JAMES PURSER PITTS
A cladistic analysis of the *Solenopsis saevissima* species-group (Hymenoptera: Formicidae)
(Under the direction of JOSEPH VINCENT MCHUGH and KENNETH GEORGE ROSS)

The cosmopolitan genus *Solenopsis* Westwood 1840 contains 185 species of ants. Probably the best known species of *Solenopsis* are the fire ants. Several of the fire ants, including *S. invicta* Buren, the red imported fire ant, belong to the *S. saevissima* species-group, a primarily Neotropical assemblage formerly called the *S. saevissima* complex of the *S. geminata* species-group. In this study, the *S. saevissima* species-group is characterized, its males, queens, and larvae are described, its workers are diagnosed, a key to the group is provided, and the distributions of the species are summarized. *Solenopsis altipunctata* sp. nov., discovered in the Serra Geral mountains in Santa Catarina State, Brazil, is described as new. A cladistic analysis of the *S. saevissima* species-group, including the social parasite *S. daguerrei* Santschi, yields the following results based on characters from workers, males, queens, and larvae: (*daguerrei* + ((*electra* + *pusillignis*) + (*saevissima* + (*pythia* + ((*altipunctata* sp. nov. + *weyrauchi*) + (*interrupta* + (*richteri* + (*invicta* + (*megergates* + (*quinquecuspis* + *macdonaghi*)))))))))). It is hypothesized that the social parasite *S. daguerrei* occupies a basal position in this species-group and is the sister group to all other species. It is not closely related to its hosts. As such, the results do not support "Emery's Rule," which claims that social parasites evolve directly from their hosts in Hymenoptera. A review of literature shows that all the modern cladistic analyses that have tested "Emery's Rule" failed to support it. This seriously undermines the proposed theories that social parasites evolve from within populations of their host species by achieving reproductive isolation under sympatric conditions.

As in most Hymenoptera, *Solenopsis* has a haplodiploidy mechanism of sex determination. This type of sex determination lends itself to certain genetic defects, such as gynandromorphy. Two gynandromorphs of *S. quinquecuspis* where found and are described.

Because imported fire ants have become a major pest in the United States, phorid flies of this genus *Pseudacteon* are of great interest as potential biocontrol agents against the imported fire ants. In Arizona, *S. aurea* is reported as a new host species for *Pseudacteon crawfordi*.

INDEX WORDS: *Solenopsis saevissima* species-group, *Solenopsis invicta*, *Pseudacteon,* gynandromorph, Cladistics, Formicidae

# A CLADISTIC ANALYSIS OF THE *SOLENOPSIS SAEVISSIMA* SPECIES-GROUP (HYMENOPTERA: FORMICIDAE)

by

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B.A., University of Tennessee, Chattanooga, 1996

A Dissertation Submitted to the Graduate Faculty of the University of Georgia in Partial Fulfillment of the Requirements for the Degree

DOCTOR OF PHILOSOPHY

ATHENS, GEORGIA

2002

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## DEDICATION

I dedicate this dissertation to my daughters, Tabitha Ivy Pitts and Holly Megan Pitts, and my wife, Theresa L. Pitts-Singer. Without them, this work would not have been possible.

## ACKNOWLEDGMENTS

I am thankful for such an esteemed advisory committee: Drs. Kenneth Ross, Joseph McHugh, James Hanula, John Wenzel, David Wahl, and Karl Espelie. I am especially thankful for the time, energy, concern, and encouragement given to me by David Wahl, Joseph McHugh, and Kenneth Ross. I learned much from the interesting conversations spanning the globe from cladistics to tarantula husbandry with David Wahl.

I am grateful to Bob Matthews for coercing me to come to UGA and study Hymenoptera.

I am thankful for a wonderful and understanding office staff. They always managed to get things done in an efficient, timely manner, complete with smiles on their faces. I want to thank Susan Watkins who made sure I got paid, Nancy Ausburn who kept track of all the Xeroxing I did, and Terry All for all the time she spent making various slides for me. Lastly, I thank Danny Fenley who helped with all my computer needs and frustrations.

I am also especially grateful for the information Erich Tilgner supplied for performing Bremer Support and Successive Approximations Weighting with NONA.

I am grateful to all my fellow students who have shared in the unforgettable experience of graduate school: Eric Romaniszyn, Aaron Shurtleff, Cory Lewis, Tatiana Kiselyova, Erica Chiao, David Banks, Chris Asaro, John Nowak, Ken McCravy, Rebecca McNall, Greg Hodges and Amanda Hodges.

# TABLE OF CONTENTS

# CHAPTER 1

# INTRODUCTION

## I. Taxonomic history and classification of *Solenopsis*

*Solenopsis* (Hymenoptera: Formicidae) is a cosmopolitan genus in the subfamily Myrmicinae. This genus includes approximately 185 species worldwide, of which 108 occur in the New World (Bolton 1995). Most of the species in this genus are called "thief ants." Thief ant species have small monomorphic workers and their colonies are found in close proximity to the nests of other ants, from which they steal food. They also have been found to live freely and capture their own food (Thompson 1980, 1989). This behavior differs greatly from that of the remaining *Solenopsis* species, which are commonly called the "fire ants." The fire ants, represented by 20 New World species, typically have larger, polymorphic workers, live in large colonies, and gather their own food.

Westwood described the genus *Solenopsis* in 1840 for the type species *S. geminata*. In his revision of *Solenopsis,* Creighton (1930) divided the genus into five subgenera: *S.* (*Diagyne*) Santschi, *S.* (*Diplorhoptrum*) Mayr, *S.* (*Euophthalma*) Creighton, *S.* (*Oedaleocerus*) Creighton, and *S.* (*Solenopsis*). The subgenus *S.* (*Solenopsis*) included the typical polymorphic fire ants with the other four subgenera representing the thief ants. Creighton revised all the *Solenopsis* species except for those in the subgenus *Diplorhoptrum.* Creighton defined the thief ant subgenera mostly on the basis of queen morphology. Not all of the queens were included in his study, however, and many remain unknown. There are also cases where queens differ substantially from described species but the workers do not. Consequently, a subgeneric classification based on the queen caste was premature.

In 1966 Ettershank synonymized Creighton's five subgenera of *Solenopsis*. He also synonymized the related genera *Lilidris* Kusnezov, *Bisolenopsis* Kusnezov, *Labauchena* Santschi, and *Paranamyrma* Kusnezov with *Solenopsis*, but gave little explanation for this decision. He did, however, recognize three "natural" groups: the fire ants (consisting of species previously placed into the subgenus *S.* (*Solenopsis*)), the social parasites (consisting of species from the genera *Labauchena* and *Paranamyrma*), and the thief ants (consisting of all of the remaining synonymized genera and subgenera).

Baroni-Urbani (1968) resurrected *Diplorhoptrum,* elevated it to the generic level, and placed all of the thief ants into it. Baroni-Urbani based his conclusion on genitalia of the common European species, *Diplorhoptrum fugax* (Latreille), without consideration of the New World thief ant fauna. Bolton (1987) presented arguments refuting Baroni-Urbani's decision, as well as supporting most of Ettershank's synonymies. Bolton questioned the synonymy of *Lilidris*: although *Lilidris* queens have 10 antennal segments, similar to the queens of some *Solenopsis* species, they have a three-segmented club as opposed to the two-segmented club normally found in *Solenopsis*. The wing venation of *Lilidris* also differs from patterns known in *Solenopsis* venation and the anterior metatarsal brush of *Lilidris* is distinctive (Kusnezov 1957, 1958). Bolton's (1995) catalog of ant species accepts Ettershank's classification.

Buren (1972) revised the imported fire ant species in North America. He raised *S. richteri* Forel and *S. quinquecuspis* Forel from synonymy, where Wilson (1952) had previously placed them. Buren (1972) also described *S. invicta*, the red imported fire ant, and *S. blumi* as two new species.

In the most recent treatment of fire ants, Trager (1991) grouped all of the fire ant species into the *Solenopsis geminata* species-group. Trager accepted Ettershank's classification and except for the synonymy of *Lilidris*. Trager's treatment included the four North American species, two hybrids, and 17 species from South America, three of which were described as new. The species that Trager recognized were distinctive both morphologically and genetically (Ross and Trager 1990). Trager placed all of the fire ants in the *S. geminata* species-group. The *S. geminata* species-group as defined by Trager does not include the socially parasitic species, *S. daguerrei* Santschi and *S. hostilis* Borgmeier, formerly placed in the genus *Labauchena*. Trager's (1991) classification of the species within the *S. geminata* species-group is shown in Table 1.1.

*Solenopsis* currently is placed in the tribe Solenopsidini, which consists of the following genera: *Allomerus* Mayr, *Antichthonidris* Snelling, *Carebarella* Emery, *Megalomyrmex* Forel, *Nothidris* Ettershank, and *Oxyepoecus* Santschi from the New World; *Anillomyrma* Emery, *Bondroitia* Forel, *Diplomorium* Mayr, *Epelysidris* Bolton, and *Phacota* Roger from the Old World; and *Monomorium* Mayr and *Solenopsis* from both regions (Bolton 1995).

The social parasites are an interesting group within *Solenopsis*. Many species of ants have social parasites, such as several species of *Cataglyphis, Pogonomyrmex*, and *Pseudomyrmex* (Hölldobler and Wilson 1990). Because *Labauchena* and *Paranamyrma* have been synonymized with *Solenopsis* (Ettershank 1966), *Solenopsis* now includes three species of social parasites that use fire ants and thief ants, respectively, as hosts

(Santschi 1930; Kusnezov 1954; Borgmeier 1959). Social parasitism occurs when a queen of one species enters a heterospecific colony and usurps the reproductive role of the host queen. Several forms of social parasitism are recognized.

*Solenopsis daguerrei* and, perhaps, *S. hostilis* exhibit permanent social parasitism, which can be separated into two types. The first type occurs when the parasitic queen either assassinates the host queen or induces the host queen's own workers to assassinate her. The second type, termed inquilism, occurs when the parasitic queen lives alongside the host queen (Hölldobler and Wilson 1990). In both types, the brood of the parasitic queen is made up of only sexuals (Bourke and Franks 1991). It is not clear what type of permanent social parasitism *S. daguerrei* exhibits. The species has been reported to kill the host queen in laboratory studies (Bruch 1930) but has been found to allow the host queen to live in field studies (Silveira-Guido *et al.* 1965). In either case, the parasite lowers the egg production of the host colony and has potential value as a biocontrol agent of the host pest species in the introduced populations (Wojcik 1990; Briano *et al.* 1997). In order for social parasites to be effective parasites as biological control agents, their hosts must be properly identified (Jouvenaz 1990; Wojcik 1990). The literature does not provide convincing evidence that such identifications have been made. Santschi (1930) described *S. daguerrei* as a parasite of *S. richteri*. A similar parasitic species, *S. hostilis*, was described by Borgmeier (1959), who reported its host as *S. saevissima* (Smith). Hölldobler and Wilson's (1990) review of social parasitism included the two fire ant social parasite species. A review of the same literature concerning *Solenopsis* (Bruch 1930; Santschi 1930; Borgmeier 1949, 1959; Kusnezov 1957; Silveira-Guido *et al.* 1965) revealed some different hosts than those reported by Hölldobler and Wilson (ibid.).

Recently, Briano *et al.* (1997) carried out a survey of social parasites of the *S. geminata* species-group in Brazil and Argentina. They found that *S. daguerrei* was a social parasite of *Solenopsis invicta, S. richteri*, and *S. macdonaghi.* The social parasite *S. hostilis* has not been collected since its original description in 1959. Obviously, there is much to be learned about *Solenopsis* host-parasite relationships.

## II. History of fire ants in North America

Until the early 1900's, only four species of fire ants occurred in North America: *Solenopsis aurea* Wheeler and *S. amblychila* Wheeler in the Southwest, and *S. geminata* (Fabricius) and *S. xyloni* McCook in the Gulf States. Around 1918, the black imported fire ant, *S. richteri*, was introduced into Mobile, Alabama from South America (Buren 1972). By the late 1920's, *S. richteri* had spread through much of Alabama and Mississippi (Lofgren *et al.* 1975). In the 1930's, the red imported fire ant, *S. invicta*, was introduced from South America into North America and swept through most of the Southeast, replacing *S. richteri* in most of its range. A population of *S. richteri* remains near the northern boundary of Mississippi and Alabama (Trager 1991; Shoemaker *et al.* 1996). From the time of its introduction until 1972, *S. invicta* was thought to be a hybrid of *S. richteri* and a Neotropical species, *S. saevissima* (Wilson 1952). However, Buren (1972) determined that it was an undescribed species, and named it *S. invicta*.

Since its introduction to the United States, the *S. invicta* has become a very successful, invasive species. These ants have become major pests because they build unsightly mounds in lawns, cause damage to crops and agricultural equipment, and inflict painful stings upon humans and livestock (Lofgren *et al.* 1975). The same behaviors that make them major pests also make them easy to identify in the southern United States. This is not the case in South America. Tropical fire ant species are small in size and worker morphology is similar between species. In their South American range, species diversity is higher and distinguishing between fire ant species using well-founded, consistent morphological criteria is exceedingly difficult. Emery called this group the *crux myrmecologorum* or "cross of the myrmecologists" (Creighton 1930). Even after revising the group in 1930, Creighton said, "the group is still a heavy cross to bear." The problematic taxonomy of the South American fire ants renders field identification difficult for these species and impedes biological studies in many parts of their native range, slowing development of adequate control measures.

### III. New Contributions to the Study of *Solenopsis*

The systematic study of the *Solenopsis saevissima* species-group described in Chapter 2 of this dissertation was performed to alleviate some of the current taxonomic problems as well as enhance the capacity to make reliable species identifications. Special attention was given to character suites that have been poorly utilized thus far in the systematics of *Solenopsis*, such as larval pubescence, and adult male and queen morphology. The first explicit phylogenetic hypothesis for the *S. saevissima* species-group was proposed using these new character suites along with worker morphology.

During this systematic study of *Solenopsis*, several genetic abnormalities were noted. A specific abnormality, gynandromorphism, was observed in several specimens. This is a condition were the body of an ant is composed of various male characteristics combined with those of one of the female castes. The division of the gynandromorph body may occur laterally, dorsoventrally, anteroposteriorly, or in mosaics. This condition, both in the bilateral form and the mosaic form, is documented for *S. quinquecuspis* in Chapter 3.

The final study presented in this dissertation addresses parasitism by Phoridae. A mass-rearing program is underway to provide *Pseudacteon tricuspis* Borgmeier and *P. curvatus* Borgmeier (Diptera: Phoridae), non-native flies, for release as biological control agents of the imported fire ants in the southern United States. *Pseudacteon* females oviposit into the thorax of their ant host. After hatching, the larva works its way into the host's head capsule and ultimately decapitates it. In order to execute a biological control strategy using *Pseudacteon,* it is imperative to determine the degree of host specificity of these flies (Gilbert and Morrison, 1997). All four North American *Solenopsis* species overlap in their ranges in the southwestern United States, mainly in Arizona and Texas (Trager 1991). One concern is whether or not imported *Pseudacteon* species will attack native North American fire ants as well as their intended introduced hosts. To answer this question, field studies of fire ants and *Pseudacteon* are necessary, in both North and South America. In Chapter 4, I report that the native *Pseudacteon crawfordi* Coquillett, which is known to attack *S. geminata*, also attacks *S. aurea* in southern Arizona. This work, as well as my taxonomic and phylogenetic investigations, will aid in seeking out promising biological control agents of *S. invicta* for importation from South America.

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Table 1.1. Classification of the *Solenopsis geminata* species-group according to Trager (1991).

| Taxon | | | Author |
|---|---|---|---|
| *S. virulens* complex | | | |
| | | *S. virulens* | (Smith) 1858 |
| *S. tridens* complex | | | |
| | | *S. substituta* | Santschi 1925 |
| | | *S. tridens* | Forel 1911 |
| *S. geminata* complex | | | |
| | *S. geminata* subcomplex | | |
| | | *S. geminata* | (Fabricius) 1804 |
| | *S. xyloni* subcomplex | | |
| | | *S. amblychila* | Wheeler 1915 |
| | | *S. aurea* | Wheeler 1906 |
| | | *S. xyloni* | MacCook 1879 |
| | *S. gayi* subcomplex | | |
| | | *S. bruesi* | Creighton 1930 |
| | | *S. gayi* | (Spinola) 1851 |
| *S. saevissima* complex | | | |
| | *S. saevissima* subcomplex | | |
| | | *S. interrupta* | Santschi 1916 |
| | | *S. invicta* | Buren 1971 |
| | | *S. macdonaghi* | Santschi 1916 |
| | | *S. megergates* | Trager 1991 |
| | | *S. pythia* | Santschi 1934 |
| | | *S. quinquecuspis* | Forel 1913 |
| | | *S. richteri* | Forel 1909 |
| | | *S. saevissima* | (Smith) 1855 |
| | | *S. weyrauchi* | Trager 1991 |
| | *S. electra* subcomplex | | |
| | | *S. electra* | Forel 1914 |
| | | *S. pusillignis* | Trager 1991 |

# CHAPTER 2

## A CLADISTIC ANALYSIS OF THE *SOLENOPSIS SAEVISSIMA* SPECIES-GROUP (HYMENOPTERA: FORMICIDAE)[1]

[1] Pitts, J. P., J. V. McHugh, and K. G. Ross. To be submitted to *Journal of Hymenoptera Research*.

*Abstract*.—The *Solenopsis saevissima* species-group, a primarily Neotropical assemblage formerly called the *S. saevissima* complex of the *S. geminata* species-group, is herein revised, its adult males and queens, and worker larvae are described, its adult workers are diagnosed and keyed, and the distributions of the species are summarized. A new species, *S. altipunctata* sp. nov., is described from Santa Catarina State, Brazil. A cladistic analysis of the *S. saevissima* species-group, including the social parasite *S. daguerrei*, yields the following results based on morphological characters from the various castes and life stages: (*daguerrei* + ((*electra* + *pusillignis*) + (*saevissima* + (*pythia* + ((*altipunctata*, sp. nov. + *weyrauchi*) + (*interrupta* + (*richteri* + (*invicta* + (*megergates* + (*quinquecuspis* + *macdonaghi*)))))))))). There is a trend towards large major worker size for this species-group. Polygyny is a derived trait. The social parasite *S. daguerrei* is the sister group to the clade comprising all other species. It is not closely related to its hosts *S. invicta*, *S. macdonaghi,* and *S. richteri*. "Emery's Rule," which states that social parasites are close relatives of, and evolved from, their hosts is not supported in this case.

# INTRODUCTION

*Solenopsis* Westwood (Hymenoptera: Formicidae) is a large, cosmopolitan genus of ants in the subfamily Myrmicinae that consists of approximately 185 species worldwide. Most of the species have small, monomorphic workers and are lestobiotic (Thompson 1980, 1989). In the New World, however, there are 20 species of *Solenopsis* that differ greatly from this life history. These species have larger polymorphic workers and are known as "fire ants." Four species of fire ants are native to North America. The remaining species are Neotropical.

Although the four native North American fire ants are seldom nuisances to humans, the two species introduced into the United States from South America have achieved pest status. *Solenopsis richteri* Forel, the black imported fire ant, was introduced from South America into Mobile, Alabama, around 1918 (Buren 1972). The red imported fire ant, *S. invicta* Buren, was introduced into North America in the 1930's, and subsequently colonized most of the southern United States. It displaced *S. richteri* from most of its previous range and has become a major pest. It is invasive, builds unsightly mounds on lawns, causes damage to crops and agricultural equipment, and is a health hazard to humans and livestock due to its aggressive stinging behavior (Lofgren *et al.* 1975).

Not only are fire ants a menace to humans, but they have displaced native ants and undoubtedly have had a negative impact on other animals that share their habitat (Lofgren *et al.* 1975). Attempts have been made to eliminate the invasive fire ants using conventional chemical and mechanical control methods, but these methods are useful only for temporary local suppression (Jouvenaz 1990). Researchers currently are exploring the use of biological control agents from South America (e.g., Cook *et al.* 1997; Gilbert and Morrison 1997; Heraty *et al.* 1993). No single method has proven to be effective at eradicating imported fire ants, so efforts continue to curtail their spread.

Fire ants are also of great interest because they provide many opportunities for studies in evolutionary biology. For instance, fire ants offer one of relatively few well-documented cases of a hybrid zone forming in historical times (Vander Meer *et al.* 1985; Ross *et al.* 1987a; Ross and Trager 1990; Shoemaker *et al.* 1996). Moreover, fire ants (at least *S. invicta*) have become important model systems in the study of social evolution (Crozier 1979, Ross *et al.* 1987b, 1988; Ross and Trager 1990; Krieger and Ross 2002).

Historically, the fire ants have been a taxonomically difficult group (Creighton 1930, 1950; Wilson 1952; Buren 1972). In South America, species diversity is high and distinguishing between fire ants is exceedingly difficult. They are considered a myrmecologist's nightmare. Emery called the group the *crux myrmecologorum* or "cross of the myrmecologist" (Creighton 1930). After his revision of *Solenopsis*, Creighton (1930) said, "the group is still a heavy cross to bear." For several of the species in this group, there exists more intraspecific variation than interspecific variation in many important character systems.

Since 1966 *Solenopsis* has included two social parasites that have as their hosts various fire ant species (Ettershank 1966). Many ants have social parasites, including several species of *Cataglyphis, Pogonomyrmex*, and *Pseudomyrmex* (Ward 1989, 1996; Hölldobler and Wilson 1990; Agosti 1994; Taber 1998). Social parasitism occurs when a queen of one species enters a heterospecific colony and usurps the reproductive role of the host queen. One of the fire ant social parasites, *S. daguerrei*, exhibits permanent social parasitism, which is subdivided into two types based on whether the host queen is assassinated or allowed to live alongside the parasitic queen (termed inquilism) (Buschinger 1986; Hölldobler and Wilson 1990). *Solenopsis daguerrei* was reported to kill the host queen in laboratory studies (e.g., Bruch 1930). Recently, this report has been contradicted by new studies suggesting that *S. daguerrei* allows the host queen to live and is a true inquiline (Silveira-Guido *et al.* 1965).

The question of the origin of social parasites is a longstanding one, dating back to Charles Darwin (1859). Emery (1909) wrote, "The slave-making ants and the parasitic ones, both permanent and temporary, all originate from closely related forms which serve them as slaves or hosts" (original in German). This statement has been developed into Emery's Rule. This interpretation is acceptable because hymenopteran social parasites are clearly related to their hosts. Emery's Rule interpreted in the strict sense implies that the social parasite is the sister species of, and forms an exclusive monophyletic group with, its host(s) (Wilson 1971; Buschinger 1990; Bourke and Franks 1991). The latter formulation is more difficult to demonstrate.

It is assumed that social parasites originate from their hosts by either allopatric speciation (Wilson 1971; Hölldobler and Wilson 1990) or sympatric speciation (Buschinger 1986, 1990; Hölldobler and Wilson 1990; Bourke and Franks 1991). Bourke and Franks (ibid.) developed a sympatric model to explain the evolution of workerless inquilines from their host. The model begins with a facultatively polygynous (multiple queens per nest) ancestral species exhibiting variation in queen size. Smaller queens, termed microgynes, evolve specialization in the production of sexuals, and size-based assortative mating eventually leads to reproductive isolation between parasite and host. This model and similar ones rest on the assumption that the strict version of Emery's Rule is valid, yet there have been surprisingly few explicit tests of this hypothesis for ants (Ward 1989, 1996; Agosti 1994; Taber 1998).

One reason why Emery's rule has seldom been tested is that the brood of the social parasites consists only of sexuals (Hölldobler and Wilson 1990; Bourke and Franks 1991). This creates a problem for a phylogenetic analysis based on morphological characters, because the worker caste is usually the best known caste for ants and most analyses thus rely largely on worker characters. To remedy this problem for *S. daguerrei* and its relatives, new systematic data derived from the morphology of fire ant sexuals and larvae are developed. An examination of the *S. saevissima* species-group using these new data provides an excellent opportunity to test and refine these theories of speciation and the evolution of social parasitism.

This systematic study was undertaken with several objectives in mind: 1) to update the classification of the fire ants; 2) to evaluate several life stages and castes for morphological characters that are phylogenetically informative; 3) to aid the identification of species within the *S. saevissima* species-group; 4) to produce a phylogeny of the *S. saevissima* species-group; and 5) to provide a test for Emery's rule.

## Taxonomic History and Current Problems within *Solenopsis*

Westwood described the genus *Solenopsis* in 1840 for the type species, *S. geminata*. Later, Creighton (1930) revised the genus. At that time the genus was divided into five subgenera: *S.* (*Diagyne*) Santschi, *S.* (*Diplorhoptrum*) Mayr, *S.* (*Euophthalma*)

Creighton, *S.* (*Oedaleocerus*) Creighton, and *S.* (*Solenopsis*). The subgenus *S.* (*Solenopsis*) included the typical polymorphic fire ants. The other four subgenera represented the thief ants. Creighton's revision included all *Solenopsis* species except for those in the subgenus *Diplorhoptrum* and, to date, these species have not been revised. Creighton based the delineation between the thief ant subgenera mostly on morphology of the queens. However, not all of the queens were included in his study and many of the queens remain unknown. Also, there are cases where queens differ substantially from described species, but the workers do not. Consequently, a subgeneric classification based on the queen caste was premature.

In 1966 Ettershank synonymized Creighton's five subgenera of *Solenopsis*. He also synonymized the related genera *Lilidris* Kusnezov, *Bisolenopsis* Kusnezov, *Labauchena* Santschi, and *Paranamyrma* Kusnezov with *Solenopsis*, but gave little explanation for this decision. He did, however, recognize three "natural" groups: the fire ants, the social parasites, and the thief ants. The fire ants comprised species previously placed into the subgenus *S.* (*Solenopsis*), the social parasites were made up of species from the genus *Labauchena* and *Paranamyrma*, and the thief ants were made up of all of the other synonymized genera and subgenera.

Although the thief ant species have not been revised, other taxonomic work has been done in the past. Baroni-Urbani (1968) resurrected *Diplorhoptrum* and elevated it to the generic level, separate from *Solenopsis*. Baroni-Urbani (1968) placed all of the thief ants into this genus. He based his decision on genitalia of the common European species, *S. fugax* (Latreille), without knowledge of the New World thief ant fauna. Bolton (1987) presented arguments refuting Baroni-Urbani's decision, as well as supporting Ettershank's (1966) other synonymies. To further establish the synonymy of *Diplorhoptrum* with *Solenopsis*, I performed a cursory study of the genitalia of *Solenopsis*. I found that the characters used by Baroni-Urbani (1968) to raise *Diplorhoptrum* to the generic level are not found in all of the species that were to be placed into the genus (pers. obs.). Species, such as *S. tennesseensis* and *S. abdita*, have genitalia closely resembling the fire ants, rather than the European species, *S. fugax*.

Also for the thief ants, Creighton (1930) had previously defined five species-groups within the subgenus *Diplorhoptrum*. These species-groups are no longer in use for the following reasons: their relationships remain unresolved, many species were never placed into species-groups, and several subspecies were subsequently placed into different species-groups. Recently, Trager (1991) placed all species of the old subgenus *Diplorhoptrum* into a single, informal species-group called the *S. fugax* group. He designated a *S. tenuis* subcomplex within the *S. fugax* species-group but did not define which species belong in this subcomplex.

The fire ants have been revised several times in the past (Creighton 1930; Wilson 1952; Buren 1972). In the latest revision of the fire ants, Trager (1991) grouped all of the fire ant species into the *Solenopsis geminata* species-group. Trager (1991) confirmed that all of the satellite genera, except *Lilidris*, were synonymous with *Solenopsis*. Trager's (1991) revision included the four North American species, two hybrids, and 17 species from South America, three of which were described as new. The species that Trager (1991) recognized were distinctive both morphologically and genetically (Ross and Trager 1990).

Trager (1991) also reaffirmed some of Ettershank's synonymies, differing, however, from Ettershank's by recognizing two distinct origins of social parasitism in the former genera *Labauchena* and *Paranamyrma.* Although they each show clear relationships to their host's species -group, suggesting a recent common ancestry of host and parasite, they were not included in his revision.

*Solenopsis* is currently placed in the tribe Solenopsidini (Bolton 1995). Bolton (1987) suggested that *Solenopsis* could be closely related to *Carebarella* Emery and *Oxyepoecus* Santschi. This relationship is based on the shared occurrence of geniculate maxillary palpi, but this character needs a more thorough examination. Conjectures on the phylogenetic relationships within the Solenopsidini and *Solenopsis* are still premature. Interestingly, the species of *Carebarella* and *Oxyepoecus* for which the biology is known exhibit lestobiosis or some other form of social parasitism.

## MATERIALS AND METHODS

### Measurements

Measurements of adult *Solenopsis* were made at 50X or 100X on a stereo dissecting microscope with either an ocular micrometer or a digital micrometer. All measurements are reported in millimeters. Measurements of the holotype of new species are listed separately in parentheses. Head measurements were made with the head held in dorsal view, positioned so that the greatest straight-line distance between the midpoints of the clypeal border and the vertex was achieved. The viewing axis is approximately perpendicular to the surface of the frons. Abbreviations and definitions for measurements and indices are given below:

L Total length of the ant, measured in lateral view with the head in a natural hypognathic position. This measurement is not as accurate as the DML measurement (below) due to the distortional affect on the length of the metasoma from collection into alcohol and subsequent drying of the specimens.

HW Maximum width of the head, including the eyes, measured in full-face, dorsal view (Fig. 2.6).

VW Width of the posterior portion of the head (vertex), measured along a line drawn through the lateral ocelli, with the head in full-face, dorsal view (Fig. 2.6).

HL Midline length of head, measured in full-face, dorsal view, from the anterior clypeal margin to the midpoint of a line drawn across the occipital margin (Fig. 2.6).

EL Length of compound eye, measured with the head in full-face, dorsal view (Fig. 2.6).

OD Ocellar distance, which is the distance from the middle of the median ocellus to the midpoint of a line drawn between the lateral ocelli. Measured with the head in full-face, dorsal view (Fig. 2.6).

OOD Ocellocular distance, which is the distance from the middle of the median ocellus to a line drawn across the posterior margins of the compound eyes (this distance is negative in value if the posterior margin of the compound eye exceeds the median ocellus) (Fig. 2.6).

LOW Maximum width of the lateral ocelli (Fig. 2.6).

MOW Maximum width of the median ocellus (Fig. 2.6).

CD Distance from the anterior clypeal margin to a line drawn across the anterior margins of the frontal carinae (Fig. 2.6).

MFC Minimum distance between the frontal carinae, measured with the head in full-face, dorsal view (Fig. 2.6).

EW Maximum width of compound eye, measured along its short axis, in an oblique dorsolateral view of the head.

SL Length of scape, excluding the radicle (Fig. 2.6).

SW Maximum width of the scape, measured only for the males.

PDL Maximum length of the pedicel, excluding its basal articulation.

PEW Maximum width of the pedicel, measured only for the males.

LFl Maximum measurable length of the first flagellomere, excluding its basal articulation.

LF2 Maximum measurable length of the second flagellomere.

LF3 Maximum measurable length of the third flagellomere.

WF1 Maximum width of the first flagellomere.

FL Maximum measurable length of the forefemur, measured in posterior view.

FW Maximum measurable width of the forefemur, measured from the same view as FL, at right angles to the line of measurement of FL.

PW Maximum width of the pronotum in dorsal view, measured only for the major workers.

MW Width of the mesonotum in dorsal view, anterior to tegulae.

DML Diagonal length of the mesosoma, measured in lateral view along a diagonal line drawn from the anterior base of pronotum (exclusive of anterior "cervical flange," which is often hidden from view) to posterior edge of metapleuron (Fig. 2.7).

PL Petiole length, measured in lateral view from the lateral flanges of the anterior peduncle to the posterior margin of the petiole (Fig. 2.8).

PND Petiolar node distance, distance from the anterior margin of petiole to a vertical line drawn through the petiole at the highest point of the node, measured from the same view as PL (Fig. 2.8).

PH Maximum height of the petiole, measured in lateral view at right angles to PL, but excluding the anteroventral process (Fig. 2.8).

PPL Length of the postpetiole, measured in lateral view, from the anterior peduncle (of the postpetiole) to the point of contact with the fourth abdominal tergite.

DPW Maximum width of the petiole, measured in dorsal view.

PPW Maximum width of the postpetiole, measured in dorsal view.

PHB Postpetiolar height measured from attachment of postpetiole to T3.

Indices calculated from the preceding measurements include the following ratios:

CI Cephalic index: HW/HL

OI Ocular index: EW/EL

REL Relative eye length: EL/HL

| | |
|---|---|
| REL2 | Relative eye length, using HW: EL/HW |
| OOI | Ocelloocular index: OOD/OD |
| VI | Vertex width index: VW/HW |
| FCI | Frontal carinal index: MFC/HW |
| CDI | Clypeal distance index: CD/HL |
| SI | Scape index: SL/HW |
| SI2 | Scape index, using EL: SL/EL |
| SI3 | Scape index, using LF2: SL/LF2 |
| FI | Forefemur index: FW/ FL |
| NI | Petiole node index: PND/PL |
| PLI | Petiole length index: PH/PL |
| PHI | Petiole height index, using PPL: PH/PPL |
| PWI | Petiole width index: DPW/PL |
| PPWI | Postpetiole width index: PPW/PPL |
| PPWB | Postpetiole width index, using PHB: PPW/PHB |

The measurements for workers reported here differ from those of Trager (1991) as follows: the abbreviation DML is used instead of AL to denote mesosomal diagonal length, REL is used instead of OI for relative eye length, and CI, SI, and REL are not converted to percentages. Measurements of head length reported here include the length of the clypeal teeth.

## Morphological Terminology for Adults

Head: Compound eyes (ce) and ocelli (oc) are used as labeled in Figs. 2.1, 2.4, 2.9, 2.10. The apices of the clypeal carinae (cc) are called clypeal teeth (Fig. 2.1). Sometimes paracarinal teeth are present lateral to clypeal teeth, as is a small median tooth (mct) between the clypeal teeth (Fig. 2.1). Often a linear or triangular shaped, darkly, pigmented area is present on the head (Fig. 2.50) and is called a frontal streak.

Mesosoma: The mesosoma of the worker is divided into several well-defined regions. Visible in dorsal view are the pronotum (prn), mesonotum (mes), metanotum (met), and the propodeum (ppm) (Fig. 2.2). In lateral view, the profiles of these are visible, as well as the mesopleura (msp) (Fig. 2.3).

