Gelhaus, Nelson & Koenig; ANSP. Big Bend Nat Pk, Chisos Mts, Oak Spr, 1189m; 1 Jun 1993; Gelhaus, Nelson & Koenig; ANSP. **CROCKETT**: Live Oak Cr at US290; Feb 1975 (as larvae); J. T. Goodwin; FSCA. **DENTON**: Denton; 23 Apr 1933; TAMU. **DONLEY**: Clarendon; 13 Sep 1981; J. Lindley; TTU. **GILLESPIE**: Aug 1967, Aug 1968; H. Borcher; FSCA. **JEFF DAVIS**: 2 mi NW Ft Davis; 10 Sep 1971; at black light, 5100 ft; K.W. Brown; PMNH. 7 Jun 1974; D.E. Foster & J.V. Moody; TTU. W Ft Davis on SR 118, Limpa Canyon; 17 Aug 1974; H. Greenbaum; TAMU. **KERR**: Kerrville; 5 Nov 1964, 13, Jul 1966, 23 Jun 1969; R. R. Blume; USDA. Kerrville; 9, 15, 18, 29 Jul 1966; R.R. Blume; TAMU. Kerrville; 19 Aug 1968; W.F. Chamberlain; TAMU. **KIMBLE**: Texas Tech U Ctr,

Junction; 6-17 Aug 1973, N. Nichols, TTU. 23 Oct 1974; J.L. Robbins; TTU. Texas Tech Univ Ctr, Junction; 20 Oct 1982; Gerik; TTU. **POTTER-RANDALL**: Amarillo; 9 Aug 1978; G. Wuruh; GSU. **PRESIDIO**: Shafter; 13 Aug 1969; Board & Hafernik; TAMU. **REAL**: Rio Frio; 10 Aug 1960; H.R. Burke; TAMU. 5-9 June 1982; G.B. Fairchild; FSCA. **UVALDE**: Uvalde; 26 May 1939; C.L. Dednier; FSCA. 15 May (Stone, 1938). **VAL VERDE**: Juno; 19 May 1974; J.L. Robbins; TTU. Devils R, Dolan Falls; 14 Aug, 17, 18 Sep 93; 16, 17-24 Oct 1993; C.R. Nelson, S. M. Stringer, K.A. Taylor, S. Thomas, & K.D. Alexander; UTAU.



Map 73. Counties of Collection: *Tabanus dorsifer*.

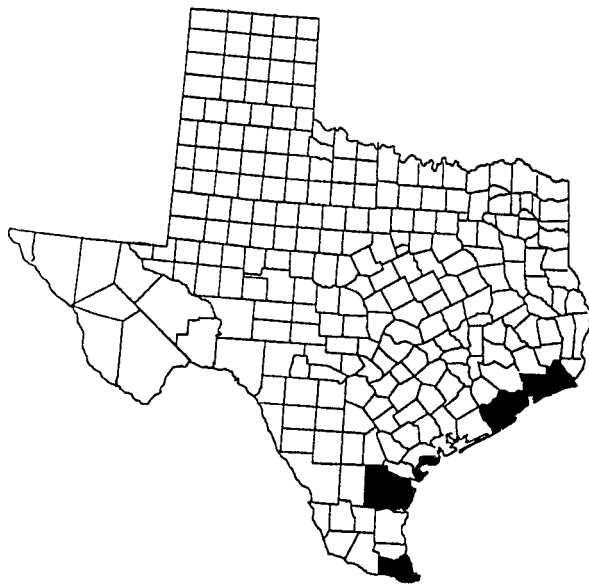
Tabanus eadsi Philip

Tabanus eadsi Philip 1962: 171

Moderate (11 mm); yellowish and brown; frons about 3 to 3½ times as high as wide basally; basal callus dark brown to black, more or less quadrate, united or separated from median callus; thorax yellowish, without stripes; abdomen brownish with a middorsal pale stripe and two submedian stripes, first three tergites yellowish laterally; wing hyaline, costal cell brownish. Male with large and small facets of eyes sharply differentiated; eyes bare.

Comments: This species is known from the coastal areas of Texas (Philip 1962, 1965; Thompson and Krauter 1978) and Louisiana. The immature stages are not known.

Known Distribution (Map 74, p. 103): **ARANSAS**: 19 Jul 1960; TAMU. Goose Island St. Pk.; 10 May 1964; L.L. Pechuman; CU. **BRAZORIA**: West Bay; 18 Jun 1971; P.H. Thompson; TAMU. West Bay, 12 mi S Danbury; 2, 15 Jul 1971; P.H. Thompson; TAMU. Haskens Mound; 25 Aug - 29 Sep; P. H. Thompson; TAMU. 11 mi E Angleton; 17, 22, 26, 29 Aug, 2, 9 Sep 1971; P.H. Thompson; TAMU. 2 Sep 1971; B. Walsh, TAMU. 11 mi E Angleton; 14 Jun 1972; L. Meeks; TAMU. 11 mi E Angleton; 21, 22, 26 Aug 1972; B.J. Bade; TAMU. **CAMERON**: Padre Is; 7 May 1964; L.L. Pechuman; CU. Boca Chica; 14 Jun 1969; Board & Hafernik; TAMU. **CHAMBERS**: 7 May 1964; L.L. Pechuman; FSCA. 17 Apr 1965; Eads; FSCA. 24 Apr 1966, 24 Apr 1967; H.R. Hermann; FSCA.



Map 74. Counties of collection: *Tabanus eadsi*.

GALVESTON: Galveston; May; F.H. Snow; LACM. Galveston; 13 May 1961, 5 May 1968; W.W. Gibson; on beach; SFASU. Galveston; 1961; A.L. Melander; TAMU. Galveston; 10, 11 May 1964; L.L. Pechuman; swept from vegetation, CU. 10 May 1964; Gilkrist; CU. 11 May 1964; L.L. Pechuman; CU. 5 May 1968; W.W. Gibson; SFASU. **JEFFERSON & CHAMBERS:** Beach, 17 mi W Sabine Pass; 6 May 1958; H.E. Evans & Flint; paratype male; CU. Sabine Pass; 16 May 1976; M. Turell; CU. **JIM WELLS:** 17 Jul 1969; J. Snelgrove; CBP. **KLEBERG:** Kingsville; student collection; CU. **NUECES:** Padre Is Nat Seashore; A.R. Ortez; TAMU.

Tabanus equalis Hine

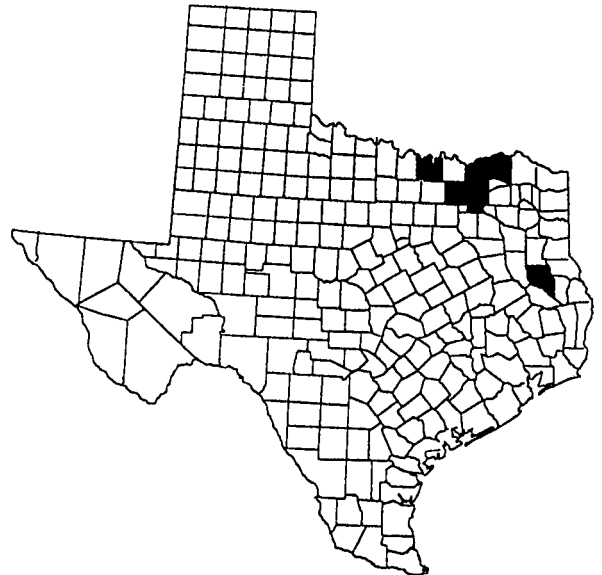
Tabanus uniformis Hine 1917: 270 (preoccupied Ricardo 1911)

Tabanus equalis Hine 1923: 205 (new name for *uniformis* Hine)

Moderate to large (19 mm); brown with grayish pattern; basal callus reddish brown, rather broadly connected to wide elongate median callus of same color; frons moderate in width, about 4½ times as high as wide basally, widened above; abdomen reddish brown with a median row of distinct grayish triangles; wings hyaline, bifurcation of vein R₄₊₅ and crossveins faintly margined with brown, costal cell not darkened; eyes bare. Male with large and small eye facets sharply differentiated; eyes bare.

Comments: This species is known from the central United States from eastern Texas (McGregor and Schomberg 1952, Philip 1965) and Louisiana northward into Iowa, Illinois and Indiana, reaching western limits in mid-Oklahoma and mid-Kansas and eastern limits in eastern Mississippi, and the western halves of Tennessee and Kentucky. The immature stages are not known.

Known Distribution (Map 75); COLLIN & HUNT: Merit; 9 Jun 1950; V.M. Potts; UC. **COOKE:** Gainesville; 1 Jun 1974; J. Blenn; GSU. **FANNIN:** Bonham; summer 1975; J.B. Tucker; TAMU. **HUNT:** Greenville; 10 Jun 1935; TAMU. **LAMAR:** Paris; F.C. Bishopp; TAMU. **NACOGDOCHES:** 27 May 196; C. Adams; SFASU.



Map 75. Counties of Collection: *Tabanus equalis*.

Tabanus erythraeus (Bigot)

Tabanus erythraeus (Bigot) 1892: 661

Moderate (14 mm); yellowish brown to black; frons 3½ to 4 times as high as wide basally, hardly widened above; basal callus orange to orange brown, narrowed above and rather broadly joined to narrow median callus; scape of antenna greatly enlarged dorsally, extending hoodlike over pedicel and base of basal plate; scape, pedicel and extreme base of plate orange to orange brown, remainder of antenna black; thorax dark gray with lighter longitudinal lines; abdomen orange brown to black, with large median triangles and sublateral patches on tergites 2 to 6; wings hyaline, sometimes with a faint trace of infuscation at bifurcation of vein R₄₊₅. Male with eyes sparsely pilose, large and small facets poorly differentiated; thorax rather densely haired, but coloration similar to female.

Comments: This has been reported as a montane species of New Mexico, Arizona and northern Mexico. However, the Texas locality noted below is low, rolling hills of central Texas. The single specimen available was previously reported from Texas (Thompson 1977) as *eurycerus*. The authors are not convinced that the specimen is *erythraeus*, but it is closer to that species than to *T. eurycerus*. The immature stages are not known.



Map 76. Counties of collection: *Tabanus erythraeus*.

Known Distribution (Map 76): BRAZOS: Mile Dr, S College Station; 20 Jul 1975; P.H. Thompson; TAMU.

***Tabanus fairchildi* Stone**

Tabanus fairchildi Stone 1938: 63

Moderate (14 mm); blackish brown with grayish white pattern; basal callus dark brown to black, distinctly connected to rather short broad median callus; frons moderately broad, 3½ to 4 times as high as wide basally, widened above; antennae black, basal segment swollen above; abdomen blackish with three rows of grayish white spots; wings hyaline; eyes bare or with short sparse hairs. Male with large and small eye facets but these not sharply differentiated.

Comments: This species has not been collected in Texas. It is known from most of the eastern ½ of the United States and areas of southern Canada from as far west as central Kansas and western Arkansas and Louisiana. However, it has not been reported from the more coastal counties of the states along the Atlantic nor from Florida outside the panhandle area. Teskey (1969) reported collecting larvae from under stones and gravel in riffle areas of a stream. Tidwell (1973) reported finding larvae beneath a layer of moss covering a partially submerged log in a beaver dam. The senior author has collected a great many larvae from riffle areas of streams and small rivers in several southeastern states.

***Tabanus fulvulus* Wiedemann**

Tabanus fulvulus Wiedemann 1828: 153
Tabanus fulvofrater Walker 1848: 181
Tabanus mutatus Walker 1850: 23

Moderate (14 mm); yellowish to orange; basal callus dark brown to black, higher than wide, usually not connected to elongate oval median callus; frons narrow, 5 to 6 times as high as wide basally, nearly parallel-sided; basal plate of third antennal segment orange, annuli black; thorax without obvious pattern; abdomen with a median row of contiguous yellow triangles and sublateral spots; eyes bare. Male with large and small facets but these not distinctly differentiated; eyes bare.

Comments: This species has not been reported from Texas. It has been collected from most of the southeastern ⅔ of the United States extending northward into Wisconsin, Illinois, Indiana, Ohio and across to southern New York and westward into eastern Kansas and Oklahoma, most of Louisiana and into southern Florida. Tidwell and Tidwell (1973) reported collecting larvae from well-drained soil of a mixed pine-hardwood forest.

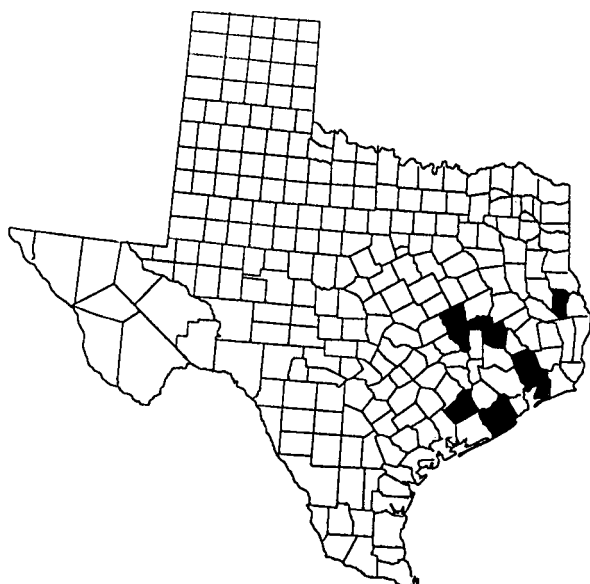
***Tabanus fuscicostatus* Hine**

Tabanus fuscicostatus Hine 1906: 24

Small (11.5 mm); brown with yellowish pattern; basal callus yellowish brown, square or slightly higher than wide, usually not connected to small oval median callus; frons moderately broad, 3½ to a little more than 4 times as high as wide basally, nearly parallel-sided; thorax dark brown, usually with paler longitudinal stripes; abdomen dark brown with a parallel-sided median yellowish stripe and usually small faint sublateral spots; wings hyaline, costal cell brown; eyes bare. Male with large and small facets of eyes sharply differentiated; eyes bare; body pattern essentially like female but darker areas are much paler, especially abdomen and legs.

Comments: This species has been reported from most of the southern ½ of the eastern United States from Kansas, Oklahoma and Texas (McGregor and Schomberg 1952; Philip 1947, 1965; Thompson 1973b, 1974a and b, 1975b, 1977) in the west to the Atlantic coast. The immature stages are not known.

Known Distribution (Map 77, p. 105): BRAZORIA: Alvin; 28-30 Jun 1965; H.E. Evans; CU. 11 mi E Angleton; 1 Oct 1973; P.H. Thompson; TAMU. **BRAZOS:** Mile Dr, S College Station; 7 Jul 1975; P.H. Thompson; TAMU. **CHAMBERS:** Double Bayou, 6 Jun 1975; J.S. Ashe & M.L. Whitcomb; TAMU. **GRIMES:** Navasota R & FM 2038; 15 Jun 1971, 8, 30 May, 5, 12, 13, 19 Jun, 1, 7, 14, 21 Aug 1972, 3 Jun 1973, 7, 14 Jun 1974; 7, 16, 19, 21, 26 May, 9, 12 Jun. 4, 11, 21, 22, 23 Jul 1975; P.H. Thompson; TAMU. **LIBERTY:** 16 mi ESE Cleveland FM 162; 10, 31 May, 2, 7, 14, 21, 28 Jun, 19, 25, 26 Jul, 2, 7, 8, 11, 16 Aug, 3 Sep 1972, 26 Apr, 10, 29 May 1973; P.H. Thompson; TAMU. **ROBERTSON:** FM 1940 3.3 mi N jct OSR; 10 Jul 1981; sweeping *Cassia* spp.; S.J. Merritt; TAMU. **SAN AUGUSTINE:** 12 Jun 1963; W.W. Gibson; CU. **WALKER:** Huntsville St Pk; 16 Jun - 8 Sep; P.H. Thompson; TAMU. **WHARTON:** 7, 8, 2-9 Aug 1969; R.R. Blume; TAMU.



Map 77. Counties of Collection: *Tabanus fuscicostatus*.

***Tabanus gilanus* Townsend**

Tabanus gilanus Townsend 1897: 92

Moderate (14 mm); blackish with grayish pattern; frons 3 to 3½ times as high as wide basally, widened above; basal callus shiny chestnut brown to black, subquadrate to rounded, somewhat protuberant, narrowly joined to the irregular, subshiny, black, median callus; subcallus predominantly denuded, yellowish brown; thorax blackish with narrow grayish longitudinal stripes; abdomen blackish with three rows of pale grayish spots, the medians triangular, the sublaterals larger and oblique; wing hyaline, venation normal; eye pilose, the hairs short. Male with large and small facets but the areas of each not sharply differentiated; eyes pilose; coloration essentially like female.

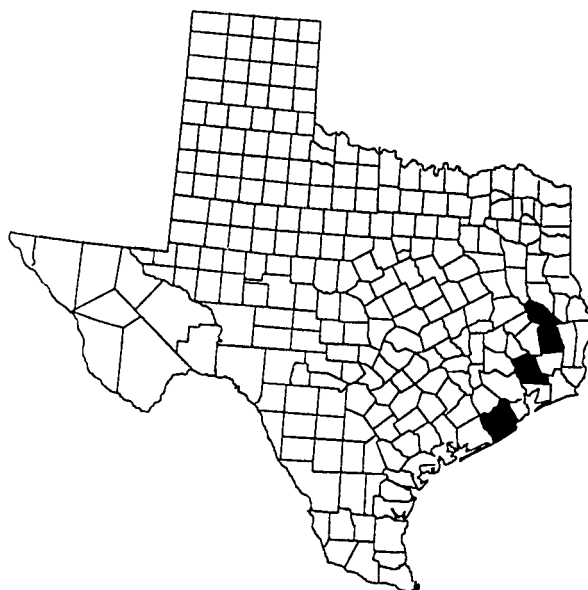
Comments: This species has been collected from Colorado and Nebraska southward through southwestern Texas (Philip 1965), New Mexico and Arizona into northern Mexico. No specimens of this species from Texas have been seen by us, and we have been unable to find any specific collection records for Texas. Burger (1977) reported collecting larvae in both terrestrial and aquatic habitats, the terrestrial specimens taken from damp forest loam beneath a large log on a well-drained hillside in mixed evergreen oak/deciduous hardwood forest and the aquatic larvae from the margins of small streams and, most commonly, from moist soil adjacent to springs in deciduous hardwood and mixed hardwood-coniferous forest communities.

***Tabanus gladiator* Stone**

Tabanus gladiator Stone 1935: 12

Large (23 mm); predominantly orange brown; basal callus brown, narrowly connected to long slender attenuate median callus; frons slender, about 6 times as high as wide basally, very slightly widened above; second palpal segment very long and slender; thorax with a lavender cast; abdomen orange brown, sometimes with dark median anterior spots and pale posterior triangles on some tergites; wings tinted yellowish brown, bifurcation of vein R₄₊₅ and crossveins margined in darker brown; costal cell brown; cell r₅ nearly closed; eyes bare. Male with large eye facets only slightly larger than small eye facets, not sharply differentiated; eyes bare.

Comments: This species occupies a predominantly southern range in the United States south of a line from eastern Texas (McGregor and Schomberg 1952; Philip 1965; Thompson 1974b) to southern New Jersey with a narrow northward extension along both sides of the Mississippi River into southeastern Missouri and southwestern Kentucky. Goodwin (1973b) reported collecting larvae from the upper inch of mud and debris at the margins of ponds and lakes.



Map 78. Counties of collection: *Tabanus gladiator*.

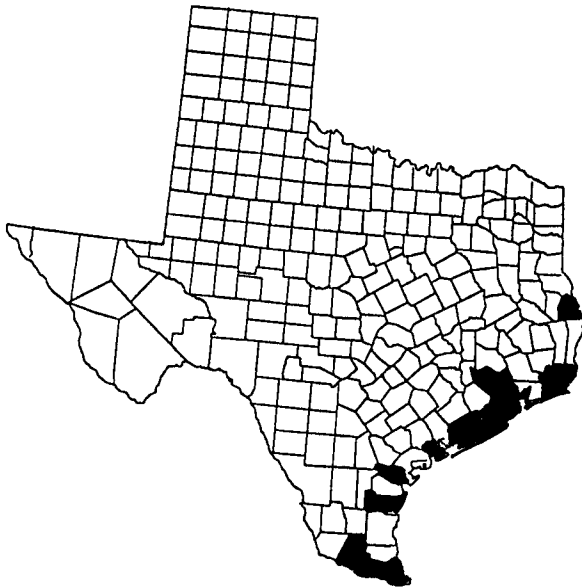
Known Distribution (Map 78): ANGELINA: Boykin Spr Cpgd, Angelina Nat For, 20 mi NW Jasper; 10 Oct 1994; malaise trap; J.C. Abbott and J.W. Chirhart; JTG. BRAZORIA: 7.5 mi S Angleton, Mickey Clement Farm; 5 Jun 1975; at light; M.L. Holcomb & J.S. Ashe; TAMU. LIBERTY: 16 mi ESE Cleveland, FM 162; 30 Aug 1972; P.H. Thompson; TAMU. TYLER: Fred; 16 May 1950; TAMU. 2 mi E Fred, FM1943; 8 Aug 1972; P.H. Thompson; TAMU.

Tabanus hinellus Philip

Tabanus lineola variety *hinellus* Philip 1960: 366

Moderate (13 mm); yellowish brown with grayish white abdominal pattern; frons 4 to 4½ times as high as wide, widened above; basal callus black, a little higher than wide, touching or narrowly separated from eyes, narrowly united or separated from slender concolorous median callus; abdomen brownish with parallel-sided median grayish white stripe and similarly colored irregular sublateral stripes; wings hyaline. Male with large and small facets of eyes sharply differentiated, eyes bare; otherwise similar to female.

Comments: This species has been collected from coastal areas of Texas (Goodwin 1987; Thompson 1973a; Thompson and Krauter 1978), Louisiana and Mississippi. Goodwin (1987) reported collecting larvae of this species from wet mud at the margin of a brackish pool about 300 meters inland from the coast of the Gulf of Mexico.



Map 78. Counties of collection: *Tabanus hinellus*.

Known Distribution (Map 78): **BRAZORIA:** 12 mi S Danbury, West Bay; 29 Jun 1971; P.H. Thompson; TAMU. **CALHOUN:** Port Lavaca; 4-6 Jul 1954; Glick & Smith; INHM. **CAMERON:** Pt Isabel; 22 Jun 1948; S.S. Robock; female at light on beach; INHM. Brownsville; 15 Sep 1950; T.F. Beunter; LLP. 9 mi E Brownsville; 30 Jun 1961; R.L. Westcott; LACM. Brownsville; 11 Jul 1967; J.W. Tilden; SJ. Oct. 1967; P.C. Harmston; FSCA. South Padre Is; reared 1976; J.T. Goodwin; males and females; FSCA. 31 May - 3 Jun 1980; G.B. Fairchild; FSCA. Roadside Pool, 3 mi N South Padre Island; 2 Apr 1994 (as larva); J.T. Goodwin; JTG. **GALVESTON:** Galveston; May; F.H. Snow; LACM. Texas City; 24 Sep 1962; W.W. Gibson; SFASU. Texas City; 24 Sep 1962; N. Nichols; SFASU. Gilchrist; 11 May 1964; L.L. Pechuman; CU. **HARRIS:** Seabrook; 19 Aug 1970; W.W. Gibson; at electric light; SFASU. **HIDALGO:** Benson St Pk; 20-24 May 1974; A.E. & D.S. Lewis; CU. **JEFFERSON:** beach, 1.7 mi W Sabine Pass; 10-12 Jun 1956; Elane & Mathews; CU. 8 Jun 1963; W.W. Gibson; SFASU. 8 Jun 1963; N. Nichols; on tree; SFASU. Sabine Pass; 11 May 1964; L.L. Pechuman; CU. 21 May 1971; D. Castlamer; SJ.

Sabine Pass; 16 May, 1 Aug 1976; M. Turell; CU. **KLEBERG:** Baffin Bay; 18 Jun 1963; B. McDaniel; CU. Kingsville; 5 Apr 1964; student collection; CU. **MATAGORDA:** 8 May 1959; R.H. Roberts; FSCA. Palacios; 10 May 1964; L.L. Pechuman; CU. **ORANGE:** 21 Jun 1917; Sim; CU. **SABINE:** Sabine Pass; 24 Jul 1942; E.S. Hathaway; FSCA. Milam; 29 Jun 1960; W.W. Gibson; SFASU. 29 Jul 1960; N. Nichols; SFASU. **SAN PATRICIO:** Naval Air Sta at Corpus Christi; 1 Jul 1943; W.W. Gorden; CU. 23 Nov 1968; UTA. Corpus Christi; 27 Jun 1969; B. Wright; HA.

Tabanus imitans Walker

Tabanus imitans Walker 1848: 146

Large (22 mm); dark reddish brown; frons nearly parallel-sided, 3 to 4 times as high as wide basally; basal callus brown, a little higher than wide, rounded above, narrowly united to slender elongate median callus; abdomen dark reddish brown with a median row of small pale white triangles; wings hyaline, costal cell dark brown, bifurcation of vein R_{4+5} and crossveins margined in brown; cell r_5 somewhat narrowed; eyes bare. Male with large and small eye facets sharply differentiated; eyes bare.

Comments: This species has been collected from the southeastern coastal states from Texas (McGregor and Schomberg 1952; Philip 1965) to North Carolina. McGregor and Schomberg (1952) and Philip (1965) report Texas in the species distribution, but neither provide specific locality information. Goodwin (1976b) reported collecting three larvae, two from sphagnum moss at the margin of a lake and one from moist soil about 0.5 m from the edge of the same lake, the last larva at a depth of about 25 cm.



Map 79. Counties of collection: *Tabanus imitans*.

Known Distribution (Map 79): **TYLER:** Fred; June 1952; McGregor; TAMU. 16-23 May 1950; TAMU.

Tabanus laticornis Hine

Tabanus laticornis Hine 1904b: 239

Moderate (14.5 mm); blackish with considerable orange at sides of abdomen; frons about 3½ times as high as wide basally, widened above; basal callus shiny black, somewhat oval to subquadrate, widely separated from eyes, narrowly joined to lanceolate median callus; small denuded patch above, but no ocellar tubercle; thorax dull black without distinct pattern; abdomen predominantly black but with a faint line of median yellowish triangles and tergites 1 to 4 broadly orange to orange-brown laterally; wing hyaline, costal cell yellow. Male with large and small facets distinctly differentiated, eyes densely pilose; coloration and pattern essentially like female.

Comments: This species has not been collected in Texas. It has been reported from northern Mexico, Arizona and New Mexico. Burger, *et al* (1987) considered this a montane species. If present in Texas, it is likely to be found only in the mountains of west Texas. Burger (1977) reported collecting larvae of this species from wet mud along the margins of streams.

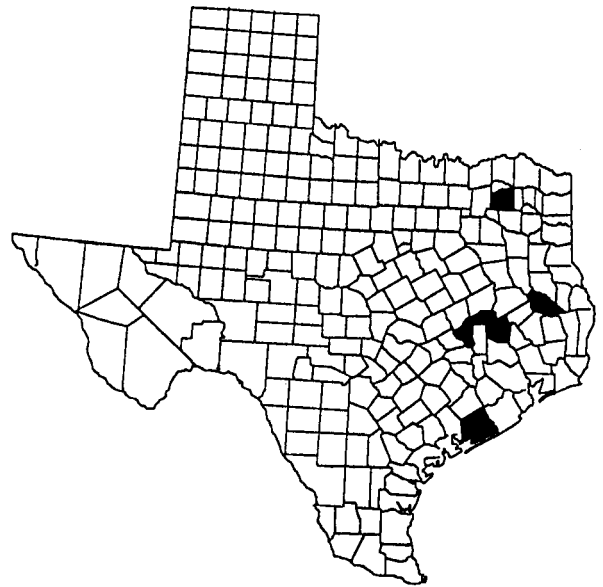
Tabanus limbatinevris Macquart

Tabanus limbatinevris Macquart 1847: 32 (1847: 16)

Moderate to large (17 mm); brown with grayish white pattern; basal callus brown to black, higher than wide, rounded above, narrowly united with slender median callus; frons narrow, usually 5-6 times as high as wide basally, parallel-sided to a little widened above; abdomen brown with pale hind and side margins on tergites and a row of distinct median triangles on tergites 2 - 6, these equilateral to a little longer than broad; wing predominantly hyaline but with distinct brown spots on crossveins and bifurcation of vein R₄₊₅, costal cell brown, veins margined a paler brown than spots on crossveins; cell r₅ at a minimum greatly narrowed, usually closed and often petiolate. Male with large and small eye facets sharply differentiated; otherwise like female except pattern somewhat darker and cell r₅ usually narrowed but rarely closed or petiolate.

Comments: This species has been collected from the southern two-thirds of the eastern half of the United States, excluding southeastern Alabama and South Carolina, the southern half of Georgia and all of Florida, as far west as eastern Kansas and Texas and northward to the southern Great Lakes with extensions farther north in Michigan and along the east coast into southern New Hampshire and Vermont. Goodwin (1973b) reported collecting larvae of this species (as *T. abdominalis*) from the upper 5 cm of mud at the margin of a slough in mixed bottomland hardwood forest. Teskey (1969) reported collecting larvae (as *T. sulcifrons*) from wet grassy banks of a shallow drainage

ditch that traversed a predominantly maple woodlot.



Map 80. Counties of collection: *Tabanus limbatinevris*.

Known Distribution (Map 80): ANGELINA: 14 Jul 1969; J. Sheppard; TTU. BRAZOS: 23 Sep 1977; R. R. Blume; TAMU. GRIMES: Navasota R at FM2038; 28 Jul 1971, 10 Apr 1972, 19 Jun 1974, 8 Aug 1975; P. H. Thompson; TAMU. HOPKINS: 22 mi W Saltillo; J.T. Goodwin; reared #2495, June 1974; FSCA. MATAGORDA: 4 Jul 1959; R.H. Roberts; FSCA. WALKER: Huntsville St Pk; 1, 23 Aug 1972; P. H. Thompson; TAMU.

Tabanus lineola Fabricius

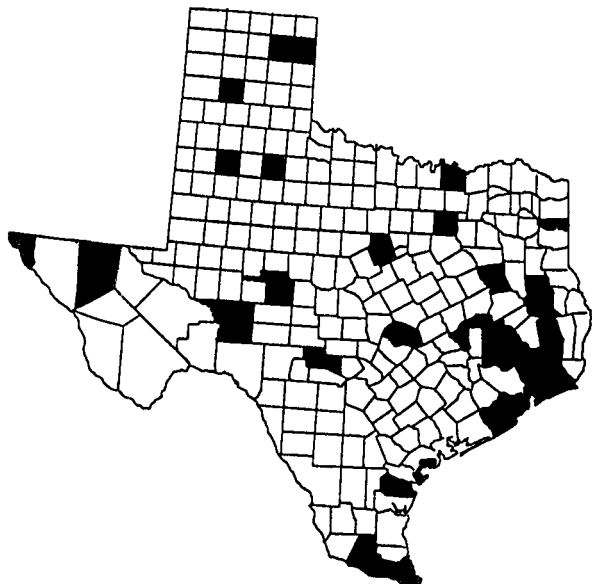
Tabanus lineola Fabricius 1794: 369

Tabanus quinque maculatus (error for *quinquevittatus*)
Wiedemann of Hine 1904c: 58

Moderate (13 mm); dark brown to black with grayish white pattern; basal callus dark brown to black, higher than wide, rounded above, narrowly united to slender elongate median callus; frons narrow, generally 5 to 6 times as high as wide basally, distinctly widened above; abdomen blackish with a parallel-sided white median stripe and white sublateral spots that are usually united to form irregular sublateral stripes; wings hyaline; scutellum entirely dark; hind femora predominantly dark; eyes bare. Male with large and small eye facets sharply differentiated; eyes bare.

Comments: This species is known from the entire eastern half of the United States and southern Canada as far west as eastern Kansas, Oklahoma and Texas (McGregor and Schomberg 1952; Philip 1965; Thompson 1973a and b, 1974a and b, 1975b, 1977; Thompson *et al.* 1978), and extends southward into northeastern Mexico. Larvae of this species have been collected from a wide variety of habitats including mud at the margins of ponds and lakes, wooded swamps and alder swamps, sphagnum bogs, beneath the bark of logs in or near the margins of ponds or streams,

moist forest soils, intermittently flooded ditches and moist pasture sod (Teskey 1969; Tidwell 1973). The senior author has collected many larvae from habitats like those identified above in several of the southeastern states.



Map 81. Counties of collection: *Tabanus lineola*.

Known Distribution (Map 81): ARANSAS: Aransas Wildlife Ref; 2 Aug 1971; L. Meek; TAMU. ANDERSON: Salmon; 1-15 May 1974; 17 May - 6 Jun 1975; modified malaise trap; H.R. Burke; TAMU. 10 mi SW Elkhart; 5-6 Jun 1976; H.R. Burke; TAMU. ANGELINA: 6 Jun 1969; J. Sheppard; TTU. BRAZORIA: 11 mi E Angleton; 29, 31 Jul, 2, 4, 9, 14, 16, 18, 21, 23, 25, 28 Aug, 1, 4, 6, 8, 11, 13, 18, 22, 24, 29 Sep, 5, 7, 10, 12, 17, 26 Oct 1967; 6, 8, 10, 13, 15, 20, 24, 29, 31 May, 5, 10, 12, 14, 17, 19, 24, 26, 28 Jun, 1, 5, 8, 10, 15, 17, 19, 21, 23, 31 Jul, 5, 7, 12, 14, 21, 26, 30 Aug, 1, 6, 9, 20, 27 Sep, 4, 7, 14, 16, 18, 25, 28, 30 Oct, 1 Nov 1968, 22, 28, 30 Apr, 2, 12, 16, 19, 21, 23, 26, 28, 30 May, 2, 4, 6, 11, 13, 25, 27, 30 Jun, 7, 9, 14, 21, 28, 30 Jul, 1, 4, 6, 8, 11, 13, 15, 18, 27 Aug, 2, 5, 15, 17, 19, 26, 29 Sep, 8, 13 Oct 1969; 19 Apr, 7, 17, 26 May, 17, 18, 24 Jun, 1, 8, 15, 22, 29 Jul, 11, 12, 15, 26 Aug, 2, 7, 9, 16, 22, 29 Sep 1971, 27 Jul, 16, 17, 22 Aug 1972 malaise trap; P. H. Thompson; TAMU. 12 mi W Danbury; 13-15 Aug 1970; TAMU. 24 Jun 1971; P.H. Thompson; TAMU. 2 Sep 1971; B. Walsh; TAMU. BRAZOS: 10 Oct 1917, 11 Apr 1918, 10 Jul 1919, 13 Apr 1920, 19 Jun 1930, 19 Apr 1941, 24 Apr 1943, 9 May 1943, 14, 21 May 1944, 10 Jun 1950; H.J. Reinhard; TAMU. Mile Dr, S College Station; 11 Jun 1974, 19 Jul 1975, 31 Aug 1977; P.H. Thompson; TAMU. CAMERON: Brownsville; 20-22 Jun 1969; light trap; P.L. Clark; TAMU. Brownsville, Las Palomas Resv; 22 Jun 1969; Board & Hafernik; TAMU. Brownsville; 17-18 Aug 1971; R.R. Murray & M.E. Murray; TAMU. Brownsville; 23 Aug 1972; S. Tucker; TAMU. CHAMBERS: Double Bayou; 6 Jun 1975; at light; J.S. Ashe & M.L. Holcomb; TAMU. CROCKETT: 14 Aug 1982; Thompson; TTU. CULBERSON: Guadalupe Mts Nat Pk, Pine Sp Cpgd; 23 Jul 83; C.B. Barr; LSU. DALLAS: Dallas; 20 Apr 1950; TAMU. DICKENS: Spur; 11 Sep 1935; TAMU. EL PASO: TAES; 29 Jul 1977; light trap; C.R. Burgess; TAMU. ERATH: 5 mi N Stephenville; 1-6 Jun 1980; P.T. Riherd; malaise trap; TAMU. GALVESTON: Galveston; 15 Oct (Stone, 1938). GRAYSON: Denison; 26 Jun 1930; J.N. Roney; TAMU. GRIMES: Navasota R at FM 2038; 28 May, 22 Jun 1971, 24 Apr, 8 May, 5 Jun, 17 Jul 1972, 7, 14 Jun 1974, 5, 7, 19 May, 7, 18, 23, 30 Jun, 11, 16 Jul 1975; P.H. Thompson; TAMU. HARDIN: 3 mi NE Kountz FM 418; 3 May, 30 Aug 1972; P.H. Thompson; TAMU. HEMPHILL: 23 Jun 1970; N. Nichols; at black light; TTU. HIDALGO: Weslaco; 1928; S.W. Clark;

TAMU. Donna; Apr, 7 May, 1, 11 Jun, 12, 15 Oct 1933; J.W. Monk; TAMU. JEFFERSON: Beaumont; 20 Apr 1932; TAMU. Pleasure Is; 15 Jun 1972; D. McLean; TAMU. KERR: Kerrville; 3, 4 Jun 1968; R.R. Blume & P.H. Thompson; TAMU. LIBERTY: ½ mi E Hull; 2, 26 Apr, 3, 10, 17 May, 7, 14, 21, 28 Jun, 8, 19, 21, 30 Aug, 13, 20 Sep 1972; P.H. Thompson; TAMU. LUBBOCK: 8 Oct 1968; C.E. Carton; TTU. MARIÓN: 2 mi N Jefferson; 4 Jul 1993; J. T. Goodwin; JTG. MONTGOMERY: Jones St For, 8 mi Conroe; 12 Sep 1987; Wharton, Wang & Praetorius; TAMU. NACOGDOCHES: 16 May 1960. 19 May 1963; N. Nichols; SFASU. 19 May 1967; L.A. Geist; SFASU. NUECES: Corpus Christi; 10 Oct 75; A. Overton; UTAU. RANDALL: Palo Duro Canyon, Canyon; 11 Jun 1967; D. Brooks; WTAM. ROBERTS: Miami, 3 mi N Roberts; 26 Aug 1968; D. Bennett & R. Kirby; with Coleman lantern; TTU. SAN JACINTO: Sam Houston Nat For, Big Creek; 12 May 1985; D. Adamski & B. Farmer; MSU. SAN PATRICIO: Aransas Wildlife Ref; 2 Aug 1971; L. Meek; TAMU. TOM GREEN: San Angelo; 8 Aug 1978; W.D. Sisson, O.F. Francke, T.B. Hall, J.V. Moody; TTU. TRAVIS: 7.5 MI nnw Austin; 11 May 1969; B. Vogel; TMM. TYLER: Fred; 30 Jun 1952; McGregor; TAMU. 2 mi E Fred, FM 1943; 10 May 1972; P.H. Thompson; TAMU. Town Bluff Res; 17-18 May, 7-8 June 1975; S.J. Merritt; TAMU. WALKER: Huntsville St Pk; 6, 7, 21 May, 3, 5, 16, 30 Jun, 7, 10, 21, 28 Jul, 17 Aug 1971, 17, 24 Apr, 1, 8 May, 13, 16, 19, 26 Jun, 3, 12 Jul, 14, 15 Aug, 6 Sep 1972; P.H. Thompson; TAMU. Ellis Prison; 25 Jul 1977; modified malaise trap; W.L. Sterling; TAMU. WILLIAMSON: Taylor; 7, 8 Sep 1968; J.E. Hafernik; TAMU.

Tabanus longiusculus Hine

Tabanus longiusculus Hine 1907: 226

Moderate (12.5 mm); dark brown with grayish pattern; frons 4 to 4½ times as high as wide basally, widened above; basal callus orange brown, distinctly higher than wide, typically united with relatively brown oval median callus by a slender line; abdomen predominantly dark brown, paler laterally, with slender median row of grayish contiguous triangles and isolated sublateral spots; wing hyaline, costal cell yellowish; basal plate of third antennal segment about as long as combined length of terminal annuli; eyes bare. Male with large and small eye facets moderately differentiated; eyes bare.

Comments: This species has not been collected in Texas. It has been collected in the southeastern coastal states from Louisiana to Maryland. It is also known from Tennessee. The immature stages are not known.

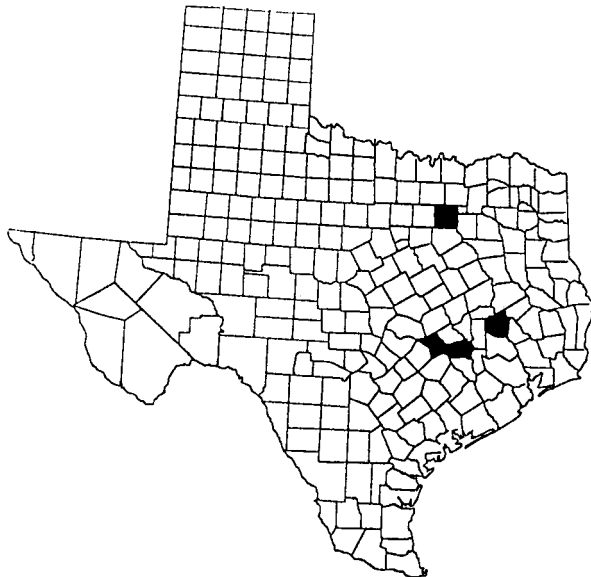
Tabanus longus Osten Sacken

Tabanus longus Osten Sacken 1876: 447

Moderate (14 mm); dark brown with grayish pattern; basal callus subquadrate, yellowish to dark brown, united by a slender line to moderately broad oval median callus; frons moderately wide, about 3½ times as high as wide basally, parallel-sided; abdomen dark brown with a pale grayish median row of contiguous triangles and usually oval isolated yellowish sublateral spots; wings hyaline; third antennal segment slender, with little indication of a tooth on basal plate; eyes bare. Male unknown.

Comments: This rarely collected species has been

reported from most of the eastern 1/2 of the southern United States from Arkansas and Texas (McGregor and Schomberg 1952; Thompson 1973a, 1975b) eastward to the Atlantic and northward into Pennsylvania. The immature stages of this species are not known.



Map 82. Counties of collection: *Tabanus longus*.

Known Distribution (Map 82): DALLAS: Dallas; no date; SMU; TAMU. LEE: Giddings; 5 Aug 1931; TAMU. WALKER: Huntsville St Pk; 25 Aug - 1 Sep 1972; P. H. Thompson; TAMU. WASHINGTON: 18 Aug 1929; D. Isley; TAMU.

***Tabanus maculipennis* Wiedemann**

Tabanus maculipennis Wiedemann 1828: 138
Tabanus imitans variety *excessus* Stone, 1938: 87

Moderate to large (19.5 mm); dark with reddish purple hues; frons about 3 to 3 1/2 times as high as wide basally, nearly parallel-sided; basal callus brown, higher than wide, rounded above, separated from eyes, united with elongate concolorous linear median callus; thorax brown with faint grayish longitudinal stripes; abdomen reddish brown with small median triangles on most tergites; wing hyaline, bifurcation of vein R₄₊₅ and crossveins distinctly margined with brown, costal cell and wing base heavily infuscated. Male with large and small facets of eyes sharply differentiated; dorsal abdominal triangles smaller, but in general similar to female.

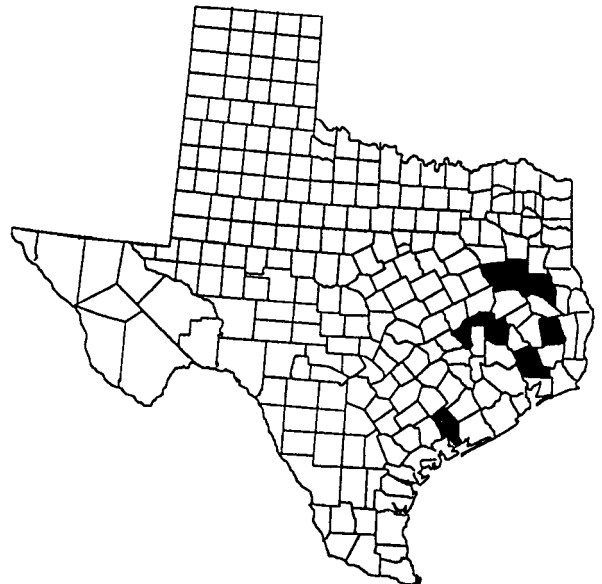
Comments: This species has not been collected in Texas. It has been collected in southeastern coastal states from Louisiana to South Carolina. Tidwell (1973) reported taking larvae from muck along the margin of a cypress swamp in mixed bottomland hardwood forest end along the marginal area of a stream in a longleaf-slash pine region.

***Tabanus melanocerus* Wiedemann**

Tabanus melanocerus Wiedemann 1828: 122

Moderate (17 mm); dark-brown to black with whitish pattern; basal callus dark brown, distinctly higher than wide, narrowly united with slender median callus; frons narrow, generally 5 to 6 times as high as wide basally, very slightly widened above; abdomen with narrow whitish hind margins and a row of distinct whitish median triangles, that of second tergite sometimes narrowly attaining anterior margin; wings hyaline, cell r₅ narrowed, sometimes closed but not petiolate. Male with large and small eye facets sharply differentiated; eyes bare.

Comments: This species is known from the southern 1/2 of the eastern United States from eastern Oklahoma and Texas (Thompson 1973b, 1974a and b, 1977) to the Atlantic and northward in the eastern coastal states to Massachusetts. Teskey (1969) reported collecting larvae from the margins of streams, and Tidwell (1973) reported finding them in small sandy-bottom streams in pine and upland hardwood forests and in a beaver dam. The senior author has frequently collected larvae of this species from wet organic mud at the margins of lakes and forest streams.



Map 83. Counties of collection: *Tabanus melanocerus*.