The mesosoma of males and queens are divided into additional sclerites. The following are usually visible: pronotum (prn), mesonotum (mes), parapsidal lines (pl), scutellum (sct), axillae (ax), metanotum (met) and the propodeum (ppm) (Figs. 2.2, 2.5, 2.9). The mesopleuron is further divided into a dorsal sclerite, the anepisternum (an), and a ventral plate, the katepisternum (k) (Figs. 2.5, 2.9). The wing venation terminology used here is as labeled in Fig. 2.11.

Metasoma: The metasoma has a two-segmented petiole. These two segments are referred to as the petiole (pt) and the postpetiole (ppt) (Figs. 2.5, 2.9). The dorsal surface of each of the segments is modified as an upward or diagonally directed scale or as a rounded node when viewed laterally. The remaining portion of the metasoma is comprised of four segments called the gaster, which each bear a dorsal plate (tergite) and ventral plate (sternite). The tergites and sternites covering these segments are numbered from anterior to posterior as T1, T2, T3, T4, and S1, S2, S3, and S4, respectively.

Male genitalia: Genitalia are composed of several structures. The outermost structures are the parameres. Mesad of the parameres are the volsellae (Fig. 2.74). Each volsella has a single cuspis (cus) and digitus (dig) (Fig. 2.74). The innermost organ is the aedeagus, which has an apodeme (ap) projecting dorsad (Fig. 2.74) (Snodgrass 1941).

## Measurements for Larvae

Measurements were made at 400X or 1000X on a compound microscope. Only fourth instar worker larvae or prepupae were used for the study and are discernible by their completely sclerotized mandibles (Petralia and Vinson 1979). Larvae were prepared as outlined in Wheeler (1960). Length was measured through the spiracles as in Wheeler and Wheeler (1976). The terminology used follows Wheeler and Wheeler (1976) (Fig. 2.12), however, in addition, several rows of setae are named as follows: the posterior row of setae on head is termed the occipital setal row (Fig. 2.13), the first setal row of vertex (Fig. 2.14), and the second setal row of vertex (Fig. 2.15).

## Specimen Preparation

For scanning electron micrographs, the adults and larvae were dehydrated in ethanol and critical point dried before being sputter-coated with gold. To save preparation time, several attempts were made to prepare specimens using the methods of Nation (1983): specimens were dehydrated through a graded ethanol series, immersed into hexamethyldisilazane (HMDS), and air dried without critical-point drying. This usually ended with damaged adult male and larval specimens and was discontinued.

For light microscopy, workers were allowed to air-dry after storage in 70%-85% ethanol. The males and queens were saturated with amyl acetate and allowed to slowly air-dry in a fume hood. Preparing specimens in this manner helped to maintain their natural color and kept fragile specimens from collapsing. Air-drying male specimens directly out of an alcohol solution often caused the head and mesosoma to collapse and resulted in very poor quality specimens.

Loaning institutions or depositories of specimens:

AEIC – American Entomological Institute, Gainesville, Florida.

AMNH – American Museum of Natural History, New York, USA.

BMNH – The Natural History Museum, London, United Kingdom.

CNCI – Canadian National Collections, Ottawa, Canada.

FSCA – Florida State Collection of Arthropods, Gainesville, Florida, USA.

ICIB – Museu de Entomologia, Instituto de Biologia, FEIS/UNESP, Ilha Solteira, São Paulo, Brazil.

IMLA – Fundacion e Instituto Miguel Lillo, Tucumán, Argentina.

JPPC – J. P. Pitts Personal Collection, Athens, Georgia, USA.

LACM – Los Angeles County Museum of Natural History, Los Angeles, California, USA.

MACN – Museo Argentino de Ciencias Naturales, Buenos Aires, Argentina.

MCZ – Museum of Comparative Zoology, Cambridge, Massachusetts, USA.

MHNG – Muséum d'Histoire Naturelle, Geneva, Switzerland.

MZSP – Museu de Zoologia, Universidade de São Paulo, São Paulo, Brazil.

NHMB – Naturhistorisches Museum, Basel, Switzerland.

NMNH – National Museum of Natural History, Washington, D.C., USA.

SDPC – Sanford D. Porter Personal Collection, Gainesville, Florida, USA.

UCDC – University of California, Davis, California, USA.

UGCA – University of Georgia Collection of Arthropods, Athens, Georgia, USA.

## Sample Collection and Specimens Studied

It was important to sample the *S. saevissima* species-group to obtain samples from large portions of the native ranges. Furthermore, it was necessary to have the different castes and life stages available and associated with workers. This material is not normally available from museums therefore all of it had to be collected specifically for systematics work on this group. Samples were collected from South American during previous trips made by K. G. Ross and others in 1988, 1992, 1998 (see App. A), and 2001 (see App. B). James C. Trager identified the material from the 1988 and 1992 collection trips. A concerted effort was made to obtain the necessary castes and life stages in the last three field trips, and resulting in the collection of more than 1,200 colonies.

Other specimens were studied as well. One hundred and eighteen colonies collected in 1991 by S. D. Porter (USDA-ARS, Center for Medical, Agricultural, and Veterinary Entomology, Gainesville, Florida) were studied. In addition, an examination of the large alcohol collection of undetermined South American *Solenopsis* at the Florida State Collection of Arthropods, Division of Plant Industry, Gainesville, Florida, revealed samples from more than 1,500 colonies collected throughout South America that were used for this study.

Voucher specimens from the 1998-collecting trip (App. A) are deposited into Georgia Museum of Natural History, Athens, Georgia, USA and into the J. P. Pitts Personal Collection. Voucher specimens from the 2001 collecting trip (App. B) are deposited into Museu de Entomologia, Instituto de Biologia, FEIS/UNESP, Ilha Solteira, São Paulo, Brazil and into the J. P. Pitts Personal Collection.

## CLADISTIC ANALYSIS OF THE *SOLENOPSIS SAEVISSIMA* SPECIES-GROUP

*Material Examined.*—Taxa examined for this study are listed below. These specimens were obtained from our collecting trips and from the institutions and individuals given in the Acknowledgments section. Although the main focus of this study is the *S. saevissima* species-group, several other species of *Solenopsis* were studied. The following species were examined ("all" refers to adult males, queens, and workers and worker larvae): *S. abdita* Thompson (all), *S. amblychila* Wheeler (adults), *S. aurea* Wheeler (adults), *S. bruesi* Creighton (workers), *S. carolinensis* (Forel) (queens and workers), *S. clytemnestra* Emery (workers), *S. corticalis* Forel (workers and queens), *S. daguerrei* Santschi (males and queens), *S. electra* Forel (queens and workers), *S. fugax* (Lat.) (adults), *S. gayi* (Spinola) (adults), *S. geminata* (Fabricius) (all), *S. globularia littoralis* (Smith) (all), *S. interrupta* Santschi (all), *S. invicta* Buren (all), *S. macdonaghi* Santschi (all), *S. megergates* Trager (all), *S. molesta* (Say) (all), *S. nigella* Emery (all), *S. nickersoni* Thompson (workers), *S. pergandei* Forel (adults), *S. picta* Emery (all), *S.*

*pusillignis* Trager (all), *S. pythia* Santschi (queens and workers), *S. quinquecuspis* Forel (all), *S. richteri* Forel (all), *S. saevissima* (Smith) (all), *S. substituta* Santschi (all), *S. succinea* Emery (workers and queens), *S. tennesseensis* Smith (males and workers), *S. tenuis* Mayr (workers), *S. texana* Emery (workers and larvae), *S. tonsa* Thompson (workers), *S. tridens* Forel (all), *S. virulens* (workers), *S. westwoodi* Forel (adults), *S. weyrauchi* Trager (workers), and *S. xyloni* McCook (all).

*Characters.*—Thirty-four characters for adult workers, queens, and males and worker larvae were analyzed. Autapomorphies and characters with continuous, overlapping, or non-discrete states were excluded. When a character state was polymorphic within a species "0&1" was coded for binary characters. For three-stae multistate characters, "0&1" or "0&2" was used. Only three multistate characters were studied. Taxa that were missing data for a character due to inapplicability were scored as "-" in the appropriate cell of the matrix. Taxa that were missing data for a character due to lack of specimens were scored as "?". This convention is purely secretarial, as the analysis treats both types of missing data similarly.

Phylogenetic analysis can be sensitive to the choice and number of included taxa, making sampling strategy a serious concern (e.g., Lecointre *et al.* 1993; Sanderson 1996; Graybeal 1998; Hillis 1998). To address this problem, the ingroup includes all 13 known (and one undescribed) fire ant species and one of the two parasitic species in the *S. saevissima* species-group. The social parasite *S. hostilis* was excluded from the phylogenetic analysis, as it has not been reported since it was first described (Borgmeier 1959) and specimens were not available for study. The species concept used in this study is that of the phylogenetic species concept *sensu* Wheeler and Platnick (2000). Outgroup comparison was used to determine character polarity (Nixon and Carpenter 1993). *Solenopsis geminata* was used as an outgroup, because it clearly is not a member of the *S. saevissima* species-group (Trager 1991). Adult character data were obtained from at least five individuals (if available) per species. In the case of the common and wide-ranging species, a minimum of 50 individuals (from 50 nests) were examined per species. Larval character data were obtained from at least 3 individuals (if available) per species, or in the case of the common and wide-ranging species, a minimum of 30 individuals (from 30 nests) per species.

*Adult worker characters*

0. *Frontal furrow* deep, wide as median ocellus, with transverse striae [0], absent [1] (Figs. 2.131, 2.133, 2.135, 2.137, 2.139, 2.141, 2.143, 2.145, 2.147).
1. *Median clypeal tooth* absent [0], present [1] (Figs. 2.131, 2.133, 2.135, 2.137, 2.139, 2.141, 2.143, 2.145, 2.147).
2. *Ventral mesosternal process* present in largest workers [0], always absent [1].
3. *Ventral petiolar process* present [0], absent [1] (Figs. 2.131, 2.133, 2.135, 2.137, 2.139, 2.141, 2.143, 2.145, 2.147).
4. *Mandibular shape* strongly curved mesad [0], gently curved mesad [1] (Figs. 2.131, 2.133, 2.135, 2.137, 2.139, 2.141, 2.143, 2.145, 2.147).
5. *Mesonotal pilosity* with $\leq$26 setae [0], $\geq$30 setae [1].
6. *Median frontal streak* absent [0], present [1] (e.g. Fig. 2.50). (*Solenopsis pythia, S. interrupta,* and *S. quinquecuspis* are polymorphic for this character, with various levels of development found even within colonies.)

7. *Median ocellus* in largest major workers present (with obvious lens) or puncture present where ocellus would occur (lens not obvious) [0], absent [1].

8. *Piligerous foveolae* on head ovate or elongate [0], round [1].

9. *Mandibular costulae* absent [0], absent mesally [1], present throughout [2].

10. *Pronotum* rounded anterolaterally, bosses absent, [0], quadrate anterolaterally, distinct bosses present [1].

11. *Promesonotal suture* angulate medially, sometimes projecting upward [0], gently curved medially, never projecting upward [1]. (This character is present in the largest workers of *S. macdonaghi* and *S. quinquecuspis* and is not present in every colony. Similarly sized specimens of *S. megergates* lack this character.)

12. *Propodeum sculpture* glabrous posteroventrad to spiracle [0] (Figs. 2.130, 2.132, 2.134, 2.136, 2.138, 2.142, 2.144, 2.146), granulate posteroventrad to spiracle [1] (Fig. 2.140).

13. *Propodeum* in largest major workers curves upward from metanotal groove to flattened posterior portion [0], produced upward from metanotal groove above and curves downward to flattened posterior portion (in lateral view, propodeum appears to have an anterior lobe projecting dorsally) [1]. (This character is present in the largest workers of *S. macdonaghi* and *S. quinquecuspis* and is not present in every colony. Similarly sized specimens of *S. megergates* lack this character.)

14. *Postpetiole striae* present on lower 0.75 or more [0], present on lower 0.50 or less [1].

15. *Postpetiole shape* much broader than high [0], as high or higher than broad [1].

16. *Postpetiole sculpture* with upper 0.50 weakly to distinctly granulate [0], glabrous [1].

*Adult queen characters*

17. *Mandibular shape* strongly curved mesad [0], gently curved mesad [1] (Figs. 2.22, 2.30, 2.32, 2.34, 2.36, 2.38, 2.40).

18. *Median clypeal tooth* absent [0], present [1] (Figs. 2.22, 2.24, 2.26, 2.28, 2.30, 2.32, 2.34, 2.36, 2.38, 2.40).

19. *Median frontal streak* absent [0], present [1] (Fig. 2.50). (This character is polymorphic for *S. invicta* and *S. megergates*. This character was coded as absent for *S. richteri* because the surrounding integument is as darkly colored as a normal frontal streak but it very well could be present and thus obscured.)

20. *OOI* >0.80, usually much greater [0] (Figs. 2.22, 2.24, 2.26, 2.28, 2.32, 2.34, 2.36, 2.38), <0.75 [1] (Figs. 2.30, 2.40).

21. *Eye placement* low on head, upper 0.33 of eye at midpoint of head, as seen in frontal view [0], midpoint of eye at midpoint of head, as seen in frontal view [1].

22. *Head sculpture* with small piligerous foveolae with interfoveolar space glabrous and < 0.005 mm [0], large piligerous foveolae with interfoveolae space striate and >0.01 mm [1].

23. *Integument around parapsidal lines* with maculations absent or not distinctly margined [0] (Fig. 2.51), with maculations present and having distinct margins [1] (Fig. 2.52).

24. *Mesonotal anteromedian maculation* absent (Fig. 2.51) or not distinctly margined [0], with maculations present and having distinct margins [1] (Fig. 2.52).

25. *Median maculation of T1* always absent or with indistinct posterior margin (color evenly changing) [0], tergal maculation sometimes with distinct, posterior margin

of maculation abrupt [1]. (*Solenopsis richteri* and *S. interrupta* only occasionally exhibit a tergal maculation with a distinct posterior margin.)

*Adult male characters*

26. *Head* with area posterior to ocellar triangular glabrous [0], weakly to strongly granulate [1].
27. *Head striae anterior to occipital carina* present [0], absent [1].
28. *Mandibular color* yellow [0], brown [1]. (*Solenopsis invicta* and *S. macdonaghi* were coded as polymorphic for this character. Some specimens are either color, while others are yellow basally and brown apically.)
29. *Color of male* predominantly yellow brown [0], dark brown to black [1].
30. *Pubescence on mesonotum* sparse [0] (Fig. 2.72), dense [1] (Fig. 2.73).

*Worker fourth instar larval characters*

31. *Occipital setal row* bifid [0] (Figs. 2.148, 2.151, 2.152, 2.155, 2.157, 2.160, 2.162, 2.163, 2.177, 2.182, 2.183, 2.189, 2.193), simple mesally, bifid laterally [1] (Figs. 2.165, 2.169, 2.170, 2.173, 2.174), simple [2] (Figs. 2.176, 2.178, 2.186, 2.192).
32. *First setal row on vertex* bifid [0] (Figs. 2.148, 2.151, 2.152, 2.155, 2.157, 2.160, 2.162, 2.163, 2.177, 2.182, 2.183, 2.189, 2.193), dentate [1] (Figs. 2.165, 2.169), simple [2] (Figs. 2.170, 2.173, 2.174, 2.176, 2.178, 2.186, 2.192).
33. *Second setal row on vertex* bifid laterally [0] (Figs. 2.148, 2.151, 2.155, 2.165, 2.169, 2.182, 2.183, 2.189, 2.192, 2.193), simple [1] (Figs. 2.152, 2.157, 2.160, 2.162, 2.163, 2.170, 2.173, 2.174, 2.176, 2.178, 2.185, 2.188).

Several other characters were examined, but these proved unsatisfactory as they were found to be continuous and broadly overlapping among species.

## Phylogenetic Analysis

The data set (Table 2.5) was entered into a matrix using Winclada (BETA) version 0.9.9 (Nixon 1999) and a parsimony analysis was performed using NONA version 2.0 (Goloboff 1997) and Hennig86 version 1.5 (Farris 1988). All characters were analyzed as unordered, and several characters were coded as polymorphic for certain species. In NONA, a heuristic search was performed with the following command sequence "hold 1000; hold/100; mult*100;" (hold 1,000 trees in memory; hold 100 starting trees in memory; perform tree bisection-reconnection branch swapping on 100 random addition replicates). The parsimony ratchet (Nixon 2000) was implemented on the data using Winclada (BETA) version 0.9.9 (Nixon 1999). For the parsimony ratchet, 200 iterations were performed per run and 1 tree was held per iteration. The parsimony ratchet was performed three times for each character sampling at 10% (4 characters), 15% (5 characters) and 20% (6 characters), for a total of 9 performances. In Hennig86, the analysis was performed with the implicit enumeration command (ie*;).

Although the value of commonly used confidence statistics remains somewhat controversial (see Hillis 1995; Sanderson 1995; Wenzel 1997), the relative degree of support for each node in the obtained trees was assessed with Bremer Support values (Bremer 1994) as implemented by NONA. The branch support for a given node is the number of extra steps from the shortest tree required to collapse the node. Branch support indices were calculated with NONA (by means of the command sequence ‘hold 1000; sub 1; find *; <enter>, hold 2000; sub 3; find *; <enter>, hold 4000; sub 5; find *; <enter>”, bsupport;). Successive approximations character weighting (Farris 1969; Carpenter 1994) was conducted in NONA using the squared consistency index as a weighting function, by means of the swt.run file (command sequence ‘run swt.run mult*10;’). Methods of *a posteriori* character weighting, such as successive weighting, are generally used to find topologies supported by the most consistent characters. This facilitates the choice of a preferred tree or trees from the initial set of most parsimonious trees obtained under equal weighting (Carpenter 1988, 1994; Carpenter *et al.* 1993).

## Results of the Phylogenetic Analysis

The parsimony analysis using NONA for the 34 characters from all character systems resulted in two most parsimonious trees (length 57; CI 64; RI 69) (Figs. 2.201, 2.202). Parsimony analysis using ie* in Hennig86 resulted in four trees, after discarding non-optimal and optimization sensitive trees with NONA, only the two trees from the previous analysis remained. Lastly, use of the parsimony ratchet resulted in a total of 1005 trees, after discarding non-optimal and optimization sensitive trees with NONA, the same two trees again were obtained. Successive approximation weighting of these two trees yielded one most parsimonious tree (scaled branch length 3692), with the same topology as the one original tree (Fig. 2.201). This tree is presented as the preferred hypothesis of the *S. saevissima* species-group (Fig. 2.201). Bremer support values are given near their representative nodes (Fig. 2.201).

It is notable that 50% of the data were coded as missing for *S. weyrauchi* because only workers were available for study and 59% of the data were coded as missing for *S. daguerrei* because this species lacks a worker caste. In order to see if the missing data of these taxa affected the results, an analysis was performed without the *S. weyrauchi* and *S. daguerrei* data using NONA. The parsimony analysis resulted in two most parsimonious trees (length 55; CI 67; RI 72) (Figs. 2.203, 2.204). Successive approximation weighting of these two trees yielded one most parsimonious trees which is identical to one of the two NONA trees (Fig. 2.203). These results give relationships similar to those obtained with the inclusion of both the *S. weyrauchi* and the *S. daguerrei* data (Fig. 2.201) suggesting that missing data did not affect the results.

The appropriate approach for analyzing different classes of data currently is a subject of debate (Bull *et al.* 1993; Eernisse and Kluge 1993; Chippendale and Wiens 1994; Huelsenbeck *et al.* 1996), with some advocating partitioning of different data classes and others advocating combining all data in a total evidence analysis. There seems to be general agreement that different classes of data should be combined if they are concordant. There is no consensus, however, on an appropriate approach when different data sets provide conflicting signals.

Independent analyses of characters partitioned among the source castes and life stages were also conducted. Independent analyses were performed to judge the relative utility of the different classes of characters regarding phylogenetic inference in fire ants and to justify the labor and time invested in study of the castes and life stages other than workers. NONA was used for the parsimony analysis in each data partition.

First, the data set was analyzed with worker characters only. For this partition, *S. daguerrei* was removed from the analysis because all of the data were lacking for this taxon. Parsimony analysis resulted in two most parsimonious trees (length 32; CI 56; RI 54) (Figs. 2.205, 2.206). Successive approximation weighting of these two trees yielded one most parsimonious tree (scaled branch length 3768), identical to the previous NONA tree (Fig. 2.205). Allowing for decreased resolution, this cladogram is concordant with the preferred hypothesis (Fig. 2.201).

Second, an analysis was performed with only male characters. For this partition, *S. altipunctata* sp. nov., *S. electra, S. pythia,* and *S. weyrauchi* were removed from the analysis because all of the data were lacking for these taxa. Parsimony analysis resulted in one most parsimonious tree (length 5; CI 100; RI 100) (Fig. 2.207). Allowing for decreased resolution, this cladogram is somewhat congruent with the preferred hypothesis except that *S. pusillignis* is placed basal to the species-group rather than *S. daguerrei*.

Third, an analysis was performed with only queen characters. For this partition, *S. weyrauchi* was removed from the analysis because all of the data were lacking for this taxon. The analysis resulted in 19 most parsimonious trees (length 15; CI 66; RI 76). Successive approximations weighting obtained 13 trees. A strict consensus tree was calculated from these 13 trees (Fig. 2.209). This cladogram is congruent with the preferred hypothesis.

Fourth, in order to see the effect of the larval characters, an analysis was performed with only larval characters. For this partition, *S. daguerrei, S. electra, S. pythia,* and *S. weyrauchi* were removed because all of the data were lacking for these taxa. This resulted in three most parsimonious trees (length 6; CI 83; RI 85). Successive approximations weighting failed to choose between any of these trees, so a strict consensus tree was calculated (Fig. 2.208). The consensus tree is somewhat congruent with the preferred hypothesis. It deviates from the preferred hypothesis by suggesting that *S. richteri* is more closely related to *S. macdonaghi*, *S. megergates*, and *S. quinquecuspis*.

Fifth, in order to see the effect of the sexual characters, an analysis was performed with both queen and male characters. When the analysis was performed with all taxa present, it resulted in 252 most parsimonious trees and 178 trees after successive approximations weighting. A strict consensus tree provided no resolution. When *S. altipunctata* sp. nov., *S. electra, S. pythia,* and *S. weyrauchi* were removed from the analysis (male data or 36% of data lacking), the analysis resulted in six most parsimonious trees (length 19; CI 78; RI 87). Successive approximations weighting failed to choose between any of these trees, so a strict consensus tree was calculated (Fig. 2.211). This cladogram is also congruent with the preferred hypothesis.

Lastly, the analysis was performed without the three larval characters to assess their utility. Parsimony analysis resulted in three trees (length 49; CI 66; RI 72). Successive approximations weighting yielded the same three trees (rescaled branch length of 3200). A strict consensus tree was produced from the three trees (Fig. 2.210). This result differs greatly from the preferred hypothesis (Fig. 2.201). Although *S. daguerrei* is maintained as being the basal species for the group, the remaining clade appears to be rooted in at a different node without greatly altering the specific relationships (allowing for decreased resolution). This is the only data partition that conflicts greatly with preferred cladogram.

The partitioned analyses show that all character classes play an integral part in providing a resolved tree. The total evidence approach, where the most data are explained, provides the most conclusive phylogenetic hypothesis (Fig. 2.201).

## DISCUSSION

### Cladistic Analysis

We present a first phylogenetic analysis of fire ants species. The preferred cladogram presents several interesting relationships and trends for these species. There seems to be an evolutionary trend toward increase in major worker size for this species-group. Support is provided for the monophyly of the three species with the largest workers, *S. megergates*, *S. macdonaghi*, and *S. quinquecuspis* (Fig. 2.201). It may be thought that the characters that define the (*S. megergates* + (*S. macdonaghi* + *S. quinquecuspis*)) clade are a function of size. This is not the case. The major workers of the smaller species, *S. electra, S. altipunctata* sp. nov., and *S. interrupta,* have some of these same characters but are not place in this clade.

Our phylogenetic hypothesis also provides support for a sister-group relationship between *S. electra* and *S. pusillignis*. This relationship was also proposed by Trager (1991), and he termed this clade the *S. electra* subcomplex (Table 4). We feel that it is unwarranted to divide the *S. saevissima* species-group into smaller divisions and we do not offer names for this clade or any other presumed monophyletic groups within this species-group.

Another notable feature of the cladogram is that *S. saevissima* and *S. pythia* are not sister species, despite a similar appearance. Due to this resemblance and sporadic distribution of *S. pythia*, this species has been suspected to be a social parasite (Trager 1991). The queens of *S. pythia* lack the typical reductions in sculpture, wing venation, and other features typically seen in a permanent social parasite (Hölldobler and Wilson 1990), and the species occurs outside of the known range of *S. saevissima* (Fig. 2.205) making it doubtful that the queen is a permanent social parasite of *S. saevissima*. Temporary social parasitism on sympatric species of fire ants cannot be ruled out as a life history strategy of this species because its biology remains largely unknown.

An important biogeographical implication of the phylogenetic analysis is that many sister species occur either allopatrically or parapatrically. This pattern of differentiation gives support to the idea that speciation within this group is an allopatric process. The most obvious case involves the sister species *S. weyrauchi* and *S. altipunctata* sp. nov. whose ranges are separated by the vast distance between the Andes and mountainous southeastern Brazil.

The phylogenetic analysis also has an important implication for social evolutionary theory by predicting whether having a polygynous social form (multiple-queen colonies) is an ancestral or derived condition. Several species in the *Solenopsis saevissima* species-group exhibit polygyny, namely *S. richteri*, *S. invicta*, *S. macdonaghi*, and *S. quinquecuspis,* and these species, along with *S. megergates*, form the most derived clade in this species-group. Polygyny is not known in the more basal species, except for maybe *S. pythia*. As such, this social behavior may represent a synapomorphy for the clade and suggests that polygyny is actually a derived trait rather than monogyny. (It is remains unknown whether there are polygynous colonies of *S. megergates* or not due low number of colonies sampled.) After analysis of the sequence evolution of the Gp-9 gene, which determines social form, Krieger and Ross (2002) also suggest that polygyny is a derived trait. In the past, some authors have suggested that polygyny is a primitive condition (Nonacs 1988; Ward 1989a; Ross and Carpenter 1991) while others have suggested it is derived (e.g. Hölldobler and Wilson 1977; Fletcher and Ross 1985; Hölldobler and Wilson 1990; Bourke and Franks 1995), but neither suggestion has been proven by cladistical methods.

Previously, Ross and Trager (1990) studied the relationships of several species in the *S. saevissima* species-group using allozyme data. They obtained a sister species relationship for *S. richteri* and *S. quinquecuspis,* in contrast with the results of the current study. There were, however, some difficulties with the allozyme data. A "species x" was included in the analysis that was genetically diagnosable but not morphologically distinct from *S. quinquecuspis* (specimens of this putative cryptic species were not available for this study). "Species x" and *S. quinquecuspis* were not found to be sister taxa. Instead, *S. macdonaghi*, "species x" and *S. invicta* formed a monophyletic group (Ross and Trager 1990). Because *S. quinquecuspis* and "species x" are not morphologically distinct, this second relationship is similar to the results reported here for *S. quinquecuspis*, which are that *S. invicta* is sister species to a clade made up, in part, of *S. quinquecuspis* and *S. macdonaghi*.

We are currently examining the relationships of mitochondrial DNA (mtDNA) sequences within the *S. saevissima* species-group. Preliminary data, using *S. electra* as an outgroup, again suggest that *S. quinquecuspis* and *S. richteri* are sister species.

Moreover, the *S. invicta* haplotypes do not form a monophyletic clade. Several of the *S. invicta* haplotypes are more closely related to *S. megergates* and to the *S. quinquecuspis* + *S. richteri* clade than to other *S. invicta* haplotypes. The occurrence of such paraphyletic sequence groupings leads to the suspicion that *S. quinquecuspis* and *S. invicta* may be cryptic species complexes that contain several species not readily recognizable morphologically.

It is interesting that both the allozyme and mtDNA studies found *S. richteri* and *S. quinquecuspis* to be sister species. This conclusion for the allozyme study was based on single synapomorphy and several species were not included in the analysis. The use of more nuclear genes and inclusion of the remaining species may give alternate results. The mtDNA results should be interpreted with caution as well. Mitochondrial DNA is effectively a single maternally transmitted gene and in fire ants, it is undoubtedly influenced by selection acting on the cytoplasmic parasite *Wolbachia* (see Werren 1997; Shoemaker *et al*. 2000). The mtDNA may leave a more durable record of hybridization between species than does nuclear DNA, because of its smaller effective population size, and possibly, the effects of *Wolbachia* infection. Occasional historical hybridization events, such as that between *S. richteri* and *S. invicta* in the United States, may have occurred periodically between recently diverged species with overlapping ranges. The extensive overlap of ranges of *S. richteri* and *S. quinquecuspis* may have increased the opportunities for occasional historical hybridization. Nonetheless, there does seem to be some higher-level concordance between the mtDNA data and the morphological data.

Finally, our cladistic analysis indicates that the social parasite *S. daguerrei* does not have a sister group relationship with any of its hosts, *S. invicta, S. richteri,* or *S.*

*macdonaghi.* The possibility that *S. daguerrei* arose via sympatric speciation directly from its current host(s) or an immediate ancestor of those hosts should be dismissed as its mode of speciation. Emery's Rule (in the strict sense) is, therefore, unjustified in this case.

Some insights into the probable mode of speciation of *S. daguerrei* can be gained by considering the non-fire ant species of *Solenopsis* as well as its sister genera, *Carebarella* and *Oxyepoecus* (Bolton 1987). First, many of the smaller *Solenopsis* species are lestobiotic (thief ants). Second, *Carebarella bicolor* Emery (as *C. punctatorugosa*) presumably also has a lestobiotic relationship with *Acromyrmex subterraneus* Forel (Eidmann 1936). Third, *Oxyepoecus* species apparently are inquilines of both *Solenopsis* and *Pheidole* that have a worker caste (Kusnezov 1952; Ettershank 1966; Kempf 1974; Hölldobler and Wilson 1990). Such behaviors suggest that *Solenopsis* has a predisposition for symbiosis with other ants. Buschinger (1986) stated that there was "no direct evidence for an evolution of guest ants toward inquilism…". Although neither parabiotic nor xenobiotic relationships have been found in *Solenopsis*, it seems reasonable that *S. daguerrei* evolved social parasitism from a previous lestobiotic relationship with its hosts (the nest-sharing hypothesis (Wilson 1971; Hölldobler and Wilson 1990)). Definitive evidence for this hypothesis will be gained only when the closest relatives of the *S. saevissima* species-group are determined and natural history of these species are better studied.

All other instances where cladistic methods have been used to test the validity of Emery's Rule, also have resulted in the Rule being unsupported (Ward 1989, 1996; Carpenter *et al.* 1993; Agosti, 1994; Choudary *et al.* 1994; Taber 1998; Fanelli *et al.*

2001). In both cases where there has been more than one species of social parasite in the ingroup (studies of *Pogonomyrmex* (Taber 1998) and *Polistes* (Carpenter *et al.* 1993; Choudary *et al.* 1994; Fanelli *et al.* 2001)), the social parasites formed a monophyletic group. Furthermore, the polistine wasp *Polistes atrimandibularis* is reported to have no constraints on host choice and thus is a generalist social parasite (Fanelli *et al.* 2001). These findings add to the body of evidence rejecting the generality of the sympatric speciation model.

It is premature to abandon Emery's Rule altogether. It cannot be expected that the limited attempts at testing this Rule have covered all the variation found in social Hymenoptera as a whole. There seem to be several untested examples, such as the parasitic *Myrmica colax* (Cole), *Pheidole inquiline* (Wheeler), *Leptothorax buschingeri* Kutter, and *Strumigenys xenos* Brown, that could actually provide support for the Rule and a sympatric speciation model. Also in instances where more than one social parasite are included in the ingroup, convergence of characters due to reduction in body size and sculpture, and missing data associated with the lost worker caste, could cause the social parasites to cluster together, causing Emery's Rule to be rejected on the basis of an incorrect phylogenetic hypothesis. This is certainly an area where much can be learned by the addition of genetic data. In any case, Emery's Rule is, at best, only a hypothesis and the theory that hymenopteran social parasites generally evolve sympatrically from their hosts is weakened due the failure of these studies to support Emery's Rule. It is far too early to accept a single general theory proposing the factors that led to the evolution of social parasitism and several routes probably exist.

Delineation of Species Groups within *Solenopsis*

Trager (1991) placed the fire ants in the *S. geminata* group, which includes the closest relatives, *S. substituta* and *S. tridens,* as well as their more distant relative, *S. virulens.* Trager refers to smaller groupings within the *S. geminata* species-group as species complexes, and groups within the complexes as subcomplexes. The *S. geminata* species-group is informal and clearly is not monophyletic due to the inclusion of *S. virulens*. This situation, coupled with the unwieldy terminology of complexes and subcomplexes has led us to propose a new classification of fire ants (Table 4):

*Solenopsis virulens* is placed in the *S. tenuis* species-group, which is defined by monomorphic workers, eyes small with 20-60 facets, the first flagellomere being as broad or broader than long and the postpetiole not dilated (= the *S. tenuis* subcomplex of the *S. fugax* species-group of Trager).

*Solenopsis tridens* and *S. substituta* are placed in the *S. tridens* species-group, which is defined by monomorphic workers with long scapes, a long first flagellomere (at least 1.5X longer than broad), propodeal carinae, and an elongate petiolar peduncle (= the *S. tridens* complex of Trager).

The *S. geminata* species-group includes *S. geminata, S. xyloni, S. amblychila, S. aurea, S. gayi,* and *S. bruesi*. This species-group is defined by strongly polymorphic workers with short scapes, with a long first flagellomere (at least 1.5X longer than broad), with a reduced or absent median clypeal tooth, and with a ventral petiolar process (= the *S. geminata* complex of Trager). This species-group should be viewed with skepticism until their relationships are more thoroughly studied.

The *S. saevissima* species-group includes *S. altipunctata,* sp. nov., *S. daguerrei, S. electra*, *S. hostilis, S. interrupta, S. invicta, S. macdonaghi, S. megergates, S. pusillignis, S. pythia, S. quinquecuspis, S. richteri, S. saevissima,* and *S. weyrauchi*. This group is defined by strongly polymorphic workers with long scapes, a long first flagellomere (at least 1.5X longer than broad), a strongly developed median clypeal tooth, weak sculpturing, and a small or absent ventral petiolar process (= the *S. saevissima* complex of Trager).