Known Distribution (Map 83): ANDERSON: Palestine; 10 Aug 1963; W.W. Gibson; at black light; SFASU. BRAZOS: 7 mi S Bryan, Peach Tree; 6, 13 Aug 1970; P.H. Thompson; TAMU. Lk Placid; 21 Jun - 9 Jul 1971; P.H. Thompson; TAMU. Carter Lk; 21 Jun 1971; P.H. Thompson; TAMU. Mile Dr, S College Station; 28 Jun, 3, 5, 13, 24 Aug 1973, 24, 25, 28 May, 1, 4, 7, 11, 17, 21 Jun, 21, 24 Jul, 26, 28, 29 Aug 1974, 3, 8, 12, 15, 17, 22, 23, 24, 29 Jun, 6, 8, 12, 13, 15, 16, 17, 18, 19, 21, 22, 25 Jul, 4, 5, 9, 12, 14, 15 Aug 1975; P.H. Thompson; TAMU. College Station; 21, 26 Jun 1976; P.H. Thompson; TAMU. CHEROKEE: Jacksonville; 25 Jun 1951; TAMU. GRIMES: Navasota R. at FM 2038; 22 Jun 1975; P.H. Thompson; TAMU. JACKSON: Aug 1921; C.D. Duncan; locality with a "?" on the label; UCB. LIBERTY: Hull; 21 Jun -

16 Aug 1972; P. H. Thompson; (Thompson 1974b). **NACOGDOCHES:** 16 Jun 1969; W. Black; at black light; SFASU. 2 Jul 1969; D. West; at black light; SFASU. 21 Jul 1971; N. Nichols; on potatoes; SFASU. **SMITH:** Lindale; 10 Jun 1980; T. Payne; GSU. **TYLER:** Fred; 21 Jun - 16 Aug 1972; P. H. Thompson; (Thompson 1974b). **WALKER:** Huntsville St Pk; 3, 16, 30 Jun, 7, 10, 16, 21 Jul, 1 Sep, 1 Oct 1971; P.H. Thompson; TAMU.

***Tabanus mixis* Philip**

Tabanus molestus subspecies *mixis* Philip 1950b: 241

Moderate to large (18 mm); dark brown to black with grayish white pattern; basal callus brown, slightly higher than wide, rounded above, distinctly united with rather broad elongate median callus; frons rather broad, about 4 to 4½ times as high as wide basally, slightly widened above; genae, pleurae and venter brown haired; thorax dark brown with whitish lines, scutellum whitish; abdomen with narrow pale hind margins, a median row of distinct whitish triangles, that on tergite 2 distinctly smaller than those on tergites 3 and 4; wings nearly hyaline, bifurcation of vein R₄₊₅ and crossveins faintly margined with brown, costal cell brown; eyes bare. Male with large and small eye facets sharply differentiated; eyes bare.

Comments: This species is very similar to *T. molestus* treated below, differing only in the characters used in the keys to species. For many years it has been treated as a variety of *T. molestus*, but the differences used to separate the two forms have proven consistent throughout their ranges. *Tabanus mixis* is reported from the southern half of the eastern United States from Texas (McGregor and Schomberg 1952; Philip 1965; Thompson 1974b) and Arkansas eastward to the Atlantic, except south Florida. The immature stages are not known.



Map 84. Counties of collection: *Tabanus mixis*.

Known Distribution (Map 84): **ANGELINA:** Graham Cr, ca 14 km S of Zavala; 16 May 1993; C.T. Maier; **CTM. TYLER:** Fred, 7 Jun 1972; P. H. Thompson; (Thompson 1974).

***Tabanus moderator* Stone**

Tabanus moderator Stone 1938: 98

Relatively large (19 mm); dark brown with whitish pattern; basal callus orange brown, about twice as high as wide, rounded above, distinctly united with elongate slender median callus; frons narrow, 8 or more times as high as wide basally, distinctly widened above; thorax dark brown with yellowish gray stripes, scutellum white; abdomen with narrow whitish hind margins and a row of broad white median triangles, that of tergite 2 decidedly smaller than those of tergites 3 and 4; wings hyaline to faintly tinted, bifurcation of vein R₄₊₅, crossveins and longitudinal veins margined in pale brown, costal cell pale brown; eyes bare. Male with large and small facets of eyes sharply differentiated; median triangle of tergite 2 reduced; tergites with pale hind margins broader; basic color and pattern similar to female.

Comments: This species has not been collected in Texas. It is known from the southern half of the eastern United States from Arkansas and Louisiana eastward to the Atlantic. The immature stages are not known.

***Tabanus mogollon* Burger**

Tabanus mogollon Burger 1974a: 8

Moderate (14 mm); dark grayish with paler abdominal markings; frons a little more than 3 times as high as wide, a little widened above; basal callus subquadrate, shiny black, narrowly separated from eyes, narrowly joined to concolorous suboval median callus; abdomen dull blackish with grayish pollen, first tergite with a pair of submedian black patches and a median pale spot, remaining tergites with pale median triangles and oblique sublateral dashes both of which usually cross tergites; wings hyaline. Male with large and small facets of eyes only weakly differentiated, eyes densely pilose; middorsal triangles of abdomen narrower and less distinct, but in general similar to female.

Comments: This species has been reported from southern Utah southward through southwestern Texas to Arizona and into northern Mexico. Burger (1977) reported taking larvae of this species from wet mud at the margins of streams and seeps.

Known Distribution (Map 85, p. 111): **JEFF DAVIS:** Davis Mts; 2 Jul 1940; **CAS. SWISHER:** Tulia; 13 Oct 1954; **F.C. HARMSTON;** FSCA.



Map 85. Counties of Collection: *Tabanus mogollon*.

Tabanus molestus Say

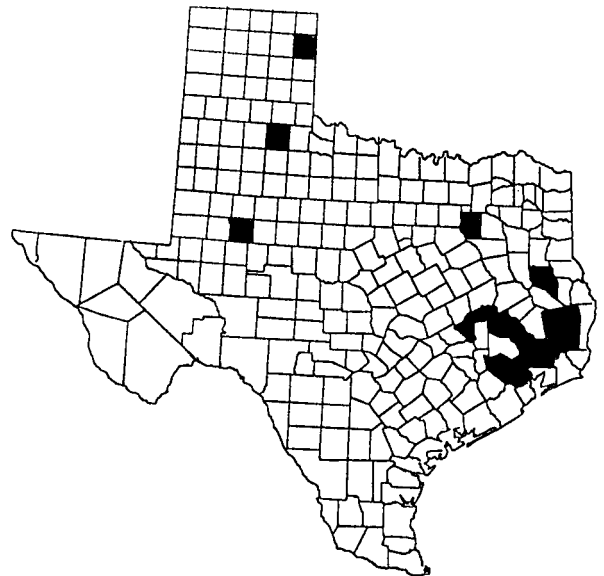
Tabanus molestus Say 1823: 31 (1859: 53)
Atylotus tenessensis Bigot 1892: 660

Moderate (18 mm); dark brown to black with grayish white pattern; basal callus brown, slightly higher than wide, rounded above, distinctly united with rather broad elongate median callus; frons rather broad, about 4 to 4½ times as high as wide basally, slightly widened above; thorax dark brown with whitish lines, scutellum whitish; abdominal tergites with narrow pale whitish hind margins, a median row of distinct whitish triangles, that on tergite 2 distinctly smaller than those on tergites 3 and 4; wings nearly hyaline, bifurcation of vein R₄₊₅ and crossveins faintly margined in brown, costal cell brown, eyes bare. Male with large and small eye facets sharply differentiated; eyes bare.

Comments: This species has been collected throughout the southern two-thirds of the eastern United States, except southern Florida, from eastern Kansas, Oklahoma and Texas (McGregor and Schomberg 1952; Philip 1965; Stone 1938; Thompson 1973b, 1974a and b, 1975b, 1977; Thompson *et al.* 1978) to the Atlantic (see also comments on *T. mixis* above). The immature stages are not known.

Known Distribution (Map 86): BRAZOS: Carter Lk; 27 May - 9 Jun 1971; P. H. Thompson; TAMU. Mile Dr, S College Station; 9, 30 Jun 1971, 9 Jun 1973, 8, 25, 26 May, 3, 6, 7 Jun, 5 Jul 1974, 16, 18, 19, 21, 28, 31 May 1975; P.H. Thompson; TAMU. 2 mi SW Bryan; 11 Jun 1972; R.R. Blume; TAMU. GRIMES: Navasota R @ FM2038; 31 May - 29 Jun 1971; P. H. Thompson; TAMU. HARDIN: Saratoga; G.B. Fairchild; FSCA. 3 mi NE Kountz, FM 418; 3 May, 19, 20 Jul 1972, 23 May, 20, 27 Jun, 5, 9, 12, 19 Jul 1973; P.H. Thompson; TAMU. HARRIS: Houston; 3 Jun 1979; C.W. Agnew; TAMU. HEMPHILL: 23 Jun 1970; C.W. O'Brien; TTU. HOWARD: 10 Jun 1968; Denver; TTU. JASPER: 23 May 1977; B. Wolfe; UT. KAUFMAN: Terrel; 13 Jun 1969; Mayhew; SFASU.

LIBERTY: ½ mi E Hull; 31 May, 21, 28 Jun 1972, 29 May 1973, 15 May 1975; P.H. Thompson; TAMU. MOTLEY: Matador; 6 Jun 1969; K. Pitts; TTU. NACOGDOCHES: 6 Apr 1960, 21 Feb 1962; N. Nichols; SFASU. 13 Jun 1966; S. Warren; in meadow; SFASU. 12 Jun 1977; D.C. Kennedy; SFASU & JTG. SAN JACINTO: Big Cr Scenic Area; 28 Jun 1980; P.W. Kovarik; TAMU. TYLER: Fred; 16-23 May 1950; McGregor; TAMU. Fred; 23 Jun 1950, 18 May 1951; O. Schomberg; FSCA. 1 Jul 1952; TAMU. 2 mi E Fred; 7, 21 Jun 1972; P.H. Thompson; TAMU. Town Bluff Lk; 7-8 Jun 1975; S.J. Merritt; TAMU. WALKER: Huntsville St Pk; 21 May, 3, 16, 23, 28 Jun 1971, 30 May, 5, 13, 19, 26 Jun, 3 Jul 1972, 29 May 1973; P.H. Thompson; TAMU.



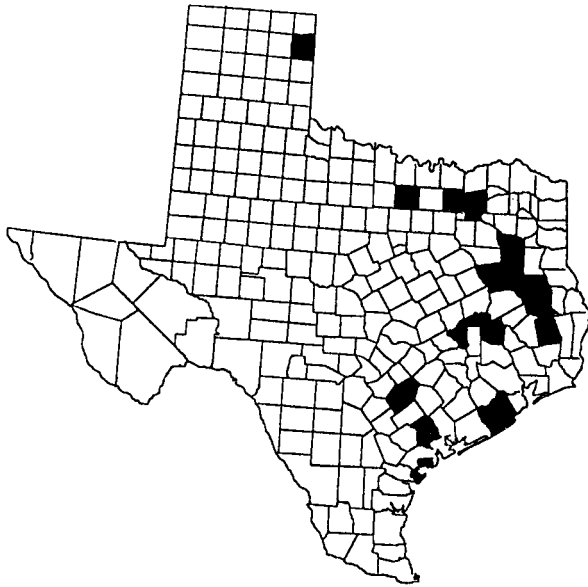
Map 86. Counties of collection: *Tabanus molestus*.

Tabanus mularis Stone

Tabanus mularis Stone 1935: 15

Small (9 mm); olive green and blackish with grayish yellow pattern; basal callus dark brown to black, slightly higher than wide, usually not connected to small oval median callus; frons moderately broad, about 4 times as high as wide basally, parallel-sided; thorax olive green without pattern; abdomen blackish with a parallel-sided yellowish gray median stripe and hints of faint sublateral spots; wings hyaline, costal cell brownish; eyes bare. Male with large and small eye facets sharply differentiated; eyes bare.

Comments: This species has been reported from most of the southern ⅔ of the eastern United States from western Kansas and Oklahoma and eastern Texas (Blume *et al.* 1972; McGregor and Schomberg 1952; Philip 1965; Thompson 1973a, 1974a, 1975b, 1977; Thompson *et al.* 1977) to the Atlantic, excluding southeastern Georgia and Florida. Goodwin (1994) described the immature stages based on specimens reared from eggs obtained in the laboratory by Thompson and Krauter (1978), hence no information is available on the habitats of the immature stages.



Map 87. Counties of collection: *Tabanus mularis*.

Known Distribution (Map 87): **ANDERSON:** 10 mi SW Elkhart; 5-6 Jun 1976; H.R. Burke; TAMU. **ANGELINA:** Bouton Lk, Angelina Nat For; 15 May 1993; J. T. Goodwin; JTG. **ARANSAS:** Aransas Nat Wildlife Ref; 10 Aug 1975; S.J. Hanselmann; TAMU. **BRAZORIA:** 15, 20 May, 3 Jun, 16 Aug, 8 Sep 1968, 14, 16, 19, 23 May, 13, 27, 30 Jun 1969; malaise trap; P. H. Thompson; TAMU. Haskins Mound; 4 Jun - 29 Sep 1971; P.H. Thompson; TAMU. 11 mi E Angleton; 17, 18, 22 Jun, 15 Jul, 26, 29 Aug, 2, 9, 16, 22, 29 Sep 1971, 15 Jul 1972; P.H. Thompson; TAMU. **BRAZOS:** 12 mi S College Station; V.V. Board; TAMU. College Station; 16 May 1964; H.J. Reinhard; TAMU. College Station; 28 Aug 1969; collector unknown; USDA. 2 May 1970; V.V. Board; TAMU. Minter Spr; 19 May 1970; Board, Gates & Murray; TAMU. Vterl. College Station; 27 May 1971; P.H. Thompson; TAMU. 5 mi E of Bryan; 23 Sep 1973; P.H. Thompson; TAMU. Mile Dr, S College Station; 3 Jun 1974, 1, 6, 7, 8, 10, 12, 14, 16, 17, 18, 19, 20, 21, 23, 25, 26, 27, 28, 31 May, 1, 3, 5, 6, 7, 11, 12, 14, 15, 16, 17, 18, 19, 23 Jun, 4, 7, 17, 18 Jul, 16, 26 Aug 1975; P.H. Thompson; TAMU. W.E.-M.K. Jordon Prop, 9.3 mi E College Station; 15 May 1976; malaise trap; S.J. Merritt; TAMU. 29-30 May 1976; modified malaise trap; H.R. Burke; TAMU. College Station; 22 Jun 1976; R.R. Blume; TAMU. nr College Station; 18-24 Jun 1978; S.J. Merritt; TAMU. White Cr Rd, 5 mi SW College Station; 17 Jun 1981; R. Turnbow; UG. **COLLIN-HUNT:** Merit; 9 Jun 1950; V.M. Potts; UC. **GONZALES:** Palmetto St Pk; 13 May 1969; V.V. Board; TAMU. **GRIMES:** Navasota R at FM 2038; 3 Jun 1973, 15, 18, 22, 23, 28, 29 May, 5, 14, 19, 21, 24 Jun 1974, 14, 19, 21, 23, 26 May, 4, 5, 9, 16, 18, 23, 30 Jun 1975; P.H. Thompson; TAMU. **HARRISON:** 1 mi E Karnack; 18 May 1971; R.E. Acciavitti; CU. **HEMPHILL:** 14 mi NE Canadian Lk, Marvin; 23 Jun 1967; C.W. O'Brien; TTU. **NACOGDOCHES:** 7 Mar 1961, 26 Sep 1960; W.W. Gibson; SFASU. 26 Sep 1960; A. Valentine; SFASU. 2 May 1961; N. Nichols; SFASU. **SMITH & CHEROKEE:** Troup; 31 May 1962; O.G. Babcock; ASU. **SMITH:** Troup; 31 May 1962; O.G. Babcock; TMM. **TYLER:** Fred; 15 Aug 1952; McGregor; TAMU. **VICTORIA:** Inez; 6 May 1970; P.H. Thompson; TAMU. Victoria; 27 Aug, 6 Oct 1971; TAMU. 12 mi NE Victoria; 10 Apr, 24, 29 May, 5 Jun, 24 Jul, 16 Aug 1974; P.H. Thompson; TAMU. **WALKER:** Huntsville St Pk; 1 May 1972; P.H. Thompson; TAMU. **WISE:** Decatur; 5 Jun 1956; P.H. Thompson; TAMU.

Tabanus nefarius Hine

Tabanus nefarius Hine 1907: 224

Large (21 mm); brown with grayish pattern; basal callus orange, higher than wide, not quite touching eyes, narrowed above, united with slender, elongate, concolorous median callus; frons moderately slender, about 5 times as high as wide basally, slightly widened above; thorax brown with yellowish brown stripes; abdomen brown with a median row of grayish yellow triangles joined to the narrow hind margins of tergites; sublateral pale spots absent; wings subhyaline with prominent brown spots on crossveins and bifurcation of vein R_{4+5} , costal cell yellowish brown and cell r_5 closed or strongly narrowed apically; eyes bare. Male unknown.

Comments: This species has been collected from the southern coastal states from Texas (McGregor and Schomberg 1952; Philip 19675) to Florida. The immature stages are not known.



Map 88. Counties of collection: *Tabanus nefarius*.

Known Distribution (Map 88): **TYLER:** Fred; 1 Aug 1951; L.L. Pechuman; CU.

Tabanus nigrescens Palisot de Beauvois

Tabanus nigrescens Palisot de Beauvois 1809: 100

Large (22 mm); black; basal callus dark brown, higher than wide, slightly constricted dorsally, distinctly united with rather broad elongate median callus; frons broad, $3\frac{1}{2}$ to 4 times as high as wide basally nearly parallel-sided; thorax and abdomen black dorsally, without pattern; wing pale yellowish, bifurcation of vein R_{4+5} and crossveins marked by dark spots, costal cell dark, cell r_5 narrowed apically; eyes bare. Male with large and small facets of eyes sharply differentiated; body, especially thorax, more brownish than female; eyes bare.

Comments: This species has been collected from

most of the southern 2/3 of the eastern United States from eastern Louisiana, Arkansas, Missouri, Iowa and southeastern Minnesota eastward to the Atlantic, excluding southeastern Louisiana, extreme southern Mississippi and Alabama, southeastern Georgia and all of Florida. Philip (1965) reported this species from Texas but provided no specific habitat information. We have not seen any Texas specimens. Goodwin (1973b) reported collecting larvae from beneath the bark of a partially submerged log in a spring-fed marsh and from wet mud near the edges of open marsh, a lake and woodland streams. Tidwell (1973) reported taking larvae from a beaver pond.

Tabanus nigripes Wiedemann

Tabanus nigripes Wiedemann 1821a: 25 (1821b: 75)

Tabanus coffeatus Macquart 1847: 39 (1847: 23)

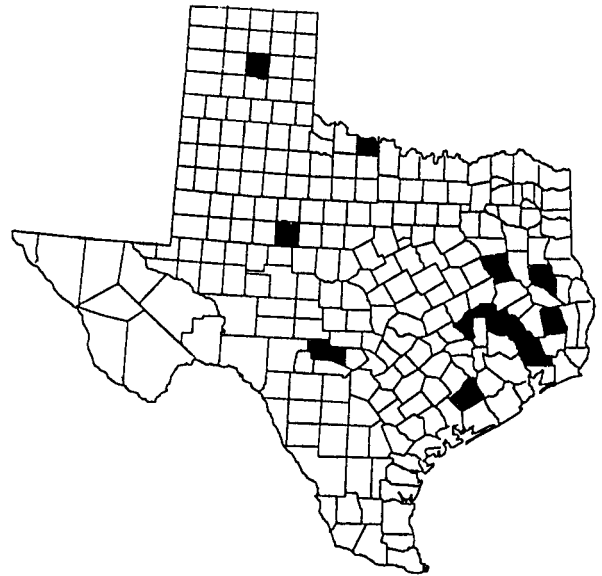
Tabanus winthemi Kröber 1931: 295

Moderate (12 mm); blackish brown with grayish pattern; basal callus yellowish brown to black, higher than wide, rounded above, distinctly united with slender median callus; frons narrow, about 4½ times as high as wide basally, slightly widened above; subcallus at least partly denuded; abdomen blackish brown with a row of grayish median triangles; wings hyaline, sometimes faintly tinted at bifurcation of vein R₄₊₅ and crossveins, costal cell yellow; eyes bare. Male with large and small eye facets sharply differentiated; frontal triangle denuded, prominent; eyes bare.

Comments: This species has been reported from most of the United States east of the Mississippi River excluding southern Florida, western Kentucky, southwestern Indiana, all of Illinois except the northeastern corner and western Wisconsin. The range extends westward from western Tennessee and northern Mississippi through northern Arkansas and southern Missouri into southeastern Nebraska and across mid-Oklahoma into the panhandle of Texas and eastern Texas (McGregor and Schomberg 1952; Philip 1965; Thompson 1974b, 1975b, 1977). The eastern Texas population is united with that of northeastern Louisiana and southern Mississippi. Larvae have been collected from sphagnum and cranberry bogs and bog-like backwaters of streams having a layer of moss and peat over sand (Teskey 1969) and at the margin of a small pond in mixed pine-hardwood forest (Tidwell 1973). The senior author has collected larvae from the margins of lakes and streams in mixed pine and hardwood forests in several southeastern states.

Known Distribution (Map 89): **ANDERSON:** Burke Farm, Salmon; 17 Apr 1994 (as larva); J.T. Goodwin; JTG. **BRAZOS:** Mile Dr, S College Station; 19 May, 26 Aug 1973, 3, 28 May 1974, Jul, 16 Aug, 3 Sep 1975; P.H. Thompson; TAMU. **CARSON:** McBride Canyon; 4 Sep 1973; Ritayamer, Bezarht & Eberty; SJ. **GRIMES:** Navasota R at FM 2038; 17, 21, 28 May 1971, 15, 19, 24, 26, 29 Apr, 6, 8, 15, 20, 22, 24, 28, 29 May, 3, 5, 7, 10, 14, 19, 24, 26 Jun, 1, 8 Jul, 4, 23 Aug 1974, 25

Apr, 5, 19, 26 May, 18, 23, 25 Jun, 2, 7, 14, 15, 16, 17 Jul, 3 Sep 1975; P.H. Thompson; TAMU. **KERR:** Kerrville; 23 Jul 1969; collector unknown; USDA. **LIBERTY:** 5 mi ESE Cleveland, HW 321; 21 Jun 1971; P.H. Thompson; TAMU. **NACOGDOCHES:** 17 May 1958, 4 May 1960, 17 Jun 1969; J. Daniel; SFASU. **NOLAN:** Wright Ranch; 20 Jul, 20 Oct 1982; S.R. Kingston; TTU. **SAN JACINTO:** Double Lake Rec Area, Sam Houston Nat For; 4 Sep 1976; M. Turell; CU. **TYLER:** Fred; 15 Aug 1952; McGregor; TAMU. **WALKER:** Huntsville St Pk; 6 May, 16, 30 Jun, 17 Aug 1971, 26 Jun, 3 Jul, 15 Aug 1972; P.H. Thompson; TAMU. **WHARTON:** Wharton; 2 Jul 1969; collector unknown; USDA. **WICHITA:** 5 mi E Burkburnett; 30 Jul 1982; S.R. Kingston; TTU.



Map 89. Counties of collection: *Tabanus nigripes*.

Tabanus nigrovittatus Macquart

Tabanus nigrovittatus Macquart 1847: 40 (1847: 24)

Tabanus simulans Walker 1848: 182

Tabanus contactus Walker 1850: 194

Tabanus allynii Marten 1883: 110

Tabanus floridanus Szilady 1926: 24

Tabanus divisus Harris 1833: 593. Nomen nudum

Moderate (12 mm); yellowish brown with median parallel-sided pale stripe on abdomen; frons a little over 3 times as high as wide basally, very slightly widened above; frontal callus black, subquadrate, separated from eyes, narrowly united or separated from slender linear median callus; thorax grayish to yellowish with little indication of pattern; abdomen yellowish sublaterally with a median parallel-sided grayish yellow stripe, the sublateral yellowish area sometimes represented by oblique pale spots; wing hyaline, costal cell yellow. Male with large and small facets strongly differentiated; patterned as in female.

Comments: This species, often called the salt-marsh greenhead, has been reported from coastal states from Nova Scotia to Texas (McGregor and Schomberg 1952, Philip 1965, Thompson 1973a, Thompson and Krauter 1978). Larvae have been taken from mud and decaying organic

material in salt marsh areas (Teskey 1969; Freeman 1987; Thompson *et al.* 1978).



Map 90. Counties of collection: *Tabanus nigrovittatus*.

Known Distribution (Map 90): ARANSAS: 19 Jul 1960; TAMU. BRAZORIA: Haskins Mound; 9 Apr - 29 Sep 1971; P.H. Thompson; TAMU. 12 mi S Danbury; 25 Jun, 8, 22, 29 Jul 1971; P. H. Thompson; TAMU. GALVESTON: Pt Bolivar; 11 May 1964; Gillchrist; CU. JEFFERSON: Beach, 17 mi W Sabine Pass; 10-12 Jun 1956; H.E. Evans; CU. Sabine Pass; 11 May 1964; L.L. Pechuman; CU. 21 May 1971; D. Castlamer; SJ. Sabine Pass; 10 May, 31 Jul, 1 Aug 1976; M. Turrel; CU. MATAGORDA: Sargent Beach; 14 Jun 1956; H.E. Evans; CU. Palacios; 10 May 1964; L.L. Pechuman; CU. ORANGE: Orange; 21 Jun 1917; CU.

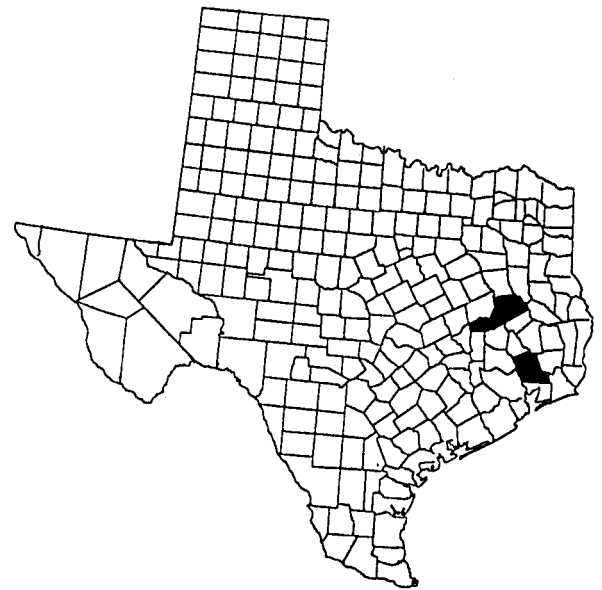
Tabanus pallidescens Philip

Tabanus fulvulus variety *pallidescens* Philip, 1936c: 150

Except for the characters noted in the keys to species, this species is essentially like *T. fulvulus* described earlier, except that the eye of the female in life typically has a single purple band in contrast to the usual three bands of *T. fulvulus*, and the male of *T. pallidescens* has large and small facets of eyes more distinctly differentiated than *T. fulvulus*.

Comments: This species has been reported from the southern 2/3 of the eastern United States from eastern Kansas, Oklahoma and Texas (Thompson 1974b) to the Atlantic excluding the southern 1/2 of Florida. Tidwell and Tidwell (1973) reported collecting larvae from the ruts of an old logging road in a mixed pine-hardwood forest and from well-drained soil at another location in similar forest.

Known Distribution (Map 91): GRIMES: Navasota R; 4 Jul 1975; P.H. Thompson; TAMU. HOUSTON: Ratcliff St Pk; 7-8 Jun 1975; J.H. Holmes, Jr.; TAMU. LIBERTY: 16 mi ESE Cleveland; 31 May 1972; P.H. Thompson; TAMU. 1/2 mi E Hull; 14 Jun 1972; P.H. Thompson; TAMU.



Map 91. Counties of collection: *Tabanus pallidescens*.

Tabanus petiolatus Hine

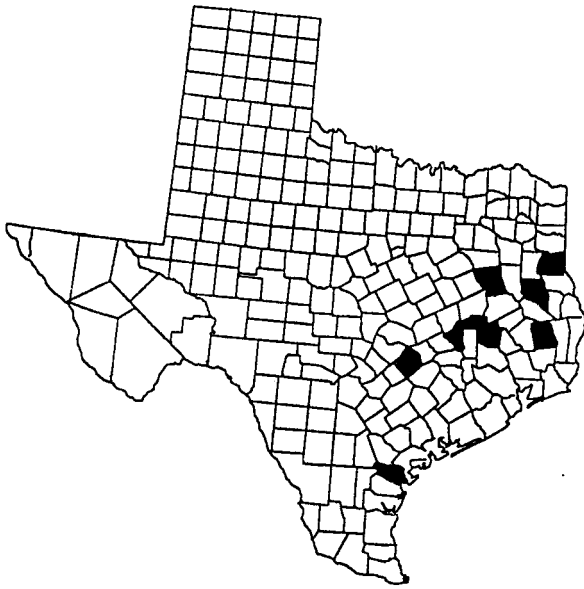
Tabanus petiolatus Hine 1917: 270

Moderate (16 mm); dark brown with grayish white pattern; basal callus dark brown, higher than wide, rounded above, narrowly united with slender median callus; frons narrow, usually 6.5 or more times as high as wide basally, distinctly widened above; abdomen dark brown to blackish, darker posteriorly, with a distinct median row of grayish white triangles, that of tergite 2 almost always broadly reaching anterior margin, almost always with some yellow in ground color laterally on basal 1 or 2 sternites; wing hyaline, bifurcation of vein R_{4+5} and, to a lesser extent, the crossveins with brown spots; cell r_5 nearly always closed and petiolate; eyes bare. Male with large and small eye facets sharply differentiated; eyes bare.

Comments: This species has been reported from most of the southern 1/2 of the eastern United States from Arkansas and eastern Texas (McGregor and Schomberg 1952; Philip 1965; Thompson 1973b, 1974a and b, 1975b, 1977; Thompson *et al.* 1978) to the Atlantic. Teskey (1969) reported taking larvae from the banks of streams in leaf mold liberally mixed with sand or in moss. Tidwell (1973) reported collecting larvae from small sandy-bottom streams in pine or upland hardwood forests. The senior author has frequently found larvae in sandy or silty soil containing a little decaying vegetative matter on the banks of streams in woodland areas.

Known Distribution (Map 92, p. 115): ANDERSON: Salmon; 1 Jun 1974; H.R. Burke; TAMU. Burke Farm, Salmon; 17 Apr 1994 & 14 Mar 1996 (as larvae); J.T. Goodwin; JTG. BASTROP: Bastrop St Pk; 16 Jun 93; A.W. Hook; UTAU. BRAZOS: Navasota R at FM2038; Jun - Sep 1975; P. H. Thompson; TAMU. GRIMES: Navasota R at FM2038; 31 May - 29 Jun 1971; P. H. Thompson; TAMU. NACOGDOCHES: 10 Sep

1969; W.W. Gibson; at electric light; SFASU. **PANOLA**: US79, 1.5 mi W DeBerry; 17 May 1993 (as larva); J. T. Goodwin; JTG. **SAN PATRICIO**: Welder Wildlife Ref, 8 mi NE Sinton; 13-15 May 1985; N. Bedwell & R. Brown; MSU. **TYLER**: Fred; 16-23 May 1950, 30 Jun 1952; McGregor; TAMU. Town Bluff Res; 7-8 Jun 1975; S.J. Merritt; TAMU. **WALKER**: Huntsville St Pk; 1 Aug 1972; P.H. Thompson; TAMU.



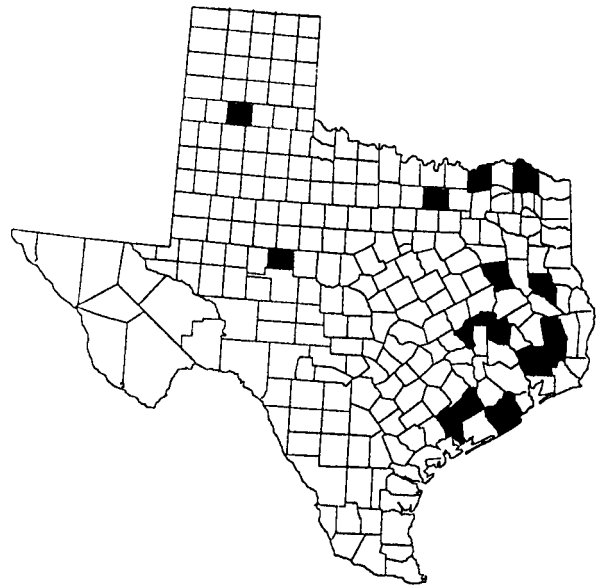
Map 92. Counties of collection: *Tabanus petiolatus*.

Tabanus proximus Walker

Tabanus proximus Walker 1848: 147

Large (26 mm); dark brown; basal callus reddish brown, distinctly higher than wide, narrowly united with elongate attenuate median callus; frons narrow, about 6 times as high as wide basally, widened above; abdomen black, thinly grayish pollinose; wing pale brownish, bifurcation of vein R_{4+5} and crossveins with spots; costal cell brownish; eyes bare. Male with large and small eye facets sharply differentiated; eyes bare.

Comments: This primarily southeastern species has been reported from all areas east of the Mississippi River south of Kentucky to the Atlantic excluding southern Florida. Its range extends northward along the Mississippi River into western Kentucky and southern Illinois and in the east into eastern Virginia and Delaware, southeastern Pennsylvania and southern New Jersey. A westward extension includes all but northern Louisiana and a large part of southeastern Texas (Blume *et al.* 1972; McGregor and Schomberg 1952; Philip 1947, 1965; Stone 1938; Thompson 1973a and b, 1974a and b, 1975b, 1977; Thompson *et al.* 1977; Thompson *et al.* 1978). Tidwell (1973) reported collecting larvae from moist floodplain soils of large rivers. The senior author has collected larvae on two occasions from similar habitat, and has observed a female ovipositing on vegetation over damp floodplain soil near a stream.



Map 93. Counties of collection: *Tabanus proximus*.

Known Distribution (Map 93): **ANDERSON**: Palestine; W.W. Gibson; SFASU. **BRAZORIA**: 18 Jun 1969; malaise trap; P. H. Thompson; TAMU. Haskins Mound; 18 Jun, 8 Jul 1971; P. H. Thompson; TAMU. 11 mi E Angleton; 18, 24 Jun, 22 Jul 1971; P.H. Thompson; TAMU. **BRAZOS**: Navasota R, 11 mi E Bryan; 4,12 Aug 1970; P.H. Thompson; TAMU. Carter Lk; 21 Jun - 9 Jul 1971; P.H. Thompson; TAMU. Mile Dr, S College Station; 23, 31 Jul, 1 Aug 1973, 22 Aug 1975, 11 Jul 1977; P.H. Thompson; TAMU. College Station; 17 Jun 1975; D. Ring; TAMU. **COKE**: 3 Jul 1970; N. Nichols; TTU. **DENTON**: Mike Ranch; 20 Oct 1967; D.H.O.; UNT. Clear Cr @ confluence of Elm Cr; 21 Jul 1973; R.V.O.; UNT. **FANNIN**: ca 14 mi NW Honeygrove; T. W. Miller; 1 Aug 1989; TTU. **GRIMES**: Navasota R at FM 2038; 15, 22, 24, 28, 29 Jun, 6, 10, 28 Jul, 17, 25, 26 Aug, 1 Sep 1971, 12 Apr, 5, 13, 19, 26 Jun, 3, 13 Jul, 1, 28 Aug, 8 Sep 1972, 24 May, 3, 5, 7, 10, 14, 21, 26 Jun, 1 Jul, 16, 23 Aug 1974, 6, 9, 15, 16, 17, 18, 23, 25 Jun, 9, 11, 22 Jul, 1, 8, 11, 25 Aug, 15 Sep 1975, 28 Jun 1977; P.H. Thompson; TAMU. **HARDIN**: 3 mi NE Kountz; 8 Aug 1972, 5, 12 Jul 1973; P.H. Thompson; TAMU. **JACKSON**: Edna; 3 Sep 1976; J. Harney; TTU. **LIBERTY**: ½ mi E Hull; 21,28 Jun, 19, 25, 26 Jul, 2, 7, 8, 16, 21, 23, 30 Aug, 3, 13, 20 Sep 1972; P.H. Thompson; TAMU. **NACOGDOCHES**: July 1960; N. Nichols; SFASU. 4 Jul 1966; W.W. Gibson; on deer; SFASU. 8 Jul 1966; C. Griffin; SFASU. 19 Jun 1969; Alsobrook; on horse; SFASU. 29 Jul 1971; T. Thompson; SFASU. **RED RIVER**: Clarksville; 5 Jul 1957; M. Miesch; PU. Oct 1976; Lawson; TTU. **SWISHER**: 24 Sept. 1976; T. Reed; TTU. **TYLER**: 2 mi E Fred, FM 1943; 21, 28 Jun 1972; P.H. Thompson; TAMU. **WALKER**: Huntsville St Pk; 16, 30 Jun, 7, 10, 21, 28 Jul, 17, 25 Aug, 1 Sep, 10 Oct 1971, 3, 11, 14-17 Jul, 1, 2, 7, 14, 16 Aug 1972; P.H. Thompson; TAMU. **WHARTON**: Wharton; 2 Jul 1969; collector unknown; USDA.

Tabanus pruinus Bigot

- Tabanus pruinus* Bigot 1892: 683
- Tabanus limpidipennis* Hine 1907: 273
- Hybostraba albobillosa* Kröber 1931b: 92
- Tabanus schmidtii* Kröber 1931a: 292

Moderate (16.5 mm); brown with grayish pattern; frons 3½ to 4 times as high as wide basally, a little widened

above; basal callus brown, rounded above, not touching eyes, narrowly united with slender elongate black median callus; thorax grayish brown with faint paler longitudinal stripes; abdomen grayish brown tinged with reddish with a row of faint pale grayish median triangles and gray oblique sublateral spots which reach hind margins of tergites 2 - 5; wing hyaline, venation normal; eye bare to finely pilose. Male with large and small facets not strongly differentiated, the latter extensive and surrounding former; coloration essentially like female.

Comments: This species has not been collected in Texas. It is primarily a Neotropical species found from Panama northward into Arizona. Burger (1977) reported collecting larvae from springs and seepage areas, along the margins of sluggish rivulets from springs in wet soil 30 -120 cm from the water and in and under rotting logs partially buried in mud, and along the margins of spring ponds. The senior author has taken many larvae from a thin silty layer of mud and a thin layer of moss growing on the nearly vertical surface of an extensive hillside seepage area.

***Tabanus pumilus* Macquart**

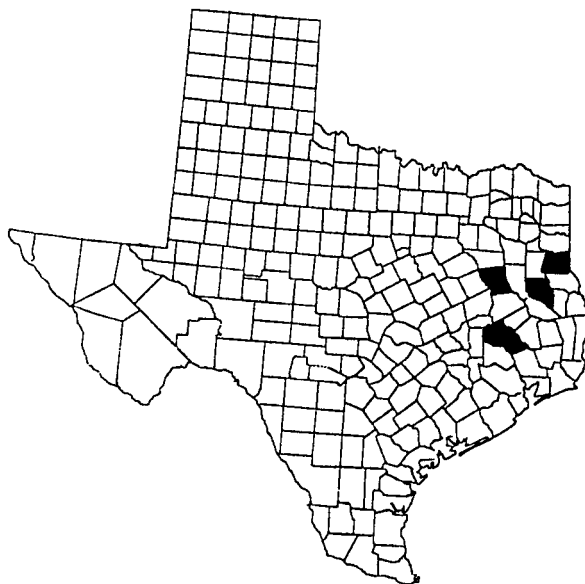
Tabanus pumilus Macquart 1838: 150 (1838: 146)

Small (9.5 mm); dark brown to grayish black; basal callus black, higher than wide, usually not connected with rather broad irregularly shaped median callus; frons narrow, about 4½ to 5 times as high as wide basally, distinctly widened above; second palpal segment with blunt apex, not greatly swollen basally; abdomen brownish black with grayish hind margins to tergites and small faint grayish median triangles and rounded grayish sublateral spots; wing hyaline; eyes bare. Male with large and small eye facets sharply differentiated; occipital tubercle conspicuous; eyes bare.

Comments: This species is known from most of the eastern ½ of the United States from eastern Texas (McGregor and Schomberg 1952; Philip 1965; Thompson 1973b, 1974a, 1975b, 1977b), Oklahoma, and Missouri, southeastern Iowa, extreme southern Wisconsin, and most of Michigan eastward to extreme northern New Hampshire and Vermont, excluding south Florida. Teskey (1969) reported collecting larvae from almost totally organic substrates of bogs and swamps and one from silty soil of an open grassy spring-fed seepage area. Tidwell (1973) reported collecting a single larva from the margin of a small water-filled ditch. The senior author has taken larvae from mud at the margins of permanent streams and more commonly from predominantly organic substrate in spring-fed seepage areas.

Known Distribution (Map 94): ANDERSON: Salmon; 26-27 Apr 1975; H.R. Burke; TAMU. 10 mi SW Elkhart; 5-6 Jun 1976; modified malaise trap; H.R. Burke; TAMU. CROSBY: 2 mi S Cone; 28 Aug 1939; Rehn & Rehn; 2850 ft; ANSP. NACOGDOCHES: 28 Apr, 22 May 1960; N. Nichols; SFASU. PANOLA: DeBerry; 8 May 1952; AMNH. SAN JACINTO: Sam Houston Nat For, Double Lk Cpgd; 12 May 1985; N.

Bedwell; MSU. WALKER: Huntsville St Pk; 24 Apr 1972; P.H. Thompson; TAMU.



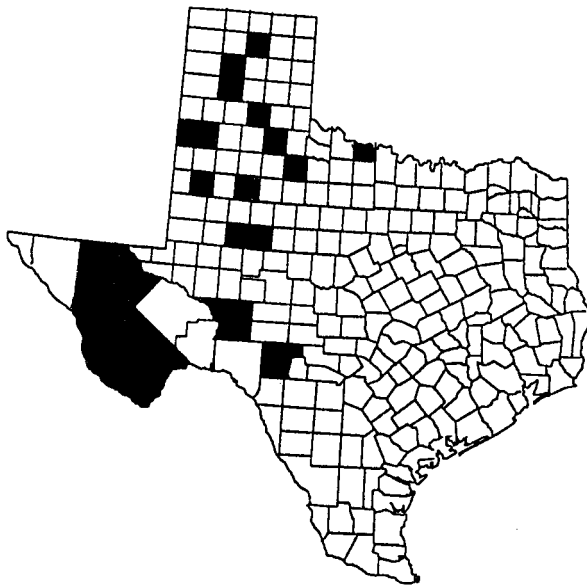
Map 94. Counties of collection: *Tabanus pumilus*.

***Tabanus punctifer* Osten Sacken**

Tabanus punctifer Osten Sacken 1876: 453

Large (20.5 mm); dorsally bicolored, black and creamy white; basal callus dark brown to black, subquadrate and often poorly defined; median callus blackish, roughly oval, but even more poorly defined; subcallus brown, bare to sparsely pilose; frons 2½ to 3 times as high as wide basally, nearly parallel-sided; thorax dark reddish brown in ground color, but in good specimens appearing creamy white due to dense covering of long hairs; abdomen entirely black; wing brownish, paler posteriorly, the bifurcation of vein R₄₊₅ and crossveins distinctly margined in brown and cell r₅ distinctly narrowed apically; eyes bare. Male with large and small facets sharply differentiated; coloration like female except that thorax dorsally is dark reddish brown except for white lateral bands and edge of scutellum.

Comments: This species has been found throughout most of the southern ½ of the western third of the United States from Utah southward into Mexico, from California into western Texas (Easton *et al.* 1968; McGregor and Schomberg 1952; Philip 1947, 1965; Stone 1938). Webb and Wells (1924) described the immature stages of this species and provided an excellent account of its biology. Burger (1977) also described the immature stages and reported taking larvae from almost any wet or moist environment, natural or artificial, including lakes, ponds, streams, stock tanks and irrigation ditches. The senior author has collected larvae at several locations in Texas in similar habitats.



Map 95. Counties of collection: *Tabanus punctifer*.

Known Distribution (Map 95): BAILEY: 10 Oct 1976; D. Chism; TTU. BREWSTER: Alpine; 30 Apr, 18 Jun, 8 Jul, 8, 10, 17, 18 Sep, 2, 9, 17, 20, 22 Oct, 8, 17 Sep, 22 Oct; SRSU. Lajitas; 4 Sep 1960; SRSU. 11 Jul 1961; SRSU. Big Bend Nat Pk; 11 Apr 1963; M.G.Naumenner; UK. Marfa; 24-30 Jul 1966; E. R.Easton; (Easton, et al 1968). Govt Spr, Big Bend Nat PK; Feb 1975 (as larvae); J. T. Goodwin; FSCA. Marathon; 6 Aug 1980, SRSU. Big Bend Nat Pk, North Rosillos Mtns, Lodge at Buttrill Spr; 12 Jul 1991; R. Vogtsberger; TAMU. BRISCOE: Silverton; 25 Jun 1967; D. Brooks; WTAM. CLAY: Petrolia; 12 Jun 1971; MISU. CROCKETT: Live Oak Cr at US290; Feb 1975 (as larvae); J. T. Goodwin; FSCA. CULBERSON: Guadalupe Nat Pk, Choza Spr at Hwys 180/63, 1600m; 31 May 1993; Gelhaus, Nelson & Koenig; ANSP. EDWARDS: 7 mi N Barksdale; 14 May 1961; SRSU. EL PASO: El Paso; 15 Aug 1977; M. Huybensz; MH. GARZA: 29 Sep 1973; D.E. Foster; TTU. HOWARD: Big Spring; 7 May 1975; D.E. Foster; TTU. HUTCHINSON: Borger; 3 Jul 1967; J.D. Burrows; GSU. Borger; 3 Jul 1969; J. Barrows; WTAM. Borger; 27 Jun 1974; T. Coleman; WTAM. JEFF DAVIS: Valentine; 8 Jul 1917; R.C. Shunnar; CU. 15 mi N Alpine at TX 118; 23 Aug 1980; Hugh; SRSU. KING: 17 Jun 1977, 22 Jun 1979; S.G. Davis; TTU. LAMB: Littlefield; 28 Aug 1961; D. Brooks; GSU & WTAM. MITCHELL: 25 Aug 1978; S.C. Davis; TTU. MOTLEY: Flomot; C. Franks; TTU. POTTER-RANDALL: Amarillo; 24 Jun 1978; D. Reis; GSU & WTAM. PRESIDIO: Plata; 23 Jun 1937; R.H. Baker; TAMU. Presidio; 18 Aug 1968; J.E. Hafernik; TAMU. RANDALL: Canyon; 10 Sep; E. May; WTAM. REEVES: Balmorhea; 30 Sep 1935; TAMU. TERRY: R. Terry Farm, Brownfield; 10 Aug 1987; K. Terry; ASU. WICHITA: Lake Wichita; 14 Mar 1956; MISU.