## Morphology of sexuals

Creighton (1930, 1950) stated that both male and queens of *Solenopsis* appear to offer better characters for specific determinations than do the workers. Individuals of the sexual caste tend to be larger than the worker caste and have a less generalized anatomy. Thus, the sexual caste could provide characters, such as male genitalia and wing venation that are not obtainable from workers and are useful for identification purposes (Creighton 1930, 1950).

This study revealed that using the morphology of the sexuals in concert with that of the workers greatly imporves the ability to identify species of fire ants. The males and queens are very similar to each other, especially in morphometric measurements and indices (Tables 2.5, 2.6). Given a choice, workers still offer the most characters, and these characters alone are sufficient for making accurate species identification. On the other hand, a well, resolved evolutionary hypothesis was impossible without inclusion of the characters from sexuals, as shown by the parsimony analyses conducted above.

For many Hymenoptera, the male genitalia are of great diagnostic utility. Sexual selection is hypothesized to drive the rapid divergence of the morphology of male genitalia once speciation occurs (Eberhard 1985). Also, because the male genitalia are structurally complex, the likelihood that related species would become similar in this structure through parallelism is extremely low (Mayr 1969). Thus, genitalic characters potentially could be useful for distinguishing even closely related species. Although there are slight differences between several of the fire ants species-groups and the *S. fugax* species-group, this study found that the male genitalia of the species within the *S. saevissima* species-group were homogeneous and uninformative (Figs. 2.74-2.86).

Wing venation in *Solenopsis* may be used to give valuable data for determining the phylogeny of the tribe Solenopsidini in the future, as proposed by Brown and Nutting (1950), however, it appears to be too conservative within the *S. saevissima* species-group to be used to define phylogenetic relationships of the species. Moreover, wing venation tends to be homogeneous among species and too intraspecifically variable within species (Figs. 2.87-2.108) to provide diagnostic information for these species.

Variation of wing venation indeed appears to be conservative for the entire genus. Although some slight differences exist, the venation of the *S. saevissima* species-group is remarkably similar to that of other groups, such as the *S. geminata* species-group (Figs. 2.109-2.114, 2.116), the *S. tridens* species-group (Figs. 2.115, 2.117, 2.118), and the *S. tenuis* species-group (Figs. 2.123-2.125). Furthermore, such distantly related species as *S.* nr *nigella, S. nigella gensterblumi*, and an unidentified species of the *S. nigella* species-group are similar as well (Figs. 2.119-2.122). Some species of *Solenopsis* in the *S. molesta* species-group have diagnostic wing venation, such as the reduction of the r-rs cross vein (Fig. 2.129), but others do not (Figs. 2.127-2.129). Generally, wing venation is taxonomically uninformative for the entire genus.

Intraspecific variation and abnormalities exist in the wing venation of many individuals, for instance: 1) the swelling in the Rs+M vein in the radial cell of a *S. pusillignis* queen (Fig. 2.87) and *S. richteri* queen (Fig. 2.102); 2) the coarseness of the Rs vein and the veins delineating the radial cell in individuals of several species (Figs. 2.89, 2.93, 2.95); 3) swellings on the Cu vein of a *S. macdonaghi* male (Fig. 2.97); 4) swellings on the Rs+M vein in the median cell of a *S. megergates* queen (Fig. 2.98). These abnormalities are found in other species-groups and are probably characteristic of the genus *Solenopsis* as a whole (Figs. 2.109, 2.119, 2.122, 2.125). In some cases, certain veins are misplaced so that the venation looks unique (Fig. 2.109), but usually the other wing on the same individual is normal. Such asymmetry has been documented for *Oxyepoecus*, a close relative of *Solenopsis* (Kempf 1974). This variation exists as well for both spectral and nebulous veins.

The lack of the m-cu cross vein for the queens of *S. altipunctata*, sp. nov. (Fig. 2.89) and the reduction of wing venation in *S. daguerrei* (Figs. 2.106, 2.108) are constant and are considered characters rather than abnormalities. The lack of the m-cu cross vein for *S. altipunctata* was observed in all four forewings of the two queens from different nests examined. All specimens of *S. daguerrei* had reduced wing venation, albeit to various degrees.

Other morphological abnormalities exist as well and are noted here. A single queen of *S. megergates* had two median ocelli and had coarse striations throughout the ocellar triangle (Fig. 2.54). These complete striations only were seen in this one atypical specimen. Another queen of *S. quinquecuspis* had four propodeal spiracles (Fig. 2.55). These two specimens did not otherwise differ from the typical queens of their species. Lastly, two gynandromorphs of *S. quinquecuspis* also were collected and are discussed elsewhere.

## Larval morphology

Wheeler and Wheeler (1976, 1986, 1991) found that larval morphology could be used to differentiate ant genera and provided a generic key using larval characters. In some cases, higher level taxonomy of Formicidae has been redefined using larval morphology (Wheeler and Wheeler 1970). Many species-level larval descriptions have been published for Formicidae, but in only two cases has larval morphology been used for phylogenetic purposes (Wheeler and Wheeler 1970; Schultz and Meier 1995).

The larval stages of ten species within the *Solenopsis saevissima* species-group are described in this study. The morphology of these species appears very similar, yet some variation can be observed. Wheeler and Wheeler (1977) reported that *S. invicta* differed from *S. richteri* x *invicta* (described as *S. richteri*) in the number of setae on the dorsal side of the labrum and the number of sensilla on the ventral margin of the labrum. The present survey of many specimens and species revealed that minute features such as these are quite variable within species, and are not very useful in species determinations. Mandibular dentition is of limited use due to varying degrees of wear resulting from feeding. Larvae are of little systematic significance because most larval features are broadly overlapping and continuous among. However, two general groups of species can be defined on the basis of the larval characters examined. One group includes those species with bifid setae above the antennal margin (*S. altipunctata*, sp. nov., *S. interrupta*, *S. invicta*, *S. pusillignis*, *S. saevissima*) and is termed the *S. saevissima* type. The other group contains those species with setae above the antennal margin that are usually simple or dentate (*S. macdonaghi*, *S. megergates*, *S. quinquecuspis*, *S. richteri*) and is termed the *S. megergates* type. As shown by the partitioning analyses, larvae yielded several new characters that provided crucial information for inferring relationships of the species.

## *SOLENOPSIS SAEVISSIMA* SPECIES-GROUP (SAY)

Diagnoses for the queens, males, and larvae of the non-parasitic species *S. saevissima* species-group are given below. Due to the drastic modification in body form of the socially parasitic species, they are not included in this description; the species description of *S. daguerrei* gives the differences between the social parasites and the remainder of the species-group. *Solenopsis hostilis* has been included in the key for completeness. To avoid repetition of the descriptive work of Trager (1991) involving the worker caste, only unique combinations of worker characters useful for identifying individual species are given. See Trager (ibid.) for a more thorough and detailed treatment of the workers.

**Queen.** *Head*. Usually broader than long, quadrate, wider posterior to eyes than anterior to them, sides weakly convex from eyes to occipital angles, straight to slightly convex below eyes and meeting anterior border of head at a sharp angle (Fig. 2.1). Occipital angles well marked, occiput flat with narrow, shallow median impression. Occipital furrow clearly to weakly defined. Frontal furrow indistinct. Clypeus projecting, carinal teeth very stout and acute, clypeus with anterior shallow concave impression between carinal teeth (Fig. 2.1). Paracarinal teeth small (Fig. 2.20), often poorly defined and, in some cases, absent (Fig. 2.1). Median carinal tooth well developed (Fig. 2.1) to indistinct (Fig. 2.20). Mandibles with outer boarder convex, masticatory border with four teeth, fourth tooth much smaller than others (Fig. 2.1). Eyes large, strongly convex, ovate (Figs. 2.1, 2.4). Antennal scape in repose reaches or passes lateral ocellus. Antenna with 10-11 segments, with 2-segmented club.

*Mesosoma.* Robust, elliptical, only slightly narrower than head (Fig. 2.2). In lateral view, mesonotum with convex anterior portion that overhangs pronotum and with straight posterior half (Fig. 2.5). Scutellum as high or higher than mesonotum, slightly convex with short perpendicular posterior face, posterior face depressed posteromesially (Fig. 2.5). Angle of propodeum well defined but obtuse, basal face shorter than declivous face (Fig. 2.5). Mesosternum large and subglobose ventrally (Fig. 2.5). Wings hyaline.

*Metasoma.* In lateral view, petiolar node obtusely triangulate, profile of peduncle flattened anteriorly, convex posteriorly (Fig. 2.5). Petiole with median longitudinal carina on anterior 0.50-0.75 of ventral surface (Fig. 2.5). Postpetiole evenly convex (Fig. 2.5). Lateral faces of postpetiole concave to slightly convex. Petiolar and postpetiolar spiracles appear tuberculate in some cases. Petiole with basal transverse carina, appears tooth-like in lateral view. In dorsal view, nodes are very strongly transverse, and postpetiole wider than petiole. In cephalic view, petiole sometimes with distinct median lobe, postpetiole broader than high, highest mesally.

**Male.** *Head.* Trapezoidal, maximum head width greater than length (Fig. 2.10). Eyes very large, strongly convex, ovate, occupying more than 0.5X side of head, their anterior border almost reaching insertion of mandible (Fig. 2.10). Eyes normally with setae protruding from between ommatidia. Ocelli small to large and prominent, elliptical (Fig. 2.10), lateral ocelli marking boundary of occiput with shallow concave depression between them. Anterior edge of clypeus approximately straight (Fig. 2.10). Clypeus with blunt, central lobe in lateral view (Fig. 2.9). Mandibles small, straight, tridentate, third tooth small, sometimes indistinct. Antennal scape longer than broad, roughly cylindrical. Pedicel subglobose, broad or broader than scape or flagellomeres (Fig. 2.10). First flagellomere >2.0X as long as broad, second flagellomere <1.6X as long as broad, remaining flagellomeres progressively decreasing in width.

*Mesosoma.* Robust, elliptical, width less than twice that of head. In lateral view, anterior part of mesonotum greatly swollen and overhanging pronotum (Fig. 2.9). Propodeum rounded, declivous face perpendicular and flat except with distinct to indistinct median longitudinal depression (Fig. 2.9), basal face strongly convex transversely and convex longitudinally. Mesosternum large and subglobose ventrally (Fig. 2.9). Wings hyaline.

*Metasoma*. Node of petiole short in lateral view with acute dorsum (Fig. 2.9); anterior face not sharply separated from thick peduncle, posterior face perpendicular laterally, gently curving mesally (Fig. 2.9). In cephalic view, dorsum of node with shallow median impression, sometime appearing bilobate. Postpetiole in lateral view as high as node of petiole, anterior face, dorsum and posterior face rounded (Fig. 2.9). In dorsal view, both nodes very transverse, postpetiole is approximately 1.0-3.0X as broad as long and as wide as node of petiole. Petiolar and postpetiolar spiracles distinctly tuberculate to not tuberculate. Genitalia strongly retracted (Fig. 2.74). Cuspis laterally flattened, appearing lobate in lateral view and lacking setae (Fig. 2.74). Digitus short and cylindrical, with apical setae and sometimes with lateral setae (Fig. 2.74). Ventral portion of volsellar plate apically produced, clothed with several setae (Fig. 2.74). Ventral surface minutely dentate with rows of triangular teeth (Fig. 2.74). Ventral margin of aedeagus with many anteriorly directed triangular teeth (Fig. 2.74). Aedeagus with anteroventrally directed triangular projection (Fig. 2.74). Apodeme of aedeagus directed perpedicular to slightly obtuse to ventral surface (Fig. 2.74).

*Sculpture and Pilosity*: Punctures fine and numerous, < 0.001mm wide. Antenna covered with dense, short, white pubescence. Pubescence on legs shorter and stouter than on body.

**Fourth instar worker larva.** *Head.* Antenna with 2-3 sensilla, each bearing spinule (Fig. 2.12). Head setae sparse (Fig. 2.12). Cranial width equal to or slightly broader than long (Fig. 2.12). Labrum small, short, slightly narrowed mesally (Fig. 2.12). Mandible heavily sclerotized with two parts (Fig. 2.12): 1) stoutly sickle-shaped body, with three apical teeth not in same plane; 2) straight medial blade forming 0-5 teeth that decrease in size dorsally. Ventral border of labrum weakly concave with ventral corners rounded (Fig. 2.12). Labrum bearing 2-3 coarse isolated spinules near each ventrolateral corner. Maxilla with sclerotized band between cardo and stipes. Labium with patch of spinules dorsal to palpus. Labium with small lateral sclerotized bands. Opening of sericteries a long transverse slit (Fig. 2.12).

*Body.* Stout. Prothorax bent ventrally at right angles forming very short stout neck. Remainder of body straight. Abdominal diameter greatest at fourth somite. Both ends of body broadly rounded. Dorsal profile of body curved, ventral surface nearly flat.

Anus ventral. Leg and wing vestiges present. Segmentation indistinct. Integument of ventral surface of thorax and first three abdominal somites with few short transverse rows of minute spinules. Body setae numerous, short, and uniformly distributed. Body setae of two types: 1) simple, slightly curved with alveolus and articular membrane, 4-12 in transverse row on ventral surface of each thoracic somite and anterior abdominal somites; 2) bifid, branches more or less perpendicular to base, tips recurved occurring on various regions of body; often setae posterior to head on thoracic dorsum differ slightly from other setae. Setae on ventral surface with alveolus and articular membrane.

*Length*. Approximately 2.3-3.8 mm.

*Comments*.—Indices calculated from adult measurements are provided for queens and males in Tables 2.6 and 2.7, respectively.

## Identification of Fire Ants

The characters used here for the identification of fire ants are characters normally used for myrmecological taxonomic work. The most useful characters for the workers are size, coloration, head shape, and postpetiolar shape. After a thorough examination of males and queens, we feel that the workers are superior to sexuals for distinguishing amongst the various species. The queens and males of many species are very similar and in some cases are indistinguishable between species without a reference collection. As with the workers, queen characters such as pilosity or sculpturing are highly variable but sometimes can be useful. Size, coloration, and head shape also are of some use in identification of the queens. Coloration and size of males tend to be very similar for many species, making these characters of limited value for identification purposes. Some males, however, have reliable sculpture characters. Lastly, geographical distribution is another useful character in identifying fire ants but as discussed by Trager (1991), fire ants are easily transported to new regions and so this information should not be used alone for identification. Also, our knowledge of the full range of these species is almost certainly incomplete and many species could have a much broader range than currently known.

## KEY TO THE *SOLENOPSIS SAEVISSIMA* SPECIES-GROUP

(Modified from Trager 1991)

Note: This key is not designed for minor workers. In order to obtain an accurate identification and use all of the available information, it is recommended to take a large sample of workers from a colony to ensure that many major workers are available, and also to collect males and queens. Depending on the developmental stage of the colony, a positive identification may not be possible for a given sample. Tabular keys to the major workers, queens, and males are given in Tables 2.1, 2.2 and 2.3, respectively.

1. Queens and males small, 5.0 mm or less in length; sculpture reduced, body polished; parapsidal lines of queen absent; metapleuron fused to propodeum; clypeus of queen lacking longitudinal carinae or apical teeth; (social parasites lacking workers) ........................................................................ 2

\- Queens and males larger, greater than 5.0 mm in length; sculpture not reduced, propodeum, petiole and postpetiole at least sculptured; parapsidal lines present;

metapleuron not fused to propodeum; clypeus of queens with longitudinal carinae terminating in teeth apically (free living with workers) …………..…………3

2. Queen with posterior margin of head angulate (Fig. 2.195), appearing lobate in lateral view (Fig. 2.196). Distribution: south from Mato Grosso do Sul, Brazil to Buenos Aires Province, Argentina (Fig. 2.215) ..………………… *daguerrei*

- Queen with posterior margin of head rounded, not appearing lobate in lateral view. Distribution: Jacarepaguá, Rio de Janeiro, Brazil southwest to Rolândia, Paraná, Brazil …………………………………………… *hostilis*

3. Major worker: pronotum low and nearly flat or weakly convex in profile; metasoma black, legs yellow (yellowish brown in darker specimens), head and mesosoma ranging from clear yellowish red with some black or brownish black markings in the occipital area to uniformly brownish black (especially in vicinity of Cochabamba, Bolivia). Distribution: western Argentina and Paraguay, north to Bolivia in Andean foothills (Fig. 2.213) ...………………………… *electra*

- Major worker: pronotum higher, angular or strongly convex in profile; color variable but never with metasoma completely black and with yellow legs ...……4

4. Major worker: area immediately behind and above metapleural spiracle finely punctate or striato-punctate (Fig. 2.140); largest major worker with head strongly cordate (Fig. 2.141). Male: weak to distinct mesonotal maculations present; ocelli

large, OOI 0.80-1.26 (Fig. 2.65). Distribution: southern half of Mato Grosso, Mato Grosso do Sul, Brazil (Fig. 2.212) ..…………………..… *pusillignis*

- Major worker: area surrounding metapleural spiracle shining and smooth (Figs. 2.130, 2.132, 2.134, 2.136, 2.138, 2.142, 2.144, 2.146); largest major worker with head moderately (Figs. 2.131, 2.133, 2.137, 2.139) to weakly cordate (Figs. 2.135, 2.143, 2.145, 2.147). Males: mesonotal maculations absent; male ocelli moderate to small, OOI > 1.00 (Figs. 2.57, 2.59, 2.61, 2.63, 2.67, 2.69, 2.71) ……..... …. 5

5. Major worker: posterior face of postpetiole as high or higher than broad……. 6

- Major worker: posterior face of postpetiole broader than high…………... 11

6. Major worker: pronotal dorsum in posterodorsal view mesally concave; anterolateral bosses giving squared-off appearance to anterodorsal rim of pronotum; head uniformly brownish black; mandibles usually brownish yellow; frons without dark median streak or this barely distinct from remainder of frons. Male: often with distinct tuberculate postpetiole, tubercle height $\geq$1.5X width at base, glabrous; OOI < 1.35. Distribution: southeastern Brazil to central eastern Argentina (Fig. 2.215); introduced into Southeastern United States …… *richteri*

- Major worker: pronotal dorsum in posterodorsal view usually flat or weakly convex; pronotum lacking anterolateral bosses; or if bosses present, head yellowish, at least near mandibular bases and clypeus and often more extensively Male: often with distinct tuberculate postpetiole, tubercle height $\leq$1.5X width at base, granulate or rugose; OOI > 1.4 ….. …………………………… 7

7. Major worker: median streak usually present (Fig. 2.50). Queen: mesonotal maculations present (Fig. 2.52) (queen of *S. weyrauchi* was not examined) ….. 9

\- Major worker: median streak usually absent. Queens: mesonotal maculations normally absent ……………………………………………….. 10

8. Major worker: large with DML exceeding 1.75 mm (up to over 2.0 mm) in largest workers of most series; small piligerous foveolae (0.001-0.005 mm) present. Queen: if T1 maculation present, sometimes with T1 maculations with distinct posterior margin, always lacking anterolateral dark spots within maculation. Distribution: normally lowlands species in western Argentina and Bolivia (Fig. 2.214) ……………………………………………….. *interrupta*

\- Major worker: small with DML rarely in excess of 1.7 mm in even largest workers of most series (rarely up to 1.80 mm); large piligerous foveolae (0.005-0.03 mm) present; Queen: if T1 maculation present, maculation lacking distinct posterior margin or lacking anterolateral dark spots within maculation (queen of *S. weyrauchi* was not examined). Distribution: normally high elevation species ……….……….…………………………………… 9

9. Major worker: small piligerous foveolae (0.005-0.01 mm) present on head; rear face of postpetiole of major worker with striae present on lower 0.50 - 0.75; mandibles of major worker with 5-6 costulae; katepisternum of mesopleuron not or only weakly defined dorsally by finely striate furrow. (Queen unknown.)

Distribution: Peruvian and Bolivian Andes, 2,000-3,500 m elevation (Fig. 2.212) ……………………..…………………………….. *weyrauchi*

\- Major worker: large piligerous foveolae (0.01-0.03 mm) present on head; rear face of postpetiole of major worker with striae present on lower 0.25-0.33 (Fig. 2.19); mandibles of major worker with 10-12 costulae, weak to obsolescent mesally; katepisternum of mesopleuron weakly to distinctly defined dorsally by finely striate furrow (Fig. 2.18). (Queen: large piligerous foveolae (0.01-0.03 mm) present on head; interfoveolar areas of head striate; ocellar triangle striate (Fig. 2. 20); median cell open by loss of m-cu cross vein (Fig. 2.89); postpetiole glabrous on upper 0.75 (Fig. 2.44)). Distribution: Serra Geral, Santa Catarina, Brazil (Fig. 2.212) ……..………………………… ………. *altipunctata*, sp. nov.

10\. Major worker: larger species, DML 1.4-l .6 mm (rarely 1.7 mm) in large workers; piligerous foveolae usually very small, inconspicuous. Queen: cephalic pilosity approximately 0.30-0.33 mm long; metasoma pilosity arising from small, inconspicuous foveolae; median furrow on posterior 0.33 or less of mesonotum bidentate metasternal process present. Distribution: Orinoco drainage, Guianas, Amazonia and along rivers in bordering regions, also southeastern Brazil (Fig. 2.213) …. ……………. …………..………………… *saevissima*

\- Major worker: smaller (and much rarer) species; DML < 1.4 mm in even the largest workers; piligerous foveolae on head and pronotum of some workers conspicuous, 5-l0X as wide as base of seta. Queen: cephalic pilosity about 0.15-0.20 mm long (Fig. 2.53); metasoma pilosity arising from conspicuous piligerous foveolae nearly or actually as large as those of head and mesosoma (Fig. 2.51); median furrow on posterior 0.33-0.50 of mesonotum (Fig. 2.51); bidentate metasternal process absent. Distribution: Mato Grosso do Sul to southeastern Brazil and Misiones, Argentina (Fig. 2.212) …………………….. *pythia*

11. Major worker: smaller species, DML rarely in excess of 1.70 mm in even largest workers of most series; median frontal streak present. Queen: frontal streak present (e.g. Fig. 2.50), sometimes faint; postpetiole usually completely sculptured, only extreme dorsum lacking striae (Fig. 2.42). Male: head usually completely granulate, appearing shagreened; gena moderately to coarsely rugose. Distribution: lowland species, western Amazonia, south through Mato Grosso, eastern Bolivia, Paraguay and southeastern Brazil to Santa Fe Province, Argentina (Fig. 2.214); introduced into Southern United States ..……..… *invicta*

\- Major worker: larger species, DML exceeding 1.75 mm (up to over 2.0 mm) in largest workers of most series; median frontal streak usually absent. Queen: median frontal streak usually absent; postpetiole usually completely sculptured, only highest portion lacking striae (Figs. 2.41, 2.43). Male: head usually incompletely granulate, glabrous anterolaterally of median ocellus, not appearing shagreened; gena striate to granulate ………………………………. 12

12. Major worker: color mainly red to orange; mesosoma pilosity usually flattened basally, not curved; transverse striae or rugae on rear face of postpetiole usually lacking, or faint, appearing punctate or shagreened; outer surface of mandible

usually shining mesally, costulae obsolescent. Distribution: Uruguay, Entre Rios Province and adjacent parts of bordering Provinces in Argentina; apparently introduced at Cochabamba, Bolivia (Fig. 2.218) ................ *macdonaghi*

- Major worker: color brown to nearly black; mesosoma pilosity not flattened basally, longest setae usually appearing curved; sculpture on rear face of post-petiole with conspicuous transverse striae or rugae on lower 0.66-0.75, appearing punctate or shagreened; outer surface of mandible with costulae, sometimes obsolescent mesally ............................................ 13

13. Major worker: small with HL of majors 1.45-l .55 mm; eye of largest workers relatively (and often absolutely) larger, REL 0.18-0.20 in large majors; head mostly dark brown to brownish black; in contrast, distal portion of clypeus, head near base of mandible, and (usually) area around dark median frontal sulcus distinctly lighter yellowish brown. Males: lateral faces of scutellum weakly to distinctly striate. Distribution: Buenos Aires and La Pampa Provinces, Argentina, Uruguay, north to Santa Catarina, Brazil (Fig. 2.215) ............ *quinquecuspis*

- Major worker: large with HL 1.6-1.75 mm in largest workers; eye of largest workers relatively (and often absolutely) smaller than above species, REL 0.16-0.18 in large majors; head uniform reddish brown or gradually fading anteriad to a slightly lighter reddish brown; distal portion of clypeus, sides of head anterior to eye, and frons faintly or not at all chromatically distinct from posterior portions of head, median frontal streak absent or very faint. Males: lateral faces of scutellum glabrous. Distribution: Southeastern Brazil (Fig. 2.218) ........... *megergates*

### *Solenopsis altipunctata* Pitts, new species

(Figs. 2.16-2.20, 2.44, 2.89)

**Diagnosis of Worker.** Head broad, cordate (Fig. 2.16). Head sculpture with large piligerous foveolae, 0.01-0.03 mm. Median frontal streak present. Median ocellus in largest major workers absent (Fig. 2.16). Mandibular costulae present throughout. Mesonotum with 30-36 setae. Promesonotal suture in largest major workers angulate medially, sometimes projecting upward (Fig. 2.18). Propodeum sculpture glabrous posteroventral to spiracle (Fig. 2.18). Postpetiole shape as high or higher than broad (Fig. 2.19). Postpetiole sculpture as seen from behind with lower 0.25-0.33 transversely rugose, upper surface glabrous and shiny (Fig. 2.19).

**Description of worker.** *Head.* Cordate, slightly longer than broad, widest posterior to eyes, sides weakly convex (Fig. 2.16). Posterior border of head with concave median impression, concavity 0.5X as wide as distance between apices of frontal lobes. Lower edge of anterior border of clypeus bearing large median seta borne on weakly developed median tooth, tooth is absent in some specimens (Fig. 2.16). Clypeal carinae, strongly developed, divergent distad, projecting as triangular teeth that notably larger than median tooth and much larger than paracarinal teeth (Fig. 2.16). Paracarinal teeth reduced in some specimens. Carinal and paracarinal of teeth more dorsad on clypeal border than median tooth (Fig. 2.16). Mandibles with four teeth (Fig. 2.16). Mandible with normal curvature (Fig. 2.16). Mandibular with 10-12 fine costulae, weakly developed or obsolescent mesally, apically becoming broader with shallower intercostular furrows on upper surface. Eye ovate, elliptical, with maximum diameter 10-

12 ommatidia, and minimum diameter 6-7 ommatidia. Scapes curved basally, thickest subapically. Apex of scape in repose not surpassing posterior border of head.

*Mesosoma.* Anterodorsal pronotal border, weakly convex (Fig. 2.18). Anterolateral pronotal corners variously rounded, never distinctly angulate and bearing slight humeral bosses. Promesonotal suture angulate mesally with small dorsal projection at apex (Fig. 2.18). Pronotum with steep anterior declivity defined by from dorsum with slight break in outline at point of anterior mesonotal projection. Metanotal impression conspicuous, set off by steep, coarsely striate, posterior mesonotal and anterior propodeal declivities (Fig. 2.18). Propodeum with dorsal face slightly convex, curving evenly into declivous face. Propodeum angulate posterolaterally due to slight longitudinal, posterolateral bosses. Mesopleural katepisternum defined dorsally by finely striate impression (Fig. 2.18), weakly defined in some specimens.

*Metasoma*. Petiolar peduncle notably to slightly shorter than base of node. Postpetiolar node globular to subrectangular with dorsum convex, lateral faces straight, parallel to convergent ventrally. Postpetiole, as seen from behind, with height greater than width.

*Pilosity.* Composed of yellow setae. Longer setae curved. Mesonotum usually with 30-36 erect setae. Mesopleuron with several dorsal setae. Longest setae on metasomal dorsum usually at least 3-4X length of shortest. Suberect pubescence present on cervical flange of pronotum, on anterior face of petiolar nodes, and on propodeal dorsum.

*Sculpturing*. Integument mostly smooth, except for distinct piligerous foveolae present on head, mesosoma and petiole, 0.01-0.03 mm wide (conspicuous even in minors). Piligerous foveolae conspicuous but smaller on legs. Sculpture of metapleuron consisting of longitudinal striae. Posterior face of petiole with striae on basal 0.25. Posterior face of postpetiole with transverse striae on basal 0.25, upper 0.75 glabrous with several conspicuous piligerous foveolae (Fig. 2.19).

*Coloration.* Ranging from yellow orange with brown metasoma and with T1-T4 lighter anteriorly to brown red dorsally with ventral portion of head and legs orange, and T1 with apical margin orange. Some specimens with darker medial portions of leg segments. Median streak present but faint in some specimens.

*Measurements*. HL 1.14-1.31, HW 1.00-1.24, SL 0.91-1.06, EL 0.17-0.20, PW 0.59-0.70, DML 1.48-1.70, CI 0.90-0.95, SI 0.80-0.86, REL 0.14-0.16, N=21, (HL 1.21, HW 1.14, SL 0.94, EL 0.18, PW 0.62, DML 1.61, CI 0.94, SI 0.83, REL 0.15).

**Queen.** *Head.* Broader than long, quadrate, wider above eyes than below them, sides of head convex from eyes to occipital angles, curving inwards to mandibular base (Fig. 2.20). Eyes sometimes with 1-4 setae protruding from between ommatidia, setae ≤ 3X length of ommatidium. Ocelli small (Fig. 2.20). Median ocellus circular to slightly elliptical, lateral ocelli ovate, smaller than median ocellus (Fig. 2.20). Clypeus projecting, carinal teeth stout and sharp, carinae well defined, less so dorsally, greatly divergent ventrally (Fig. 2.20). Paracarinal teeth small, sometimes poorly defined. Median clypeal tooth poorly developed to absent (Fig. 2.20). Approximately 0.33 of eye above midpoint of head (Fig. 2.20). Antenna 11-segmented.

*Mesosoma.* Narrower than head, robust, ovate. Parapsidal lines present on posterior 0.50 to 0.75 of disk. Mesonotum without posteromedian furrow. Median bidentate process present on metasternum. Wing venation as in Fig. 2.89, m-cu cross vein absent, medial cell open.

*Metasoma.* Lateral faces of postpetiole strongly to slightly concave. Petiolar spiracle appear tuberculate in some cases.

*Coloration, Sculpturing, and Pilosity.* Piligerous foveolae large, width 0.01-0.03 mm, larger on head than on thorax and abdomen. Pubescence simple, yellow and erect, longer and denser on head than elsewhere, longest on anterior edge of clypeus. Mesosoma with longest pubescence (length >0.30 mm) 2X longer than shortest pubescence. Mandibles with 7-8 coarse, distinct costulae present throughout. Propodeum with fine striae posteriorly, anterior 0.25 polished. Petiolar node with 0.25 coarsely striate, remainder polished. Lower 0.25 of posterior face of postpetiole granulate to striato-granulate, upper 0.75 of surface polished (Fig. 2.44). Area between ocelli coarsely striate, sometimes drastically so. Interfoveolar spaces on head finely striate. Remaining integument smooth and polished. Color orange with black mesonotal maculations present anteromesally and around parapsidal lines. Dorsal transverse band on pronotum and mesopleuron dark brown. Metasoma dark brown, except petiole ventrally, and T1 and S1 0.25 base orange blending to dark brown apically. Leg segments orange, brown mesally. Sometimes T1 base completely dark brown. Internal margins of ocelli dark brown. Wings hyaline with pale yellow veins.

*Measurements.* L ~6.1-6.4, HW 1.30-1.40, VW 0.80-0.85, HL 1.10-1.15, EL 0.31-0.36, OD 0.19-0.22, OOD 0.16, LOW 0.04-0.06, MOW 0.07-0.09, CD 0.19-0.22, MFC 0.13-0.15, EW 0.29-0.36, SL 0.90-1.01, PDL 0.14-0.16, LF1 0.08-0.11, LF2 0.07-0.10, LF3 0.07-0.10, WF1 0.05-0.08, FL 1.10-1.20, FW 0.19-0.30, MW 1.15-1.31, DLM

2.34-2.51, PRH 0.93-1.10, PL 0.60-0.70, PND 0.55-0.65, PH 0.55-0.65, PPL 0.25-0.35, DPW 0.50-0.65, PPW 0.66-0.74, PHB 0.34-0.44, N=2.

**Male.** Unknown.

**Fourth instar worker larva.** *Head*. Large, subpyriform in anterior view (height 0.43 mm, width 0.45 mm) (Figs. 2.148, 2.151). Cranium slightly broader than long (Figs. 2.148, 2.151). Antennae each with 2 or 3 sensilla, each bears spinule (Figs. 2.148, 2.151). Occipital setal row with 7-8 bifid setae, base 0.5-0.8X total length of seta, setae 0.070-0.162 mm long (Figs. 2.148, 2.150, 2.151). First setal row on vertex with 2 bifid setae, base ~0.66X total length of seta, 0.103 mm long (Figs. 2.148, 2.151). Second setal row on vertex with 4 setae, inner 2 setae simple, outer 2 setae with bifid apices (base ~0.66X length), 0.100-0.152 mm long (Figs. 2.148, 2.151). Setae below antenna level simple, 0.147-0.172 mm long (Figs. 2.148, 2.151). Clypeus with row of 3-4 setae, inner setae shorter than outer setae, 0.053-0.095 mm long (Fig. 2.148). Labrum small, short (width 2X length) (Figs. 2.148, 2.151). Labrum with 4-5 minute sensilla and 2 setae on anterior surface of each half and ventral border with 3-6 sensilla on each half. Labrum with 2-3 coarse isolated spinules near each ventrolateral corner. Straight medial portion of mandibles with 2-5 teeth that decrease in size dorsally (Fig. 2.149). Maxillae with apex conical, palpi peg-like with 5 sensilla, 1 bearing spinule. Galea conical with 2 apical sensilla, 1 bearing spinule. Labium with patch of spinules dorsal to each palpus, spinules coarse and isolated or in short rows of 2-3. Labial palpi are slightly elevated with 5 sensilla, 1 bearing spinule.

*Body*. Spiracles small, first spiracle larger than others. Body setae of 2 types: 1) simple (0.050-0.100 mm long), some with shortly denticulate tips, 6-9 in transverse row on ventral surface of each thoracic somite and on each of 3 anterior abdominal somites; 2) elsewhere setae are bifid (0.06-0.090 mm long), base 0.5X length.

*Length.* Approximately 2.6-2.8 mm.

**Type material.** Holotype is the largest of three workers on a single pin: Brazil, Santa Catarina State, Rt166 ca 22 km north of Santa Cecilia, Serra Geral, 1200 m, XI.1998, K. G. Ross, M. C. Mescher, D. D. Shoemaker, and L. Keller (MZSP). Thirty paratypes are divided between AMNH, FSCA, ICIB, LACM, and NMNH. Twenty paratypes (including two queens) are deposited in UGAC. Paratypes were collected from the same colony as the holotype.

**Etymology.** From the Latin *altus* "high" and *punctum* "puncture" in reference to the altitude at which the species lives and the large piligerous foveolae present on the workers and queens of this species.

**Distribution.** Only known from four colonies collected in the same place and on same date as type specimens (Fig. 2.212).

**Comments.** This highly derived species is easily distinguished from others in this species-group by the presence of the large piligerous foveolae on the head and mesosoma, the weakly to distinctly defined furrow of the katepisternum of the mesopleuron, and the dense pubescence on the major workers. Other distinguishing characters are the greatly diverging clypeal carinae, the large piligerous foveolae on the head and mesosoma, the strongly to weakly defined striae between the ocelli, the lack of a median cell due to the loss of the m-cu cross vein, and the reduction in postpetiolar sculpturing of the queen. The postpetiole of the workers is most similar to *S. saevissima* but the sculpturing is coarser. The darker colored workers look bicolored, which is similar in coloration to *S. electra*.

The major workers of *S. altipunctata* can be differentiated from its sister species, *S. weyrauchi*, by the presence of 10-12 costulae that are obsolescent medially on the mandible and by the larger piligerous foveolae on the head and mesosoma. In comparison, the major workers of *S. weyrauchi* have 5-6 complete costulae and their foveolae are smaller.

The minor workers of this species are usually lighter than the majors or sometimes are similar coloration. They also have large, distinct foveolae on the head and mesosoma. Regardless, the minors are not distinct from the other species in this group (Fig. 2.17).

The larvae of this species are unremarkable and are similar to *S. saevissima* and *S. invicta* by having bifid setae on the head capsule. Most notably, the setae on the head capsule are longer for this species than for *S. invicta* or *S. saevissima.*

### ***Solenopsis daguerrei* (Santschi)**

(Figs. 2.86, 2.106, 2.108, 2.195-2.200)

*Labauchena daguerrei* Santschi 1930: 81. [Holotype (?) queen, males. ARGENTINA. Buenos Aires Province. Rosas. F. C. Sud. MACN]

*Labauchena acuminata* Borgmeier 1949: 208. [IMLA]

*Solenopsis daguerrei*: Ettershank 1966: 140.

**Queen.** *Head:* broader than long, quadrate, wider anterior to eyes, sides of head weakly convex from eyes to occipital angles, nearly straight anterior to eyes. Occipital angles well defined (Fig. 2.195), appearing lobate in lateral view (Fig. 2.196). Vertex flattened posteriorly with narrow, transverse impression just anterior to occipital carina. Occipital furrow lacking (Fig. 2.195). Frontal furrow lacking (Fig. 2.195). Ocelli small, median ocellus below posterior margin of eyes (Fig. 2.195). Clypeus not projecting, lacking carinae or carinal teeth, anterior margin straight. Mandibles gently curving, masticatory border with one large tooth and usually rudiments of two more teeth, with dorsal lobe above teeth rudiments (Fig. 2.197). Eyes convex, ovate, midpoint of head reaches posterior 0.33 of eye. Antennal scape in repose surpasses lateral ocellus. Antenna 11-segmented. Pedicel is $\geq$ 2X length of second flagellomere. First and second flagellomeres length >1.5X their width.

*Mesosoma.* Elliptical, narrower than head. In lateral view, mesonotum convex anterior portion that greatly overhangs pronotum, appearing lobate (Fig. 2.196), posterior half straight. Pronotum wider than mesonotum. Scutellum as high as mesonotum, flattened with short, perpendicular posterior face. Angle of propodeum well-defined, obtuse, differentiation between basal and declivous faces indistinct (Fig. 2.198). Mesosternum small, slightly rounded beneath. Parapsidal lines absent. Posterior and ventral margin of metapleuron fused to pronotum. Propodeal spiracle much reduced in size (Fig. 2.198). Metasternal bidentate median process present. Wing venation reduced (Fig. 2.106), medial cell lacking or barely discernable as such.

*Metasoma.* Petiolar node thick, dorsum somewhat flattened at obtuse angle, appearing to have anterior median boss on dorsum. Petiole ventrally with median carina on anterior 0.50. Postpetiole lacking ventral transverse carina, only slightly convex.

*Coloration, Sculpturing, and Pilosity.* Sculpture lacking, body appearing polished, except posterior 0.25 of petioles finely striate. Setae long (0.10-0.28 mm), golden, semi-erect, somewhat longer on mesosoma than elsewhere. Color yellow with apex of mandibles and apices of metasoma segments 3-6 brown. Internal margins of ocelli yellow. Wings and veins hyaline.

**Male.** *Head.* Trapezoidal (Fig. 2.199). Eyes very large, strongly convex, ovate, occupying more than 0.5X side of head, their anterior border reaching insertion of mandible (Fig. 2.199). Ocelli large, prominent (Fig. 2.199). Anterior edge of clypeus straight (Fig. 2.199). In lateral view, clypeus shows small, blunt, beak-like central lobe. Mandibles linear, with single apical tooth, lobe present dorsal to tooth (Fig. 2.199). Antennal scape ~1.7X as long as broad, cylindrical (Fig. 2.200). Pedicel subglobose, broader than scape or following flagellomere (Fig. 2.200).

*Mesosoma.* Robust, elliptical. In lateral view, mesonotum swollen anteriorly, overhangs pronotum. Scutellum convex, slightly higher than mesonotum. Propodeum rounded, basal face strongly convex transversely, only slightly convex longitudinally, declivous face flat and perpendicular. Posterior and ventral margins of metapleuron fused to propodeum. Wing venation reduced (Fig 2.108), many veins being nebulous.

*Metasoma*. Anterior face of petiole gently sloping, posterior face abruptly curved. In lateral view, postpetiole elongate, slightly shorter than petiole. Dorsum of both with slight median longitudinal impression. Petiole dorsolaterally rounded, not appearing bilobate. Postpetiole wider than petiole, ventral surface flat. Genitalia reduced in form, digitus lacking setae, aedeagus with few ventral teeth (Fig. 2.86).

*Coloration, Sculpturing, and Pilosity.* All sculpture lacking except for basal 0.25 of petiole and postpetiole finely striate. Body appears smooth and polished. Setae golden, suberect, length 0.10-0.16 mm, mesonotum and petiolar nodes sparsely pubescent. Mesonotal pubescence sparse (e.g. Fig. 2.72). Color yellow, vertex of head and gaster brown. Wings and veins hyaline.

**Material Examined.** See appendix A.

**Distribution.** The known range of *S. daguerrei* extends from Buenos Aires Province, Argentina northward, including Uruguay, to Campo Grande, Brazil and eastward to São Paulo, Brazil (Fig. 2.212) (Briano *et al.* 1997). *Solenopsis daguerrei* seems to be generally sparse over most of its range, concentrated in colonies only in certain areas (Briano *et al.* 1997).

**Comments.** The males and queens of this species are distinct from the other members of the group by their coloration, and the reduction in their size, sculpturing, and wing venation due to their socially parasitic existence. The genitalia of the male are distinct from the other species by lacking setae on the digitus, having a reduced number of ventral setae on the volsella, and having a reduced number of ventral teeth on the aedeagus (Fig. 2.86).

*Solenopsis daguerrei* exhibits permanent social parasitism. It has been reported to both kill the host queen in laboratory studies (Bruch, 1930) and to be an inquiline, allowing the host queen to live (Silveira-Guido *et al.* 1965). Regardless of the outcome for the host queen, the parasite lowers the egg production of the host colony and some speculation has been made about using it as a biological control agent (Jouvenaz, 1990;

Wojcik, 1990). Most recently, it was found to parasitize *S. invicta, S. richteri,* and *S. macdonaghi* (Briano *et al.* 1997).

### ***Solenopsis electra*** **Forel**

(Figs. 2.39, 2.40, 2.107)

*Solenopsis pylades electra* Forel 1914: 397. [Syntype workers. ARGENTINA. Salta. Jujuy. XI-913 (=1913). Schuer. #129. MHNG.]

*S. saevissima electra*: Santschi 1916: 381.

*S.* (*Solenopsis*) *saevissima electra*: Creighton 1930: 92. Worker, queen.

*S. saevissima saevissima* cline *S. saevissima richteri* (Bolivian variant): Wilson 1952: 65. [MCZ.]

*S. saevissima saevissima* cline *S. saevissima richteri* subsp. *electra*: Wilson 1952: 65. [MCZ.]

*S. electra*: Trager 1991: 192.

**Worker.** Head subovate. Head sculpture with small piligerous foveolae, 0.003-0.005 mm. Median frontal streak absent. Median ocellus in largest major workers present. Mandibular costulae present throughout. In lateral view, pronotum low and nearly flat to weakly convex. Mesonotum with 20-25 setae. Promesonotal suture in largest major workers gently curved medially, never projecting upward. Mesonotum weakly convex in lateral view. Propodeum sculpture granulate posteroventral to spiracle. Postpetiole shape as high or higher than broad. Postpetiole sculpture as seen from behind with lower 0.66 transversely rugose, granulate, upper surface glabrous and shiny. Color of head, legs, antennae generally red yellow. Mesosoma and gaster dark brown. T1 yellow anteriorly. Mandibles brown. Some specimens darker brown black, with appendages slightly lighter.

**Queen.** *Head.* Slightly broader to as broad as long, quadrate, sides of head convex from eyes to occipital angles, straight anterior to eyes (Fig. 2.40). Eyes sometimes with 2-4 long setae protruding from between ommatidia, length greater than length of 4 ommatidia. Ocelli large, prominent (Fig. 2.40). Median ocellus circular, lateral ocelli slightly ovate (Fig. 2.40). Ocelli in more anterior position on head (Fig. 2.40). Clypeus projecting, carinal teeth stout and sharp, carinae well defined, prominent between antennal scrobes, slightly divergent ventrally (Fig. 2.40). Paracarinal teeth slight to absent (Fig. 2.40). Median clypeal tooth well developed (Fig. 2.40). Eyes with approximately 0.50 of eye above midpoint of head (Fig. 2.40). Antenna 11-segmented.

*Mesosoma.* Parapsidal lines present on posterior half of disk (Fig. 2.39). Mesonotum without posteromedian furrow. Metasternum with bidentate median process. Wing venation as in Fig. 2.107.

*Metasoma.* Lateral faces of postpetiole weakly concave. Petiolar spiracle normally not tuberculate. Postpetiolar spiracles normally tuberculate.

*Coloration, Sculpturing, and Pilosity.* Piligerous foveolae small, sparse, width <0.01 mm, larger on head than on thorax and abdomen. Pubescence simple, golden and erect, longer and denser on head than elsewhere, longest on anterior edge of clypeus. Mesonotum pubescence 0.16-0.25 mm, longest pubescence on mesonotum 2X longer than shortest pubescence. Mandibles with 5-8 coarse, distinct costulae present throughout. Propodeum with fine striae throughout (Fig. 2.39). Petiolar node basal 0.75 with striate, dorsum polished. Postpetiolar node basal 0.50 with fine striae, dorsum polished. Remaining integument smooth and polished. Color yellow with gaster red brown. T1 with basal 0.50 yellow, remaining segments yellow anterolaterally. Internal margins of ocelli dark brown. Wings hyaline with yellow veins.

*Measurements.* L ~6.2-6.5, HW 1.15-1.28, VW 1.09-1.15, HL 1.20-1.30, EL 0.36-0.44, OD 0.15-0.21, OOD 0.09-0.12, LOW 0.10-0.15, MOW 0.10-0.16, CD 0.15-0.19, MFC 0.18-0.21, EW 0.25-0.34, SL 0.78-0.91, PDL 0.14-0.19, LF1 0.07-0.11, LF2 0.05-0.10, LF3 0.07-0.10, WF1 0.04-0.07, FL 0.92-1.05, FW 0.21-0.29, MW 1.21-1.33, DLM 2.15-2.31, PRH 0.88-1.04, PL 0.56-0.68, PND 0.45-0.56, PH 0.55-0.64, PPL 0.31-0.36, DPW 0.50-0.68, PPW 0.56-0.64, PHB 0.32-0.45, N=2.

**Male.** Unknown.

**Fourth instar worker larva.** Unknown.

**Material Examined.** Various specimens (FSCA).

**Distribution.** Currently the range of *S. electra* extends northward from Santiago del Estero Province of Argentina to Santa Cruz, Bolivia (Fig. 2.213). Trager (1991) lists a sample examined from Asunción, Paraguay. Many samples collected between the known range and Asunción, Paraguay have not produced any specimens of this species, so this record probably represents an introduction.

**Comments.** The queen of *S. electra* is similar to *S. pusillignis, S. saevissima,* and *S. macdonaghi* in coloration and the lack of mesonotal maculae. The queen of this species have a thinner petiolar node, a smaller OOI, and a smaller body size than those of *S. saevissima* and *S. macdonaghi*. It differs from the queen of the sister species, *S. pusillignis*, by having a smaller OI, a more developed median clypeal tooth, and a darker coloration of the gaster.

The northern populations of *S. electra* have much larger workers than the southern populations, the queens of these populations remain unchanged in size. The males were not available for examination for this study, but Trager (1991) reports them as being relatively small compared to males of the rest of the species-group.

### ***Solenopsis interrupta* Santschi**

(Figs. 2.21, 2.22, 2.47, 2.52, 2.56, 2.57, 2.73, 2.74, 2.92, 2.93, 2.132, 2.133, 2.152-2.154, 2.157)

*Solenopsis saevissima* var. *interrupta* Santschi 1916: 397. [Syntype (?) workers. ARGENTINA. La Rioja. Bajo Hondo. NMNH.]

*S.* (*Solenopsis*) *saevissima interrupta*: Creighton 1930: 89. (In part.)

*S. interrupta* Wilson 1952: 61. (In part.)

**Worker.** Head weakly to strongly cordate (Fig. 2.132). Head and mesosomal sculpture with small piligerous foveolae, 0.003-0.005 mm. Median frontal streak mostly absent, but sometimes distinctly darkened. Median ocellus in largest major workers absent (Fig. 2.132). Mandibular costulae dense, present throughout, rarely partially obsolescent. Mesonotum with 20-25 setae (Fig. 2.133). Promesonotal suture in largest major workers gently curved medially, never projecting upward (Fig. 2.133). Propodeum sculpture glabrous posteroventral to spiracle (Fig. 2.133). Postpetiole shape as high or higher than broad. Postpetiole sculpture as seen from behind weakly transversely rugose, weakly granulate, reaches dorsum only in largest workers. Color generally red yellow to brown yellow, with head and mesosoma dorsum darker. Gaster dark brown. T1 with maculation red yellow to brown yellow.

**Queen.** *Head:* broader than long, quadrate, slightly wider above eyes than below them, sides of head convex from eyes to occipital angles, straight to nearly straight below eyes (Fig. 2.22). Eyes sometimes with 3-4 setae protruding from between ommatidia, setal length ≤3X length of ommatidium. Ocelli large, prominent (Fig. 2.22). Median ocellus circular, lateral ocelli slightly ovate (Fig. 2.22). Clypeus projecting, carinal teeth stout and sharp, carinae well defined, less so dorsally, slightly divergent ventrally, edge of clypeus between carinae with shallow concave depression, depression deepest between carinal teeth (Fig. 2.22). Paracarinal teeth poorly defined to absent (Fig. 2.22). Median clypeal tooth usually well developed, sometimes less developed (Fig. 2.22). Approximately 0.50 of eye above midpoint of head (Fig. 2.22). Antenna 11-segmented.

*Mesosoma.* Parapsidal lines present on posterior half of disk (Fig. 2.21). Mesonotum with indistinct to distinct, median furrow, most often on posterior 0.25-0.33 of disk. Propodeum sometimes with median longitudinal depression. Median bidentate process present on metasternum. Wing venation as in Fig. 2.92.

*Metasoma.* Lateral faces of postpetiole weakly concave to straight sided. Petiolar spiracle appears tuberculate in some cases. Postpetiolar spiracle most often not tuberculate.

*Coloration, Sculpturing, and Pilosity.* Piligerous foveolae moderate to small, sparse, width 0.01-0.025 mm on head, smaller on meso- and metasoma. Pubescence golden and erect, longer and denser on head than elsewhere, longest on anterior edge of clypeus. Pubescence darker on darkly maculated areas. Mesosoma with longest pubescence (length 0.30 mm or greater) 3X longer than shortest pubescence. Mandibles with several coarse, 6-8, distinct costulae present throughout. Propodeum with fine striae posteriorly, anterior 0.25 polished to finely striate. Petiolar node posterior surface with lower 0.75 coarsely striate, dorsum finely striate. Postpetiolar node posterior surface with middle 0.50 striate (with 7-10 striae), finely granulate, lower 0.25 coarsely granulate (Fig. 2.47). Interfoveolar spaces on head finely striate when piligerous foveolae are large. Remaining integument smooth and polished. Two color varieties: dark form brown with katepisternum, metasoma and mesally on legs dark brown; light form orange to yellow orange, except vertex and T2-4, T1 laterally and apically and sternites apically dark brown. Light form with posterior margin of orange maculation of T1 distinct. Both color forms with dark brown maculations anteriorly on pronotum, anteromedian area mesonotum, area around parapsidal lines, sometimes on median area of axillae, anteromedian and triangular posteromedian area of scutellum, mesally on anepisternum, and mesally and laterally on propodeum (Fig. 2.52). Internal margins of ocelli dark brown. Median frontal streak present (e.g. Fig 2.50). Wings hyaline with pale yellow to hyaline veins.

*Measurements*. L ~7.8-8.4, HW 1.35-1.60, VW 0.89-1.01, HL 1.20-1.35, EL 0.40-0.51, OD 0.10-0.15, OOD 0.15-0.20, LOW 0.10-0.12, MOW 0.10-0.12, CD 0.15-0.20, MFC 0.18-0.23, EW 0.30-0.35, SL 0.90-1.10, PDL 0.15-0.20, LF1 0.10-0.12, LF2 0.08-0.11, LF3 0.08-0.10, WF1 0.06-0.08, FL 1.10-1.21, FW 0.21-0.31, MW 1.30-1.40, DLM 2.49-2.62, PRH 1.00-1.11, PL 0.59-0.75, PND 0.55-0.65, PH 0.60-0.72, PPL 0.30-0.40, DPW 0.61-0.82, PPW 0.59-0.73, PHB 0.41-0.50, N=5.

**Male.** *Head.* Eyes sometimes with 3-4 setae protruding from between ommatidia, length ≤3X length of ommatidium. Ocelli large and prominent, median ocellus circular, lateral ocelli elliptical (Fig. 2.57). In lateral view, clypeus with blunt, central lobe with indistinct anterior transverse carina.

*Mesosoma.* Propodeum rounded, declivous face perpendicular, flat except with distinct to indistinct median longitudinal depression, basal face strongly convex transversely and convex longitudinally (Fig. 2.56). Metapleuron broad almost 0.66 as wide as high (Fig. 2.56). Wing venation as in Fig. 2.93.

*Metasoma*. In cephalic view, dorsum of node transverse to having weak median depression and appearing weakly bilobate. Petiolar and postpetiolar spiracles slightly tuberculate to not tuberculate. Genitalia Fig. 2.74.

*Coloration, Sculpturing, and Pilosity.* Pubescence thin, yellow to yellow orange, erect to suberect, not of uniform length over body (0.10-0.35 mm long), longer on gena and vertex. Mesonotal pubescence dense (Fig. 2.73). Base of propodeum striato-granulate. Propodeum anteromedial area glabrous. Area between eye and insertion of antenna (Fig. 2.57), and lateral faces of scutellum finely striate. Area between ocelli granulate. Remainder of head weakly to coarsely granulate throughout, appearing shagreened in some cases (Fig. 2.57). Lower surface of petiolar nodes coarsely striato-granulate, dorsum finely striato-granulate. Postpetiole often with fine striations present dorsomesally. Metapleuron with dorsal longitudinal region finely striate. Gena granulate. Remaining integument smooth and polished. Color red brown to dark brown. Mandible brown anteriorly changing yellow brown at apex. Flagellum yellow brown and legs segments brown mesally grading to yellow towards base and apex. Wings hyaline, veins and pterostigma clear to pale yellow.

*Measurements*. L ~5.6-6.0, HW 1.00-1.10, VW 0.30-0.55, HL 0.81-0.92, EL 0.40-0.51, OD 0.10-0.15, OOD 0.15-0.20, LOW 0.11-0.14, MOW 0.11-0.15, CD 0.15-0.25, MFC 0.15-0.21, EW 0.32-0.40, SL 0.15-0.20, SW 0.10-0.15, PDL 0.05-0.10, PEW 0.11-0.15, LF1 0.20-0.25, LF2 0.13-0.16, LF3 0.16-0.22, WF1 0.08-0.10, FL 1.09-1.22, FW 0.20-0.30, MW 1.35-1.50, DLM 2.30-2.51, PRH 0.90-1.00, PL 0.60-0.75, PND 0.50-0.65, PH 0.39-0.52, PPL 0.29-0.41, DPW 0.60-0.71, PPW 0.55-0.75, PHB 0.18-0.30, N=6.

**Fourth instar worker larva.** *Head*. Large, subpyriform in anterior view (height 0.44 mm, width 0.51 mm) (Figs. 2.152, 2.154). Cranium slightly broader than long (Figs. 2.152, 2.154). Antennae each with 2 or 3 sensilla, each bears spinule (Figs. 2.152, 2.154). Occipital setal row with 8-12 bifid setae, base 0.5 to 0.8X total length of seta, 0.066-0.097 mm long (Figs. 2.152, 2.154). First setal row on vertex with 1-2 bifid setae, base ~0.66X total length of seta, 0.069-0.089 mm long (Figs. 2.152, 2.154). Second setal row on vertex with 4 simple setae, 0.132 mm long. Setae below antenna level simple, 0.147-0.213 mm long (Figs. 2.152, 2.154). Clypeus with transverse row of 4 setae, inner setae shorter than outer setae, 0.069-0.117 mm long (Figs. 2.152, 2.154). Labrum small, short (breadth 2X length) (Fig. 2.152). Labrum with 4-6 minute sensilla and 2 setae on anterior surface of each half and ventral border with 5-6 sensilla on each half. Each half of posterior surface of labrum with 2-4 isolated sensilla. Straight medial portion of mandibles with 2-5 teeth that decrease in size dorsally (Fig. 2.154). Maxillae with apex conical, palpi peg-like with 5 sensilla, 1 bearing spinule. Galea conical with 2 apical sensilla, 1 bearing spinule. Labium with patch of spinules dorsal to each palpus, spinules in short rows of 2-3. Labial palpi are slightly elevated with 5 sensilla, 1 bearing spinule.

*Body*. Spiracles small, first spiracle larger than others. Body setae of 2 types: 1) simple (0.045-0.111 mm long), some with shortly denticulate tips, 5-10 in transverse row on ventral surface of each thoracic somite and on each of 3 anterior abdominal somites; 2) elsewhere setae are bifid (0.070-0.100 mm long), base 0.5-0.75X length (Fig. 2.153). Some bifid setae on thoracic dorsum with base 0.33X length of seta.

*Length*. 3.2-3.4 mm.

**Material examined.** Various specimens (FSCA). Also, see appendix A.

**Distribution.** There is some question concerning the exact type locality for *S. interrupta.* The locality listed on the specimen is "Bajo Hondo, Argentina." There are two locations in Argentina called by this name. The locality is probably from Bajo Hondo in the La Rioja Province because the other Bajo Hondo is outside the native range of *S. interrupta* (Trager 1991). The current range of *S. interrupta* extends from Cordoba and Mendoza Provinces in Argentina northward into Bolivia (Fig. 2.214).

**Comments.** The queens of *S. interrupta* are superficially very similar to *S. pythia* and *S. altipunctata* in both coloration and sculpture of the head. Both *S. pythia* and *S. altipunctata* are highly derived, however, and thus easily distinguished from *S. interrupta*.

The queens of *S. interrupta* and *S. richteri* are similar in coloration and both sometimes have a distinct orange tergal maculation with a demarcated posterior margin. In many cases, the queens of these two species are difficult to differentiate but they may be separated by the sculpture of the postpetiole. The queens of *S. interrupta* are typically slightly lighter in coloration. In addition, the OOI of *S. interrupta* queens is much greater than that of the *S. richteri* queens. The workers of these species, however, are relatively easy to separate from the other members of this species-group.

The male is dark in coloration and is similar to most of the other species in this group. The pubescence of the males is longer and denser than that of *S. saevissima* males. Often, the head of the male is shagreened as are *S. invicta* males.

The *S. interrupta* larvae are similar to *S. invicta* and *S. saevissima*. They differ, however, in the size and shape of the body setae. Also, the setae below the antennal level are typically longer in *S. interrupta* than in *S. invicta* or *S. saevissima*.

## ***Solenopsis invicta*** **Buren**

(Figs. 2.23, 2.24, 2.42, 2.58, 2.59, 2.75, 2.94, 2.95, 2.134, 2.135, 2.167, 2.160-2.164)

*Solenopsis saevissima* var. *wagneri* Santschi 1916: 380. [Syntype workers. ARGENTINA. Santiago de Estero. Near Icano. Wagner. NHMB.] (Name suppressed (Anonymous 2001).)

*S. saevissima saevissima* cline *S. saevissima richteri*: Wilson 1952: 65. [MCZ.]

*S. invicta* Buren 1971: 9. Worker, queen, male. [NMNH.] (Name withheld (Anonymous 2001).)

**Worker.** Head subquadrate to weakly cordate (Fig. 2.135). Head of largest specimens cordate. Sculpture of head and mesosomal dorsum with small piligerous foveolae, 0.003-0.005 mm. Median frontal streak present. Median ocellus in largest major workers absent (Fig. 2.135). Mandibular costulae absent mesally, distinct apically and basally along outer boarder. Mesonotum with 20-25 setae. Mesonotum with anteromedian margin in largest major workers gently curved. Mesonotum in lateral view convex (Fig. 2.134). Propodeum sculpture glabrous posteroventral to spiracle (Fig. 2.134). Postpetiole shape as seen from behind width greater than height. Postpetiole as seen from behind with lower 0.66 or greater transversely rugose to punctate-rugose, extreme dorsum nitid, granulate. Color generally with head and mesosoma from yellow red to dark red brown, gaster brown, T1 with maculation yellow red to concolorous with surrounding integument.

**Queen.** *Head.* Slightly broader than long, quadrate, wider above eyes than below them, sides of head convex from eyes to occipital angles, straight to nearly straight below eyes (Fig. 2.24). Eyes sometimes with 2-10 setae protruding from between ommatidia, length of setae ≤3X length of ommatidium. Median ocellus large, prominent, circular (Fig. 2.24). Lateral ocelli moderate to large, slightly ovate (Fig. 2.24). Clypeus projecting, carinal teeth stout and sharp, carinae well defined, less so dorsally, slightly divergent ventrally (Fig. 2.24). Paracarinal teeth small, sometimes poorly defined. Median clypeal tooth well developed (Fig. 2.24). Eyes with approximately 0.50 of eye above midpoint of head (Fig. 2.24). Antennal scape in repose surpass lateral ocellus. Antenna 11-segmented.

*Mesosoma.* Parapsidal lines present on posterior 0.50 of disk (Fig. 2.23). Mesonotum with indistinct, median furrow on posterior one-sixth or less. Bidentate median process present on metasternum (Fig. 2.23). Wing venation as in Fig. 2.94.

*Metasoma.* Lateral faces of postpetiole slightly concave to wider ventrally. Petiolar and postpetiolar spiracles appear slightly tuberculate to not tuberculate.

*Coloration, Sculpturing, and Pilosity.* Piligerous foveolae small, sparse, width <0.01 mm, larger on head than on thorax and abdomen. Pubescence simple, golden and erect, longer and denser on head than elsewhere, longest on anterior edge of clypeus. Mesosoma with longest pubescence (length ≤0.25 mm) 2X longer than shortest pubescence (Fig. 2.23). Mandibles with 9-11 fine, distinct, costulae, sometimes costulae obsolescent mesally. Propodeum with fine striae throughout (Fig. 2.23). Petiolar nodes with lower 0.75 finely striate, granulate throughout. Postpetiole usually with 12-18 striations, often transverse (Fig. 2.41), other times appearing to create swirling or circular patterns. Remaining integument smooth and polished. Color varies from red brown with dorsum of head, dorsum of thorax, and katepisternum of mesopleuron to brown red. Gaster brown. Sometimes on lighter colored individuals, bases of T1 and S1 are somewhat orange blending to brown apically. Brown maculations sometimes present anteromesally and on parapsidal lines (e.g. Fig. 2.52). Median streak present (e.g. Fig. 2.50), weak, sometime indistinctive or absent. Internal margins of ocelli often dark brown. Wings hyaline with yellow veins.

*Measurements.* L ~5.9-8.3, HW 1.30-1.46, VW 0.66-0.88, HL 1.18-1.43, EL 0.38-0.49, OD 0.10-0.18, OOD 0.19-0.26, LOW 0.08-0.15, MOW 0.16-0.24, CD 0.15-0.22, MFC 0.15-0.25, EW 0.25-0.48, SL 0.78-1.11, PDL 0.13-0.25, LF1 0.08-0.14, LF2 0.07-0.10, LF3 0.07-0.12, WF1 0.06-0.11, FL 0.94-1.26, FW 0.22-0.36, MW 1.14-1.48, DLM 2.42-2.73, PRH 0.88-1.19, PL 0.72-0.83, PND 0.56-0.84, PH 0.57-0.78, PPL 0.24-0.42, DPW 0.51-0.74, PPW 0.71-0.77, PHB 0.26-0.48, N=25.

**Male.** *Head.* Eyes sometimes with 2-10 setae protruding from between ommatidia, length ≤3X length of ommatidium. Ocelli large and prominent, elliptical (Fig. 2.59).

*Mesosoma.* Propodeum rounded, declivous face perpendicular, flat except with distinct to indistinct median longitudinal depression, basal face strongly convex transversely and convex longitudinally. Metapleuron not broad, ~0.33 as wide as high, sometimes with transverse posterior carina (Fig. 2.58). Wing venation as in Fig. 2.95.

*Metasoma*. In cephalic view, dorsum of node with shallow to deep median impression and appearing weakly to strongly bilobate. Petiolar and postpetiolar spiracles distinctly tuberculate to not tuberculate. Genitalia Fig. 2.75.

*Coloration, Sculpturing, and Pilosity.* Pubescence short, thin, yellow to brown, erect to suberect (0.20-0.30 mm), longest on gena and vertex. Mesonotal pubescence dense (e.g. Fig. 2.73). Propodeum with base striato-granulate, mesally finely granulate (Fig. 2.58). Area between eye and insertion of antenna, posterior portion of metapleuron, lateral faces of scutellum, and base of petiolar node granulate to striato-granulate (Fig. 2.58). Posterior surface of postpetiolar node granulate throughout, rugae present dorsomesally. Area between ocelli weakly to coarsely striato-granulate (Fig. 2.58). Gena coarsely rugose to coarsely striato-granulate. Often, head completely granulate, shagreened, appearing dull. Remaining integument smooth and polished. Color red brown to black with antenna completely yellow, sometimes scape and pedicel of antennae brown. Mandibles brown to light brown. Wings hyaline, veins clear to pale yellow, pterostigma yellow.

*Measurements.* L ~5.4-6.3, HW 0.91-1.08, VW 0.30-0.40, HL 0.67-0.83, EL 0.37-0.53, OD 0.06-0.11, OOD 0.18-0.26, LOW 0.09-0.18, MOW 0.10-0.17, CD 0.16-0.24, MFC 0.13-0.18, EW 0.28-0.39, SL 0.16-0.20, SW 0.09-0.14, PDL 0.06-0.10, PEW 0.10-0.15, LF1 0.10-0.17, LF2 0.13-0.15, LF3 0.12-0.16, WF1 0.07-0.10, FL 1.00-1.15, FW 0.15-0.20, MW 1.20-1.68, DLM 2.27-2.64, PRH 0.78-1.04, PL 0.62-0.69, PND 0.54-0.61, PH 0.44-0.56, PPL 0.20-0.28, DPW 0.55-0.71, PPW 0.58-0.69, PHB 0.14-0.28, N=25.

**Fourth instar worker larva.** *Head*. Large, subpyriform in anterior view (height 0.50 mm, width 0.54 mm) (Figs. 2.160, 2.162). Cranium slightly broader than long (Figs. 2.160, 2.162). Antennae each with 2 or 3 sensilla, each bears spinule. Integument of head with minute spinules. Occipital setal row normally with 6-8 bifid setae, base ~0.66X total length of seta, setae 0.075-0.095 mm long (Figs. 2.160, 2.162). First setal row on vertex with 2 bifid setae, base ~0.66X total length of seta, 0.053-0.073 mm long (Figs. 2.160, 2.162). Second setal row on vertex with 4-6 simple setae, ~0.100 mm long (Figs. 2.160, 2.162). Setae below antenna level simple, 0.081-0.144 mm long (Figs. 2.160, 2.162). Clypeus with transverse row of 4 setae, inner setae shorter than outer setae, 0.057-0.081 mm long (Figs. 2.160, 2.162). Labrum small, short (breadth 2.5X length). Labrum with 4-6 minute sensilla and 2 setae on anterior surface of each half and ventral border with 4-6 sensilla on each half. Each half of posterior surface of labrum with 2-3 isolated and 2 contiguous sensilla. Straight medial portion of mandibles with 2-5 teeth that decrease in size dorsally (Fig. 2.160). Maxillae with apex conical, palpi peg-like with 5 sensilla, 1 bearing spinule (Fig. 2.161). Galea conical with 2 apical sensilla bearing spinules (Fig. 2.161). Maxillae with sclerotized band between cardo and stipes. Labium with patches of spinules dorsal to each palpus, in 2-3 rows. Labial palpi are slightly elevated with 5 sensilla, 1 bearing spinule.

*Body*. Stout. Spiracles small, first spiracle larger than others. Body setae of 2 types: 1) simple (0.063-0.113 mm long), some with shortly denticulate tips, 6-12 in transverse row on ventral surface of each thoracic somite and on each of 3 anterior abdominal somites; 2) elsewhere setae are bifid (0.063-0.088 mm long), base ~0.5X length (Fig. 2.172).

*Length*. About 3.1 mm (Fig. 2.164).

**Material examined.** Various specimens (FSCA). Also, see appendices A and B.

**Distribution.** The range of *Solenopsis invicta* in South America currently extends from as far north as Porto Velho, Rondônia State, Brazil and eastward from Peru and Bolivia to Cuiabá, Mato Grosso State, Brazil, southward to Santiago del Estero Province of Argentina, through Uruguay to São Paulo State, Brazil (Fig. 2.214). Its range in North America includes the Gulf States west to Texas, and it is found sporadically in New Mexico and Arizona and apparently is well established in California. It recently has been introduced to the northern coast of Australia.