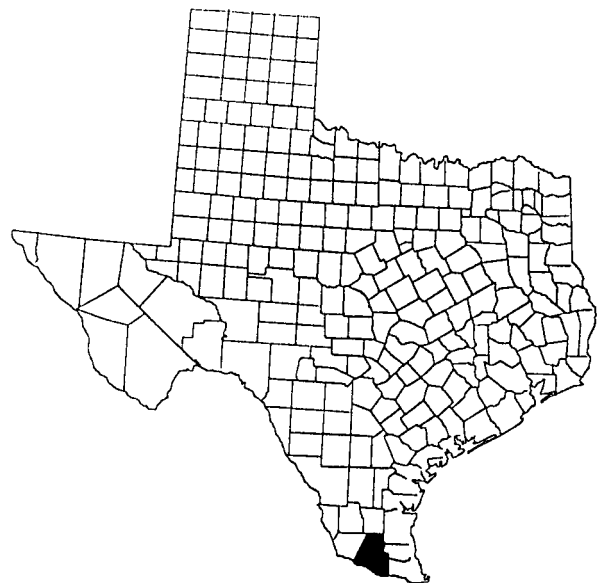
Tabanus pungens Wiedemann

Tabanus pungens Wiedemann 1828: 175
Tabanus desertus Walker 1850: 119
Tabanus nuntius Walker 1854: 207
Tabanus univittatus Macquart 1855: 50 (1855: 30)
Tabanus sallei Bellardi 1859: 61
Tabanus propinquus Bellardi 1859: 65 (preoccupied Macquart 1855)
Tabanus discifer Bigot 1892: 684 (preoccupied Walker 1850)

Tabanus dorsiger variety *angustivitta* Kröber, 1929: 250
Agelanius ruficornis Kröber 1931c: 287 (preoccupied Fabricius 1775)
Agelanius rufus Kröber 1931c: 287 (preoccupied Scopoli 1763)
Tabanus erythrocerus Kröber 1934: 300 (new name for *rufus* Kröber)
Tabanus ruficolor Kröber 1934: 302 (new name for *rufus* Kröber)

Moderate (13 mm); brownish with grayish abdominal pattern; frons nearly parallel-sided, about 3 to 3½ times as high as wide basally, with a distinct tubercle at vertex; basal callus more or less quadrate, nearly as wide as frons, yellowish, little or no indication of a median callus; scutellum reddish apically, abdomen blackish in middle, reddish yellow laterally, with a middorsal pale stripe consisting of a row of slender but broadly connected triangles and sublateral stripes of oblique, contiguous dashes; wings hyaline. Male with large and small facets of eyes sharply differentiated, eyes bare; vetexal tubercle prominent; otherwise similar to female.

Comments: This is a Neotropical species found throughout the region except for Chile and the West Indies. Fairchild (1980) reported a specimen of this species from Hidalgo County, Texas, the northern known limit of its distribution. Goodwin and Murdoch (1974) reported the collection of larvae of this species from wet mud.



Map 96. Counties of collection: *Tabanus pungens*.

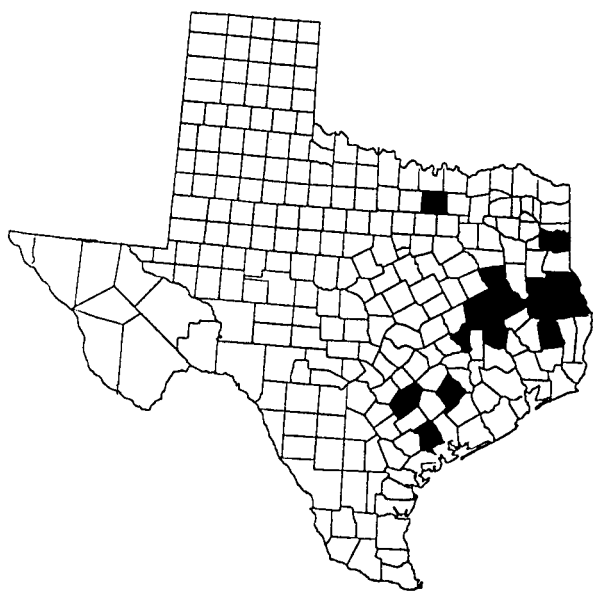
Known Distribution (Map 96): HIDALGO: McAllen; C.C. Porter; (G.B. Fairchild 1980); FSCA.

Tabanus quaesitus Stone

Tabanus quaesitus Stone 1938: 54

Moderate (11 mm); brown with grayish pattern; basal callus shiny, dark brown, wider than high, protuberant, touching eyes; median callus a narrow line that may slightly widen above; frons about 2½ times as high as wide basally, parallel-sided; vertex with a more or less quadrate, denuded dark spot but no ocellar tubercle; thorax dark brown with faint grayish stripes; abdomen blackish-brown with three rows of pale spots and narrow pale hind margins, the median spots triangular, sometimes narrowly crossing tergites, but not appearing as a serrate median stripe, the sublaterals united with hind margins or more commonly isolated from it; wing hyaline, venation normal; eyes sparsely but distinctly pilose. Male with large and small facets not sharply differentiated, eyes distinctly pilose; coloration essentially like female.

Comments: This species is so far known only from Texas (McGregor and Schomberg 1952; Philip 1965; Stone 1938; Thompson 1973b, 1974a and b, 1975b, 1977; Thompson *et al.* 1977) and Louisiana. The immature stages are not known.



Map 97. Counties of collection: *Tabanus quaesitus*.

Known Distribution (Map 97): **ANDERSON:** Salmon; 26-27 Apr 1975; modified malaise trap; H.R. Burke; TAMU. **ANGELINA:** Bouton Lk, Angelina Nat For; 15 May 1993; J. T. Goodwin; JTG. Graham Cr, ca 14 km S of Zavalla; 16 May 1993; C.T. Maier; CTM. **BASTROP:** 6-7 Apr 1959; Bottemir, Mason & McAlpine; CNC. Lost Pine Pk, Bastrop; 8 Apr 1959; W.R.M. Mason; CNC. Bastrop St Pk; 27 Apr 1959; Painter; CU. **BEE:** Beeville; 28 Mar 1943; W.H. Gordon; LLP. **BRAZOS:** College Station; 2 Apr 1933; H.J. Reinherd; TAMU. 1 mi E HW 6 & 30; 29 Apr, 7 May 1971; P.H. Thompson; TAMU. Mile Dr, S College Station; 4, 10, 12, 12-15, 19-20 Apr 1971, 21, 23, 24, 25, 26, 27, 28 Mar, 2, 8, 17, 26, 29 Apr 1972, 12, 15, 20, 21, 25, 28 Apr, 3, 4, 16 May 1973, 20, 23, 26, 28, 29, 31 Mar, 1, 2, 3, 4, 7, 11, 12, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 31

Apr, 2, 7, 15, 19 May 1974, 23, 24, 25, 27, 28-30 Mar, 1, 4, 5, 6, 7, 9, 10, 11, 12, 14, 15, 16, 17, 18, 22, 23, 30 Apr, 1, 2, 3, 4, 5, 6, 7, 8 May 1975, 11-21 Apr 1976; P.H. Thompson; TAMU. 5 mi S HW 6; 1-7 May 1971; P.H. Thompson; TAMU. 17 Apr 1983; T.P. Friedlander; TAMU. **COLORADO:** 5, 11, 12 Apr 1922; Grace Riley; USNM (this is type locality). **DENTON:** Denton; 22 Apr 1967; J.L.M.III; UNT. **GONZALES:** Seguin; 7 May 1959; TAMU. Palmetto St Pk; 17 Apr 1965, 13 Apr 1968; J.C. Schaffner; TAMU. Palmetto St Pk; 14 Apr 1979; C. W. Agnew; TAMU. **GRIMES:** Navasota R at FM2038; 5, 6, 10, 17 Apr 1972, 8, 19, 24, 25, 26, 27, 28, 29 Apr 1974, 2, 9, 11, 12, 14, 16, 18, 21, 23, 25, 28 Apr, 2, 5 May 1975; P. H. Thompson; TAMU. **HARRISON:** 1 mi E Karneck; 18 May 1971; R.E. Acciavitti; CU. **HOUSTON:** Davey Crockett Nat For, 3 mi W Ratcliff, Rd 521; 21 Apr 90; Baumann & Nelson; UTAU. **LEON:** 4 May 1952; TAMU. **NACOGDOCHES:** 28 Apr 1960; 18 Apr 1962; N. Nichols; SFASU. 28 Apr 1960, 22 Jun 1969; D. Daniel; at electric light; SFASU. 8 Apr 1962, 9 May 1971; R. Boyett; at electric light; SFASU. 24 Apr 1968; J. Hartzel; on deer; SFASU. **SABINE:** Moss Cr, 2 mi N Milam, Hwy 87 nr Red Hills L Cpgd; 23 Apr 90; Baumann & Nelson; UTAU. **SAN AUGUSTINE:** San Augustine Pk by Sam Rayburn Resv; 14 May 1993; C.T. Maier; CTM. Piney Woods Cons Area; 15 May 1993; C.T. Maier; CTM. Piney Woods Field Sta; 15 May 1993; J. K. Gelhaus, C. R. Nelson & D. P. Koenig; ANSP. Stephen F. Austin Conf Ctr; 16 May 1993; J.T. Goodwin; JTG. 6 km E Zavalla, Angelina Nat For; 13 May 1995; JTG; TAMU. **SHELBY:** Britain Cr, Rd 126, 2 mi SE Patroon; 23 Apr 90; Baumann & Nelson; UTAU. Sabine Nat For, Boles Field, 304 ft; 23 Apr 90; Baumann & Nelson; UTAU. **TARRANT:** 2 mi N Colleyville; 23 Apr 1972; R.E. Acciavitti; CU. **TYLER:** 2 mi W Fred; 12 Apr, 3 May 1972; P.H. Thompson; TAMU. **VICTORIA:** 12 mi NE Victoria; 27 Mar, 3, 10, 24 Apr 1974; R.R. Blume & P.H. Thompson; TAMU. **WALKER:** Apr 1951; F.A. Cowan; TAMU. Huntsville St Pk; 12 May - 16 Jun; P.H. Thompson; TAMU. Huntsville; 17, 24 Apr, 1, 8 May 1972; P.H. Thompson, TAMU.

Tabanus quinquevittatus Wiedemann

Tabanus quinquevittatus Wiedemann 1821a: 34
(1821b: 84)

Tabanus costalis Wiedemann 1828c: 173

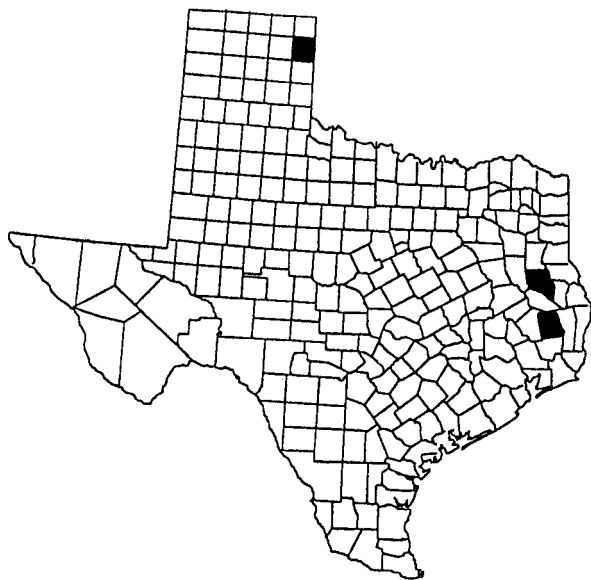
Tabanus vicarius Walker 1848: 187

Tabanus manifestus Walker 1850: 41

Tabanus baltimorensis Macquart 1855: 54 (1855: 34)

Moderate (12.5 mm); predominantly yellowish; frons nearly parallel-sided, about 4 times as high as wide basally, basal callus black, about as high as wide, slightly rounded above, united with slender median callus at most by a narrow dark line; abdomen with a median parallel-sided yellowish stripe bordered by dark brown or black, sides yellowish; wings hyaline, costal cell yellow; eyes bare. Male with large and small eye facets sharply differentiated; eyes bare.

Comments: This species has been collected from most of the eastern ½ of the United States as far west as the panhandle of Texas (McGregor and Schomberg 1952, Philip 1965) and western Oklahoma. It has not been reported from Louisiana, southern Mississippi, southeastern Alabama and extreme western Florida. Goodwin (1973b) reported collecting a larva of this species from mud around the roots of grass growing in a drainage area of a pasture.



Map 98. Counties of collection: *Tabanus quinquevittatus*.

Known Distribution (Map 98): **HEMPHILL:** 4 mi NE Canadian; 23 Jun 1970; C.W. O'Brien; CBP. **NACOGDOCHES:** 28 Apr 1960; 18 Apr 1962; N. Nichols; SFASU. 9 May 1971; R. Boyett; at electric light; SFASU. **TYLER:** Fred; 30 Jun 1962; McGregor; TAMU.

***Tabanus reinwardtii* Wiedemann**

Tabanus reinwardtii Wiedemann 1828: 130

Moderate (17 mm); grayish black; basal callus reddish brown to black, nearly square, usually separated from short slender median callus; frons broad, about 2½ times as high as wide basally, parallel-sided or slightly narrowed above; abdomen black with pale hind margins and distinct grayish narrow median triangles and larger sublateral spots, these not joined posteriorly; wings hyaline, bifurcation of vein R₄₊₅ and crossveins spotted with brown; eyes bare or with sparse short hairs. Male with large and small facets little differentiated; eyes hairy.

Comments: This species is reported from the northern ⅔ of the United States and southern Canada from the Atlantic westward to British Columbia and Montana and most of Colorado. Its range extends southward in the east to include northern Arkansas, Tennessee, and the Appalachians from extreme north Georgia northward. Teskey (1969) reported collecting larvae in saturated or silty materials, often overlaying clay, on the banks of sluggish streams or small stagnant pools. Tidwell (1973) reported finding larvae at the margin of a stream, and Jones and Bradley (1923) stated that larvae were taken from the sandy margin of a sluggish brook. The senior author has collected larvae from the upper few centimeters of the forest floor in mixed bottomland hardwood forest areas subject to frequent short periods of inundation; the areas of collection were silty to sandy, overlain with leaf litter, and characterized by

subsurface seepage and surface flow from numerous springs.



Map 99. Counties of collection: *Tabanus reinwardtii*.

Known Distribution (Map 99): **BRAZOS:** College Station; 15 Jul 1979; C.W. Agnew; TAMU. **LUBBOCK:** 28 Apr 1970; L. Wade; FSCA.

***Tabanus rufokrater* Walker**

- Tabanus rufokrater* Walker 1850: 26 (as *rufokrator*)
- Tabanus unicolor* Macquart 1847: 38 (1847: 22)(preoccupied Wiedemann 1828)
- Tabanus lateritius* Rondani 1863: 80 (1864: 80)(new name for *unicolor* Macquart)
- Tabanus tener* Osten Sacken 1876: 440

Moderate (17 mm); reddish brown with indistinct grayish pattern; basal callus chestnut brown, higher than wide, usually touching eyes and distinctly united with slender median callus of same color; frons about 5 times as high as wide basally, a little widened above; thorax brown with faint gray longitudinal stripes; abdomen reddish brown with a median row of contiguous, indistinct, grayish triangles and some gray laterally at hind margins of tergites; wing hyaline with faint brown clouds at bifurcation of vein R₄₊₅ and around crossveins; eyes bare. Male with large and small facets sharply differentiated; coloration markedly different from female, the thorax nearly black except for white hair at margin of scutellum, the abdomen with tergites 2 to 6 bicolored, anteriorly dark brown and posteriorly pinkish with white hair (the pale color covering half or a little more on tergite 2 and most of remaining tergites).

Comments: This species has not been collected in Texas. It has been collected in the southeastern coastal states from Louisiana to North Carolina. The immature stages are not known.

Tabanus sackeni Fairchild

Tabanus sackeni Fairchild 1934: 141

Moderate (13.5 mm); brownish with grayish pattern; basal callus brown to black, a little higher than wide, not united with irregularly shaped median callus; frons narrow, distinctly widened above; third antennal segment very slender, basal plate longer than combined length of annuli; abdomen brownish with a pale median line of grayish contiguous triangles and grayish sublateral spots; wings hyaline; eyes bare. Male with large and small eye facets sharply differentiated; eyes bare.

Comments: This species has not been collected in Texas. It has been reported from most of the eastern 1/2 of the United States from eastern Oklahoma and Nebraska to the Atlantic as far north as the southern Great Lakes areas and southward to southern Arkansas, mid-Mississippi, southern Alabama, and mid-Georgia. Goodwin (1976b) reported collecting larvae from damp soil under a predominantly maple canopy on a well-drained hillside; the larvae were 10-11 mm deep.

Tabanus sparus Whitney

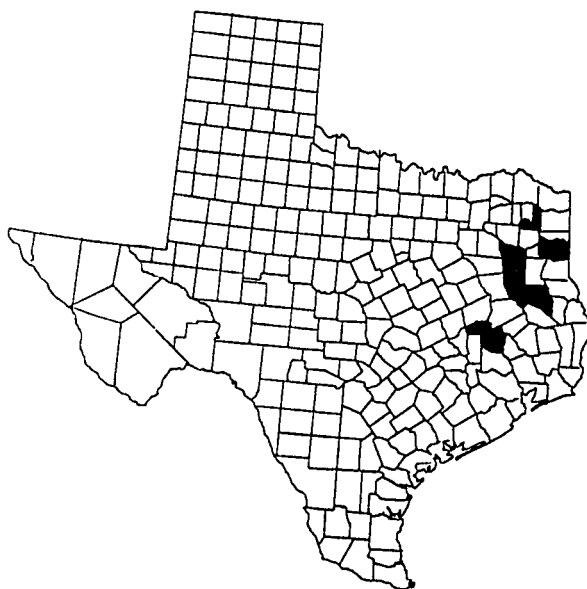
Tabanus sparus Whitney 1879: 38

Tabanus milleri Whitney 1914: 344

Small (10 mm); grayish black; basal callus dark brown, quadrate, usually narrowly connected to slender elongate median callus; frons moderately broad, about 5 times as high as wide basally, slightly widened above; second palpal segment acute at tip, distinctly swollen basally; abdomen with a row of small grayish median triangles and oval sublateral spots; wings hyaline; eyes bare. Male with large and small eye facets sharply differentiated; occipital tubercle inconspicuous, usually laterally compressed; eyes bare.

Comments: This species is found throughout the eastern 1/2 of the United States from eastern Texas (Thompson 1973b, 1974a, 1977b), Oklahoma and Nebraska, southeastern Iowa, southern Wisconsin, Michigan and eastward into southern New York, New Hampshire and Vermont. Although two forms (as varieties) have been recognized by many authors, we recognize only a single species. No characters have been found which facilitate separation of the two forms when examining dried specimens. In life, and in relaxed specimens, one form (previously called the "variety *sparus*") has unicolorous eyes whereas the other (previously called the "variety *milleri*") has a single diagonal purple band. Not all dried Texas specimens examined were relaxed, but all those relaxed and all fresh material had a single eye band. Teskey (1969) reported collecting larvae in an abandoned cranberry bog and at the boggy margins of streams. The senior author has taken larvae from wet organic mud at the margins of

streams and from predominantly organic substrate in a spring-fed seepage area.



Map 100. Counties of collection: *Tabanus sparus*.

Known Distribution (Map 100): **CAMP & MORRIS:** Daingerfield; 16 Jun 1958; R.L. Fisher; MSU. **GRIMES:** Navasota R. & FM 2038; 17 May 1971, 10, 12 Apr, 15, 31 May 1974, 7, 14, 15, 19, 21, 23, 26 May, 30 Jun, 22 Jul 1975; P.H. Thompson; TAMU. **HARRISON:** Karneck; 21 May 1951; Knulls; OHSU. 17 Jun 1958; R.L. Fischer; MStU. 1 mi E Karneck; 19 May 1971; R.E. Acciavitti; CU. 1 mi S Ozero Rest area near Sabine R; 9 Jun 1976; H.R. Hoebeke; CU. **NACOGDOCHES:** 27 Apr 1960, 13 May 1961; N. Nichols; SFASU. 25 May 1963; W.W. Gibson; at light; SFASU. 10 Jun 1964; S. Melvin; at light; SFASU. **SMITH & CHEROKEE:** Troup; 31 May 1962; O.G. Babcock; ASU. **WALKER:** Huntsville St Pk; 16, 21 May, 16 Jun 1971; P.H. Thompson; TAMU.

Tabanus stonei Philip

Tabanus stonei Philip 1941c: 144

Moderate (14.5 mm); grayish with paler abdominal pattern; frons about 3 to 3 1/2 times as high as wide, grayish pollinose, widened above; basal callus reddish brown to black, subquadrate to somewhat rounded above, narrowly joined or separated from irregularly spindle shaped median callus; abdomen dark grayish pollinose with pale median triangles and oblique sublateral dashes on tergites 2 to 5; wings hyaline. Male with large and small facets of eyes only slightly differentiated, eyes densely pilose; vertexal tubercle moderately elevated; abdominal triangles and sublateral spots more extensive, but in general similar to female.

Comments: According to Burger, *et al.* (1987), this is a montane species reported from British Columbia to Alberta and south to central Arizona and New Mexico. Philip (1965) reported Texas in the distribution of this species but provided no information on locality or date of

collection. The authors have seen no material from Texas, nor have they found any specific locality data in the literature. The immature stages are not known.

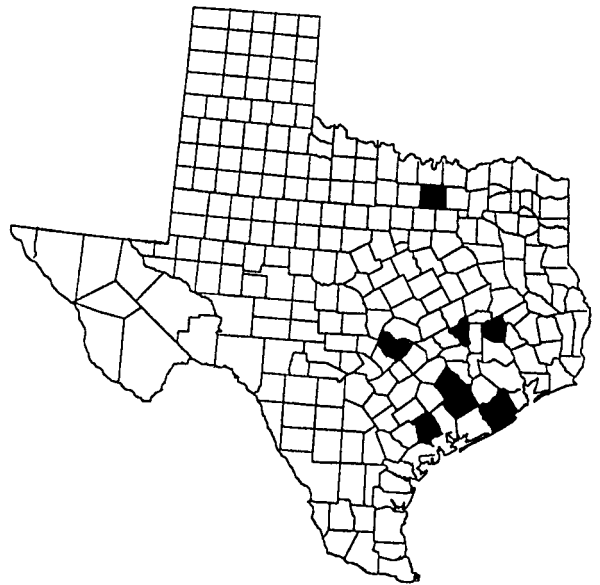
Tabanus stygius Say

Tabanus stygius Say 1823: 33 (1859: 54)

Large (22 mm); frons nearly parallel-sided, 3½ to 4 times as high as wide basally; abdomen black; basal callus reddish brown, higher than wide, nearly as wide as frons, united with a slender linear median callus; thorax with dense covering of white hairs; wings yellowish, bifurcation of vein R₄₊₅ and crossveins with brown spots, costal cell dark yellowish; eyes bare. Male with large and small eye facets sharply differentiated; hairs of thorax dark brown; eyes bare.

Comments: This species has been taken from most of the eastern ½ of the United States, excluding south Florida, from southeast Texas (McGregor and Schomberg 1952; Philip 1947, 1965; Thompson 1973a and b; Thompson *et al.* 1977), Arkansas, Iowa and southern Minnesota eastward through southern New York and northward to southwestern Maine. A westward extension includes most of northern Kansas, southeastern Nebraska and a central part of eastern Colorado. Teskey (1969) reported finding larvae in the saturated silty-clay bank of a stream overhung by shrubs but otherwise devoid of vegetation. Tidwell (1973) reported collecting larvae at the margin of a ditch filled with water hyacinth in a coastal marsh area and at the margins of ponds in mixed bottomland hardwood areas. The senior author has found larvae in the saturated mud around the roots of aquatic vegetation in slow-moving streams. In addition to the distributional information below, the authors are aware of a specimen in the American Museum of Natural History labelled only "Texas".