**Comments.** It was recently discovered that *S. wagneri* has priority over *S. invicta* (Bolton 1995) but the International Commission of Zoological Nomenclature Ruled that the name *S. invicta* is to be conserved in order to maintain stability and continuity (Anonymous 2001).

As with the workers, the queens also vary in color. The darker variants of queens are found in southeastern Brazil to Uruguay and Argentina and are associated with the darker workers. A lighter variant occurs in the northern area of its range. The queens and workers of these colonies are also similar in coloration. A third variant, a light orange form, is found in the Pantanal region of Brazil. This form has slightly larger workers and queens.

The darker colored queens of *S. invicta* look most similar to *S. megergates* and *S. quinquecuspis*. However, the CI and OI of *S. invicta* queens are normally smaller than those of *S. megergates* and the OI of *S. invicta* is normally smaller than that of *S. quinquecuspis*. The lighter queens of *S. invicta* look similar to *S. richteri* and *S. interrupta*. The queens of *S. interrupta* normally are lighter in coloration than *S. invicta*, have larger cephalic foveolae, and sometimes have distinct striations between the foveolae. The OOI of *S. invicta* queens is normally greater than that of *S. richteri*, and the postpetiole of queen *S. invicta* has straight sides, unlike the concave sides of *S. richteri*. In many cases, the sculpture of the mandible and postpetiole can help separate *S. invicta* queens from similar species. The queens of *S. invicta* normally have the most densely sculptured postpetiole compared to the other species.

The male of *S. invicta* is dark in coloration and is similar to most of the other darker species. The pubescence of the *S. invicta* male is longer and denser than that of *S. saevissima*. Sometimes the head of the *S. invicta* male is shagreened as in *S. interrupta*. A tentative autapomorphy does exist for *S. invicta*: the gena of the male is much more sculptured than in other species and, in the moderate to extreme forms, is easily recognized as that species. The males from the different regions do not vary greatly in color. However, the males of the light orange form from the Pantanal region of Brazil were not available for study.

Unpublished mtDNA data (D. D. Shoemaker and K. G. Ross, unpublished) suggest that *S. invicta* may be a group of several species. A thorough examination of the adults revealed no apparent differences, so if there is more than one "species," they are cryptic species. In one colony of *S. invicta* (colony O18, see app. A), the larvae did differ from typical *S. invicta* both in size and setal type. This colony was collected in close proximity to typical *S. invicta* and the adults do not differ from typical *S. invicta.* The larval data from this colony were coded as *S. invicta* and resulted in several of the setal characters being polymorphic. This did not alter the topology of the phylogenetic hypothesis. A description of the larva follows.

**Fourth instar worker larva (O18).** *Head*. Large, subpyriform in anterior view. Cranium slightly broader than long. Antennae each with 2 or 3 sensilla, each bears spinule. Integument of head with minute spinules. Occipital setal row with 4-6 setae (0.062-0.083 mm long), median pair simple, other setae bifid with base 0.66-0.75X total length of seta. First setal row on vertex with 2 simple setae, 0.088-0.092 mm long. Second setal row on vertex with 2 simple setae, 0.101-0.117 mm long. Setae below antenna level simple, 0.088-0.120 mm long. Clypeus with transverse row of 4 setae, inner setae shorter than outer setae, 0.051-0.103 mm long. Labrum small, short (breadth 1.8X length), slightly narrowed mesally. Labrum with 5 minute sensilla and 2 setae on anterior surface of each half and ventral border with 6 sensilla on each half. Each half of posterior surface of labrum with 2-3 isolated sensilla. Straight medial portion of mandibles with 2-5 teeth that decrease in size dorsally. Maxillae with apex conical, palpi peg-like with 5 sensilla, 1 bearing spinule. Galea conical with 2 apical sensilla. Labium with patch of spinules dorsal to each palpus, spinules coarse and isolated or in short rows of 2-3. Labial palpi are slightly elevated with 5 sensilla, 1 bearing spinule.

*Body*. Spiracles small, first spiracle larger than others. Body setae of 2 types: 1) simple (0.070-0.120 mm long), some with shortly denticulate tips, 6-9 in transverse row on ventral surface of each thoracic somite and on each of 3 anterior abdominal somites;

2) elsewhere setae are bifid (0.080-0.120 mm long), base ~0.33X length, branches more or less perpendicular to base, tips recurved.

*Length*. 2.7-2.9 mm.

### ***Solenopsis macdonaghi*** **Santschi**

(Figs. 2.25, 2.26, 2.60, 2.61, 2.76, 2.77, 2.96, 2.97, 2.136, 2.137, 2.165-2.169)

*Solenopsis saevissima* var. *macdonaghi* Santschi 1916: 379. [Syntype workers, queens. ARGENTINA. Entre Rios. Estación Sosa. MacDonagh. NHMB.]

*S. geminata pylades*: Bruch 1916: 313.

*S.* (*Solenopsis*) *saevissima interrupta*: Creighton 1930: 89.

*S. macdonaghi*: Trager 1991: 179.

**Worker.** Head broad, cordate (Fig. 2.137). Head sculpture with small piligerous foveolae, approximately 0.01 mm. Median frontal streak absent. Median ocellus in largest major workers present. Mandibular costulae obsolescent, except apically, rarely complete. Mesonotum with 20-25 setae (Fig. 2.136). Promesonotal suture in largest major workers angulate medially, sometimes projecting upward (Fig. 2.136). Mesonotum in lateral view weakly convex. Propodeum sculpture glabrous posteroventrad to spiracle (Fig. 2.136). Propodeum in largest major workers curves upward from metanotal groove higher than flattened posterior portion, appearing as anterior raised portion in lateral view. Postpetiole shape much broader than high. Postpetiole as seen from behind lacking transverse rugae or with rugae mesally, normally granulate to dorsum. Color generally red yellow to brown yellow, gaster dark brown, T1 with red yellow to brown yellow maculation.

**Queen.** *Head.* Slightly broader than long, quadrate, sides of head convex from eyes to occipital angles, straight to nearly straight below eyes (Fig. 2.26). Eyes sometimes with 3-4 setae protruding from between ommatidia, length $\leq$3X length of ommatidium. Ocelli large, prominent (Fig. 2.26). Median ocellus circular, lateral ocelli slightly ovate (Fig. 2.26). Clypeus projecting, carinal teeth stout and sharp, carinae well defined, slightly divergent ventrally, edge of clypeus between carinae with shallow concave depression, depression deepest between carinal teeth (Fig. 2.26). Paracarinal teeth small, indistinct (Fig. 2.26). Median clypeal tooth poorly developed, most often absent (Fig. 2.26). Eyes with approximately 0.50 of eye above midpoint of head (Fig. 2.26). Antenna 11-segmented.

*Mesosoma.* Parapsidal lines present on posterior 0.50 of disk (Fig. 2.25). Mesonotum with indistinct, median furrow present on posterior 0.25 or less. Bidentate median process present on metasternum. Wing venation as in Fig. 2.96.

*Metasoma.* Lateral faces of postpetiole straight to weakly convex. Petiolar and postpetiolar spiracles appear tuberculate in some cases.

*Coloration, Sculpturing, and Pilosity.* Piligerous foveolae small, sparse, width <0.01 mm. Pubescence simple, golden and erect, longer and denser on head than elsewhere, longest on anterior edge of clypeus. Mesosoma with longest pubescence (length >0.30 mm) 3X longer than shortest pubescence (Fig. 2.25). Mandibles with 10-12 fine, distinct costulae present throughout. Propodeum with fine striae throughout (Fig. 2.25). Petiolar node with lower 0.75 of surface finely striate, dorsum polished. Postpetiolar with striations on lower 0.75 of surface somewhat coarser, 7-9 striae, finely granulate, dorsum polished (Fig. 2.41). Remaining integument smooth and polished.

Color orange to dark orange, legs orange to yellow orange, T1-T4 brown laterally and apically. Basal orange of T1 blends evenly to brown apically. Mesonotum maculations absent on parapsidal lines, sometimes present anteromesally. Internal margins of ocelli not dark brown. Median frontal streak absent. Wings hyaline with yellow veins.

*Measurements.* L ~6.9-7.5, HW 1.42-1.46, VW 0.85-0.92, HL 1.22-1.34, EL 0.41-0.46, OD 0.12-0.15, OOD 0.23-0.25, LOW 0.08-0.11, MOW 0.10-0.14, CD 0.15-0.17, MFC 0.18-0.20, EW 0.30-0.34, SL 0.95-1.05, PDL 0.21-0.25, LF1 0.10-0.14, LF2 0.07-0.11, LF3 0.07-0.09, WF1 0.07-0.09, FL 1.20-1.25, FW 0.26-0.27, MW 1.35-1.45, DLM 2.48-2.84, PRH 1.02-1.09, PL 0.73-0.82, PND 0.54-0.70, PH 0.65-0.70, PPL 0.32-0.38, DPW 0.65-0.70, PPW 0.70-0.75, PHB 0.35-0.40, N=7.

**Male.** *Head.* Eyes normally with 2-4 setae protruding from between ommatidia, length $\leq$3X ommatidia length. Ocelli moderate to large, prominent, elliptical (Fig. 2.61).

*Mesosoma.* Propodeum rounded, declivous face perpendicular, flat except with distinct to indistinct median longitudinal depression, basal face strongly convex transversely and convex longitudinally. Metapleuron not broad, ~0.66 as wide as high (Fig. 2.60). Wing venation as in Fig. 2.97.

*Metasoma*: In cephalic view, dorsum of node with deep median depression, appearing bilobate. Petiolar and postpetiolar spiracles distinctly tuberculate to not tuberculate. Genitalia Figs. 2.76, 2.77.

*Coloration, Sculpturing, and Pilosity.* Pubescence short, thin, yellow, erect to suberect and of uniform length over body (0.25-0.30 mm), longest on gena and vertex. Mesonotal pubescence dense (e.g. Fig. 2.73). Propodeum with base striato-granulate, mesally finely granulate. Area between eye and insertion of antenna, pronotum posteriorly and base of petiolar node coarsely granulate. Posterior surface of postpetiolar node granulate throughout. Area between ocelli and vertex finely striato-granulate to granulate (Fig. 2.61). Areas anterolateral to median ocellus usually glabrous (Fig. 2.61). Gena with coarsely granulate, less often rugose anterior to occipital carina, never rugose throughout. Metapleuron and lateral faces of scutellum striato-granulate throughout. Remaining integument smooth and polished. Color red brown to black, antennae and legs yellow brown. Mandibles yellow, extreme apex brown. Wings hyaline, veins clear to pale yellow, pterostigma yellow.

*Measurements.* L ~5.7-6.6, HW 1.00-1.20, VW 0.34-0.39, HL 0.74-0.89, EL 0.40-0.52, OD 0.08-0.11, OOD 0.15-0.28, LOW 0.10-0.18, MOW 0.13-0.16, CD 0.16-0.22, MFC 0.13-0.18, EW 0.34-0.41, SL 0.14-0.18, SW 0.09-0.11, PDL 0.05-0.08, PEW 0.12-0.15, LF1 0.20-0.24, LF2 0.12-0.15, LF3 0.14-0.18, WF1 0.07-0.10, FL 0.95-1.30, FW 0.15-0.22, MW 1.35-1.62, DLM 2.28-2.80, PRH 0.80-1.10, PL 0.55-0.65, PND 0.50-0.60, PH 0.43-0.63, PPL 0.25-0.34, DPW 0.50-0.74, PPW 0.54-0.79, PHB 0.20-0.29, N=10.

**Fourth instar worker larva.** *Head*. Large, subpyriform in anterior view (height 0.47 mm, width 0.54 mm) (Figs. 2.165, 2.169). Cranium slightly broader than long. Antennae each with 2 or 3 sensilla, each bears spinule (Figs. 2.165, 2.169). Occipital setal row with 6-8 setae, median pair simple (Fig. 2.171) otherwise bifid, base 0.5-0.66X total length of seta, 0.061-0.101 mm long (Figs. 2.165, 2.169). First setal row on vertex with 2 denticulate to simple setae, 0.095-0.108 mm long. Second setal row on vertex with 4 simple setae, 0.098-0.128 mm long (Figs. 2.165, 2.169), rarely denticulate. Setae below antenna level simple, 0.123-0.157 mm long (Figs. 2.165, 2.169). Clypeus with transverse row of 4 setae, inner setae shorter than outer setae, 0.095-0.112 mm long (Figs. 2.165, 2.169). Labrum small, short (breadth 2X length). Labrum with 4-6 sensilla and 2 setae on anterior surface of each half. Ventral border with 4-6 sensilla on each half. Each half of posterior surface of labrum with 2-3 isolated sensilla. Straight medial portion of mandibles with 2-5 teeth that decrease in size dorsally (Fig. 2.168). Maxillae with apex conical, palpi peg-like with 5 sensilla, 1 bears spinule. Galea conical with 2 apical sensilla bearing spinules. Labium with patch of spinules dorsal to each palpus, spinules in rows of 2-3. Labial palpi are slightly elevated with 5 sensilla, 1 bearing spinule.

*Body*. Spiracles small, first spiracle larger than others. Body setae of 2 types: 1) simple (0.060-0.120 mm long), some with shortly denticulate tips, 6-10 in transverse row on ventral surface of each thoracic somite and on each of 3 anterior abdominal somites; 2) elsewhere setae are bifid (0.090-0.140 mm long), base 0.66X length (Fig. 2.166). Bifid setae on thoracic dorsum with shorter bases.

*Length.* 3.4-3.5 mm.

**Material examined.** Various specimens (FSCA). Also, see appendix A.

**Distribution.** *Solenopsis macdonaghi* is found throughout the floodplains of eastern Argentina and western Uruguay (Fig. 2.218). Several records exist for Paraguay. Trager (1991) reports a population at Cochabamba, Bolivia but this is far removed from the known range of *S. macdonaghi* and, in fact, may represent an introduction.

**Comments.** The coloration of the lighter queens of *S. macdonaghi* looks most similar to *S. interrupta* and *S. altipunctata*, but it is a duller yellow orange. Also, the *S. macdonaghi* queens lack the large piligerous foveolae on the head and mesosoma, along with interfoveolar striae. The queens of these three species differ slightly to greatly in sculpturing of the postpetiole and can be normally distinguished by this character.

Trager (1991) reports that the heads of *S. macdonaghi* are typically broader than other species. Head measurement of the queens, however, shows this is not always the case.

The males of *S. macdonaghi* look very similar to the other species but, along with *S. saevissima*, are among the biggest of the males. The males of *S. macdonaghi* are most similar to those of *S. quinquecuspis* and, although the *S. macdonaghi* males are normally less coarsely sculptured than *S. quinquecuspis,* they are not easily distinguished. The males of *S. macdonaghi* are also very similar to those of *S. megergates*, but the CI of *S. macdonaghi* males is somewhat smaller than that of *S. megergates*.

The larva of *S. macdonaghi* is distinct from the *S. saevissima* type with bifid setae on the head capsule. The larvae of *S. macdonaghi* are virtually indistinguishable from those of *S. megergates* and *S. quinquecuspis,* despite the smaller body size and the longer base of the body setae in *S. macdonaghi.*

### *Solenopsis megergates* Trager

(Figs. 2.27, 2.28, 2.62, 2.63, 2.78, 2.79, 2.98, 2.99, 2.138, 2.139, 2.170-2.175)

*Solenopsis megergates* Trager 1991: 181-182. [Holotype worker. BRAZIL. Paraná State. 4 km North of Curitiba. Trager. MZSP.]

**Worker.** Head broad, cordate (Fig. 2.139). Head sculpture with small piligerous foveolae, approximately 0.01 mm. Median frontal streak absent or faint. Median ocellus in largest major workers present (absent in Fig. 2.139). Mandibular costulae most often present throughout, sometimes obsolescent. Mesonotum with 20-25 setae (Fig. 2.138). Mesonotum weakly convex, in lateral view (Fig. 2.138). Promesonotal suture in largest major workers angulate, sometimes projecting upward (Fig. 2.138). Propodeum sculpture glabrous posteroventral to spiracle (Fig. 2.138). In largest major workers, propodeum curves directly to flattened posterior portion (Fig. 2.138). Postpetiole shape much broader than high. Postpetiole as seen from behind transversely rugose on lower 0.50-0.75, weakly granulate, sculpture not extending to dorsum. Color of head, mesosoma, legs and T1 maculation red brown. Color of metasoma excluding maculation dark brown.

**Queen.** *Head.* Slightly broader than long, quadrate, sides of head convex from eyes to occipital angles, straight to nearly straight below eyes (Fig. 2.28). Eyes sometimes with 3-4 setae protruding from between ommatidia, length most setae $\leq$3X length of ommatidium, sometimes setae longer, ~4X length of ommatidium. Ocelli large, prominent (Fig. 2.28). Median ocellus circular, lateral ocelli slightly ovate (Fig. 2.28). Clypeus projecting, carinal teeth stout and sharp, carinae well defined, less so dorsally, slightly divergent ventrally (Fig. 2.28). Paracarinal teeth small, sometimes poorly defined (Fig. 2.28). Median clypeal tooth well developed, infrequently indistinct (Fig. 2.28). Eyes with approximately 0.50 of eye above midpoint of head (Fig. 2.28). Antenna 11-segmented.

*Mesosoma.* Parapsidal lines present on posterior 0.50 of disk (Fig. 2.27). Mesonotum with indistinct, posteromedian furrow. Wing venation as in Fig. 2.98.

*Metasoma.* Lateral faces of postpetiole straight to weakly concave. Petiolar and postpetiolar spiracles appear tuberculate in some cases.

*Coloration, Sculpturing, and Pilosity.* Piligerous foveolae moderate, width 0.005-0.025 mm, larger on head than on thorax and abdomen. Pubescence simple, golden and erect, longer and denser on head than elsewhere, longest on anterior edge of clypeus. Mesosoma with longest pubescence (length >0.30 mm) 2X longer than shortest pubescence (Fig. 2.27). Sometimes fine striae present between ocelli. Mandibles with 5-7 coarse, distinct costulae present, sometimes obsolescent mesally. Propodeum with fine striae posteriorly, anterior 0.25 polished (Fig. 2.27). Petiolar nodes with lower 0.50 of posterior surface finely striate to granulate, dorsum are polished. Postpetiole with 12-16 striations, dorsum finely granulate to polished. Remaining integument smooth and polished. Color varies from red brown to brown orange. Ocellar triangle sometimes darkly pigmented. Legs sometimes lighter than body, yellow brown, usually red brown. Mesonotal maculations present on anteromesally and on parapsidal lines, usually black to dark brown, sometimes only slightly discernable from surrounding integument. Integument along internal margins of ocelli often brown. Median frontal streak lacking, sometimes area is slightly darker than surrounding integument, but is not consistently so. Wings hyaline with yellow veins.

*Measurements.* L ~7.4-8.9, HW 1.35-1.68, VW 0.90-1.02, HL 1.22-1.42, EL 0.40-0.48, OD 0.14-0.20, OOD 0.20-0.28, LOW 0.10-0.12, MOW 0.10-0.12, CD 0.16-0.26, MFC 0.16-0.28, EW 0.30-0.42, SL 0.95-1.15, PDL 0.21-0.25, LF1 0.10-0.14, LF2 0.08-0.11, LF3 0.07-0.11, WF1 0.05-0.08, FL 1.15-1.32, FW 0.25-0.30, MW 1.46-1.54, DLM 2.51-2.82, PRH 0.90-1.25, PL 0.71-0.79, PND 0.55-0.68, PH 0.65-0.75, PPL 0.30-0.41, DPW 0.56-0.68, PPW 0.74-0.79, PHB 0.38-0.45, N=6.

**Male.** *Head.* Eyes normally with 3-4 setae protruding from between ommatidia, length ≤3X length of ommatidium. Ocelli moderate to small, elliptical (Fig. 2.63).

*Mesosoma.* Propodeum rounded, declivous face perpendicular, flat except with distinct to indistinct median longitudinal depression, basal face strongly convex transversely and convex longitudinally. Metapleuron not broad, ~0.33 as wide as high (Fig. 2.62). Wing venations as in Fig. 2.99.

*Metasoma*. In cephalic view, dorsum of node with deep median impression, appearing bilobate. Petiolar and postpetiolar spiracles distinctly tuberculate to not tuberculate. Genitalia Figs. 2.78, 2.79.

*Coloration, Sculpturing, and Pilosity.* Pubescence short, thin, yellow, erect to suberect and of uniform length over body (0.25-0.30 mm), longest on gena and vertex. Mesonotal pubescence dense (e.g. Fig. 2.73). Propodeum with base striato-granulate (Fig. 2.62). Area between eye and insertion of antenna (Fig. 2.63), posterior portion of metapleuron, and base of petiolar node granulate. Sometimes, base of petiolar node rugose to striato-granulate. Area between ocelli (Fig. 2.63) and gena striato-granulate. Vertex granulate (Fig. 2.63). Areas anterolateral to median ocellus usually glabrous (Fig. 2.63). Lower 0.25 of postpetiole finely striato-granulate to granulate, remaining surface granulate. Lateral faces of scutellum glabrous (Fig. 2.62). Remaining integument smooth and polished. Color red brown to brown, antennae and legs brown yellow. Mandibles yellow to yellow brown. Wings hyaline, veins clear to pale yellow, pterostigma yellow.

Measurements. L ~5.0-6.7, HW 0.97-1.10, VW 0.30-0.38, HL 0.66-0.80, EL 0.40-0.49, OD 0.06-0.09, OOD 0.12-0.18, LOW 0.09-0.12, MOW 0.10-0.15, CD 0.15-0.18, MFC 0.13-0.16, EW 0.30-0.38, SL 0.16-0.18, SW 0.09-0.10, PDL 0.05-0.06, PEW

0.10-0.15, LF1 0.14-0.21, LF2 0.10-0.15, LF3 0.13-0.16, WF1 0.06-0.09, FL 1.04-1.11, FW 0.16-0.21, MW 1.40-1.54, DLM 2.35-2.44, PRH 0.81-1.05, PL 0.61-0.66, PND 0.56-0.61, PH 0.46-0.54, PPL 0.22-0.31, DPW 0.56-0.63, PPW 0.65-0.69, PHB 0.21-0.28, N=8.

**Fourth instar worker larva.** *Head.* Large, subpyriform in anterior view (height 0.46 mm, width 0.50 mm) (Figs. 2.170, 2.173). Cranium slightly broader than long (Figs. 2.170, 2.173). Antennae each with 2 or 3 sensilla, each bearing spinule (Figs. 2.170, 2.171, 2.173). Occipital setal row with 4-6 setae (0.062-0.084 mm long) (Figs. 2.170, 2.173); inner and outer setae simple to denticulate, otherwise bifid, base ~0.75 length of seta (Figs. 2.170, 2.173, 2.174). First setal row on vertex with 2 simple to denticulate setae, 0.070-0.084 mm long (Figs. 2.170, 2.173, 2.174). Second setal row on vertex with 4 simple setae, 0.092-0.128 mm long (Figs. 2.170, 2.173, 2.174). Setae below antenna level simple, 0.083-0.140 mm long (Figs. 2.170, 2.173, 2.174). Clypeus with transverse row of 4 setae, inner setae shorter than outer setae, 0.064-0.100 mm long (Figs. 2.170, 2.173, 2.174). Labrum small, short (breadth ~2X length). Labrum with 4 sensilla and 2 setae on anterior surface of each half and ventral border with 6 sensilla on each half. Each half of posterior surface of labrum with 3-5 isolated. Straight medial portion of mandibles with 2-5 teeth that decrease in size dorsally (Fig. 2.172). Maxillae with apex conical, palpi peg-like with 5 sensilla, 1 bearing spinule. Galea conical with 2 apical sensilla, 1 bearing spinule. Labium with patch of spinules dorsal to each palpus, in short rows of 2-3. Labial palpi are slightly elevated with 5 sensilla, 1 bearing spinule.

*Body*. Spiracles small, first spiracle larger than others. Integument with fine rugae throughout. Body setae of 2 types (Fig. 2.175): 1) simple (0.040-0.140 mm long), some with shortly denticulate tips, 6-10 in transverse row on ventral surface of each thoracic somite and on each of 3 anterior abdominal somites; 2) elsewhere setae are bifid (0.061-0.110 mm long), base ~0.5X length (Figs. 2.174, 2.175), some with bases ~0.75X (0.080-0.095 mm long) on thoracic dorsum posterior to head capsule.

*Length*. 3.7-3.8 mm.

**Material examined.** Various specimens (FSCA). Also, see appendix A.

**Distribution.** The type series locality (type specimens were unavailable for study) for *S. megergates* is Curitiba, Paraná, Brazil. *Solenopsis megergates* is currently known only from the three southern Brazilian states of Paraná, Santa Catarina, and Rio Grande do Sul (Fig. 2.216)

**Comments.** Queens and workers of *S. megergates* have similar coloration. The workers of this species are the largest of any of the fire ants. The queens are also large and, along with *S. macdonaghi* and *S. saevissima*, are the largest members of this group. The darker-colored queens of *S. megergates* could be confused with *S. invicta,* but the CI and OI of *S. megergates* are normally larger than that of *S. invicta.* In many cases, the sculpture of the mandible and postpetiole can help separate *S. megergates* from similar species.

The males of *S. megergates* are distinct from all other species by the lack of sculpture on the lateral faces of the scutellum; the males of the other species have weakly to strongly striate lateral faces. Also, the males of *S. megergates* usually have smaller ocelli than their closest relatives, *S. macdonaghi* and *S. quinquecuspis*.

The larvae of *S. megergates* are distinct from the *S. saevissima* type by having simple setae on the head capsule. The larvae are virtually identical to *S. macdonaghi* and

*S. quinquecuspis*. The *S. megergates* larvae do have bifid setae on the body that differ slightly from *S. macdonaghi* and *S. quinquecuspis* by having a slightly longer base.

### ***Solenopsis pusillignis* Trager**

(Figs. 2.29, 2.30, 2.45, 2.64, 2.65, 2.80, 2.87, 2.88, 2.140, 2.141, 2.190-2.194)

*Solenopsis pusillignis* Trager 1991: 194. [Holotype worker. BRAZIL. Mato Grosso State. Cuiabá. Trager. MZSP.]

**Worker.** Head subovate to cordate (Fig. 2.141). Head sculpture with small piligerous foveolae, 0.005-0.008 mm. Median frontal streak absent. Median ocellus in largest major workers absent. Mandibular costulae mesally present throughout. Mesonotum with 20-25 setae (Fig. 2.140). Promesonotal suture in largest major workers gently curved medially, never projecting upward (Fig. 2.140). Propodeum sculpture granulate posteroventral to spiracle (Fig. 2.140). Postpetiole shape as high or higher than broad. Postpetiole sculpture as seen from behind with lower 0.75 transversely rugose, granulate, weakly granulate to glabrous and shiny. Color generally brown yellow to darker yellow brown with brown gaster.

**Queen.** *Head.* Slightly broader than long, quadrate, sides of head convex from eyes to occipital angles, straight anterior to eyes (Fig. 2.30). Eyes sometimes with 6-10 long setae protruding from between ommatidia, length >4X length of ommatidia. Ocelli large, prominent (Fig. 2.30). Median ocellus circular, lateral ocelli slightly ovate (Fig. 2.30). Ocelli placed in more anterior position on head (Fig. 2.30). Clypeus projecting, carinal teeth stout and sharp, carinae well defined, prominent between antennal scrobes, slightly divergent ventrally, edge of clypeus between carinae with shallow concave depression, depression deepest between carinal teeth (Fig. 2.30). Paracarinal teeth small, well defined (Fig. 2.30). Median clypeal tooth well developed (Fig. 2.30). Eyes with approximately 0.50 of eye above midpoint of head (Fig. 2.30). Antenna 11-segmented.

*Mesosoma.* Parapsidal lines present on posterior 0.50 of disk (Fig. 2.29). Mesonotum with median furrow on posterior 0.25. Metasternum with bidentate median process. Wing venation as in Fig. 2.87.

*Metasoma.* Lateral faces of postpetiole weakly to strongly concave. In lateral view, petiolar node obtusely triangulate, profile of peduncle flattened anteriorly, convex posteriorly. Postpetiole evenly convex. Postpetiolar spiracles appear tuberculate.

*Coloration, Sculpturing, and Pilosity.* Piligerous foveolae small, sparse, width <0.01 mm, larger on head than on thorax and abdomen. Pubescence simple, golden and erect, longer and denser on head than elsewhere, longest on anterior edge of clypeus. Mesonotum pubescence 0.06-0.25 mm, longest pubescence on mesonotum 3-4X longer than shortest pubescence (Fig. 2.29). Mandibles with 9-11 fine, distinct costulae present throughout. Propodeum with fine striae throughout (Fig. 2.29). Petiolar node basal 0.75 with striato-granulate, dorsum polished. Posterior face of postpetiolar node with lower 0.50- 0.75 finely striate, lower 0.75 granulate, dorsum polished (Fig. 2.45). Remaining integument smooth and polished. Color orange with mandibles and antennae orange brown. Apical and lateral margins of metasoma segments 3-6 brown. Internal margins of ocelli dark brown. Wings hyaline with yellow veins.

*Measurements.* L ~6.6, HW 1.20, VW 0.80, HL 1.14, EL 0.29, OD 0.12, OOD 0.16, LOW 0.11, MOW 0.13, CD 0.13, MFC 0.16, EW 0.28, SL 0.83, PDL 0.17, LF1

0.09, LF2 0.07, LF3 0.08, WF1 0.06, FL 0.96, FW 0.23, MW 1.25, DLM 2.20, PRH 0.43, PL 0.61, PND 0.51, PH 0.60, PPL 0.34, DPW 0.50, PPW 0.62, PHB 0.36, N=1.

**Male.** *Head.* Eyes normally with 3-4 setae protruding from between ommatidia, length ≤3X length of ommatidium. Ocelli very large and prominent, elliptical (Fig. 2.65).

*Mesosoma.* Propodeum rounded, declivous face perpendicular, flat except with distinct to indistinct median longitudinal depression, basal face strongly convex transversely and convex longitudinally. Metapleuron not broad, ~0.50 as wide as high (Fig. 2.65). Wing venation as in Fig. 2.88.

*Metasoma*. In cephalic view, dorsum of node with shallow median impression, appearing weakly bilobate. Petiolar and postpetiolar spiracles distinctly tuberculate to not tuberculate. Genitalia Fig. 2.80.

*Coloration, Sculpturing, and Pilosity.* Pubescence short (0.15-0.20 mm), dense, yellow, erect to suberect and of uniform length over mesonotum, longest on gena and vertex. Mesonotal pubescence sparse (e.g. Fig. 2.72). Propodeum striato-granulate, mesally finely granulate (Fig. 2.64). Lateral faces of scutellum striato-granulate (Fig. 2.64). Area between eye and insertion of antenna (Fig. 2.65), posterior portion of metapleuron, and base of petiolar node granulate. Posterior surface of postpetiolar node with lower 0.25 of surface with finely striato-granulate, sometimes with lower 0.50 finely striato-granulate but glabrous mesally, dorsum polished. Area between ocelli rugose to granulate (Fig. 2.65). Vertex glabrous posterior to ocelli. Several striae present anterior to occipital carina. Area posterior to eyes and antennal scrobes weakly granulate. Remaining integument smooth and polished. Head and gaster red brown. Clypeus, mandibles, petiole and postpetiole lighter. Antennae and legs yellow. Mesosoma yellow to brown with median longitudinal stripe, area around parapsidal lines and scutellum red brown. Sometimes mesosoma yellow and parapsidal lines only slightly darker than surround integument. Mandibles yellow. Wings hyaline, veins clear to pale yellow.

*Measurements.* L ~4.9-5.4, HW 0.95-1.0, VW 0.35-0.42, HL 0.74-0.80, EL 0.44-0.48, OD 0.10-0.14, OOD 0.10-0.13, LOW 0.16-0.17, MOW 0.16-0.19, CD 0.10-0.12, MFC 0.33-0.36, EW 0.3-0.40, SL 0.14-0.18, SW 0.07-0.10, PDL 0.05-0.08, PEW 0.10-0.12, LF1 0.17-0.19, LF2 0.13-0.15, LF3 0.13-0.14, WF1 0.09-0.10, FL 098-1.05, FW 0.15-0.19, MW 1.20-1.30, DLM 2.15-2.30, PRH 0.80-0.88, PL 0.65-0.66, PND 0.58-0.61, PH 0.40-0.42, PPL 0.26-0.30, DPW 0.49-0.55, PPW 0.55-0.64, PHB 0.14-0.16, N=8.

**Fourth instar worker larva.** *Head*. Large, subpyriform in anterior view (height 0.44 mm, length 0.44 mm) (Figs. 2.190, 2.193). Cranium as broad as long (Figs. 2.190, 2.193). Antennae each with 2 or 3 sensilla, each bears spinule (Figs. 2.190, 2.193). Occipital setal row with 10-12 bifid setae (less often 8), base ~0.3-0.5X total length of seta (Fig. 2.191), setae 0.054-0.104 mm long (Figs. 2.190, 2.193, 2.194). First setal row on vertex with 2 bifid setae, base ~0.5X total length of seta, ~0.072 mm long (Figs. 2.190, 2.193, 2.194). Second setal row on vertex with 4 setae, inner 2 setae simple to denticulate, outer 2 setae bifid (base ~0.5X length), 0.081-0.110 mm long (Figs. 2.190, 2.193, 2.194). Setae below antenna level simple, 0.080-0.180 mm long (Figs. 2.190, 2.193, 2.194). Clypeus with transverse row of 4 setae, inner setae shorter than outer setae, 0.077-0.111 mm long. Labrum small, short (breadth 2.4X length). Labrum with 5 minute sensilla and 2 setae on anterior surface of each half and ventral border with 4-6 sensilla on each half. Each half of posterior surface of labrum with 3-4 isolated and 2 contiguous sensilla. Straight medial portion of mandibles with 2-5 teeth that decrease in size dorsally (Fig. 2.192). Maxillae with apex conical, palpi peg-like with 5 sensilla, 1 bears spinule. Galea conical with 2 apical sensilla, 1 bearing spinule, smaller than maxillary palpus. Labium with patch of spinules dorsal to each palpus, spinules coarse and isolated or in short rows of 2-3. Labial palpi are slightly elevated with 5 sensilla, 1 bearing spinule.