Known Distribution (Map 101): BRAZORIA: 7, 9 Jun 1968; malaise trap; P.H. Thompson; TAMU. West Bay, 12 mi S Danbury; 13-15 Aug 1970; P.H. Thompson; TAMU. Haskins Mound; 28 May - 2 Sep 1971; P. H. Thompson; TAMU. 11 mi E Angleton; 15, 18, 24, 26 Jun, 22 Jul, 25 Sep 1971; P.H. Thompson; TAMU. 11 mi E Angleton; 6 Jun 1972; L. Meeks; TAMU. Danbury; 18 May 1973; L. Meeks; TAMU. **BRAZOS:** 30 May 1956; H.R. Burke; TAMU. Mile Dr, S College Station; 26 May 1974; P.H. Thompson; TAMU. College Station; 10 Aug 1975; B. Cutler; BC. College Station; 2,26 Jun 1976; P.H. Thompson; TAMU. **COLORADO:** 25, 27 May, 9 Jun 1959; C.F. Bailey; TAMU. **DENTON:** Mike Ranch; 20 Oct 1967; D.H.O.; UNT. **TRAVIS:** Austin; 15 Jun 1948; S.S. Roback; INHM. **VICTORIA:** 12 mi NE Victoria; 5 Apr, 29 May 1974; R.R. Blume & P.H. Thompson; TAMU. **WALKER:** Huntsville St Pk; 16 Jun 1971; P.H. Thompson; TAMU. **WHARTON:** 26 May 1959; C.F. Bailey; TAMU.



Map 101. Counties of collection: *Tabanus stygius*.

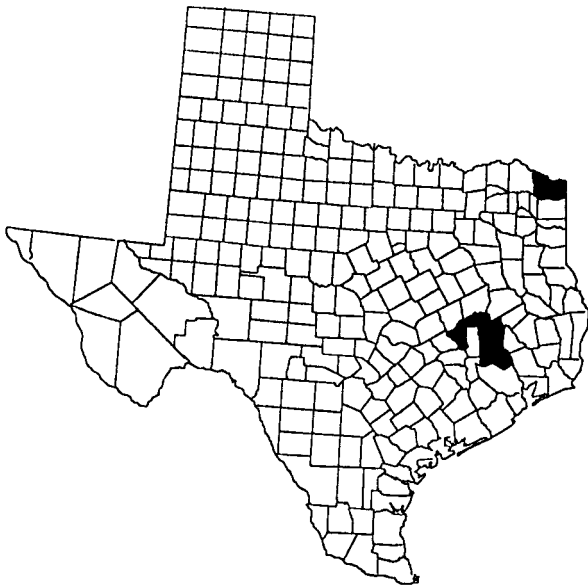
Tabanus sublongus Stone

Tabanus sublongus Stone 1938: 74

Moderate (13 mm); dark orange brown with yellowish to orange pattern; basal callus dark brown to black, square to slightly higher than wide, separated from slender median callus; frons moderately broad, 3½-4½ times as high as wide basally, parallel-sided; third antennal segment slender, basal plate a little longer than combined length of annuli; abdomen with a median row of pale yellowish contiguous median triangles and grayish yellow to orange sublateral spots; wings hyaline; eyes bare. Male with large and small eye facets sharply differentiated; eyes bare.

Comments: This species is found throughout much of the southern two-thirds of the eastern United States from eastern Texas (Thompson 1977), Oklahoma and Kansas and southeastern Iowa eastward excluding the coastal one-third to one-half of states bordering the Gulf and Atlantic coasts. Some of the specimens from the extreme southwestern part of the range may represent an undescribed species (Pechuman, personal communication). The immature stages are unknown.

Known Distribution (Map 102, p. 122): BOWIE: 5 mi E New Boston; 13 Sep 1971; R.E. Acciavitti; LLP. **BRAZOS:** College Station Airport; 3 Jul 1976; D. Bay & P.H. Thompson; TAMU. **GRIMES:** Navasota R at FM 2038; 14 Sep 1971, 5, 13 Jun 1972, 16 Jun, 4 Jul 1975; P.H. Thompson; TAMU. Navasota R at FM 2038; 3 Sep 1975; P.H. Thompson & R.L. Harris; TAMU. **MONTGOMERY:** 4 mi S Richards; 5 Jun 1974; H. Greenbur & P.H. Thompson; TAMU. **WALKER:** Huntsville St Pk; 23 Jun, 25 Aug 1971; 9, 13, 19, 26 Jun, 11 July 7 Aug 1972; E. Gregg & P.H. Thompson; TAMU.



Map 102. Counties of collection: *Tabanus sublongus*.

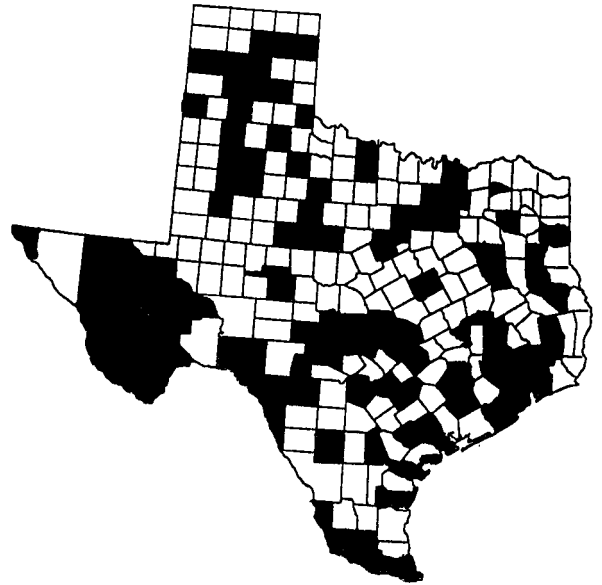
Tabanus subsimilis Bellardi

Tabanus subsimilis Bellardi 1859: 66
Tabanus vittiger subspecies *schwardti* Philip 1942: 29
Tabanus vittiger subspecies *nippontucki* Philip, 1942:
 32

Moderate (13 mm); frons moderately broad, widened above, 3½ to 5 times as high as wide basally; basal callus a little higher than wide, dark brown to black, not touching eyes laterally, narrowly joined to slender black median callus; thorax dark brown to black, with pale longitudinal stripes, scutellum at least reddish apically; hind femora dark brown and usually mid femora and fore coxae at least basally dusky, usually extensively darkened; median abdominal stripe a series of contiguous triangles, or at least consistently widened at posterior of each tergite; sublateral stripes markedly steplike rows of diagonal dashes. Male with large eye facets rather sharply differentiated from small facets, area of large facets densely pilose; color and pattern generally like female.

Comments: This species is found across the entire United States and southward into central Mexico, extending northward in the eastern United States to the southern Great Lakes areas and westward from the southwestern part of Wisconsin diagonally across to include the southern ¼ of California. Texas collections have been reported by Blume *et al* (1972), Easton *et al.* (1968), Gingrich and Hoffman (1967), McGregor and Schomberg (1952), Philip (1947, 1965), Stone 1938, Thompson (1973a and b, 1974a and b, 1975b, 1977, 1978a and b), and Thompson *et al.* (1977). Although previous authors have recognized *T. subsimilis nippontucki* Stone as a variety, the present authors recognize only the nominal species. Goodwin (1973b) reported taking larvae from below the waterline near the margins of small

sink-hole pond.



Map 103. Counties of Collection: *Tabanus subsimilis*.

Known Distribution (Map 103): ANDERSON: 10 mi SW Elkhart; 21 Aug 1968; H.R. Burke; TAMU. 22 Aug 1968; H.R. Burke; FSCA. Salmon; 17 May 1973 - 6 Jun 1973, 26-27 May 1974; modified malaise trap; H.R. Burke; TAMU. 10 mi SW Elkhart; 5-6 Jun 1976; modified malaise trap; H.R. Burke; TAMU. ARANSAS: Goose Is St Rec Area; 7 Jun 1983; C. B. Barr; LSU. ARCHER; 19 Sep 1985; T. Mayer; MISU. ARMSTRONG: Claude; 5 Jul 1968; C.E. Carton; TTU. 1 mi N Wayside; 26 Jul 1986; GSU. AUSTIN: Stephen F. Austin St Pk; 9 Apr 1966; J.C. Schaffner; TAMU. BASTROP: Bastrop; 13 Apr 1972; P.H. Thompson; TAMU. BEXAR: 9 Aug 1952; M. Washbauer; FSCA. Ft Sam Houston; 4 Oct 1952; UC. 6 Sep 1966; J.E. Hahn; FSCA. Mitchell Lk, 2 mi S San Antonio; 9 Sep 1979; S.J. Hanselmann; TAMU. BLANCO: Round Mt; ANSP. Mitchell L, 2 mi S San Antonio; 9 Sep 1979; S. J. Hanselmann; TAMU. BRAZORIA: 3, 10 May; SFASU. 22 Sep 1963, 12 Apr, 2 May, 14, 18 Jun, 21 Jul, 2 Aug, 5, 6, 11 Sep 1964; 22, 23, 28 Sep 1963; all males at black light trap; Schaffner *et al.* TAMU. 27 Apr 1965; R. Thornton; CU. 11 mi E Angleton; 18 Jul, 14, 16 Aug, 8, 11, 16, 28 Sep, 3 Oct 1967, 3 Mar, 19, 22, 25, 26 Apr, 10, 13, 17, 20 May, Jun, 5, 8, 10, 12, 15, 17, 19, 23, 26 Jul, 9, 21, 30 Aug 1968, 27, 30 Sep, 2, 7 Oct 1968, 22 Apr, 12 May, 2, 14 Jul, 1, 4 Aug, 2, 10, 26 Sep, 3, 22, 25 Oct 1969, 19 Apr, 7, 9, 27 May, 18, 24, 25 Jun, 8, 15, 22, 29 Jul, 11, 9, 12, 26 Aug, 2, 9, 15, 22, 29 Sep 1971, 15, 16, 17, 22 Aug 1972; malaise trap; P.H. Thompson; TAMU. Haskins Mound; 2 Apr - 16 Sep 1971; P.H. Thompson; TAMU. West Bay, 12 mi S Danbury; 13-15 Jul 1970, 2 Apr, 24 Jun 1971; P.H. Thompson; TAMU. 10 mi NE Angleton, HW 35; 25 Mar, 1 Apr 1972; L. Meek; TAMU. BRAZOS: College Station; 9 Oct 1951; PU. College Station; 2 Jul 1956, 18 Jul 1957, 20, 25, 27, 30 Apr 1958, 2, 22, 23, 28 Sep 1963, 14, 18 Jun, 2 Jul, 2, 30 Apr 1958; TAMU. 3, 10 May 1959; N. Nichols; SFASU. College Station; 31 Oct 1960; H.J. Reinhard; TAMU. Aug, 5, 11 Sep, 6 Oct 1964; blacklight trap; J.C. Schaffner; TAMU. College Station; 31 Oct 1966; TAMU. 22 Sep 1968; H.R. Burke; FSCA. Vterl. College Station; 3 Apr, 1, 11-12, 21, 22, 26, 30 Aug, 2, 6, 11, 17 Sep, 21, 22, 23 Oct 1970, 8 Jul, 17 Sep 1971, 28 Mar, 3 Apr 1972; P.H. Thompson; TAMU. Navasota R, 11 mi E Bryan; 4, 6, 12 Aug 1970; P.H. Thompson; TAMU. 7 mi S Bryan, Peach Tree; 13 Aug 1970; P.H. Thompson; TAMU. 1 mi E HW 6 & 30; 15 Apr 1971; P.H. Thompson; TAMU. 11 mi SE Bryan; 16 Apr. - 2 May, 2-13, 13-21 May, 21 May - 3 Jun 1971; P.H. Thompson; TAMU. HW 6 & 30; 29 Apr 1971; P.H. Thompson; TAMU. 4 mi SE College Station; 1-13 May 1971; P.H. Thompson; TAMU. 5 mi SE College Station; 13-27 May 1971; P.H.

Thompson; TAMU. Lk Placid; 13-24, May, 27 May - 9 Jun 1971; P.H. Thompson; TAMU. 7 mi S College Station, HW 6; 16 Sep 1971; P.H. Thompson; TAMU. Mile Dr, S College Station; 19, 21, 24 Sep, 8, 21, 22, 23 Oct, 2 Nov 1970, 6, 2-8, 9, 10, 11, 12-15, 16, Apr, 14 May, 3 Jun, 29 Jul, 16, 24 Sep 1971, 23, 27, 30 Mar, 6, 9, 11, 12, 17, 29 Apr, 30 May, 15, 20, 23, 26, 27 Apr, 2, 3, 4, 7, 8, 10, 11, 15 May, 1, 9, 13, 22 Jun, 1, 4, 5 Jul, 26, 27 Aug 1973, 18, 20 Mar, 12 May, 3, 4, 6, 11, 12, 15, 19, 25, 26, 29 Apr, 1, 2, 4, 6, 7, 12, 16, 18, 21, 25, 26 May, 6, 7, 9, 12, 14, 15, 16, 17, 18, 20, 23, 24, 28, 29 Jun, 7, 12, 13, 15, 17, 18, 19, 20, 21, 22 Jul, 16 Aug 1975; P.H. Thompson; TAMU. College Station; 6 May 1973; P.H. Thompson; TAMU. Vterl, College Station; 6 Nov 1972; B.A. Hoffman; TAMU. Vterl; 12 Mar 1974; L. Meek; TAMU. College Station; 13, 22 Mar 1974; R.R. Blume; TAMU. College Station; 20 Aug 1975; B. Cutler; BC. Bryan; 12, 29-30 May 1976; H.R. Burke; TAMU. W.E.-M.R. Jordon Prop; 9.3 mi E College Station; 14 May 1976; malaise trap; S.J. Merrit; TAMU. College Station; 24 Sep 1978, 8 May 1979; C.W. Agnew; TAMU. College Station, 22 May 1979; D. A. Dean; TAMU. College Station; 23, 29 Sep 1979; G.W. Brooks; TAMU. White Cr Rd, 5 mi SW College Station; 17 Jun 1981; R. Turnbow; UG. **BREWSTER**: Big Bend Nat Pk; 28-30 Jul 1956; E.G. Mathews; LLP. 10 mi S Alpine; 15 Aug 1959; Robinson; SRSU. Alpine; 29 Sep 1960; H. Stokes; SRSU. Alpine; 19 Sep 1964; T. Wason; SRSU. Presidio; 14 - 20 Jul 1966; E. R. Easton; (Easton, et al 1968). Marfa; 24 Jul - 5 Aug 1966; E. R. Easton; (Easton, et al 1968). Rio Grande Village; 12 Jul 1968; G.C. Gaumer; SU. Big Bend, Rio Grande Camping Area; 13 Jun 1968; C.R. Ward & D. Bennett; TTU. 25 Jul 1970; C.W. O'Brien; TTU. 6 mi W Alpine; 26 Aug 1971; K.W. Brown; 4500 ft.; PMNH. Dugout Well, Big Bend Nat P.; 5 May 1972; J.G.F.; CU. Big Bend Nat Pk; 17-21 Jul 1972; J. Tucker; TAMU. Rio Grande Village, Big Bend Nat Pk; 3 Jul 1972; R.L. Berry; ODH. Alpine; 22 Aug 1980; Brent Waver; SRSU. 5 km S Marathon; 17 Jun 1995; J.T. Goodwin; TAMU. **BURNET**: Inks Lk St Pk; 28 Apr 1968; at light; J.C. Schaffner; TAMU. Inks Lk St Pk; 12 Jun 1972; at light; J.S. Ashe; TAMU. **CALHOUN**: Port Lavaca; 4-6 Jul 1954; Glick & Smith; INHM. **CALLAHAN**: Clyde; Aug 1956; WSU. **CAMERON**: 4 Apr; Knoll; OHSU. Brownsville; 24 Nov 1910; INHM. Lk Loma Alta; 27 Nov 1910; INHM. Olmito; 14 Apr 1942; W.C. Reeves; FSCA. Thayer (unknown locality; probably Cameron Co as collector made other collections there on the same and following day); 14 Apr 1942; W.C. Reeves; FSCA. Pt Isabel; 22 Jun 1948; S.S. Roback; at light on beach; INHM. Brownsville; 14, 18 Apr, 9 Jul, 3, 7 Oct 1952; T.F. Beimler; LLP. Brownsville; 6 Apr 1959; W. Butt; PU. 14 mi E Brownsville; 13 Jul 1963; Byers *et al.*; at light; UK. Brownsville; 29-30 Jun 1965; H.E. Evans; MCZ. Southmost; 7 Jul 1967; J.W. Tilder; SJ. Brownsville; 11 Jul 1967; SJ. Brownsville; 4, 5 Aug 1967; P. T. Riherd; TAMU. Oct. 1967; P.C. Harmston; FSCA. La Feria; 31 Mar 1968; P.T. Riherd; TAMU. 20-22 Jun 1969; P.L. Glick; light trap; TAMU. Brownsville; 21 Jun 1969; Board & Hafernik; TAMU. Brownsville; 7 Nov 1971; B. Walsh; TAMU. Brownsville; 23 Oct 1976; F.D. Fee; FDF. Sabul Palm Grove, Southmost; 10 Oct 1977; R. Turnbow; UG. 31 May - 3 Jun 1980; G.B. Fairchild; FSCA. nr Southmost Palm Grove Sanct; 8, 19-20, 23-25 Jun, 16 Jul 1981; blacklight trap; R. Turnbow & E. Oritz; TAMU. Sabal Palm Grove Sanct; 5 Apr 1987; E. Riley & D. Rider; LSU. San Benito; 6 May 1995; J.T. Goodwin; TAMU. **CARSON**: Pan Tex; 24 Aug 1971; G.B.M.; TTU. **CASTRO**: 17 Jul 1981; M. Arnold; TTU. 30 Oct 1981; J. Armstrong; TTU. **CHAMBERS**: 8 Jul 1983; A.F. Beck; FSCA. **CHILDRESS**: 7, 27, 29 Jul, 4 Sep, 9 Oct 1982; S.R. Kingston; TTU. **CLAY**: 23 Sep 1975; T. Tomlinson; MISU. **COLORADO**: 11, 21 Jul 1957, 23 Jun, 11 Jul, 5 Aug 1959, 3 Sep 1959; C.F. Bailey; TAMU. 9 Jul, 25 May 1959; FSCA. **CROSBY**: LT Ranch; 18 May, 3, 17, Jun, 1, 15, Jul, 9, 19 Aug, 2, 3, 17, 23 Sep 1978; S.G. Davis; TTU. LT Ranch; 25 May, 8 Jun, 27 Jul 1979; D. Sanders; TTU. **CULBERSON**: 3 mi E Vanhorn; 13 Aug 1969; light trap; Board & Hafernik; TAMU. **DALLAS**: 9 Nov 1969; UTA. Garland; 8 June 1975; J.H. Holmes, Jr.; TAMU. 22 Aug 1981; L. Smart; TTU. Dallas; 3 Mar (Stone, 1938). **DAWSON**: 27 Jun 1979; D. Sanders; TTU. **DELTA**: Cooper; 10 Aug 1983; D. A. Dean; TAMU. **DENTON**: Denton; 15 Jun 1966; A. Jimenez; CU. 4 mi E Roanoke; 23 May 1971; R.E. Acciavitti; CU. C & L Brown Nursery; 18 Apr 1969; L.S. Brough; UNT. Denton; 15 Apr 1970; P. Riggs; UNT. Denton; 8 May 1970;

Skelton; UNT. Garza Little Elm; 2 Oct 1971; T.J.S.; UNT. **DONLEY**: 1 July 1978; FSCA. **EL PASO**: Adams Farm, 4 mi W Clint; 9 Jun, 6, 27, 29 Jul 1977; C.R. Burgess; TAMU. **ERATH**: Stephenville; 21 Jun 1982; blacklight trap; C.W. Agnew; TAMU. **GALVESTON**: Galveston; May; F.H. Snow; LACM. 26 Nov 1964; UTA. **GARZA**: City Pk, Post; 16 Jun 1965; Raffiniferger; CU. 30 Apr 1969; J.A. Tenorio; TTU. **GILLESPIE**: 5 Apr 1953; Knoll; OHSU. July 196 ; C.D. Schmidt; TTU. 17 Aug 1965 (as larvae); Gingrich and Hoffman (1967). **GOLIAD**: 26 May 1975; J.V. Moody & D.L. Meeks; TTU. **GONZALES**: 7 Apr 1958; TAMU. **GRAYSON**: 26 Jul 1969; B. McDermit; MISU. **GRIMES**: Navasota R. & FM 2038; 17, 28 May 1971; 1 July 1971; 5, 10 Aug, 20 Sep 1971, 20, 27 Mar, 4, 5, 10, 17, 24 Apr, 1, 8 May, 28 Aug 1972, 12, 17, 24 Apr, 29 May, 15 Jun 1974, 11, 14, 21, 28 Apr, 7, 10, 12, 14, 15, 21, 26 May, 2, 4, 9, 14, 16, 23 Jun, 18, 27 Jul 1975; P.H. Thompson; TAMU. **GUADELUPE**: Seguin; 3 Aug 1986; F.E. French; GSU. **HALE**: Plainview; 21 Sep 1953, 8 Jun, 8 Jul, 10 Aug, 10, 16 Sep 1954; F.C. Harmston; CU. 13 Sep 1960; M.D. Shea; TTU. **HARDIN**: 3 mi NE Kountz, FM 418; 3 May 1972, 5 Jul 1973; P.H. Thompson; TAMU. **HARRIS**: Houston; 20 Sep 1969; J. Bruner; at light; SFASU. 3 Aug 1973; R. Mack; TTU. Cypress; 4 Oct 1974; A. Dean; TAMU. **HARRISON**: Karnack; 22 May 1951; Knoll; OHSU. **HASKELL**: 3 Oct 1964; Moody; TTU. **HEMPHILL**: Canadian Lk, Marvin; 25 Jul 1969; Ashdown, Tenorios, Oakes & Richardson; TTU. 23, 24 Jun 1970; C.W. O'Brien; black light trap; TTU. 2 Jul 1978; E.C. Knudson; FSCA. **HENDERSON**: Payne Springs nr. Cedar Creek Lk; 3 Jun 1966; Beard; CU. **HIDALGO**: Santa Anna Wildlife Ref; TAMU. 24 Jun 1948; Roback; LLP. 20 Mar 1952, 26 Mar 1953; Knoll; OHSU. 6 mi SW Mission; 5 Sep 1959; Hsiao & Hansan; USU. 3 Apr 1961, 29 Mar 1963, 24, 25, 28, 30 Mar 1964; Knoll; OHSU. Donna; UCB. Mission; 1 Jul 1961; Bentsen St Pk; 1 Jul 1961; R.L. Westcott; LACM. 28 Jun 1968; R.L. Heitsman; FSCA. 27, 28 Mar, 3, 5 Apr 1967; Knoll; OHSU. Santa Anna; 8 Jul 1967; J.W. Tilden; SJ. Oct. 1967; UTA. 17 Jun 1969; Board & Hafernik; TAMU. Bentsen-Rio Grande St Pk; 8, 13, 16 Apr, 25 Jun 1968; G.H. Nelson; FSCA. Bentsen-Rio Grande St Pk; 18 Jun 1969; Board & Hafernik; TAMU. 4 mi S Mercedes; 9 Aug 1972; J. Tucker; TAMU. McAllen; 15 Sep 1974; light trap; SJ. Bentsen-Rio Grande St Pk; 9 Jun 1975; C.L. Smith; UG. Bentsen-Rio Grande St Pk; 17 Mar 1977; T.P. Friedlander; TAMU. Santa Anna Ref; 13 Mar 1979; C.W. Agnew; TAMU. Bentsen-Rio Grande St Pk; 12 Aug 1980; P.W. Kovarik; TAMU. Bentsen-Rio Grande St Pk; 6 Jun 1983; C. B. Barr & D. Rider; LSU. Bentsen-Rio Grande St Pk; 30 Jun 1985; W.F. Chamberlain; TAMU. **HOOD**: 8 mi S Granbury; 18 Apr 1975; J.H. Holmes, Jr.; TAMU. **HUNT**: Floyd; 27 Sep 1968; B.W. Robertson; TTU. **HUTCHINSON**: Borger; 22 Jul 1966; R. McDonald; GSU & WTAM. **JEFF DAVIS**: Limpia, Davis Mts; 15 Jul 1948; S.S. Roback; INHM. Davis Mts; 25 Jun 1964; Knoll; OHSU. 2 mi NW Ft Davis; 10 Sep 1971; K.W. Brown; 5100 ft, black light; PMNH. Sawtooth Mt St Pk; 29 May 1973; Gaumer & Clark; TAMU. **KERR**: 30 Mar 1961; R.H. Roberts; ASU. 15 Apr, 14, 17 May, 4, 12, 26, 29 Jun, 1, 10 Jul 1968, 11 Jun 1968; R.R. Blume & P.H. Thompson; TAMU. Kerrville; 18 Jun 1995; J.T. Goodwin; TAMU. **KIMBLE**: 6 Aug 1973; N. Nichols; TTU. 13 Sep 1981; B. Lance; TTU. **KING**: 30 Jul, 9, 13 Aug, 3, 17, 30 Sep 1976; D. Sanders; TTU. Guthrie; 3, 10, 30 Sep 1976; S.G. Davis; TTU. **KINNEY**: 5 mi NW Brackettville; 3-9, 17-23 Jul 1966; E. R. Easton; (Easton, et al 1968). **KLEBERG**: Kingsville; Reed; LLP. Baffin Bay; 18 Jun 1963; B. McDaniel; CU. Kingsville; 30 Sep; 18 Nov 1963, 27 Feb, 19, 22 Mar, 15 Apr, 1, 6 May 1964; student collection; CU. Kerrville; 7 Sep 1964; W.F. Chamberlain; TAMU. 3 mi N Riviera; 10 Jun 1969; Board & Hafernik; TAMU. Kingsville; 14 Mar 1974; W.E. Clark; TAMU. Kingsville; 14 Aug 1979; W.H. Cross; "at light"; MSU. **LA SALLE**: Chaparral Wildlife Mngt Area; 12, 13 Jun 1972; B. Wright; NSM. **LAMB**: Littlefield; 27, 28 Aug 1961; D. Brooks; GSU & WTAM. 4 Oct 1968; C.A. Scherton; TTU. **LIBERTY**: Dayton; 16 Aug 1971; R.D. Parker & P.H. Thompson; TAMU. 16 mi ESE Cleveland; 29 Mar, 4, 10, 12, 19 Apr, 29 May, 7 Jun, 26 Jul 1972; P.H. Thompson; TAMU. ½ mi E Hull; 29 Mar, 4, 12, 19, 26 Apr, 14 Jun, 21, 23 Aug, 13, 20 Sep 1972; P.H. Thompson; TAMU. **LIVE OAK**: Three Rivers; 12 Sep 1969; Huddleston & Ward; black light trap; TTU. **LLANO**: 10 Jun 1941; J.E. Gillaspay; FSCA & UC. Sep 1968; H.

Borcher; FSCA. **LUBBOCK**: Lubbock; 25 Apr 1965; C.H. Roundtree; CU. 5, 6 Oct 1968; D. Arnold; black light; TTU. 8 Jun 1969; J. Tenorio; TTU. 7 Jul 1969; C. Martin; TTU. 13 Sep 1969; C.G. Dodd; TTU. Oct 1969; D.W. Kiser; TTU. 8 Aug 1970; D.N. Kisen; TTU. 22 Jun 1981; P. Downer; TTU. 19 Jul 1981; B. Lance; TTU. Lubbock; 34th & Upland; 13 Jul 1989; T. Doederlain; TTU. **LYNN**: 6, 22 Oct 1968; D.R. Turner; TTU. 15 Aug 1969; R. Harris; TTU. 21 Sep 1970; K. Wien; TTU. **MASON**: 1 mi S Mason; 1 Oct 1970; J.A. Campbell; TTU. **MAVERICK**: 11 Aug 1971; R.D. Parker; TAMU. Eagle Pass; 24 Aug 1971; A.D. Walsh; TAMU. **MCLENNAN**: Waco; 16 May 1968; D.C. Darling & W.H. Tyson; at light; CU. **MONTGOMERY**: Jones St For 8 mi S Conroe; 13-19 Apr, 27 Apr - 3 May 1987; Wharton, Wang and Praetorius; TAMU. **MOTLEY**: Matador; 5 Sep 1969; K. Pitts; TTU. Flanot; 28 Sep 1969; K. Pitts; TTU. **NACOGDOCHES**: 12 May 1958; J. Daniel; SFASU. 10 Jul 1958; Gascon; SFASU. 5 Oct 1958; J. Bruner; SFASU. 30 Oct 1958; M Ballard; SFASU. 13 Apr 1960, 16 Apr, 16 MAY 1961, 17 Apr 1962, 6 May 1969; N. Nichols; SFASU. 3 Jul 1963; J. Fisk; at light; SFASU. 23 Sep 1968; G.D. Sitton; SFASU. 21 Jun 1969; R. Durrer; SFASU. 20 Sep 1969; J.T. Vincent; at electric light; SFASU. 9 May 1971; R. Humphries; SFASU. 29 Jun, Jul 1973, 14 Jun 1975; W.W. Gibson; both at electric light; SFASU. **NOLAN**: Wright Ranch; 5, 20 Jul, 2, 17, 23 Aug, 20 Oct 1982; S.R. Kingston; TTU. **OLDHAM**: Adrian; 30 May 1956; E.P. Meiner; UW. **PARKER**: 2.5 mi SW Aleda; 31 May 1971; R.E. Acciavitti; CU. **PARMER**: 27 Sep 1968; P. Johnson; TTU. **PECOS**: Ft Stockton; date & collector unknown; SRSU. Ft Stockton; 18 Jun 1995; J.T. Goodwin; TAMU. **POTTER**: Amarillo; 5 May 1964; G. Cawley; WTAM. Amarillo; 16 Jun 1974; S. Smith; WTAM. **POTTER-RANDALL**: Amarillo; 5 May 1969; G. Crowley; GSU. **PRESIDIO**: 3 mi S Brackettville; 4, 7 Jul 1966; TAMU. 6 mi NW Brackettville; 7, 9 Jul 1966; TAMU. 11 mi S Marfa; 14, 25, 26, 30, 31 Jul 1966; E.R. Easton; TAMU. 6 mi SE Presidio; 16 Jul 1966; TAMU. 1.5 mi S Brackettville; 17 Jul 1966; TAMU. Presidio; Jun 1967; C.L. Cole; TAMU. Presidio; 14 Apr 1968; Jun 1968; 22 Aug 1968; J.E. Hafernik; TAMU. Plata; 8 Jun 1968; J.E. Hafernik; TAMU. **RANDALL**: Palo Duro Canyon St Pk; 8, 9, 10, 11, 14, 16 May 1961; R.L. Westcott; LACM. Canyon; 8 Aug 1966, 18 Jun 1974; D. Brooks; GSU & WTAM. Canyon; 20 Nov 1966; R. Moore; WTAM. Canyon; 13 Jun 1967; J. Burrows; GSU & WTAM. Canyon; 20 Jun 1967; R. Howard; GSU & WTAM. Canyon; 14 Jun 1969; C. West; GSU & WTAM. Canyon; 11 Aug 1969; R. Brown; GSU & WTAM. Canyon; 29 Jun 1974; C. Robertson; WTAM. Canyon; 9, 15 Sep 1980; M. Rhea; WTAM. Canyon; 11 Sep 1980; B. Hayes; GSU. Ceta Canyon, Wayside; 8 Oct 1991; Debbi Fritts; WTAM. **REAL**: 5-9 Jun 1982; G.B. Fairchild; FSCA. **REEVES**: 3 mi S Orla; 9 Jul 1961; R.L. Westcott; LACM. Balmorhea; 12 Aug 1969; blacklight trap; Board & Hafernik; TAMU. **ROBERTS**: Miami; 26 Aug, 27 Aug 1968; D. Bennett & R. Kirby; TTU. 5.3 mi NE Jct HW 6 & OSR; 29 Jun 1975; S.J. Merritt; TAMU. **RUSK**: 14 Oct 1967; C. Wyley, Reklaw; SFASU. **SAN AUGUSTINE**: 2 Nov 1963; N. Nichols; on cow; SFASU. **SAN PATRICIO**: Corpus Christi; 21 Jul 1942; W.M. Gordon; LLP. Corpus Christi; 21 Jun 1956; Evans et. al; LLP. 5 mi N Sinton; 7 May 1958; H.E. Evans & Flint; CU. 7 mi N Sinton; 15 Apr 1961; Knull; OHSU. Corpus Christi Lk St Pk; 18 Aug 1963; G. Byers; UK. 2 Nov 1963; N. Nichols; on cow; SFASU. Welder Wildlife Ref; 10 Oct 1968, 20 Jul 1979; D.C. Darling & W.H. Tyson; CU. 27 Aug 1970; L.B. O'Brien; TTU. Welder Wildlife Ref; 28 Aug 1969; Board & Hafernik; TAMU. Welder Wildlife Ref; 14-16 May 1974; M. Turrel; at light; CU. Welder Wildlife Ref, 8 mi NE Sinton; 29-30 Jul 1975; E.R. Hoebeke; CU. Welder Wildlife Ref; 25 Apr 1977; Eichlin & Warbauer; LB. Welder Wildlife Ref; 29 May 1980; G.B. Fairchild; FSCA. Welder Wildlife Ref; 23 May 1981; R. Turnbow; UG. Welder Wildlife Ref, 8 mi NE Sinton; 13-15 May 1985; R. Brown, D. Adamski & B. Farmer; MSU. **STARR**: 13 Apr 1961; Knull; OHSU. Falcon St Pk; 20 Jun 1969; Board & Hafernik; TAMU. Falcon St Pk; 3 Sep 1976; R. Turnbow; "black light trap"; UG. **SWISHER**: Tulia; 13 Oct 1954; P.C. Harmston. FSCA. 6 Jun 1968; J. Herring; TTU. 2 Sep 1976; T. Reed; TTU. **TARRANT**: Arlington; 24 Jun 1964; B. Wright; UTA. 30 Jun, 8 Jul 1969, 6 Aug 1970; UTA. Halton City; 10, 22 Jun 1971; 2.5 mi SE Wheatland; R.E. Acciavitti; CU. Colleyville; 10 Jun 1972; R.E. Acciavitti; CU. **TAYLOR-JONES**: Abilene; 19 Jul 1961; J.F. Downes;

TAMU. **TOM GREEN**: 8 Aug 1978; W.D. Sisson, O.F. Franke, T.B. Hall, J.V. Moody; TTU. Angelo Statue Univ campus; 2 Aug 1972, 16 Jun 1989, 20 Jul 1989; ASU. **TRAVIS**: 3 Jul 1957; C.S. Limer; LLP. Austin; 1 Aug 1968; A.C. Lloyd; CMA. 10 mi S Austin; 28 Aug 1971; R.D. Walsh & P.H. Thompson; TAMU. Zilker Pk; 12 Sep 1981; P. Kovarik & G. Trevino; TAMU. Bull Cr, 7.5 mi NNW Austin; 11 May 1960; B. Vogel; TMM. Breckenridge Field Lab; 22 Jun 1972; B. Vogel; TTM. **TYLER**: 2 mi W Fred, FM1943; 12 Apr, 3 May 1972; P.H. Thompson; TAMU. **UVALDE**: Uvalde; 8 Jun 1966; J.E. Lloyd; CU. 12 Sep 1968; J. Owens & J. Puley; TTU. Speir Ranch, 3 mi NW Uvalde; 1, 2, 3, 4, 5, 6, 7 May 1977; Eichlin & Warbauer; LB. **VAL VERDE**: Devils R, Dolan Falls; 18 Jun 93; C.R. & J.R. Nelson; UTAU. 2.1 mi W Del Rio; 2 Jun 1965; R.R. Blume & P.H. Thompson; TAMU. 35 mi W Del Rio; 30 May 1972; A.E. Lewis; CU. **VICTORIA**: Victoria; 19, 26, 30 Apr, 10 May 1971; G. Underwood; TAMU. Victoria; 20 Apr 1971; G. Underwood & P.H. Thompson; TAMU. 10 mi NE Victoria; 21 Sep 1972; R.R. Blume; TAMU. **WALKER**: Huntsville St Pk; 12, 14 Apr, 6, 14, 21 May, 6, 7, 10, 15, 21, 30 Jun, 7, 10, 21, 28 Jul 1971, 5, 10, 17, 24 Apr, 1 May, 8, 13, 19 Jun, 3 Jul 1972; P.H. Thompson; TAMU. Ellis Prison; 11, 14, 15, 21, 22, 29 Jul, 1, 3, 5, 9-16 Aug 1977; modified malaise trap; W.L. Sterling; TAMU. **WARD**: Monahans Sandhills St Pk; 2 Aug 87; E. Riley & D. Rider; LSU. Monahans Sandhills St Pk; night sweep; 2 Aug 87; C.B. Barr; LSU. Monahans Sandhills St Pk; 2 Aug 1987; C.B. & J.E. Barr; LSU. **WHARTON**: 4, 9 Jun 1954; TAMU. 3 Jun 1959; C.F. Bailey; FSCA. 8 Aug 1969; P.H. Thompson; TAMU. **WICHITA**: 5 mi E Burkburnett; 2-3, 9 Jun, 28, 30 Jul, 13, 15 Aug 1982; S.R. Kingston; TTU. 4 Aug 1969; G. Thornton; MISU. 10 Aug 1969; R. Slaughter; MISU. 10 mi W Wichita Falls; 22 Jun 1971; MISU. Wichita Falls; 30 Jun, 3 Jul 1971; MISU. 3 Sep 1972; L. Dipsey; MISU. 22 Oct 1975; M.G.; MISU. 9 Sep 1976; J. Merchant; MISU. 21 Oct 1976; M. Metcalfe; MISU. 15 Sep 1977; N.D. Hodson; MISU. Wichita Falls; 3 Apr 1985; MISU. 4 Oct 1985; MISU. 11 Oct 1991; A. Chandler; MISU. **WILLIAMSON**: Taylor; 29 Apr 1967, 20 Apr, 18 May, 7, 8 Sep 1968; J.E. Hafernik; TAMU. **WOOD**: Mineola; 5 Oct 1959; J. Bruner; SFASU. **ZAPATA**: Zapata; 18 Aug 1971; R. Walsh; TAMU.

Tabanus sulcifrons Macquart

Tabanus sulcifrons Macquart 1855: 53 (1855: 33)(as *fulcifrons*)

Tabanus variegatus Fabricius 1805: 95 (preoccupied DeGeer 1776)

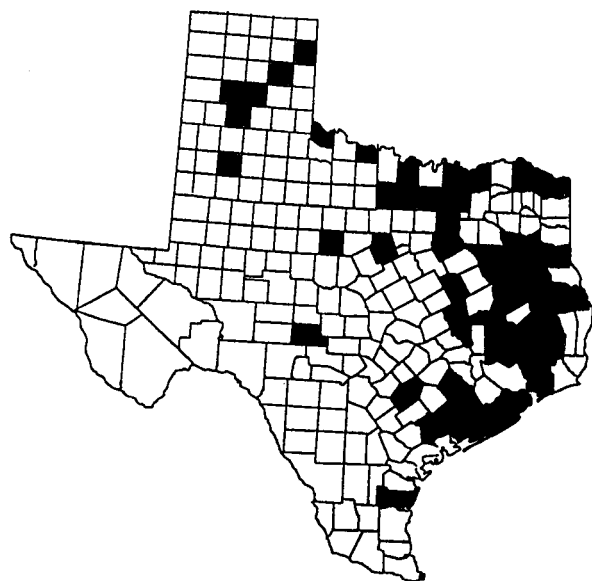
Tabanus tectus Osten Sacken 1876: 436

Tabanus exul Osten Sacken 1878: 558

Fairly large (21 mm); reddish brown with grayish to yellowish pattern; basal callus brown, higher than wide, rounded above, distinctly but narrowly connected with fairly broad elongate median callus; frons broad, 3½ to 4½ times as high as wide as basally, slightly widened above; abdomen with a median row of relatively broad grayish to yellowish triangles and pale hind margins which broaden laterally; wings somewhat tinted, bifurcation of vein R₄₊₅ and crossveins with brown spots, costal cell orange, cell r₅ usually somewhat narrowed; eyes bare. Male with large and small eye facets sharply differentiated; eyes bare.

Comments: This species is known from throughout the eastern ½ of the United States, except southern Florida, from central Texas (Blume *et al.* 1972; McGregor and Schomberg 1952; Philip 1947, 1965; Thompson 1973a, 1974a and b, 1975b, 1977; Thompson *et al.* 1977;

Thompson *et al.* 1978; Thompson and Krauter 1978), western Oklahoma and Kansas, southeastern Nebraska, and southern Iowa eastward. No field collections of larvae confirmed to be this species are known. Tashiro (1950) reared adults from eggs and provided a brief description of the larvae. Schomberg (1952) provided information on habitats of larvae presumed to be this species. Specimens described as this species by Teskey (1969) are now known to be *T. limbatinevris*.



Map 104. Counties of collection: *Tabanus sulcifrons*.

Known Distribution (Map 104): **ANDERSON:** 26 Sep 1964; W. Wolf; SFASU. **ANGELINA:** 23 Nov 1969; N. Nichols; SFASU. Boykin Spr Cpgd, Angelina Nat For, 20 mi NW Jasper; 10 Oct 1994; malaise trap; J.C. Abbott and J.W. Chirhart; JTG. **ARMSTRONG:** 1 mi N Wayside; 26 Jul 1986; F.E. French; GSU. **BOWIE:** 3 Oct 1968; J. Jennings; TTU. 6 Aug 1970; R. Mayfield; TTU. **BRAZORIA:** Angleton; 3 Jul 1945; CU. West Columbia; 28 Jun 1961; R.L. Westcott; LACM. Haskins Mound; 12, 17, 26, 28 Jun, 1, 5, 7, 8, 10, 12, 14, 15, 17, 19, 21, 23, 26, 29, 31 Jul, 9, 14 Aug 1968, 18, 20, 23, 30 Jun, 2, 7, 9, 11, 14, 23, 25, 28 Jul, 4, 6, 8, 11 Aug 1969; 4 Jun, 2 Sep 1971; malaise trap; P.H. Thompson, TAMU. 23 Jun, 8, 12, 15, 23, 26, 29, 31 Jul, 9, 12 Aug 1968; 18, 20 June 1969; TAMU. Angleton; 29 Jul 1969; TAMU. West Bay, 12 mi S Danbury; 13-15 Aug 1970; P.H. Thompson; TAMU. 11 mi E Angleton; 8, 18, 24, 25 Jun, 1, 8, 15, 22, 24, 29 Jul, 11, 12, 18 Aug 1971, 10-14 Jul 1972; P.H. Thompson; TAMU. **BRAZOS:** College Station; 13 Oct 1916, 20 Aug 1933, 6 Jun 1950; H.J. Reinhard; TAMU. College Station; 22 Jul 1932; S. Bromley; TAMU. 11 mi E Bryan; 6, 7 Aug 1970; P.H. Thompson; TAMU. Vterl, College Station; 16, 22, 23, 27 Aug, 1, 4, 6-12, 8, 20, 22, 26, 28, 30 Aug, 2, 4, 5, 24 Sep, 8 Oct 1970, 29 Jun 1971; P.H. Thompson; TAMU. 4 mi S Kurten; 5 Sep 1970; Gaumer & Murray; CU. 5 mi E Bryan; 7 Sep 1970; P.H. Thompson; TAMU. 2 Oct 1970; CU. Mile Dr, S College Station; 4 Oct 1970, 1 Jul 1971, 22, 24, 30 Jun, 1, 3, 4, 5, 9, 17, 18, 30 Jul 1973; 8 Jun, 24 Jul, 3 Aug 1974, 14 Jun, 18 Aug, 25 Sep, 2 Nov 1975; P.H. Thompson; TAMU. 7 mi S College Station; 16 Sep 1971; P.H. Thompson; TAMU. Harvey; 15 Jun 1972; J.E. Wright; TAMU. 0.3 mi N Junct Jones Rd & HW 60; 12 Jul 1975; S.J. Merritt; TAMU. College Station; 23 Jun 1975; D. Ring; 19 July 1975; BC. Bryan; 23 June 1975; B. Cutler; BC. 5 Jul 1977; R.S. Pergier; FSCA. 9,15 July 1979, C.W. Agnew, TAMU. 19 Jul 1979; FSCA. College Station; 9, 15 Aug 1979; C.W.