*Body*. Spiracles small, first spiracle larger than others. Body setae of 2 types: 1) simple (0.057-0.101 mm long), some with shortly denticulate tips, 4-5 in transverse row on ventral surface of each thoracic somite and on each of 3 anterior abdominal somites; 2) elsewhere setae are bifid (0.054-0.089 mm long), base varying between 0.2-0.5X length.

*Length.* 2.6-2.7 mm.

**Material examined.** See appendix A.

**Distribution.** Currently, *S. pusillignis* is known from the type locality and the vicinity of Corumbá, Mato Grosso do Sul, Brazil (Fig. 2.214).

**Variation.** Trager (1991) reported this to be a small species, but all of the newly collected colonies have larger workers that fall out in the ranges noted in parenthesis in Trager. In addition, some of the major workers have deeply notched heads (Fig. 2.141), a very distinct character unreported in the original description.

**Comments.** The queens and workers of *S. pusillignis* are superficially like small *S. macdonaghi*. However, this species is easily distinguished from others by having the following: yellow workers with the posterodorsal and posteroventral area of the propodeal spiracle granulate, and the heads of the largest workers deeply notched (Fig. 2.141); small queens with small OOI measurements and large OI measurements; light-colored males with mesonotal maculae. The queens of *S. pusillignis* differ from *S. electra* in coloration of the gaster (*S. pusillignis* has a lighter gaster and has an weakly developed T1 maculation) and *S. pusillignis* has a less developed median clypeal tooth.

The males of *S. pusillignis* normally have relatively large ocelli. This suggests that these males may be nocturnally active but this information remains unknown.

The larvae of this species are also distinct. Most notably, they have more setae (10-12) on the head capsule than in other species (normally 8 or less). Also, some have denticulate setae present on the body; these differ from those found in some *S. saevissima* by only being denticulate at the extreme apex.

### ***Solenopsis pythia*** **Santschi**

(Figs. 2.31, 2.32, 2.46, 2.51, 2.53)

*Solenopsis pythia* Santschi 1934: 30. [Holotype queen. ARGENTINA. Misiones Province. Lorento. A. A. Oglobin. NHMB.]

*S.* (*Solenopsis*) *pythia* Wilson 1952: 61.

**Worker.** Head weakly ovate to subquadrate. Head sculpture with small piligerous foveolae, approximately 0.01 mm. Median frontal streak absent. Median ocellus absent in largest major workers. Mandibular costulae present throughout. Mesonotum with 20-25 setae. Promesonotal suture in largest major workers gently curved medially. Mesonotum weakly convex in lateral view. Propodeum sculpture glabrous posteroventral to spiracle. Postpetiole shape as high or higher than broad. Postpetiole sculpture as seen from behind with lower 0.33-0.50 transversely rugose, upper surface glabrous and shiny. Color generally orange brown, with frons, clypeus and venter yellow brown.

**Queen.** *Head.* Slightly broader than long, quadrate, sides of head convex from eyes to occipital angles, straight to nearly straight below eyes (Fig. 2.32). Eyes normally with 2-4 several short setae protruding from between ommatidia, length ≤3X length of ommatidium. Ocelli large, prominent (Fig. 2.32). Median ocellus circular, lateral ocelli slightly ovate (Fig. 2.32). Clypeus projecting, carinal teeth stout and sharp, carinae weakly to moderately defined, less so dorsally, slightly divergent ventrally (Fig. 2.32). Paracarinal teeth poorly defined or, more often, absent (Fig. 2.32). Median clypeal tooth poorly developed, most often absent (Fig. 2.32). Approximately 0.50 of eye above midpoint of head (Fig. 2.32). Antenna 11-segmented, sometimes 10-segmented.

*Mesosoma.* Parapsidal lines present on posterior half of disk (Fig. 2.31). Mesonotum with distinct, median furrow on posterior 0.50 to 0.33 on disk. Posterior margin of mesonotum angulate mesally, bent anteriorly. Posterior margin of scutellum sometimes angulate mesally. Metasternum lacking median bidentate process. Wings not examined.

*Metasoma.* Lateral faces of postpetiole strongly to slightly concave. Petiolar spiracle appearing tuberculate. Postpetiolar spiracle not tuberculate.

*Coloration, Sculpturing, and Pilosity.* Piligerous foveolae large, conspicuous, width 0.010-0.020 mm (Fig. 2.32), slightly larger on head than on thorax and abdomen (Fig. 2.32). Dorsum of mesosoma with apparent piligerous foveolae (Fig. 2.51). Pubescence simple, golden and erect, of uniform length (0.15-0.2 mm) (Fig. 2.53), longer and denser on head than elsewhere, longest on anterior edge of clypeus. Mandibles with several coarse, distinct costulae present throughout. Propodeum and petiole postpetiole striato-rugulose throughout (Fig. 2.31). Postpetiole striato-rugulose throughout, sometimes extreme dorsum glabrous (Fig. 2.46). In some cases, sculpture of postpetiole appears tuberculate and dorsum appears finely granulate. Interfoveolar spaces of head and pronotum with finely striate, distinct to indistinct (Fig. 2.32). Remaining interfoveolar spaces smooth and polished. Color yellow orange with medial area of mesonotum, parapsidal lines, lateral margins of T1 and preapical transverse areas on gaster segments brown (Fig. 2.53). Internal margins of ocelli sometimes brown. Wings hyaline with yellow veins.

*Measurements.* L ~5.3-6.2, HW 1.3, VW 0.7-0.8, HL 1.0-1.1, EL 0.4-0.5, OD 0.1-0.15, OOD 0.15-0.25, LOW 0.08-0.12, MOW 0.10-0.12, CD 0.14-0.16, MFC 0.15-0.18, EW 0.35-0.40, SL 0.69-0.82, PDL 0.16-0.18, LF1 0.1, LF2 0.1, LF3 0.1, WF1 0.06-0.07, FL 0.91-1.02, FW 0.19-0.25, MW 1.18-1.32, DLM 2.28-2.44, PRH 0.90-1.03, PL 0.72-0.83, PND 0.61-0.73, PH 0.62-0.72, PPL 0.32-0.43, DPW 0.49-0.84, PPW 0.48-0.61, PHB 0.58-0.71, N=7.

**Male.** Unknown.

**Fourth instar worker larva.** Unknown.

**Material examined.** Specimens examined were from Campo Grande, Mato Grosso do Sul, Brazil, Boctucatua, São Paulo State, Brazil (FSCA), and Posadas, Misiones Province, Argentina (JPPC, SDPC).

**Distribution.** Currently, this species is known from the material listed above and the type locality of Loreto, Misiones Province, Argentina (Fig. 2.212).

**Comments.** The major workers of the *S. pythia* look like small workers of *S. saevissima*. The queens, however, are easily recognized by having acute occipital angles, large piligerous foveolae of the head and mesosoma, coarse costulae on the mandibles, a small OI, a distinct median furrow on the posterior 0.33 to 0.50 of the mesonotum, and a thick coarsely sculptured petiolar node. Trager (1991) lists piligerous foveolae size as 0.01-0.15 mm: this must be a misprint and should read ‘0.010 -0.015 mm.” The petiolar node is shorter and subquadrate and the posterior angles of propodeum are more defined than in *S. saevissima*. It is the only species in the *S. saevissima* species-group that lacks the bidentate metasternal process.

*Solenopsis pythia* is considered by some (Trager 1991) to be so unique that it is suspected to be a social parasite. Many of the queen’s characters may actually be sympleisomorphic, as they are shared with the queens in the *S. tenuis* species-group. These characters include a quadrate first flagellomere, large and conspicuous piligerous foveolae on the head and mesosoma, coarse costulae of the mandibles, thick and coarsely sculptured petiolar node, short and subquadrate petiolar node, well demarcated posterior angles of propodeum, and absent bidentate process of the metasternum. There are differences, however, such as the lack of a ventral petiolar process in queens, and workers of *S. pythia* are typical of the *S. saevissima* species-group.

Several dealate specimens were collected from a single nest, suggesting that this species may be polygynous. However, finding several dealate queens in a mound cannot be taken as positive identification of polygyny.

## *Solenopsis quinquecuspis* Forel

(Figs. 2.33, 2.34, 2.43, 2.55, 2.66, 2.67, 2.81, 2.100, 2.101, 2.142, 2.143, 2.176, 2.178-2.181)

*Solenopsis pylades* var. *quinquecuspis* Forel 1913: 224. [Syntype workers. ARGENTINA. Buenos Aires Province. Bahia Blanca. 28-X-913 (=1913). Zelenko. NHMB.]

*S. geminata saevissima* var. *quinquecuspis*: Wheeler 1915: 397.

*S. saevissima* var. *quinquecuspis*: Santschi 1916: 381.

*S.* (*Solenopsis*) *saevissima quinquecuspis*: Creighton 1930: 86.

*S. blumi* Buren 1972: 20. [NMNH.]

**Worker.** Head broad, cordate (Fig. 2.143). Head sculpture with small piligerous foveolae, around 0.01 mm. Median frontal streak present, sometimes indistinct. Median ocellus in largest major workers present (absent in Fig. 2.143). Mandibular costulae present throughout, sometimes obsolescent. Mesonotum with 20-25 setae. Promesonotal suture in largest major workers angulate medially, sometimes projecting upward. Mesonotum in lateral view weakly convex (Fig. 2.142). Propodeum sculpture glabrous posteroventral to spiracle (Fig. 2.142). Propodeum in largest major workers curves upward from metanotal groove higher than flattened posterior portion, appearing as anterior raised portion in lateral view. Postpetiole shape much broader than high. Postpetiole as seen from behind with lower 0.75 or greater transversely rugose to punctate-rugose, sometimes extending to dorsum. Color generally with head, mesosoma, and petiole medially brown to dark brown. Gaster dark brown. Frons, clypeus, and T1 maculation brown orange.

**Queen.** *Head.* Slightly broader than long, quadrate, sides of head convex from eyes to occipital angles, straight to nearly straight below eyes (Fig. 2.34). Eyes sometimes with 3-12 setae protruding from between ommatidia, most setae ≤3X length of ommatidium, sometime one or two ≥4X length of ommatidium. Median ocellus moderate, circular (Fig. 2.34). Lateral ocelli slightly ovate, small to moderate (Fig. 2.34). Clypeus projecting, carinal teeth stout and sharp, carinae indistinct between scrobes, slightly divergent ventrally (Fig. 2.34). Paracarinal teeth small, most often well defined (Fig. 2.34). Median clypeal tooth well developed (Fig. 2.34). Eyes with approximately 0.50 of eye above midpoint of head (Fig. 2.34). Antenna 11-segmented.

*Mesosoma.* Parapsidal lines present on posterior 0.50 of disk (Fig. 2.33). Mesonotum without posteromedian furrow. Bidentate medial process present on metasternum. Wing venation as in Fig. 2.100.

*Metasoma.* Lateral faces of postpetiole weakly concave to weakly convex. Petiolar and postpetiolar spiracles appear slightly tuberculate in some cases.

*Coloration, Sculpturing, and Pilosity.* Piligerous foveolae small, sparse, width <0.01 mm, larger on head than on thorax and abdomen. Pubescence simple, pale brown to yellow and erect, longer and denser on head than elsewhere, longest on anterior edge of clypeus. Mesosoma with longest pubescence (length >0.30 mm) 2X longer than shortest pubescence (Fig. 2.33). Mandibles with 10-12 fine costulae. Propodeum with fine striae throughout (Figs. 2.33, 2.55). Posterior face of petiolar nodes with 0.75 of lower surface fine striato-granulate. Often, median striae of postpetiole appear obsolescent laterally, normally 11-13 striae present (Fig. 2.43). Dorsum glabrous. Remaining integument smooth and polished. Color red brown, venter of head, frons and coxae orange yellow. Gaster dark brown. T1 orange on basal 0.50 of disk, blending to red brown apically. S1 orange anteriorly, sometimes gaster orange anteriorly. Dark brown maculations present on mesonotum both anteromesally and on parapsidal lines (e.g. Fig. 2.52). Median longitudinal maculation sometimes reaches scutellum. Internal margins of ocelli not brown. Median frontal streak present (e.g. Fig. 2.50). Wings hyaline with hyaline to pale yellow veins.

*Measurements.* L ~7.1-7.7, HW 1.40-1.45, VW 0.81-0.95, HL 1.24-1.36, EL 0.40-0.44, OD 0.13-0.16, OOD 0.15-0.20, LOW 0.11-0.16, MOW 0.09-0.13, CD 0.17-0.20, MFC 0.15-0.23, EW 0.30-0.34, SL 0.94-1.01, PDL 0.17-0.19, LF1 0.08-0.11, LF2 0.07-0.10, LF3 0.06-0.09, WF1 0.06-0.07, FL 1.10-1.20, FW 0.26-0.31, MW 1.26-1.33, DLM 2.50-2.70, PRH 1.00-1.05, PL 0.65-0.72, PND 0.56-0.61, PH 0.66-0.75, PPL 0.25-0.34, DPW 0.50-0.71, PPW 0.60-0.74, PHB 0.36-0.44, N=7.

**Male.** *Head.* Eyes normally with 2-8 setae protruding from between ommatidia, setae length ≤3X length of ommatidium. Ocelli large and prominent, elliptical (Fig. 2.67).

*Mesosoma.* Propodeum rounded, declivous face perpendicular, flat except with distinct to indistinct median longitudinal depression, basal face strongly convex transversely and convex longitudinally. Metapleuron broad, ~0.66 as wide as high (Fig. 2.66). Wing venation as in Fig. 2.101.

*Metasoma*. In cephalic view, dorsum of node with deep median impression, appearing bilobate, sometimes lobes appear to curve posteriorly. Petiolar spiracle distinctly tuberculate to not tuberculate. Postpetiolar spiracle distinctly tuberculate. Genitalia Fig. 2.81.

*Coloration, Sculpturing, and Pilosity.* Pubescence short, yellow, erect to suberect (0.25-0.30 mm in length) on mesonotum, few shorter pubescence (0.15 mm in length) on mesonotum, longest on gena and vertex. Mesonotal pubescence dense (e.g. Fig. 2.73). Propodeum with base striato-granulate, mesally coarsely granulate (Fig. 2.66). Area between eye and insertion of antenna, area between ocelli, margins of metapleuron, and base of petiolar node coarsely granulate (Figs. 2.66, 2.67). Vertex and, sometimes, gena striato-granulate. Head usually glabrous and shiny anteroventral to lateral ocelli. Head otherwise granulate. Pronotum granulate posteriorly. Mesonotum sometime with coarsely granulate to striate margins. Posterior surface of postpetiolar node coarsely granulate throughout, sometimes appearing rugose. Lateral faces of scutellum striate (Fig. 2.66). Remaining integument smooth and polished. Color dark brown to black, legs brown. Antennal scape, pedicel and first flagellum brown, blending to yellow apically. Mandibles yellow brown to brown. Wings hyaline, veins clear to pale yellow, pterostigma pale yellow.

*Measurements.* L ~5.3-6.0, HW 1.02-1.10, VW 0.36-0.41, HL 0.77-0.82, EL 0.46-0.50, OD 0.09-0.12, OOD 0.14-0.23, LOW 0.10-0.14, MOW 0.11-0.14, CD 0.17-0.21, MFC 0.10-0.15, EW 0.32-0.37, SL 0.15-0.23, SW 0.07-0.12, PDL 0.05-0.08, PEW 0.11-0.16, LF1 0.15-0.22, LF2 0.10-0.17, LF3 0.15-0.19, WF1 0.09-0.12, FL 1.05-1.22, FW 0.16-0.21, MW 1.41-1.52, DLM 2.36-2.53, PRH 0.90-0.96, PL 0.64-0.67, PND 0.54-0.60, PH 0.25-0.28, PPL 0.24-0.35, DPW 0.50-0.62, PPW 0.61-0.70, PHB 0.20-0.28, N=8.

**Fourth instar worker larva**. *Head*. Large, subpyriform in anterior view (height 0.49 mm, width 0.55 mm) (Figs. 2.176, 2.178). Cranium slightly broader than long (Figs.

2.176, 2.178). Antennae each with 2 or 3 sensilla, each bearing spinule (Figs. 2.176, 2.178). Occipital setal row with 6-8 simple setae, 0.093-0.128 mm long (Fig. 2.181); rarely some specimens with1-2 denticulate setae (Figs. 2.178, 2.180). First setal row on vertex with 2 simple setae, 0.092-0.114 mm long (Figs. 2.176, 2.178). Second setal row on vertex with 4 simple setae, 0.115-0.127 mm long (Figs. 2.176, 2.178). Setae below antenna level simple, 0.145-0.185 mm long (Figs. 2.176, 2.178). Clypeus with transverse row of 4 setae, inner setae shorter than outer setae, 0.064-0.107 mm long (Figs. 2.176, 2.178). Labrum small, short (breadth 2X length), slightly narrowed mesally (Figs. 2.176, 2.178). Labrum with 4 sensilla and 2 setae on anterior surface of each half. Ventral border with 4-6 sensilla on each half. Each half of posterior surface of labrum with 2-3 isolated sensilla. Straight medial portion of mandibles with 1-4 teeth that decrease in size dorsally (Fig. 2.179). Maxillae with apex conical, palpi peg-like with 5 sensilla, 1 bearing spinule. Galea conical with 2 apical sensilla, 1 bearing spinule. Labium with patch of spinules dorsal to each palpus, in short rows of 2-3. Labial palpi are slightly elevated with 5 sensilla, 1 bearing spinule.

*Body*. Spiracles small, first spiracle larger than others. Body setae of 2 types: 1) simple (0.036-0.092 mm long), some with shortly denticulate tips, 6-8 in transverse row on ventral surface of each thoracic somite and on each of 3 anterior abdominal somites; 2) elsewhere setae are bifid (0.066-0.114 mm long), base 0.5X length, branches more or less perpendicular to base, tips recurved. Setae on thoracic dorsum with short base (<0.2X length).

*Length.* Approximately 3.8 mm.

**Material examined.** Various specimens (FSCA). Also, see appendix A.

**Distribution.** The current range of *S. quinquecuspis* extends south from Rio Grande do Sul, Brazil through Uruguay and into Argentina (Fig. 2.215). In Argentina, it occurs in Buenos Aires and La Pampa Provinces and the eastern edges of Santa Fé and Córdoba Provinces (Fig. 2.215).

**Comments.** The queens of *S. quinquecuspis* are similar to the darker colored queens of *S. invicta.* However, the OI of *S. quinquecuspis* is normally larger than that of *S. invicta.*

The queens of the darker varieties of *S. richteri* could be confused for *S. quinquecuspis*. In this case, the mesonotum of *S. richteri* is completely darkened and the mesonotal maculae are indiscernible. Also for *S. richteri*, the maculation on the first segment of the gaster covers the anterior 0.75 and may have a distinct posterior margin. For *S. quinquecuspis*, this gaster maculation is only on the anterior 0.50 or less and is never distinctly margined posteriorly.

The male of *S. quinquecuspis* is dark in coloration and is similar to most of the other darker species. The pubescence is longer and denser than for *S. saevissima*. The *S. quinquecuspis* male normally is more coarsely sculptured than *S. macdonaghi.* The gena is not granulate nor is as sculptured as is that of *S. invicta*.

The larvae of *S. quinquecuspis* are distinct from the *S. saevissima* type by having simple setae on the head capsule. The larvae of *S. quinquecuspis* are similar to *S. macdonaghi* and *S. megergates*. Although the body of *S. quinquecuspis* is larger and the setae on the body have a shorter base compared to *S. macdonaghi,* they are virtually indistinguishable. These larvae are much larger than the larvae of *S. richteri* (as expected given adult worker size), and lack multi-branched setae and rugae on the head capsule.

## ***Solenopsis richteri* Forel**

(Figs. 2.35, 2.36, 2.48, 2.68, 2.69, 2.82, 2.83, 2.102, 2.103, 2.144, 2.145, 2.185-2.189)

*Solenopsis pylades* var. *richteri* Forel 1909: 267. Syntype workers. [Syntype workers, queens, males. ARGENTINA. Buenos Aires. Richter. MHNG.]

*S. pylades* var. *tricuspis* Forel 1912: 397. Syntype workers.

*S. geminata saevissima* var. *richteri*: Wheeler 1915: 397.

*S. saevissima* var. *richteri*: Santschi 1916: 281.

*S. saevissima* var. *tricuspis*: Santschi 1916: 281. [NHMB?]

*S.* (*Solenopsis*) *saevissima richteri*: Creighton 1930: 87.

*S. saevissima* var. *oblongiceps* Santschi 1936: 405. [NHMB]

*S. saevissima richteri*: Wilson 1952: 66.

*S. richteri* Buren 1972: 4. Worker, queen, male.

**Worker.** Head ovate to weakly cordate (Fig. 2.145). Head sculpture with small piligerous foveolae, 0.003-0.008 mm. Median frontal streak absent. Median ocellus in largest major workers absent (Fig. 2.145). Mandibular costulae present, obsolescent mesally. Humerus distinctly angulate, with distinct tuberculate boss. Mesonotum with 20-26 setae. Promesonotal suture curved medially, never projecting upward. Propodeum sculpture glabrous posteroventral to spiracle (Fig. 2.144). Postpetiole shape as high or higher than broad. Postpetiole with lower 0.50 or less transversely rugose to punctate-rugose, dorsum and face above sculpture nitid, glabrous. Color generally black with mandibles, clypeus laterally, antennal fossae, mesosomal sutures, and T1 maculations dark brown to yellow brown.

**Queen.** *Head.* Slightly broader than long, quadrate, sides of head convex from eyes to occipital angles, straight to nearly straight below eyes (Fig. 2.36). Eyes sometimes with 3-4 setae protruding from between ommatidia, length ≤3X length of ommatidium. Median ocellus large (Fig. 2.36). Lateral ocelli small to moderate (Fig. 2.36). Median ocellus circular, lateral ocelli slightly ovate (Fig. 2.36). Clypeus projecting, carinal teeth stout and sharp, carinae sometimes indistinct, less so dorsally, slightly divergent ventrally (Fig. 2.36). Paracarinal teeth small, most often well defined (Fig. 2.36). Median clypeal tooth well developed (Fig. 2.36). Approximately 0.50 of eye above midpoint of head (Fig. 2.36). Antenna 11-segmented.

*Mesosoma.* Parapsidal lines present on posterior 0.50 of disk (Fig. 2.35). Mesonotum with indistinct, median furrow on posterior 0.25 or less. Bidentate median process present on metasternum. Wing venation as in Fig. 2.102.

*Metasoma.* Lateral faces of postpetiole weakly to strongly concave. Petiolar and postpetiolar spiracles appear tuberculate in some cases.

*Coloration, Sculpturing, and Pilosity*. Piligerous foveolae small, sparse, width <0.01 mm, larger on head than on thorax and abdomen. Pubescence simple, pale brown to yellow and erect, longer and denser on head than elsewhere, longest on anterior edge of clypeus. Pubescence orange on T1 orange integumental maculation. Mesosoma with longest pubescence (length >0.30 mm) 2X longer than shortest pubescence (Fig. 2.35). Mandibles with several coarse, distinct costulae, obsolescent mesally. Propodeum with fine striae posteriorly, anterior 0.25 polished (Fig. 2.35). Posterior surface of petiolar node with 0.75 of lower surface with fine striae, dorsum polished. Posterior surface of postpetiolar node with 0.75 of lower surface finely striate, 12-14 striae present, median striae sometimes obsolescent laterally (Fig. 2.48), dorsum is polished to slightly granulate. Remaining integument smooth and polished. Two color forms exist. Dark form is dark brown except scapes black, flagellum brown to orange, both T1 and S1 with medial orange maculation, other sternites brown with dark brown apices, and petiole sometimes orange with dark brown dorsum. Maculations on T1 and S1 are well defined laterally and apically. Light form is orange with vertex, around compound eyes, T1 apically, and remaining tergites preapically brown. Both forms have dark brown maculations anteriorly on pronotum, anteromedian area mesonotum, area around parapsidal lines, sometimes on median area of axillae, anteromedian and triangular posteromedian area of scutellum, mesally on anepisternum, and mesally and laterally on propodeum (e.g. 2.52). Both forms have dark brown finger-like projections of pigment from preapical tergal bands to apical setae. Internal margins of ocelli dark brown. Median frontal streak most often absent, not discernable from surrounding integument, sometimes present. Wings hyaline with hyaline to pale yellow veins.

*Measurements.* L ~7.5-8.5, HW 1.4-1.5, VW 1.0-1.2, HL 1.2-1.3, EL 0.3-0.5, OD 0.1-0.2, OOD 0.15-0.20, LOW 0.08-0.10, MOW 0.10-0.15, CD 0.15-0.20, MFC 0.20-0.25, EW 0.30-0.40, SL 0.92-1.23, PDL 0.18-0.23, LF1 0.01-0.16, LF2 0.07-0.1, LF3 0.08-0.11, WF1 0.07-0.10, FL 1.10-1.23, FW 0.21-0.32, MW 1.40-1.55, DLM 2.46-2.73, PRH 1.00-1.12, PL 0.72-0.91, PND 0.51-0.60, PH 0.60-0.72, PPL 0.39-0.53, DPW 0.59-0.69, PPW 0.59-0.71, PHB 0.28-0.51, N=10.

**Male.** *Head.* Eyes normally with 2-4 setae protruding from between ommatidia, length ≤3X length of ommatidium. Ocelli large and prominent, elliptical (Fig. 2.69).

*Mesosoma.* Propodeum rounded, declivous face perpendicular, flat except with distinct to indistinct median longitudinal depression, basal face strongly convex transversely and convex longitudinally. Metapleuron broad, ~0.66 as wide as high (Fig. 2.68). Wing venation as in Fig. 2.103.

*Metasoma*. In cephalic view, dorsum of node transverse to having shallow median impression and appearing weakly bilobate, sometimes lobes appear to curve posteriorly. Petiolar spiracles distinctly tuberculate to not tuberculate. Postpetiolar spiracle distinctly tuberculate to greatly tuberculate, tubercle more >1X higher than width of base. Genitalia Figs. 2.82, 2.83.

*Coloration, Sculpturing, and Pilosity.* Pubescence short, yellow, erect to suberect and of uniform length over body (0.15-0.20 mm), longest on gena and vertex. Mesonotal pubescence dense (e.g. Fig. 2.73). Propodeum with base striato-granulate, mesally glabrous (Fig. 2.68). Area between eye and insertion of antenna, area between ocelli, pronotum, posterior portion of metapleuron, and base of petiolar node coarsely granulate (Figs. 2.68, 2.69). Gena granulate, sometimes weakly striato-granulate. Head otherwise granulate. Posterior surface of postpetiolar node with lower 0.50 of surface with striato-granulate, remainder polished. Metapleuron sometimes with striae both dorsally and ventrally. Lateral faces of scutellum striate (Fig. 2.68). Remaining integument smooth and polished. Color red brown to black, antennae and legs yellow brown. Mandibles brown. Wings hyaline, veins clear to pale yellow, pterostigma pale yellow.

*Measurements.* L ~6.1-6.5, HW 1.0-1.1, VW 0.4-0.5, HL 0.7-0.8, EL 0.4-0.5, OD 0.12-0.13, OOD 0.1-0.2, LOW 0.10-0.12, MOW 0.10-0.15, CD 0.17-0.23, MFC 0.10-0.15, EW 0.3-0.40, SL 0.15-0.20, SW 0.1-0.12, PDL 0.08-0.10, PEW 0.10-0.14, LF1

0.15-0.25, LF2 0.12-0.15, LF3 0.14-0.16, WF1 0.07-0.11, FL 1.1-1.2, FW 0.15-0.22, MW 1.39-1.52, DLM 2.40-2.62, PRH 0.89-1.12, PL 0.58-0.73, PND 0.51-0.60, PH 0.49-0.61, PPL 0.20-0.30, DPW 0.61-0.70, PPW 0.48-0.73, PHB 0.10-0.22, N=12.

**Fourth instar worker larva.** *Head*. Large, subpyriform in anterior view (height 0.52 mm, width 0.55 mm) (Figs. 2.185, 2.189). Cranium slightly broader than long (Figs. 2.185, 2.189). Antennae each with 2 or 3 sensilla, each bears spinule (Figs. 2.185, 2.189). Integument of head with fine rugae. Occipital setal row with 6-8 simple setae, 0.081-0.139 mm, rarely some specimens with single bifid to denticulate seta, base ~0.8-0.95X total length of seta (Fig. 2.185). First setal row on vertex with 2 simple setae, 0.092-0.112 mm long (Figs. 2.185, 2.189). Second setal row on vertex with 4 simple setae, inner 2 setae orientated farther from first setal row on vertex, appear out of alignment with row, 0.085-0.150 mm long (Figs. 2.185, 2.189). Setae below antenna level simple, 0.109-0.176 mm long (Figs. 2.185, 2.189). Clypeus with transverse row of 4 setae, inner setae shorter than outer setae, 0.060-0.100 mm long (Figs. 2.185, 2.189). Labrum small, short (breadth 2.8X length), slightly narrowed mesally. Labrum with 4 minute sensilla and 2 setae on anterior surface of each half and ventral border with 5-7 sensilla on each half. Each half of posterior surface of labrum with 2-3 isolated sensilla. Straight medial portion of mandibles with 2-5 teeth that decrease in size dorsally (Fig. 2.188). Maxillae with apex conical, palpi peg-like with 5 sensilla, 1 bearing spinule. Galea conical with 2 apical sensilla, 1 bearing spinule. Labium with isolated patches of spinules dorsal to each palpus. Labial palpi are slightly elevated with 5 sensilla, 1 bearing spinule.

*Body*. Spiracles small, first spiracle larger than others. Body setae of 3 types: 1) simple, slightly curved (0.075-0.150 mm long), 6-12 in transverse row on ventral surface of each thoracic somite and on each of 3 anterior abdominal somites; 2) setae are bifid (0.063-0.088 mm long), base ~0.5X length; 3) rarely, setae are multibrached and occur immediately posterior to head on thoracic dorsum (Figs. 2.186, 2.187).

*Length.* 2.7-3.1 mm.

**Material examined**. Various specimens (FSCA). Also, see appendix A.

**Distribution.** In South America, the current range of *S. richteri* extends from Paraná State, Brazil south and west from Misiones Province to Mendoza Province in Argentina (Fig. 2.215). This species also has been introduced into North America and is currently confined to the northwestern corner of Alabama and northeastern corner of Mississippi. A broad *S. richteri* x *invicta* hybrid zone exists south and east of the *S. richteri* range, including much of Mississippi, northern Alabama, and the northwestern corner of Georgia.

**Comments.** The queens of the lighter varieties of *S. richteri* and *S. interrupta* are very similar in coloration due to the first tergite of the gaster sometimes having an orange tergal maculation with a distinct posterior margin. In many cases, the queens of these two species are difficult to differentiate. However, they differ in the sculpturing of the postpetiole. Also, *S. richteri* queens are normally darker in coloration and the OOI is much smaller than in *S. interrupta*. The workers of *S. interrupta* are larger than *S. richteri* and easily separated. Queens of *S. richteri* in the United States are of the light form and are similar to those found in the northern range of the species in southern Brazil. This is probably the point of origin of the United States population.

The queens of *S. richteri* from the westernmost areas of the native range tend to be more darkly colored than the eastern representatives, resembling somewhat the darker

*S. invicta* queens. However, they are much darker in coloration and usually have a distinct tergal maculation on the gaster. Also, the lateral margins of the postpetiole are more concave than in *S. invicta.* The queens of *S. richteri* have weakly concave to straight lateral margins.

Males of *S. richteri* are similar in coloration to many of the species within the species-group. However, the OOI of *S. richteri* is much smaller than in *S. interrupta.* Also, the males of *S. richteri* sometimes have a very distinct tuberculate postpetiolar spiracle. Usually in the United States and south in the native range near Buenos Aires, the tuberculate postpetiolar spiracle is smaller and not as distinct. Males of *S. richteri* in the United States tend to have stronger sculpturing than in South America.

The larval stage described by Wheeler and Wheeler (1977) was collected in Walker County, Alabama. At the time of collection, this area was likely part of the *S. richteri* x *invicta* hybrid zone (Vander Meer *et al*. 1985; Vander Meer and Lofgren 1988) and probably represents the larva of *S. richteri* x *invicta*, rather than true *S. richteri*. It differs from the description given above for *S. richteri* in several characters, the most conspicuous of which is the stated presence of bifid and denticulate setae on the head capsule. This is much more reminiscent of *S. invicta*. True *S. richteri* larvae lack bifid setae on the head capsule. The larvae differ from *S. quinquecuspis* by the presence of multi-branched setae and fine rugae on the head capsule, as well as being smaller in size.

**_Solenopsis saevissima_ (Smith)**

(Figs. 2.37, 2.38, 2.49, 2.70, 2.71, 2.73, 2.84, 2.85, 2.90, 2.91, 2.104, 2.105, 2.146, 2.147, 2.177, 2.182-2.184)

*Myrmica saevissima* F. Smith 1855: 166. [Syntype ? worker. BRAZIL. Para State. Tapajós. Bates. BMNH.]

*Solenopsis moelleri* Forel 1904: 174. [MHNG.]

*S. moelleri* var. *gracilior* Forel 1904: 174. [MHNG?]

*S. geminata* var. *incrassata* Forel 1908: 362. [MHNG?]

*S. geminata pylades* Forel 1909: 262.

*S. saevissima* var. *morosa* Santschi 1916: 380. [NHMB.]

*S. geminata saevissima* var. *picea* Wasmann 1918: 70.

*S. saevissima* var. *perfida* Santschi 1923: 266. [NHMB.]

*S.* (*Solenopsis*) *saevissima saevissima*: Creighton 1930: 80-83.

*S. saevissima* var. *picea*: Kistner 1982: 73-74.

**Worker.** Head subquadrate to weakly ovate (Fig. 2.147). Head sculpture with small piligerous foveolae, around 0.003-0.005 mm. Median frontal streak absent. Median ocellus in largest major workers absent (Fig. 2.147). Mandibular costulae present throughout. Mesonotum with 20-25 setae. Promesonotal suture in largest major workers gently curved medially, never projecting upward (Fig. 2.146). Mesonotum weakly convex in lateral view (Fig. 2.146). Propodeum sculpture glabrous posteroventral to spiracle (Fig. 2.146). Postpetiole shape as high or higher than broad. Postpetiole sculpture as seen from behind with lower 0.33-0.50 transversely rugose, upper surface glabrous and shiny. Color generally red brown to dark brown.