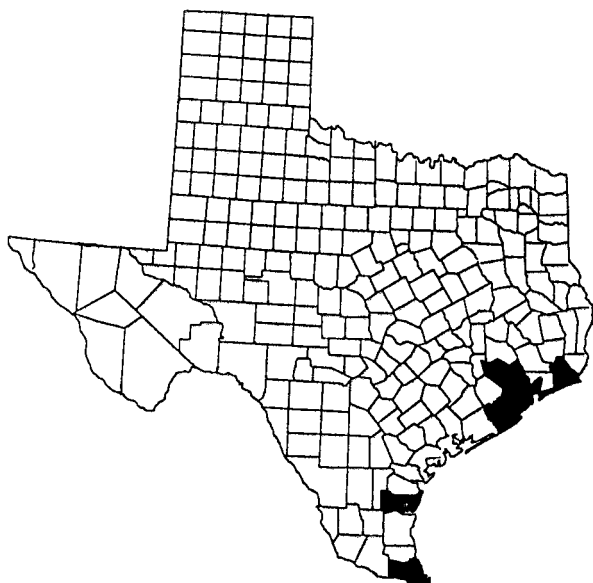
Agnew; TAMU. **CALLAHAN:** Cross Plains; 3 Sept 1968; R. Kirby & J. White; TTU. **CHAMBERS:** 15 Oct 1959; TAMU. **CHEROKEE:** 22 Sep 1964; McCliston; SFASU. **COLLIN:** McKinney; 2 Jul 1929, 1 Sep 1938; J.N. Roney; TAMU. **COLORADO:** Eagle Lk; 24 Mar 1974; J. Wiese; TTU. **DALLAS:** 21 Jun 1968; J.P. Holmer; TTU. Dallas; Jun 1989; C. Seifert; MISU. no data; INHM. Garland; J. Flook; UNT. **DENTON:** Denton; 25 Aug 1978; "M.M."; UNH. Trinity R; 27 Sep 1969; J.T.B.; UNT. Clear Cr @ confluence of Elm Fork; 21 Jul 1973; R.Y.O.; UNT. **ELLIS:** Alma; 7 Aug 1917; E.L. Dwin; CU. **ERATH:** FM 1188, 3 mi W Bluffdale; 8-15, 16-23, 22-29 Jul 1976; malaise trap; R.L. Sams; TAMU. **FANNIN:** 5 Sep 1935; C. Roys; UM. **GALVESTON:** 17 Jun 1966; N. Nichols; SFASU. **GONZALES:** Palmetto St Pk; 1976, #2709, reared; J.T. Goodwin; FSCA. **GRAY:** Pampa; 11 Aug 1969; S. Brown; GSU & WTAM. **GRAYSON:** 26 Jul 1969; B. McDaniel; MISU. **GREGG:** Longview; 8 Oct 1961; N. Nichols; SFASU. **GRIMES:** Navasota R at FM 2038; 29 May, 10, 21, 28 Jul, 7 Aug, 1, 8, 14 Sep 1971, 10 Apr 1972, 10, 12, 13, 14, 19 Jun 1974, 18 Jun, 4, 21, 30 Jul, 8 Aug 1975; P.H. Thompson; TAMU. **HARDEMAN:** Sites 6, 13, Medicine Mounds Ranch; 18-21 Jul 1995; W.D. Sissom; ASU. **HARDIN:** Kountz; G.B. Fairchild; FSCA. **HEMPHILL:** 8 Jul 1969; C.L. Busby; MISU. **HENDERSON:** 6 Oct 1962; N. Nichols; SFASU. **HOUSTON:** 1 May 1960; D. Lindsey; SFASU. **JACK:** 10 Sep 1979; T. McElroy; MISU. **JACKSON:** 10 mi NE Point Comfort; 29 Jun 1961; R.L. Westcott; LACM. **KIMBLE:** 25 Jul 1975; D.E. Foster; TTU. **KLEBERG:** Kingsville; C.T. Reed; CU. **LIBERTY:** 16 mi ESE Cleveland, FM 162; 12, 25, 26 Jul, 2, 9, 16 Aug 1972; P.H. Thompson; TAMU. ½ mi E Hull; 13, 20 Sep, 3 Oct 1972; P.H. Thompson; TAMU. **LIMESTONE:** Kosse; 16 Jul 1975; R. Abbott; BC. **LUBBOCK:** Young. **MATAGORDA:** Palacios; 29 Jun 1981; R.L. Westcott; LACM. **MONTEAGUE:** 8 mi S Bowie; 23 Sep 1979; E. Matelski; MISU. **MONTGOMERY:** Jones St For, 8 mi S Conroe; 19 Sep - 4 Oct 1987; Wharton, Carroll & Praetorius; TAMU. Jones St For, 8 mi S Conroe; 12 Oct 1987; Wharton, Wang & Praetorius; TAMU. 12 Oct 1991; C. Lundy; MISU. **NACOGDOCHES:** 8 Oct; W. Burrus; SFASU. 10 May 1958; J. Daniel; SFASU. 18 Oct 1958; McRae; SFASU. 25 Oct 1958; Ashworth; SFASU. 23 Sep 1959; E. Eubanks; SFASU. 23 Sep 1959; Stephens; SFASU. 3, 14 Oct 1959; J. Bruner; SFASU. 7 Oct 1958; G.A. Duke; at electric light; SFASU. 17 Oct 1959; Strong; SFASU. 27 Oct 1960; P. Ceborne; SFASU. 6 Oct 1961; N. Nichols; SFASU. 10 Sep 1962; W.W. Gibson; SFASU. 12 Oct 1963; R. Lanier; SFASU. 27 Sep 1964; R. Denson; SFASU. 5 Oct 1966; E. Aaron; SFASU. 17 Oct 1966; L. Endsley; SFASU. 24 Sep 1968; J.W. Roelofs; at electric light; SFASU. 22 Jul 1969; J.F. Adison; SFASU. 8 Oct 1969; C. Hall; SFASU. 29 Sep 1970; N. Nichols; SFASU. 10 Oct. 1974; W. Garasic; SFASU. **PANOLA:** 7 Oct 1962; T. Bingham; SFASU. **POLK:** 11 Oct 1958; Malone; SFASU. **RANDALL:** Canyon; 13 Aug 1971; T. Rush; GSU. Palo Duro St Pk; 10 Nov 1980; K. Hoffman; GSU & WTAM. **RED RIVER:** Clarksville; 5, 30 Jul 1957; M. Miesch; PU. **ROBERTSON:** 5.3 mi NE Jct HW 6 & OSR; 13 Jul 1975; S.J. Merritt; TAMU. **RUSK:** 4 Oct 1959; D.T. Wright; SFASU. **SABINE:** 9 mi E Hemphill; 25 Aug - 10 Nov 1989; Anderson & Morris; TAMU. **SAN AUGUSTINE:** 2 Nov 1963; N. Nichols; on house; SFASU. **SAN JACINTO:** 2 mi E Oakhurst; 3 Oct; AMNH. **SMITH:** date & collector unknown; SFASU. 6 Nov 1963; N. Emmons; Tyler; SFASU. **SWISHER:** 22 Sep; T. Reed; TTU. **TARRANT:** 24 Aug, 28 Sep 1967, Oct 1970; UTA. 15 Aug 1970; W.D. Shepard; at electric light; SFASU. **TYLER:** Warren; 7 Oct 1950; TAMU. **VICTORIA:** Victoria; 5 Jul 1970; collector unknown; USDA. 12 mi NE Victoria; 24 Jul 1974; R. R. Blume; TAMU. **WALKER:** Huntsville St Pk; 1, 21 Aug 1972; P.H. Thompson; TAMU. **WHARTON:** Wharton; 2 Jul 1969; collector unknown; USDA. **WICHITA:** Wichita Falls; 17 Jul 1969; F.G. Hnaydil; MISU. 22 Jul 1969; T. Lillard; MISU. 29 Jul 1969; C. Thornton; MISU. 5 Aug 1969; R. Slaughter; MISU. 10 Aug 1973; Hicks; MISU. 25 Sep 1975; L. Burt; MISU. 13 Nov 1976; P.R.; MISU. 13 Sep 1978; B. Crowley; MISU. 20 Sep 1979; Davenport; MISU. 5 mi E Burkburnett; 28, 30 Jul 1982; S. R. Kingston; TTU. 1 Sep 1983; MISU. 30 Sep 1985; C.D. Chaney; MISU.

***Tabanus texanus* Hine**

Tabanus texanus Hine 1907: 228

Moderate (12 mm); brown with yellowish gray pattern; basal callus shiny black, slightly transverse, not touching eyes, a little protuberant, separated from small oval median callus of same color; frons about 2½ to 3 times as high as wide basally, nearly parallel-sided; thorax brownish with darker longitudinal stripes; abdomen blackish brown with three rows of yellowish gray spots, the median spots contiguous forming a median serrate stripe and the sublateral spots being oblique and usually reaching both margins of tergites; wings hyaline, costal cell yellowish orange, venation normal; eyes bare. Male with large and small facets sharply differentiated; coloration essentially like female.

Comments: This species has been reported only from the coastal areas of Texas (Hine 1907; McGregor and Schomberg 1952; Philip 1947, 1965; Stone 1938; Thompson 1973a; Thompson and Krauter 1978) and Louisiana. Goodwin (1994) described the larvae and pupae of this species based on specimens obtained in the laboratory by Thompson and Krauter (1978), hence no information is available on the habitat of the larvae and pupae.



Map 105. Counties of collection: *Tabanus texanus*.

Known Distribution (Map 105): BRAZORIA: West Bay; 18 Jun 1971; P. H. Thompson; TAMU. 13, 15, 16, 18, 23, 28 Aug, 8, 11, 19 Sep, 14 Oct 1967, 6, 10, 13, 14, 16, 17, 31 May, 5, 12, 22, 26, 29 Jun, 23, 26 Jul, 23 Aug, 25 Sep 1968, 29 Apr, 19, 21 May, 9, 13, 27, 30 Jun, 7 Jul, 4 Aug, 15, 17 Sep, 13 Oct 1969; malaise trap; P. H. Thompson; TAMU. Haskins Mound; 19 Apr - 29 Sep 1971; P.H. Thompson; TAMU. 11 mi E Angleton; 8, 17, 18, 24 Jun, 8, 13, 15, 22, 29 Jul, 16, 26 Aug, 2, 9, 16, 29 Sep 1971, 27 Jul, 15, 16, 22 Aug 1972; P.H. Thompson; TAMU. West Bay; 12 mi S Danbury; 13-15 Aug 1970, 18 Jun 1971; P.H. Thompson; TAMU. CAMERON: Brownsville; 19 Sep (Stone, 1938). 29 May - 3 June; G.B. Fairchild; FSCA. Port Isabel; 22 Jun 1948; S.S. Roback; INHM. Boca

Chica; 30 Aug 1960; O.S. Flint; TAMU. 8 mi E Brownsville; 18 Jul 1962; N. Morton; KSU. 14 mi E Brownsville; 13 Jul 1963; Byertal; "at light"; UK. Padre Is; 7 May 1964; L.L. Pechuman; CU. 17 Nov 1964; R.B. Eads; CSU. 12 mi E. Brownsville, 31 May 1968, collector unknown; TTU. 10 mi E Brownsville; 31 May - 3 Jun 1980; L. Davis; FSCA. GALVESTON: Port Bolivar; Galveston; 10 Jun 1917; J.M. Aldrich; Type OHSU. Gilcrist; 11 May 1964; L.L. Pechuman; CU. HARRIS: Humble, 31 May (Stone, 1938). JEFFERSON: beach, 17 mi W Sabine Pass; 6 May 1958; H.E. Evans & Flint; CU. Sabine Pass; 11 May 1964; L.L. Pechuman; CU. KLEBERG: Kingsville; 18 Apr 1964; student collection; CU.

***Tabanus trimaculatus* Palisot de Beauvois**

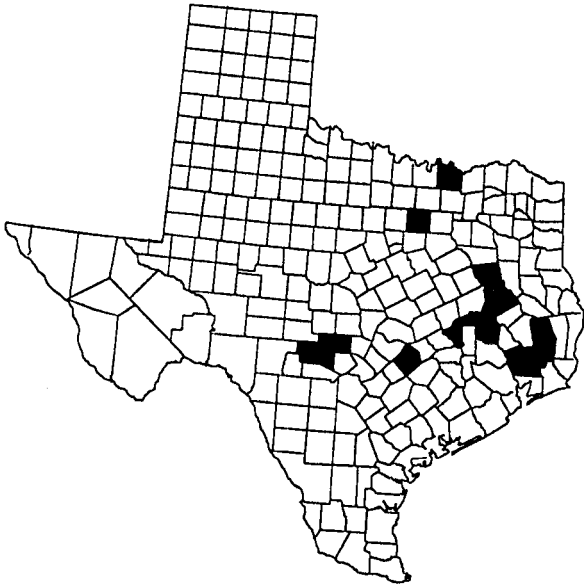
Tabanus trimaculatus Palisot de Beauvois 1806: 56
Tabanus quinquelineatus Macquart 1834: 200
Tabanus finalis Walker 1854: 638

Moderate (16 mm); black and grayish white; basal callus orange brown to black, higher than wide, rounded above, distinctly connected to relatively short slender median callus; frons broad, about 4 to 4½ times as high as wide basally, slightly widened above; abdomen with median white triangles on tergites 3 to 5, tergite 2 occasionally with a pair of small sublateral white spots; fore tibiae whitish on basal half; wings nearly hyaline, costal cell dark yellow, bifurcation of vein R₄₊₅ and crossveins with brown spots; eyes bare. Male with large and small eye facets sharply differentiated; eyes bare.

Comments: This species has been collected throughout the eastern ½ of the United States, excluding southern Florida, from central Texas (McGregor and Schomberg 1952; Philip 1947, 1965; Stone 1938; Thompson 1973b, 1974a and b, 1975b, 1977; Thompson *et al.* 1978), Oklahoma, Kansas and Nebraska, southeastern South Dakota and Minnesota, most of Wisconsin and eastward. Goodwin (1973b) reported collecting larvae from wet mud at the margins of streams, ponds, lakes and sloughs and once from a submerged saturated decaying log, and from organic substrate in a spring-fed seepage area. Tidwell (1973) took larvae from the mud of streams, ditches and temporary ponds in forested areas.

Known Distribution (Map 106, p. 127): ANDERSON: Salmon; 26-27 Apr 1975, 27 Apr 1985; H.R. Burke; TAMU. Salmon; 27 Apr 1985; P.W. Kovarik, TAMU. BASTROP: Bastrop; 13 May 1972; P.H. Thompson; TAMU. BRAZOS: 11 mi SE Bryan HW 30; 16 Apr, 16 Apr - 2 May 1971; P.H. Thompson; TAMU. Lake Placid; 1-13 May 1971; P.H. Thompson; TAMU. Mile Dr, S College Station; 5, 14 May, 27 Jun, Jul 1971, 8, 11, 18, 26, 27 May, 2, 3, 9, 26, 28 Jun 1973, 3, 7 May 1974, 18, 19, 22, 23, 24, 25 Apr, 6, 7, 8 May, 22 Jul 1975, 12 May, 14 Jun 1977; P.H. Thompson; TAMU. 4 mi SE College Station; 13 May, 13-27 May, 27 May - 9 Jun 1971; P.H. Thompson; TAMU. Carter Lk; 13 May, 27 May - 9 Jun, 9-21 June 1971; P.H. Thompson; TAMU. GILLESPIE: 14 mi N Kerrville; 20 Jun 1965; R. R. Blume; USDA. GRAYSON: Whitesboro; 2 Jun 1949; TAMU. GRIMES: Navasota R at FM 2038; 7 Aug 1970, 17, 25, 28 May, 7 Jun, 10, 28 Jul, 25 Aug, 8 Sep 1971, 10, 17 Apr, 7, 28 Aug 1972, 2, 12, 13, 14, 18, 21, 22, 24, 26, 27, 28, 29 Apr, 15 May, 7, 10, 14 Jun 1974, 11, 16, 18, 21 Apr, 2 May, 16, 30 June 1975; P.H. Thompson; TAMU. HARDIN: 3 mi NE Kountz FM 418; 5, 23 May 1973; P.H. Thompson; TAMU. HOUSTON: Crockett Nat For; 11 May 1963; L. Geist;

SFASU. **KERR**: Kerrville; 7 Jul 1965; R.R. Blume; TAMU. Kerrville; 6 May 1972; R. R. Blume; USDA. **LIBERTY**: ½ mi E Hull; 10, 20 May 1972, 29 May 1973; P.H. Thompson; TAMU. **TARRANT**: Colleyville; 7 Jun 1972; R.E. Acciavitti; CU. **TYLER**: Fred; 8 Jul 1972; W. D. Shepard; SFASU. **WALKER**: Huntsville St Pk; 1, 3, 6, 7, 16, 21 May, 3, 16 Jun, 7 Jul, Aug 1971, 13 Jun 1972, 29 May 1973, 18 Apr 1975; P.H. Thompson; TAMU. 2 mi W Fred, FM 1943; 10 May 1973; P.H. Thompson; TAMU. 1 km W Huntsville; 4 Jun 1980; C.W. Agnew & D.A. Dean; TAMU.



Map 106. Counties of collection: *Tabanus trimaculatus*.

***Tabanus turbidus* Wiedemann**

Tabanus turbidus Wiedemann 1828: 124

Fairly large (21 mm); brownish; basal callus reddish brown, about twice as high as wide, distinctly but narrowly connected to very elongate median callus; frons narrow, about 6 times as high as wide basally, widened above; abdomen orange brown usually with a median row of faint grayish triangles; wing tinted yellowish, costal cell darker, bifurcation of vein R_{4+5} and crossveins faintly brown; eyes bare. Male with large and small facets of eyes sharply differentiated; otherwise similar to female.

Comments: This species has been found throughout the southern one-half of the eastern United States, excluding southern Florida, from eastern Texas, eastern Oklahoma most of Arkansas and Louisiana, southeastern Missouri eastward to the Atlantic. In the east the range drops diagonally southeasterly in eastern Kentucky to include extreme western North Carolina and the southern half of South Carolina. The immature stages are not known.

Known Distribution (Map 107): **TYLER**: Tom Bluff Res; 7-8 Jun 1975; S.J. Merritt; TAMU.



Map 107. Counties of collection: *Tabanus turbidus*.

***Tabanus venustus* Osten Sacken**

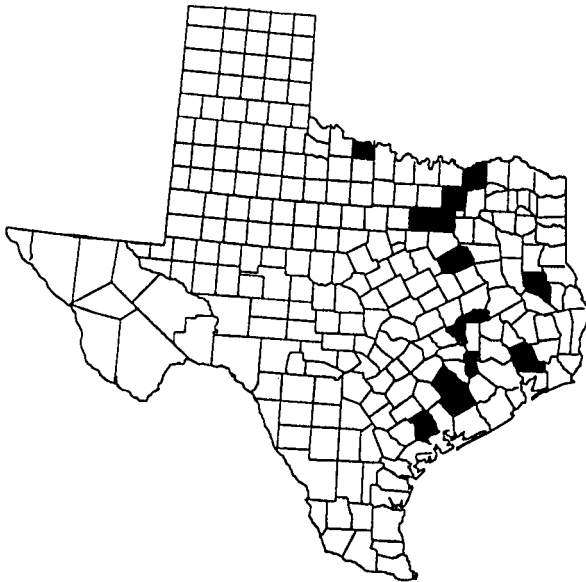
Tabanus venustus Osten Sacken 1876: 444

Moderate (17 mm); dark brown to black with whitish pattern; basal callus brown to black, quadrate, usually separated from small median callus which is surrounded by dark-brown to black pollinose region; frons broad, 3 to 3½ times as high as wide basally, slightly widened above; abdomen with a median row of white triangles and faint pale sublateral spots on some tergites; wing with large brown maculations; eyes bare. Male with large and small eye facets hardly differentiated; eyes bare.

Comments: This species exhibits a south central distribution being known from eastern Texas (McGregor and Schomberg 1952; Philip 1947, 1965; Stone 1938; Thompson 1974a and b, 1975b, 1977; Thompson *et al.* 1977; Thompson *et al.* 1978), Oklahoma, Kansas and Nebraska east to southwestern Ohio in the north and only to eastern Mississippi in the south. Thompson *et al.* (1978) reported collecting larvae at the margin of a small pond. The senior author has collected larvae once from silty mud on the steep bank of a stream.

Known Distribution (Map 108, p. 128): **BRAZOS**: College Station; 2 May; Gary Martin; TAMU. College Station; 21 Jun 1920, 23 May 1930, 31 Jul 1936, 29 May 1937, 23 May 1954; H.J. Reinhard; TAMU. 30 Aug 1959; TAMU. College Station; 27 Apr 1961; A.H. Alex; TAMU. 1 mi E HW 6 & 30; 12 Apr 1971; P.H. Thompson; TAMU. 11 mi SE Bryan, HW 30; 16 Apr - 2 May, 2-13 May 1971; P.H. Thompson; TAMU. College Station; 19 Jul 1972; G. Abbot; TAMU. Mile Dr, S College Station; 8 Aug 1971, 2 May 1972, 1 Jun 1974, 8 May, 19 Jun, 16 Jul 1975; P.H. Thompson; TAMU. College Station; 2 May 1981; G. Martin; TAMU. **COLLIN**: Plano; June 1907; E.S. Tucker; TAMU. **COLORADO**: 15, 25, 27 May, 9, 27 Jul, 5, 11, 29 Aug 1959; animal trap; C.F. Bailey; TAMU. **DALLAS**: **Lectotype**; MCZ; cotype No. 4038 (Stone, 1938). **FANNIN**: Bonham; 1975; J.B. Tucker; TAMU. **GRIMES**: Navasota

R at FM 2038; 17 May, 29 June 1971, 5, 10, 17, 19, 24 Apr, 18, 30 May, 5, 13, 19, 26 Jun, 1, 14 Aug, 11, 18 Sep 1972, 25, 29 Apr, 13, 22, 28 May, 3, 5 Jun, 5, 7, 10, 12, 14 Jul 1974, 25 Apr, 14 May, 6 Jun, 22 Jul, 4, 25 Aug 1975; P.H. Thompson; TAMU. **LIBERTY**: 16 mi ESE Cleveland, FM 162; 6 Sep 1972; P.H. Thompson; TAMU. **NACOGDOCHES**: 14 May 1960; N. Nichols; SFASU. **NAVARRO**: Corsicana; 3 Jun 1938; TAMU. **TARRANT** Colleyville; 6 Jun 1972; R.E. Acciavitti; CU. Ft. Worth; 13 May 1970; W. Grovey; UNT. **VICTORIA**: 12 mi NE Victoria; 24 Apr 1974; R.R. Blume & P.H. Thompson; TAMU. Victoria; 19 May (Stone, 1938). **WALLER**: Waller; 19 Jun 1914; TAMU. **WHARTON**: 26 May 1959; C.F. Bailey; TAMU. **WICHITA** 5 mi. E Burkburnett; 19 Jun 1982; S.R. Kingston; TTU.



Map 108. Counties of collection: *Tabanus venustus*.

***Tabanus wilsoni* Pechuman**

Tabanus wilsoni Pechuman 1962: 66

Moderate (13.5 mm); dark brown with yellowish brown pattern; basal callus dark brown, nearly twice as high as wide, separated from narrow median callus; frons narrow, about 5 to 6 times as high as wide basally, slightly widened above; basal plate of third antennal segment orange, annuli black; thorax dark brown, without obvious pattern; abdomen dark brown with a median row of contiguous yellowish triangles and yellowish sublateral spots; wing hyaline, tinted yellowish including costal cell; eyes bare. Male with large and small facets of eyes little differentiated; eyes bare.

Comments: This species has not been collected in Texas. It is presently known from a narrow band extending up to 150 miles east and west of the Mississippi River from southwestern Kentucky and southeastern Missouri southward into central Louisiana. Tidwell and Tidwell (1973) reported

finding larvae in relatively dry friable soil at the base of a large overcup oak tree in a bottomland hardwood forest area.

***Tabanus zythicolor* Philip**

Tabanus zythicolor Philip 1936c: 152

Moderate (12.5 mm); orange brown; basal callus yellowish to brown, higher than wide, constricted above, separated from oval median callus; frons relatively broad, 3½ to 4 times as high as wide basally, parallel-sided; abdomen with a median row of contiguous yellowish brown triangles and rounded sublateral spots; wing hyaline to faintly tinted, costal cell yellowish brown; eyes bare. Male with large and small eye facets not sharply differentiated; eyes bare.

Comments: This species has been reported from southeastern coastal states from Texas to North Carolina. Larvae of this species are not known, but Goodwin (1976b) reported collecting a pupa in moist sod about 4 m from the water line of a large pasture depression which holds water most of the year; the area from which the pupa was taken obviously was periodically inundated.



Map 109. Counties of collection: *Tabanus zythicolor*.

Known Distribution (Map 109): **ANGELINA:** Boykin Spr Cpgd, Angelina Nat For, 20 mi NW Jasper; 10 Oct 1994; malaise trap; J.C. Abbott and J.W. Chirhart; JTG. **MONTGOMERY:** 4.1 mi S Richards, Sam Houston Nat For; 9 Jun 1974; H. Greenbaum; TAMU.

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