**Queen.** *Head.* Slightly broader than long, quadrate, sides of head convex from eyes to occipital angles, straight to nearly straight below eyes (Fig. 2.38). Eyes sometimes with 3-4 setae protruding from between ommatidia, length ≤3X length of ommatidium. Median ocellus large, circular (Fig. 2.38). Lateral ocelli moderate to large, slightly ovate (Fig. 2.38). Clypeus projecting, carinal teeth stout and sharp, carinae well defined, less so dorsally, slightly divergent ventrally (Fig. 2.38). Paracarinal teeth small, sometimes poorly defined (Fig. 2.38). Median clypeal tooth poorly developed, most often absent (Fig. 2.38). Eyes with approximately 0.50 of eye above midpoint of head (Fig. 2.38). Antenna 11-segmented.

*Mesosoma.* Parapsidal lines present on posterior 0.50 of disk (Fig. 2.37). Mesonotum with indistinct, median furrow on posterior one-sixth or less. Median bidentate process present on metasternum. Wing venation as in Figs. 2.90, 2.104.

*Metasoma.* Lateral faces of postpetiole weakly to strongly concave. Petiolar and postpetiolar spiracles appear tuberculate in some cases.

*Coloration, Sculpturing, and Pilosity.* Piligerous foveolae small, sparse, width <0.01 mm, larger on head than on thorax and abdomen. Pubescence simple, golden and erect, longer and denser on head than elsewhere, longest on anterior edge of clypeus. Mesosoma with longest pubescence (length >0.30 mm) 2X longer than shortest pubescence (Fig. 2.37). Mandibles with 9-11 fine, distinct costulae present throughout. Propodeum with fine striae posteriorly, anterior 0.25 polished (Fig. 2.37). Posterior surface of petiolar node with 0.75 of lower surface with fine striae, dorsum polished. Posterior surface of postpetiolar node with 0.75 of lower surface with coarse striae, 4-7 striae present, median striae weak to obsolescent laterally, dorsum polished (Fig. 2.49).

Remaining integument smooth and polished. Color varies from dark brown with front of head, mesonotum laterally, mandibles, mesosternum, gaster segments apically, and appendages paler to pale yellow with vertex, interior margins of ocelli, medial area of mesonotum, parapsidal lines, lateral margins of T1 and preapical transverse areas on metasomal segments brown. Internal margins of ocelli dark brown. Median streak not present. Wings hyaline with yellow veins.

*Measurements.* L ~7.1-8.0, HW 1.3-1.8, VW 0.5-0.9, HL 1.2-1.3, EL 0.4-0.6, OD 0.1-0.2, OOD 0.15-0.25, LOW 0.08-0.15, MOW 0.13-0.16, CD 0.15-0.22, MFC 0.20-0.25, EW 0.25-0.40, SL 0.89-1.12, PDL 0.18-0.25, LF1 0.1-0.14, LF2 0.07-0.1, LF3 0.07-0.12, WF1 0.09-0.12, FL 1.00-1.2, FW 0.19-0.31, MW 1.32-1.43, DLM 2.53-2.81, PRH 0.98-1.10, PL 0.58-0.82, PND 0.51-0.61, PH 0.52-0.83, PPL 0.28-0.43, DPW 0.48-0.83, PPW 0.60-0.91, PHB 0.27-0.51, N=13.

**Male.** *Head.* Eyes normally without setae protruding from between ommatidia. Ocelli large and prominent, elliptical (Fig. 2.70).

*Mesosoma.* Propodeum rounded, declivous face perpendicular, flat except with distinct to indistinct median longitudinal depression, basal face strongly convex transversely and convex longitudinally. Metapleuron sometimes not broad, ~0.33 as wide as high, sometimes with transverse posterior carina, most often broader (Fig. 2.70). Wing venation as in Figs. 2.91, 2.105.

*Metasoma*. In cephalic view, dorsum of node transverse to having deep median impression and appearing bilobate. Petiolar and postpetiolar spiracles distinctly tuberculate to not tuberculate. Genitalia Figs. 2.84, 2.85.

*Coloration, Sculpturing, and Pilosity.* Pubescence short, thin, yellow, erect to suberect and of uniform length over body (0.15-0.20 mm), longest on gena and vertex. Mesonotal pubescence sparse (Fig. 2.72). Propodeum with base striato-granulate, mesally finely granulate (Fig. 2.70). Area between eye and insertion of antenna, area between ocelli, posterior portion of metapleuron, and base of petiolar nodes granulate to weakly granulate (Figs. 2.70, 2.71). Vertex posterior to ocellar triangle glabrous (Fig. 2.71). Gena weakly striate. Posterior surface of petiolar node with lower 0.25 of surface with fine striae, lower 0.50 of surface granulate, sometime granulations obsolescent mesally, dorsum polished. Lateral faces of the scutellum striate. Remaining integument smooth and polished. Color red yellow to yellow brown, antennae and legs pale yellow. Mandibles yellow. Wings hyaline, veins clear to pale yellow, pterostigma yellow.

*Measurements.* L ~6.0-7.5, HW 0.89-1.10, VW 0.28-0.51, HL 0.70-0.81, EL 0.40-0.62, OD 0.05-0.11, OOD 0.18-0.32, LOW 0.10-0.22, MOW 0.15-0.25, CD 0.15-0.25, MFC 0.15-0.21, EW 0.30-0.40, SL 0.15-0.20, SW 0.09-0.15, PDL 0.05-0.12, PEW 0.09-0.15, LF1 0.10-0.21, LF2 0.10-0.15, LF3 0.15-0.20, WF1 0.09-0.10, FL 1.00-1.12, FW 0.15-0.21, MW 1.18-1.64, DLM 2.10-2.82, PRH 0.77-1.12, PL 0.50-0.61, PND 0.38-0.60, PH 0.30-0.61, PPL 0.18-0.44, DPW 0.40-1.03, PPW 0.43-0.94, PHB 0.30-0.40, N=12.

**Fourth instar worker larva.** *Head.* Large, subpyriform in anterior view (height 0.40 mm, width 0.43 mm) (Figs. 2.177, 2.182). Cranium slightly broader than long (Figs. 2.177, 2.182). Antennae each with 3 sensilla, each bears spinule (Figs. 2.177, 2.182). Occipital setal row with 4-8 bifid setae, base 0.5-0.66X total length of seta, 0.033-0.070 mm long (Figs. 2.177, 2.182, 2.183). First setal row on vertex with 2 bifid setae, base

~0.66X total length of seta, setae 0.033-0.064 mm long (Figs. 2.177, 2.182, 2.183). Second setal row on vertex with 4 setae, inner 2 setae simple, outer 2 setae with denticulate to bifid apices, 0.088-0.098 mm long (Figs. 2.177, 2.182, 2.183). Setae below antenna level simple, 0.115-0.139 mm long (Figs. 2.177, 2.182). Clypeus with transverse row of 4 setae, inner setae shorter than outer setae, 0.033-0.090 mm long (Figs. 2.177, 2.182). Labrum small, short (breadth 2.3X length) (Figs. 2.177, 2.182). Labrum with 4-6 sensilla on anterior surface of each half and ventral border with coarse isolated spinules. Each half of posterior surface of labrum with 2-3 isolated and 2 contiguous sensilla. Straight medial portion of mandibles with 2-5 teeth that decrease in size dorsally. Maxillae with apex conical, palpi peg-like with 5 sensilla, 2 with spinules. Galea conical with 2 apical sensilla, 1 bearing spinule. Labium with patch of spinules dorsal to each palpus, spinules coarse and isolated or in short rows of 2-3. Labial palpi are slightly elevated with 4-5 sensilla, 1 bearing spinule.

*Body*. Spiracles small, first spiracle slightly larger than others. Body setae of 2 types: 1) simple to denticulate (0.053-0.128 mm long), 6-8 in transverse row on ventral surface of each thoracic somite and on each of 3 anterior abdominal somites; 2) elsewhere setae are bifid (0.050-0.078 mm long), base ~0.5X length (Figs. 2.183, 2.184).

*Length*. Approximately 2.3 mm.

**Material examined.** Various specimens (FSCA). Also, see appendices A and B.

**Distribution.** A light color variant of *S. saevissima* occurs throughout the Amazon basin (Fig. 2.213). The dark color variant occurs south from Goais and Bahia to São Palo State in Brazil (Fig. 2.213). The dark color variant occurs sporadically throughout the Amazon basin.

**Comments.** This species is highly variable in both coloration and size of the workers and queens. They range from the small dark forms in southern Brazil to the large orange brown forms in northern Brazil. These color forms are not morphologically distinct, however, as there is an almost continuous cline in size and coloration. To illustrate this point, figures are provided for both color forms.

The queens of *S. saevissima* lack mesonotal maculae like *S. electra, S. pusillignis*, and *S. macdonaghi*. Some callow queens have been studied and have integumental maculations on the mesonotum. These maculations are not distinctly margined and have not been observed in mature queens.

There is a large size variation of the males as well. However, it is opposite to that of the workers and queens. The larger males are normally found within colonies of the smaller, dark-form workers.

Males of *S. saevissima* are similar only to *S. pusillignis* in their lighter coloration and in having the head posterior to the ocellar triangle glabrous. The males of *S. saevissima* lack the large ocelli and mesonotal maculations possessed by males of *S. pusillignis*. Males of *S. saevissima* tend to have OOI (2.50-3.50) larger than any other species (<2.70).

The larvae of *S. saevissima* are similar to *S. invicta*. Although *S. saevissima* larvae normally have a smaller head capsule than *S. invicta,* the setal characters are similar between the two species. Some larval specimens of *S. saevissima* have denticulate setae present on the body, which differs from *S. invicta*.

## *Solenopsis weyrauchi* Trager

*Solenopsis weyrauchi* Trager 1991: 190. [Holotype worker. "Abra Gavilán b. Caramarca, 2,800 m. PERU. #709. ex. col. Weyrauch. LACM.]

**Worker.** Head ovate to subrectangular. Head sculpture with small piligerous foveolae, 0.005-0.01 mm. Median frontal streak present, sometimes consisting of 2 elongate darkened spots. Median ocellus in largest major workers absent. Mandibular costulae present throughout, sometimes obsolescent near base. Mesonotum with 30 or more setae. Promesonotal suture in largest major workers gently curved medially, never projecting upward. Mesonotum weakly convex in lateral view. Propodeum sculpture glabrous posteroventral to spiracle. Postpetiole shape as high or higher than broad. Postpetiole sculpture as seen from behind with lower 0.50-0.75 transversely rugose, upper surface shiny with some piligerous foveolae present. Color of head, mesonotum and T1 maculation red yellow. Remainder of gaster black brown. Propodeum and dorsum of petiolar nodes yellow brown. Sometimes rear portion of head, frons around median streak, and pronotum yellow brown. T1 maculations with 2 small anterolateral spots.

**Female.** Not examined.

**Male.** Unknown.

**Fourth instar worker larva.** Unknown.

**Material examined.** Three specimens from Bolivia, 6 km northeast of Potosí, 19° 32' S, 65 ° 43' W, 3900 m, 25.XII.1993, P.S. Ward (UCDC). These specimens were identified by J. C. Trager.

**Distribution.** *Solenopsis weyrauchi* was previously known only from several widely spaced locations at high elevations in the Peruvian Andes. The holotype (unavailable for study) is from Cajamarca, Peru (Fig. 2.212). As the new locality data suggest and as Trager (1991) predicted, the range of *S. weyrauchi* likely extends throughout the Andes, at least from Peru to Bolivia, but perhaps as far northward as Columbia and southward as Argentina and Chile.

# ACKNOWLEDGMENTS

We thank T. L. Pitts-Singer (University of Arkansas at Little Rock) for critically reviewing drafts of this paper; S. Cover (MCZ), C. Flechtmann (ICIB), L. E. Gilbert (Department of Zoology, University of Texas, Austin), J. T. Huber (CNCI), I. Löbl (MHNG), S. D. Porter (USDA-ARS, Center for Medical, Agricultural and Veterinary Entomology, Gainesville, Florida), L.A. Stange (FSCA), and P. S. Ward (UCDC) for loans of specimens; J. M. Carpenter (AMNH), P. Folgarait (Unidad de Investigación en Interacciones Biológicas, Universidad Nacional de Quilmes, Buenos Aires, Argentina), J. Heraty (Department of Entomology, University of California at Riverside), C. Kugler (Biology Department, Radford University, Virginia), T. R. Schultz (NMNH), R. R. Snelling (LACM), J. C. Trager (Shaw Arboretum of Missouri Botanical Gardens, Missouri), D. B. Wahl (AEIC), and J. Wheeler for answering questions concerning this project. We are grateful for J. Wiley's effort in gathering and moving the large alcohol collection of *Solenopsis* from the FSCA. We are thankful for the assistance provided by M. A. Farmer and J. A. Shields of the Center of Ultrastructural Studies, University of Georgia. The following institutions provided support to JPP for this study: the Canadian National Insect Collection for a CanaColl grant allowing JPP to travel to Ottawa, Canada in 1999, and the American Museum of Natural History for a Theodore Roosevelt Memorial Fund grant for travel to the Southwestern Research Station, Portal, Arizona during 2000. We thank Wade Sherbrooke for his hospitality and help during JPP's stay at the Southwestern Research Station. JPP is also grateful for the financial support provided by the University of Georgia, Department of Entomology. This research was funded by United States Department of Agriculture grant, "Systematics of fire ants in the *Solenopsis saevissima* Complex," provided to KGR, JVM, and D. D. Shoemaker.

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# FIGURE LEGENDS

2.1. Head of *Solenopsis* queen, dorsal view (see text for definitions of abbreviations).

2.2. Mesosoma of *Solenopsis* queen, dorsal view (see text for definitions of abbreviations).

2.3. Mesosoma of *Solenopsis* worker, lateral view (see text for definitions of abbreviations).

2.4. Head of *Solenopsis* queen, lateral view (see text for definitions of abbreviations).

2.5. Mesosoma of *Solenopsis* queen, dorsal view (see text for definitions of abbreviations).

2.6. Head of *Solenopsis* queen with measurements noted, dorsal view (see text for definitions of measurement abbreviations).

2.7. Mesosoma of *Solenopsis* worker, lateral view (see text for definition of measurement abbreviation).

2.8. Petiole of *Solenopsis* queen with measurements noted, lateral view (see text for definitions of measurement abbreviations).

2.9. Head and mesosoma of *Solenopsis* male, lateral view (see text for definitions of abbreviations).

2.10. Head of *Solenopsis* male, dorsal view (see text for definitions of abbreviations).

2.11. Forewing of *Solenopsis* queen showing wing venation.

2.12. Larval head capsule of typical *Solenopsis*.

2.13. *Solenopsis* larval head capsule, occipital setal row darkened.

2.14. *Solenopsis* larval head capsule, first setal row on vertex darkened.

2.15. *Solenopsis* larval head capsule, second setal row on vertex darkened.

2.16. Head of major worker of *Solenopsis altipunctata* sp. nov., dorsal view, scale = 0.22 mm.

2.17. Head of minor worker of *Solenopsis altipunctata* sp. nov., dorsal view, scale = 0.22 mm.

2.18. Mesosoma of major worker of *Solenopsis altipunctata* sp. nov., lateral view, scale = 0.22 mm (pms = promesonotal suture).

2.19. Postpetiole of major worker of *Solenopsis altipunctata* sp. nov., rear view, scale = 0.22 mm.

2.20. Head of queen of *Solenopsis altipunctata* sp. nov., dorsal view, scale = 0.22 mm.

2.21. Mesosoma of queen of *Solenopsis interrupta*, lateral view.

2.22. Head of queen of *Solenopsis interrupta*, dorsal view.

2.23. Mesosoma of queen of *Solenopsis invicta*, lateral view.

2.24. Head of queen of *Solenopsis invicta*, dorsal view.

2.25. Mesosoma of queen of *Solenopsis macdonaghi*, lateral view.

2.26. Head of queen of *Solenopsis macdonaghi*, dorsal view.

2.27. Mesosoma of queen of *Solenopsis megergates*, lateral view.

2.28 Head of queen of *Solenopsis megergates*, dorsal view.

2.29. Mesosoma of queen of *Solenopsis pusillignis*, lateral view.

2.30. Head of queen of *Solenopsis pusillignis*, dorsal view.

2.31. Mesosoma of queen of *Solenopsis pythia*, lateral view.

2.32. Head of queen of *Solenopsis pythia*, dorsal view.

2.33. Mesosoma of queen of *Solenopsis quinquecuspis*, lateral view.

2.34. Head of queen of *Solenopsis quinquecuspis*, dorsal view.

2.35. Mesosoma of queen of *Solenopsis richteri*, lateral view.

2.36. Head of queen of *Solenopsis richteri*, dorsal view.

2.37. Mesosoma of queen of *Solenopsis saevissima*, lateral view.

2.38. Head of queen of *Solenopsis saevissima*, dorsal view.

2.39. Mesosoma of queen of *Solenopsis electra*, lateral view.

2.40. Head of queen of *Solenopsis electra*, dorsal view.

2.41. Postpetiole of queen of *Solenopsis macdonaghi*, rear view.

2.42. Postpetiole of queen of *Solenopsis invicta*, rear view.

2.43. Postpetiole of queen of *Solenopsis quinquecuspis*, rear view.

2.44. Postpetiole of queen of *Solenopsis altipunctata* sp. nov., rear view.

2.45. Postpetiole of queen of *Solenopsis pusillignis*, rear view.

2.46. Postpetiole of queen of *Solenopsis pythia*, rear view.

2.47. Postpetiole of queen of *Solenopsis interrupta*, rear view.

2.48. Postpetiole of queen of *Solenopsis richteri*, rear view.

2.49. Postpetiole of queen of *Solenopsis saevissima*, rear view.

2.50. Head of queen of *Solenopsis sp.* with median frontal steak (fs), dorsal view.

2.51. Mesosoma of queen of *Solenopsis pythia* showing large foveolae, dorsal view.

2.52. Mesosoma of queen of *Solenopsis* sp. showing maculae, dorsal view.

2.53. *Solenopsis pythia* queen, lateral view.

2.54. Ocellar triangle of *Solenopsis quinquecuspis* queen with two median ocelli, dorsal view.

2.55. Propodeum of *Solenopsis quinquecuspis* queen with four propodeal spiracles, lateral view.

2.56. Mesosoma of male of *Solenopsis interrupta*, lateral view.

2.57. Head of male of *Solenopsis interrupta*, dorsal view.

2.58. Mesosoma of male of *Solenopsis invicta*, lateral view.

2.59. Head of male of *Solenopsis invicta*, dorsal view.

2.60. Mesosoma of male of *Solenopsis macdonaghi*, lateral view.

2.61. Head of male of *Solenopsis macdonaghi*, dorsal view.

2.62. Mesosoma of male of *Solenopsis megergates*, lateral view.

2.63. Head of male of *Solenopsis megergates*, dorsal view.

2.64. Mesosoma of male of *Solenopsis pusillignis*, lateral view.

2.65. Head of male of *Solenopsis pusillignis*, dorsal view.

2.66. Mesosoma of male of *Solenopsis quinquecuspis*, lateral view.

2.67. Head of male of *Solenopsis quinquecuspis*, dorsal view.

2.68. Mesosoma of male of *Solenopsis richteri*, lateral view.

2.69. Head of male of *Solenopsis richteri*, dorsal view.

2.70. Mesosoma of male of *Solenopsis saevissima*, lateral view.

2.71. Head of male of *Solenopsis saevissima*, dorsal view.

2.72. Mesosomal dorsum of male of *Solenopsis saevissima*, dark form, lateral view.

2.73. Mesosomal dorsum of male of *Solenopsis interrupta*, dark form, lateral view.

2.74. Genitalia of male of *Solenopsis interrupta*, aedeagus, upper, scale = 62 µm (ap = dorsal apodeme); volsella, lower, scale = 25 µm (cus = cuspis and dig = digitus).

2.75. Genitalia of male of *Solenopsis invicta*, aedeagus, upper, scale = 62 µm, volsella; lower, scale = 25 µm.

2.76. Genitalia of male of *Solenopsis macdonaghi*, aedeagus, upper, scale = 62 µm; volsella, lower, scale = 25 µm.

2.77. Genitalia of male of *Solenopsis macdonaghi*, aedeagus, upper, scale = 62 µm; volsella, lower, scale = 25 µm.

2.78. Genitalia of male of *Solenopsis megergates*, aedeagus, upper, scale = 62 µm; volsella, lower, scale = 25 µm.

2.79. Genitalia of male of *Solenopsis megergates*, aedeagus, upper, scale = 62 µm; volsella, lower, scale = 25 µm.

2.80. Genitalia of male of *Solenopsis pusillignis*, aedeagus, upper, scale = 62 µm; volsella, lower, scale = 25 µm.

2.81. Genitalia of male of *Solenopsis quinquecuspis*, aedeagus, upper, scale = 62 µm; volsella, lower, scale = 25 µm.

2.82. Genitalia of male of *Solenopsis richteri*, aedeagus, upper, scale = 62 µm; volsella, lower, scale = 25 µm.

2.83. Genitalia of male of *Solenopsis richteri*, aedeagus, upper, scale = 62 µm; volsella, lower, scale = 25 µm.

2.84. Genitalia of male of *Solenopsis saevissima*, light form, aedeagus, upper, scale = 62 µm; volsella, lower, scale = 25 µm.

2.85. Genitalia of male of *Solenopsis saevissima*, dark form, aedeagus, upper, scale = 62 µm; volsella, lower, scale = 25 µm.

2.86. Genitalia of male of *Solenopsis daguerrei*, aedeagus, upper, scale = 62 µm; volsella, lower, scale = 25 µm.

2.87. Forewing of *Solenopsis pusillignis* queen, scale = 350 µm.

2.88. Forewing of *Solenopsis pusillignis* male, scale = 350 µm.

2.89. Wings of *Solenopsis altipunctata* sp. nov. queen, scale = 350 µm.

2.90. Wings of *Solenopsis saevissima* queen, light form, scale = 350 µm.

2.91. Forewing of *Solenopsis saevissima* male, light form, scale = 350 µm.

2.92. Wings of *Solenopsis interrupta* queen, scale = 350 µm.

2.93. Forewing of *Solenopsis interrupta* male, scale = 350 µm.

2.94. Forewing of *Solenopsis invicta* queen, scale = 350 µm.

2.95. Forewing of *Solenopsis invicta* male, scale = 350 µm.

2.96. Forewing of *Solenopsis macdonaghi* queen, scale = 350 µm.

2.97. Forewing of *Solenopsis macdonaghi* male, scale = 350 µm.

2.98. Wings of *Solenopsis megergates* queen, scale = 350 µm.

2.99. Wings of *Solenopsis megergates* male, scale = 350 µm.

2.100. Forewing of *Solenopsis quinquecuspis* queen, scale = 350 µm.

2.101. Wings of *Solenopsis quinquecuspis* male, scale = 350 µm.

2.102. Forewing of *Solenopsis richteri* queen, scale = 350 µm.

2.103. Forewing of *Solenopsis richteri* male, scale = 350 µm.

2.104. Wings of *Solenopsis saevissima* queen, scale = 350 µm.

2.105. Forewing of *Solenopsis saevissima* male, scale = 350 µm.

2.106. Wings of *Solenopsis daguerrei* queen, scale = 350 µm.

2.107. Wings of *Solenopsis electra* queen, scale = 350 µm.

2.108. Wings of *Solenopsis daguerrei* male, scale = 350 µm.

2.109. Wings of *Solenopsis geminata* queen, scale = 350 µm.

2.110. Forewing of *Solenopsis geminata* male, scale = 350 µm.

2.111. Forewing of *Solenopsis xyloni* queen, scale = 350 µm.

2.112. Forewing of *Solenopsis xyloni* male, scale = 350 µm.

2.113. Wings of *Solenopsis amblychila* queen, scale = 350 µm.

2.114. Forewing of *Solenopsis amblychila* male, scale = 350 µm.

2.115. Wings of *Solenopsis tridens* queen, scale = 350 µm.

2.116. Wings of *Solenopsis aurea* queen, scale = 350 µm.

2.117. Wings of *Solenopsis substituta* queen, scale = 350 µm.

2.118. Wings of *Solenopsis amblychila* male, scale = 350 µm.

2.119. Forewing of *Solenopsis* nr. *nigella* queen, scale = 350 µm.

2.120. Forewing of *Solenopsis* nr. *nigella* male, scale = 350 µm.

2.121. Forewing of *Solenopsis* sp. "thief ant" queen, scale = 350 µm.

2.122. Forewing of *Solenopsis gensterblumi* queen, scale = 350 µm.

2.123. Forewing of *Solenopsis globularia littoralis* queen, scale = 350 µm.

2.124. Forewing of *Solenopsis picta* queen, scale = 350 µm.

2.125. Forewing of *Solenopsis picta* male, scale = 350 µm.

2.126. Forewing of *Solenopsis abdita* queen, scale = 350 µm.

2.127. Forewing of *Solenopsis tennesseensis* male, scale = 350 µm.

2.128. Forewing of *Solenopsis abdita* male, scale = 350 µm.

2.129. Forewing of *Solenopsis carolinensis* queen, scale = 350 µm.

2.130. Mesosoma of major worker of *Solenopsis altipunctata* sp. nov., lateral view.

2.131. Head of major worker of *Solenopsis altipunctata* sp. nov., dorsal view.

2.132. Mesosoma of major worker of *Solenopsis interrupta*, lateral view.

2.133. Head of major worker of *Solenopsis interrupta*, dorsal view.

2.134. Mesosoma of major worker of *Solenopsis invicta*, lateral view.

2.135. Head of major worker of *Solenopsis invicta*, dorsal view.

2.136. Mesosoma of major worker of *Solenopsis macdonaghi*, lateral view.

2.137. Head of major worker of *Solenopsis macdonaghi*, dorsal view.

2.138. Mesosoma of major worker of *Solenopsis megergates*, lateral view.

2.139. Head of major worker of *Solenopsis megergates*, dorsal view.

2.140. Mesosoma of major worker of *Solenopsis pusillignis*, lateral view.

2.141. Head of major worker of *Solenopsis pusillignis*, dorsal view.

2.142. Mesosoma of major worker of *Solenopsis quinquecuspis*, lateral view.

2.143. Head of major worker of *Solenopsis quinquecuspis*, dorsal view.

2.144. Mesosoma of major worker of *Solenopsis richteri*, lateral view.

2.145. Head of major worker of *Solenopsis richteri*, dorsal view.

2.146. Mesosoma of major worker of *Solenopsis saevissima*, lateral view.

2.147. Head of major worker of *Solenopsis saevissima*, dorsal view.

2.148. Larval head capsule of *Solenopsis altipunctata* sp. nov., dorsal view, scale = 46 µm.

2.149. Mandible of *Solenopsis altipunctata* sp. nov. larva, dorsal view, scale = 18 µm.

2.150. Bifid setae on larval head capsule of *Solenopsis altipunctata* sp. nov., dorsal view, scale = 18 µm.

2.151. Larval head capsule of *Solenopsis altipunctata* sp. nov., dorsal view.

2.152. Larval head capsule of *Solenopsis interrupta*, dorsal view, scale = 46 µm.

2.153. Bifid setae on larval body of *Solenopsis interrupta*, dorsal view, scale = 18 µm.

2.154. Larval mandible of *Solenopsis interrupta* larva, dorsal view, scale = 18 µm.

2.155. Larval head capsule of *Solenopsis saevissima*, dorsal view, scale = 46 µm.

2.156. Denticulate setae on larval body of *Solenopsis saevissima*, dorsal view, scale = 46 µm.

2.157. Larval head capsule of *Solenopsis interrupta*, dorsal view.

2.158. Larval maxillary palpus and galea of *Solenopsis invicta*, lateral view.

2.159. Antennal setae of larval *Solenopsis pusillignis* dorsal view.

2.160. Larval head capsule of *Solenopsis invicta*, dorsal view, scale = 46 µm.

2.161. Bifid setae on larval head capsule of *Solenopsis invicta*, scale = 18 µm.

2.162. Larval head capsule of *Solenopsis invicta*, dorsal view.

2.163. Larval head capsule of *Solenopsis invicta*, lateral view.

2.164. Larva of *Solenopsis invicta*, lateral view.

2.165. Larval head capsule of *Solenopsis macdonaghi*, dorsal view, scale = 46 µm.

2.166. Bifid setae on larval body of *Solenopsis macdonaghi*, dorsal view, scale = 18 µm.

2.167. Setae on larval head capsule of *Solenopsis macdonaghi*, dorsal view, scale = 18 µm.

2.168. Mandible of larva of *Solenopsis macdonaghi*, dorsal view, scale = 46 µm.

2.169. Larval head capsule of *Solenopsis macdonaghi*, dorsal view.

2.170. Larval head capsule of *Solenopsis megergates*, dorsal view, scale = 46 µm.

2.171. Antenna of *Solenopsis megergates*, dorsal view, scale = 18 µm.

2.172. Mandible of larva of *Solenopsis megergates*, dorsal view, scale = 18 µm.

2.173. Larval head capsule of *Solenopsis megergates*, dorsal view.

2.174. Larval head capsule of *Solenopsis megergates*, lateral view.

2.175. Larva of *Solenopsis megergates*, lateral view.

2.176. Larval head capsule of *Solenopsis quinquecuspis*, dorsal view.

2.177. Larval head capsule of *Solenopsis saevissima*, dorsal view.

2.178. Larval head capsule of *Solenopsis quinquecuspis*, dorsal view, scale = 46 µm.

2.179. Mandible of *Solenopsis quinquecuspis*, dorsal view, scale = 18 µm.

2.180. Bifid setae on larval head capsule of *Solenopsis quinquecuspis*, lateral view, scale = 18 µm.

2.181. Simple setae on larval head capsule of *Solenopsis quinquecuspis*, lateral view, scale = 18 µm.

2.182. Larval head capsule of *Solenopsis saevissima*, dorsal view, scale = 46 µm.

2.183. Larval head capsule of *Solenopsis saevissima*, lateral view.

2.184. Larva of *Solenopsis saevissima*, lateral view.

2.185. Larval head capsule of *Solenopsis richteri*, dorsal view.

2.186. Multi-branched setae on body of *Solenopsis richteri*, lateral view, scale = 18 µm.

2.187. Multi-branched setae on body of *Solenopsis richteri*, lateral view, scale = 18 µm.

2.188. Mandible of *Solenopsis richteri* larva, lateral view, scale = 46 µm.

2.189. Larval head capsule of *Solenopsis richteri*, dorsal view, scale = 46 µm.

2.190. Larval head capsule of *Solenopsis pusillignis*, dorsal view, scale = 46 µm.

2.191. Bifid setae on larval head capsule of *Solenopsis pusillignis*, lateral view, scale = 18 µm.

2.192. Larval mandible of *Solenopsis pusillignis*, lateral view, scale = 46 µm.

2.193. Larval head capsule of *Solenopsis pusillignis*, dorsal view.

2.194. Larval head capsule of *Solenopsis pusillignis*, lateral view.

2.195. Head of *Solenopsis daguerrei* queen, dorsal view, scale = 0.14 mm.

2.196. Head and pronotum of *Solenopsis daguerrei* queen, scale = 0.14 mm.

2.197. Mandible of *Solenopsis daguerrei* queen, dorsal view, scale = 0.14 mm.

2.198. Propodeum of *Solenopsis daguerrei* queen, lateral view, scale = 0.14 mm.

2.199. Head of *Solenopsis daguerrei* male, dorsal view, scale = 0.14 mm.

2.200. Scape, pedicel and flagellomeres 1-2 of *Solenopsis daguerrei* male, lateral view, scale = 0.14 mm.

2.201. First of two trees (length 57; CI 64; RI 69) obtained by parsimony analysis of 34 unordered characters of equal weight; tree also obtained by successive approximations weighting of these two equal weight trees. Bremer support values are given near their representative nodes. Black circles represent apomorphic characters and open circles represent homoplastic characters.

2.202. Second of two trees (length 57; CI 64; RI 69) obtained by parsimony analysis of 34 unordered characters of equal weight.

2.203. First of two trees (length 55; CI 67; RI 72) obtained by parsimony analysis without including *Solenopsis daguerrei* or *S. weyrauchi* data; tree also obtained by successive approximations weighting of these two equal weight trees.

2.204. Second of two trees (length 55; CI 67; RI 72) obtained by parsimony analysis without including the *Solenopsis daguerrei* or *S. weyrauchi* data.

2.205. First of two trees (length 32; CI 56; RI 54) obtained by parsimony analysis of worker characters without including *Solenopsis daguerrei* data; tree also obtained by successive approximations weighting of these two equal weight trees.

2.206. Second of two trees (length 32; CI 56; RI 54) obtained by parsimony analysis of worker characters without including the *Solenopsis daguerrei* data.

2.207. Single most parsimonious tree (length 5; CI 100; RI 100) obtained by parsimony analysis of male characters without including the *Solenopsis altipunctata* sp. nov., *S. electra, S. pythia* or *S. weyrauchi* data.

2.208. Strict consensus tree calculated from the three most parsimonious trees (length 6; CI 83; RI 85) obtained by parsimony analysis of larval characters without including the *Solenopsis daguerrei, S. electra, S. pythia* or *S. weyrauchi* data.

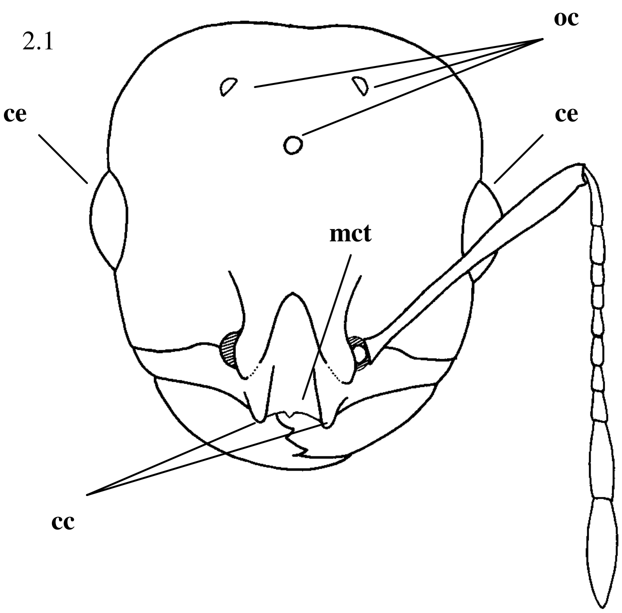
2.209. Strict consensus tree calculated from the 13 most parsimonious trees (length 15; CI 66; RI 76) obtained by successive approximations weighting of larval characters without including the *Solenopsis weyrauchi* data.

2.210. Strict consensus tree calculated from three trees (length 49; CI 66; RI 72) produced by parsimony analysis of worker, queen, and male characters.

2.211. Strict consensus tree calculated from the six most parsimonious trees (length 19; CI 78; RI 87) obtained by parsimony analysis of male and queen characters without including *Solenopsis altipunctata* sp. nov., *S. electra, S. pythia* or *S. weyrauchi* data.

2.212. Distribution of *Solenopsis altipunctata* sp. nov., *S. pusillignis*, *S. pythia,* and *S. weyrauchi*.

2.213. Distribution of *Solenopsis electra* and *S. saevissima*.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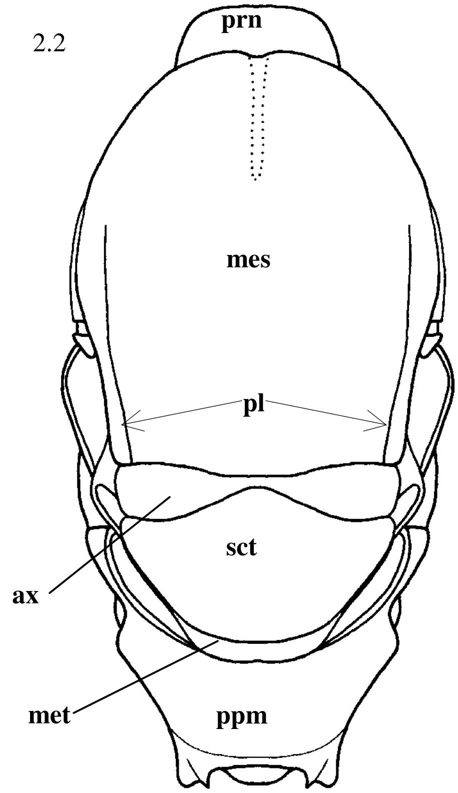
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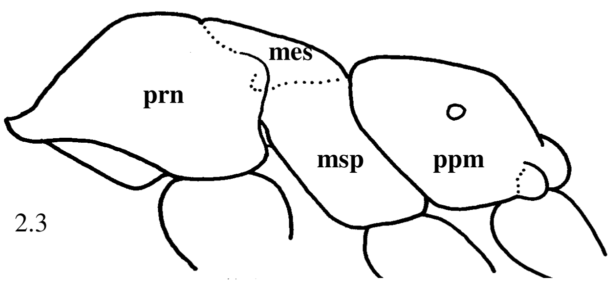
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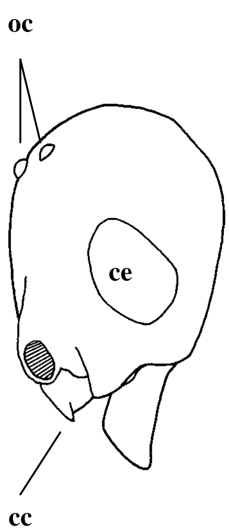
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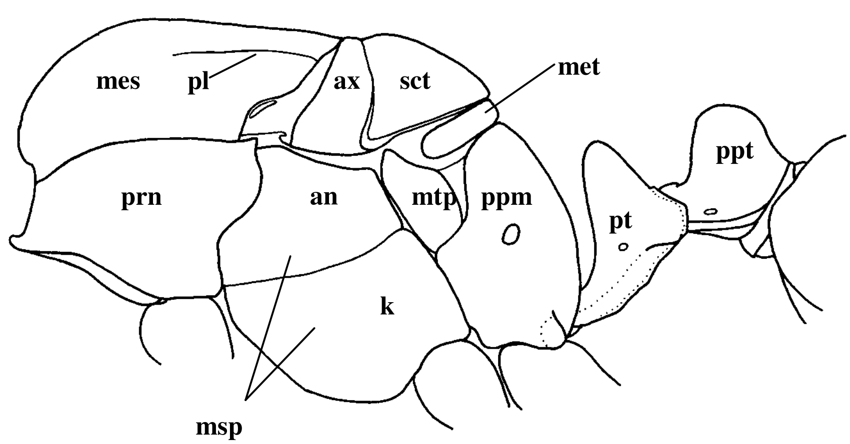
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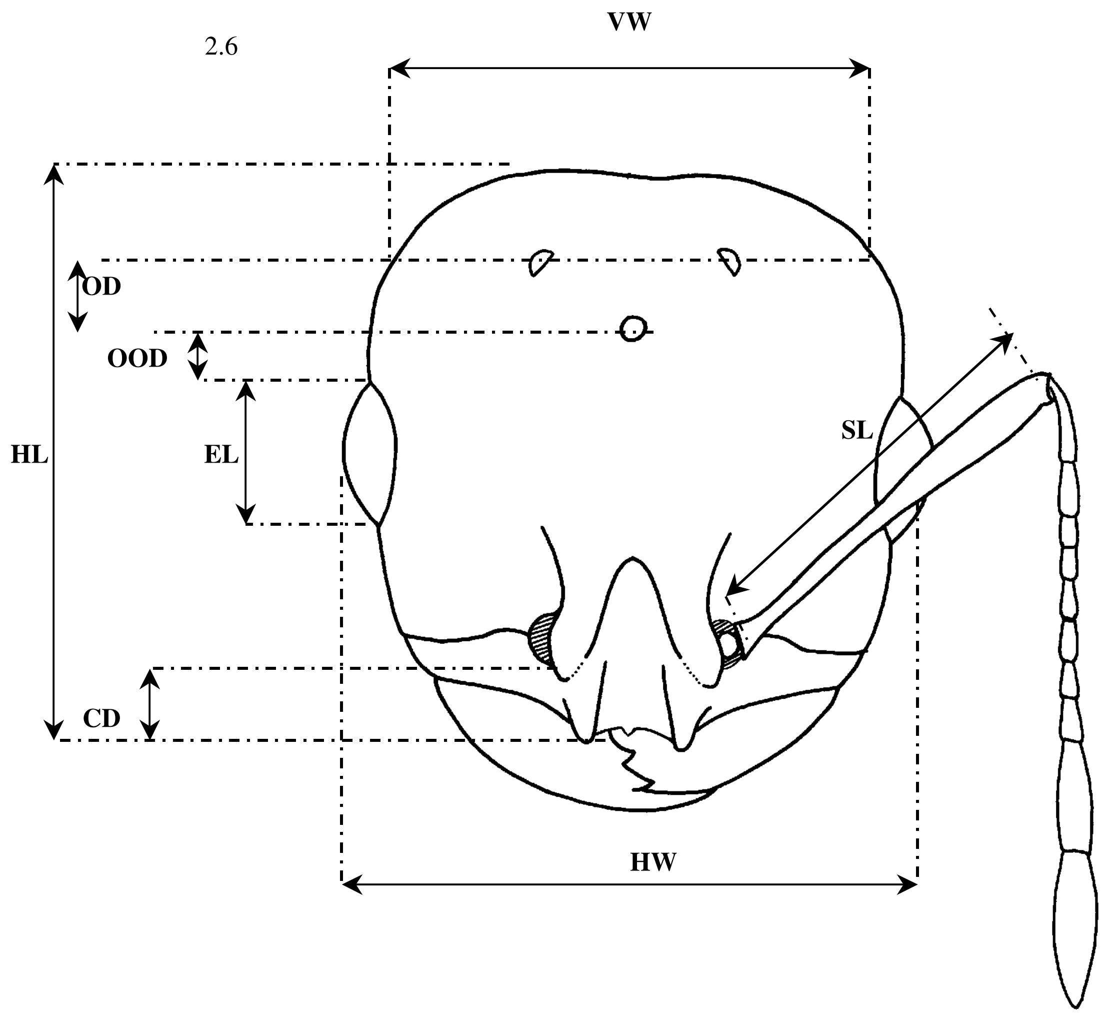


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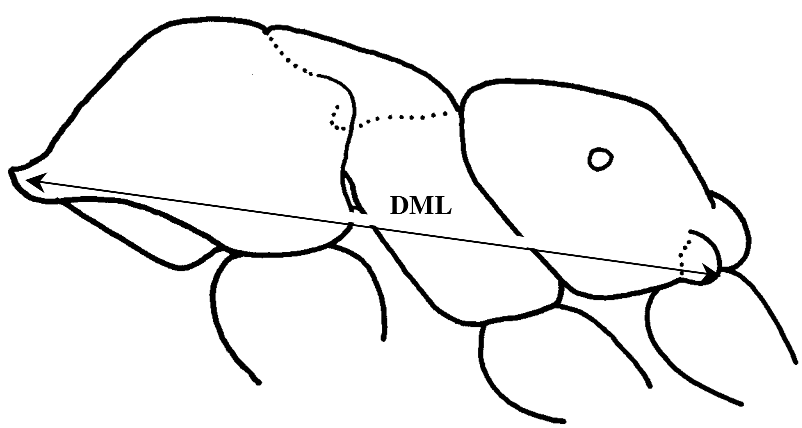

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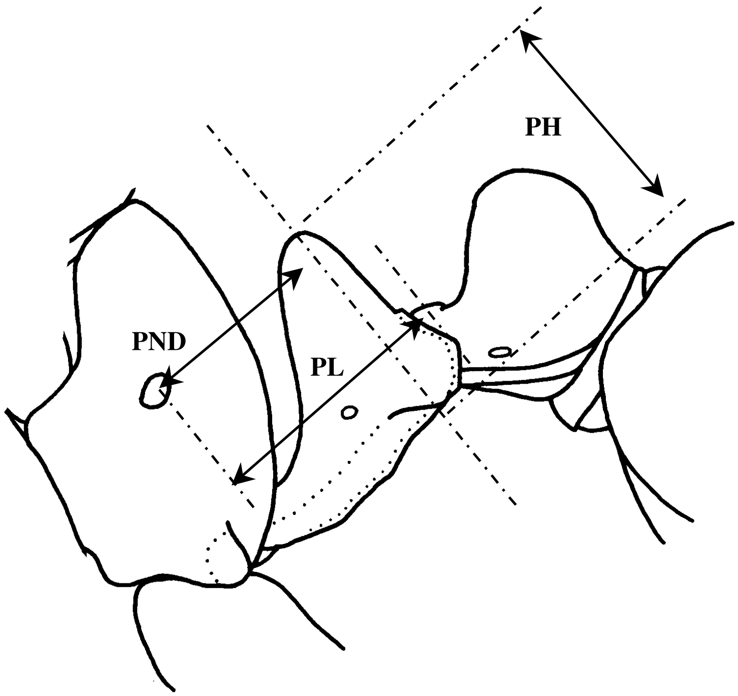


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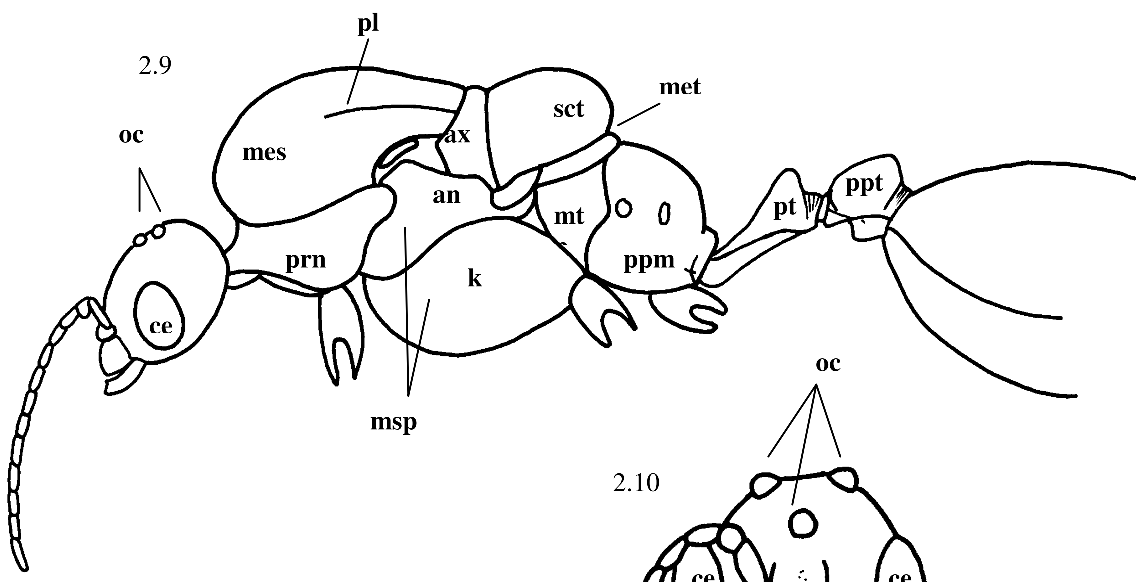


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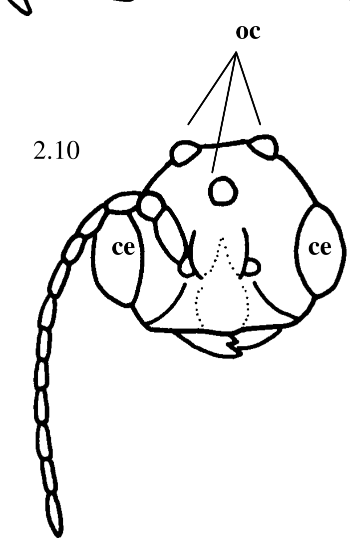

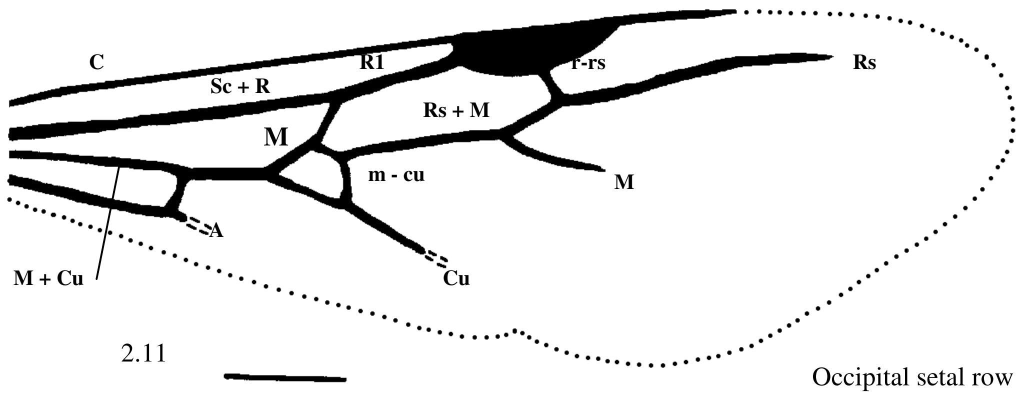


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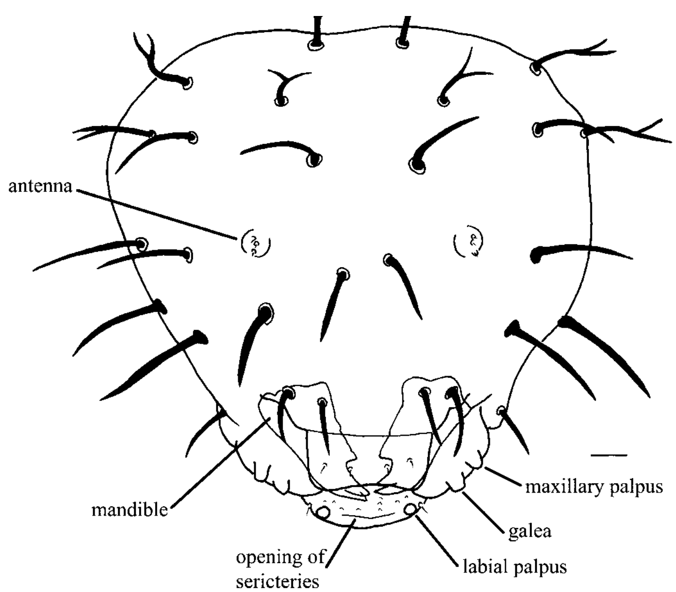


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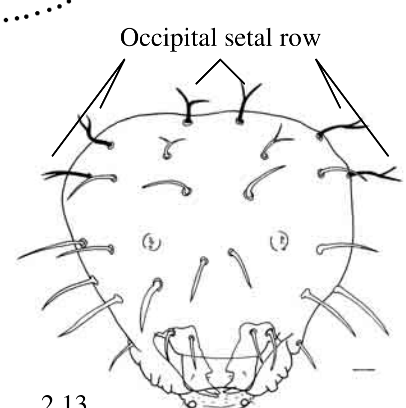


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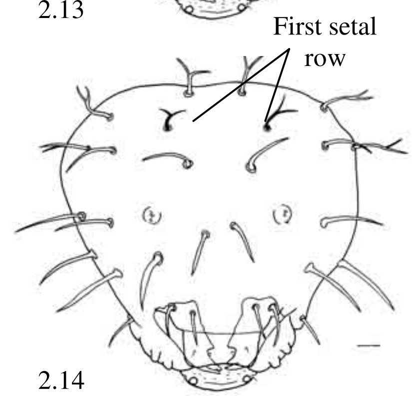


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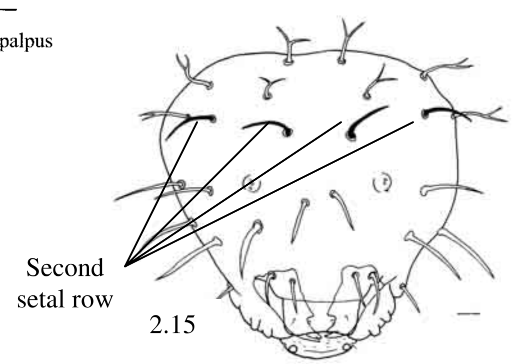


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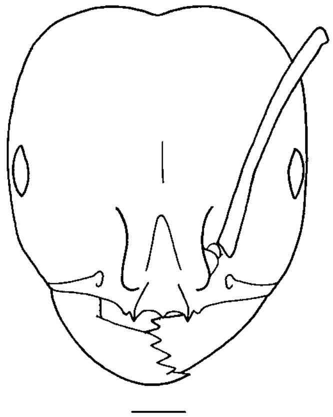
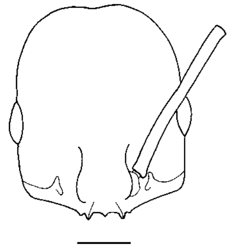
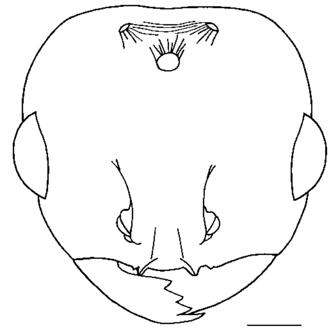


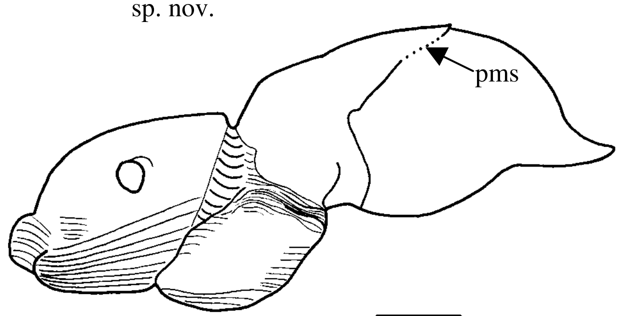
2.16. *S. altipunctata,* sp. nov.



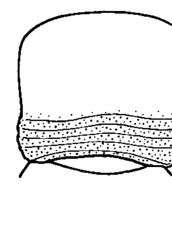
2.17. *S. altipunctata,* sp. nov.



2.20. *S. altipunctata,* sp. nov.



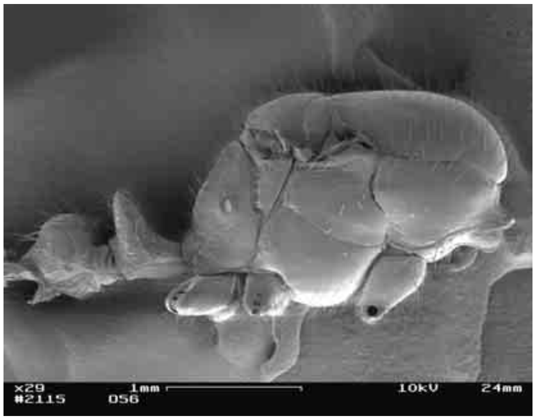

2.18. *S. altipunctata,* sp. nov.



2.19. *S. altipunctata,* sp. nov.

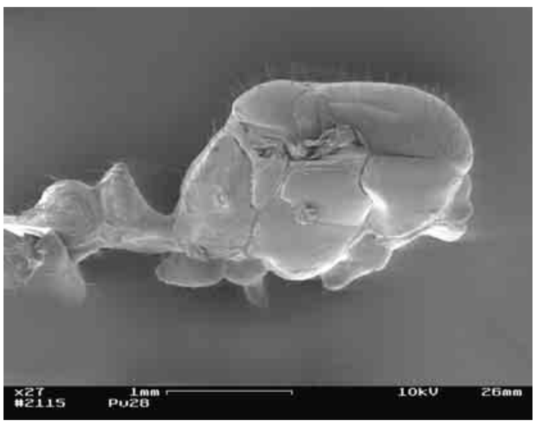

2.21. *S. interrupta,* Pu43


2.22. *S. interrupta,* Pu43

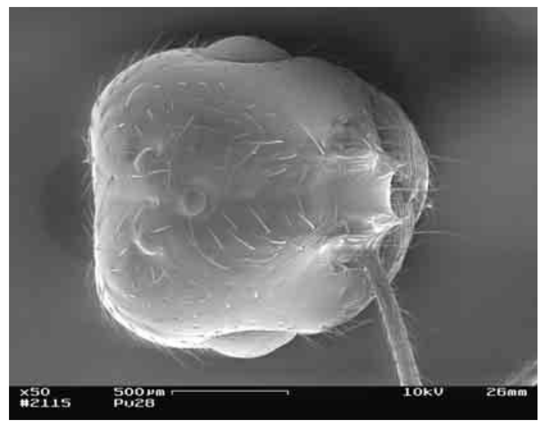



2.23. *S. invicta,*
O56

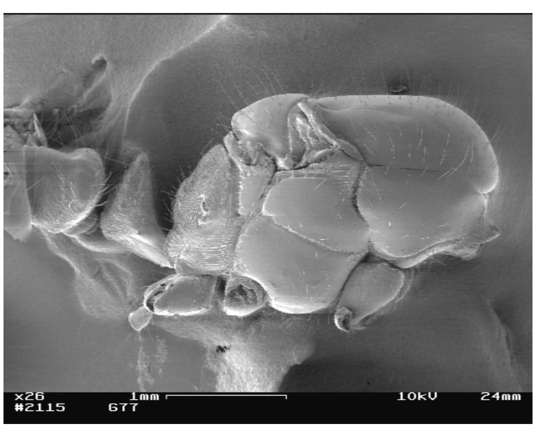

2.24. *S. invicta,*
O56



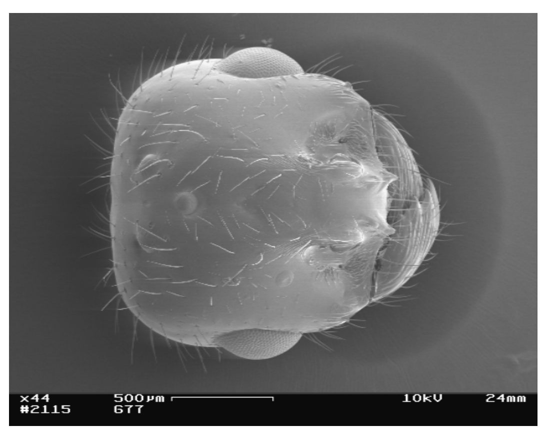

2.25. *S. macdonaghi,*
Pu28




2.26. *S. macdonaghi,*
Pu28



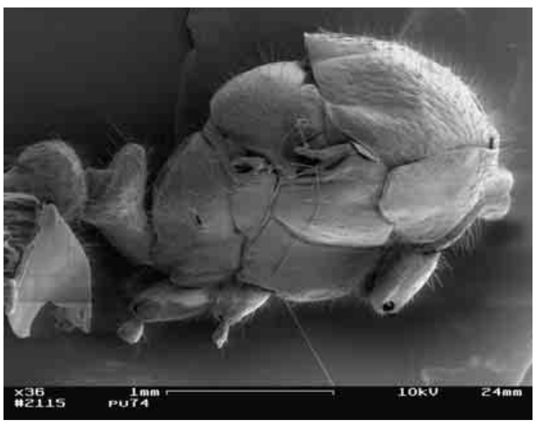

2.27. *S. megergates,*
G77



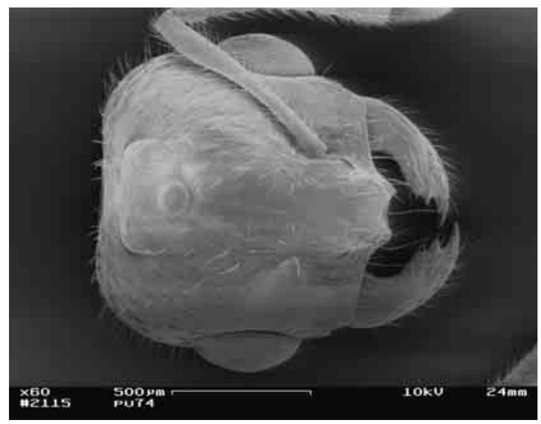

2.28. *S. megergates,*
G77


2.29. *S. pusillignis*


2.30. *S. pusillignis*




2.31. *S. pythia*



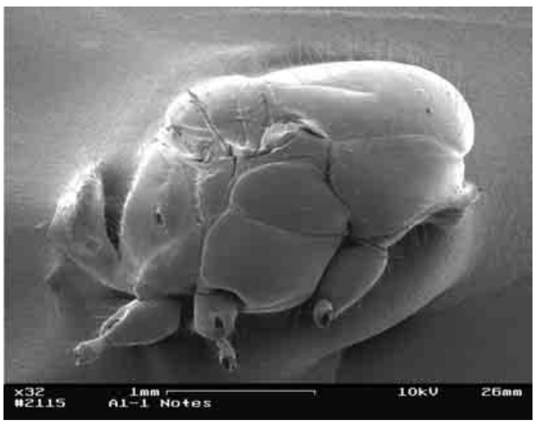

2.32. *S. pythia*


2.33. *S. quinquecuspsis,*
Pu48


2.34. *S. quinquecuspsis,*
Pu48

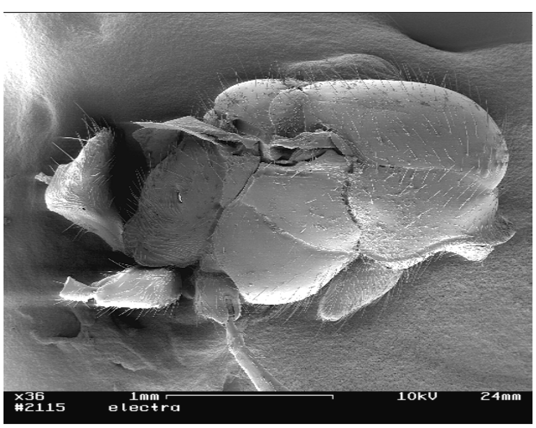

2.35. *S. richteri,*
Pu70


2.36. *S. richteri,*
Pu70

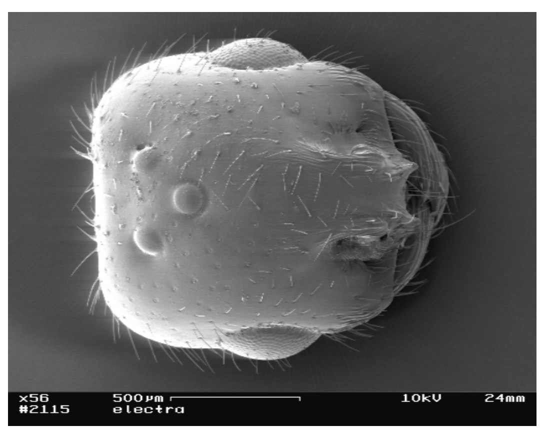



2.37. *S. saevissima,*
O5

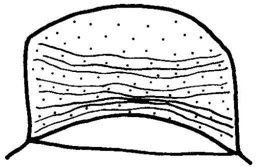

2.38. *S. saevissima,*
O5



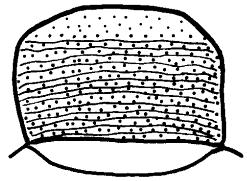

2.39. *S. electra*



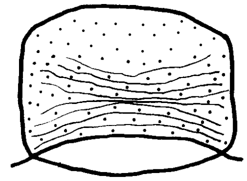

2.40. *S. electra*



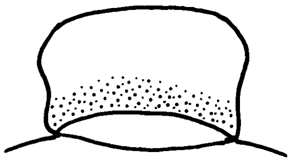
2.41. *S. macdonaghi*



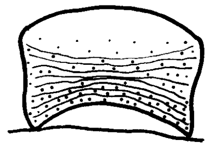
2.42. *S. invicta*



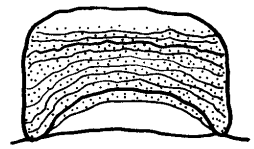
2.43. *S. quinquecuspis*



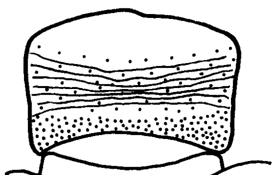
2.44. *S. altipunctata,* sp. nov.



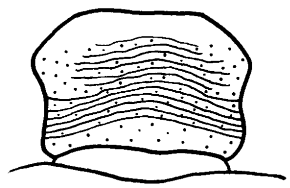
2.45. *S. pusillignis*



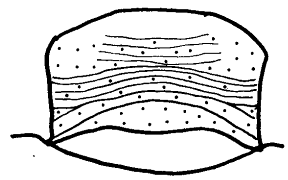
2.46. *S. pythia*



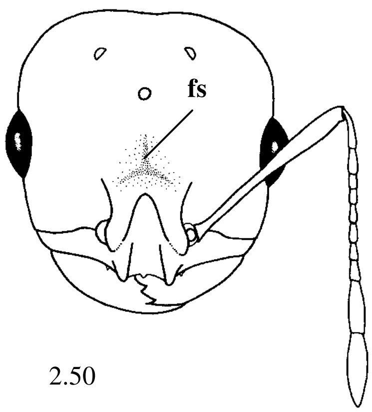
2.47. *S. interrupta*



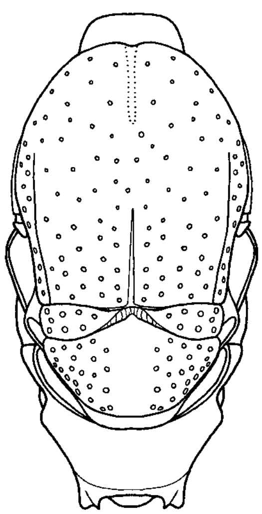
2.48. *S. richteri*



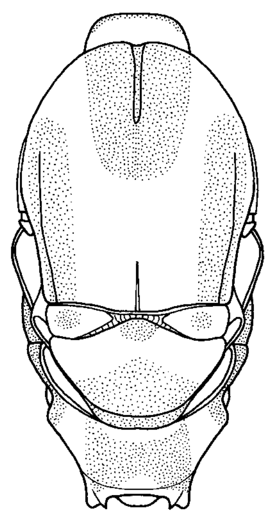
2.49. *S. saevissima*



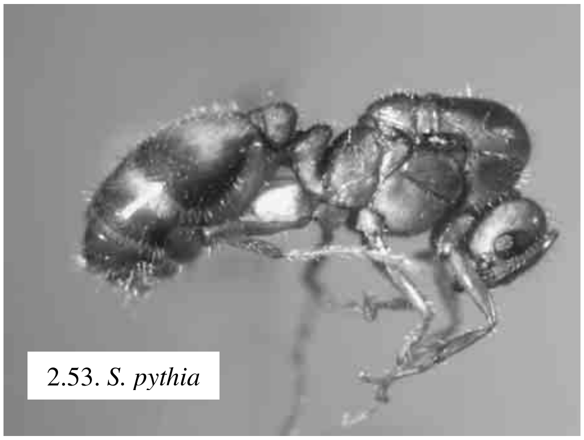

2.50



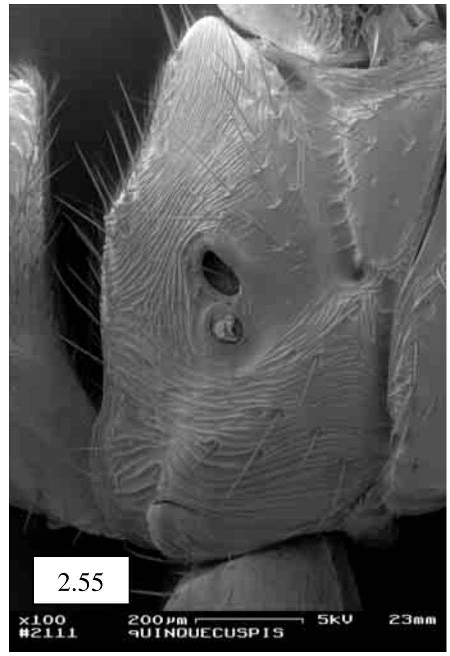
2.51. *S. pythia*



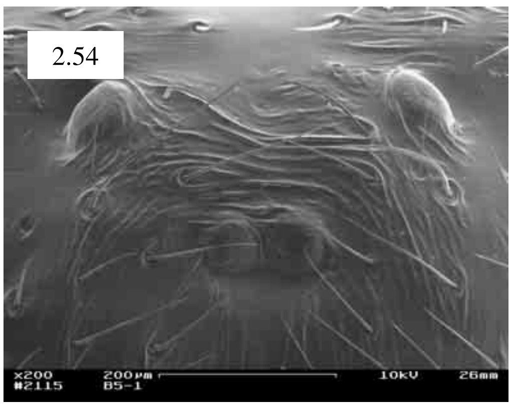
2.52. *S. interrupta*



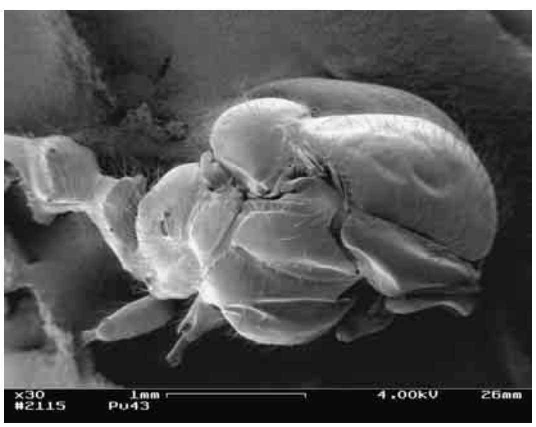
2.53. *S. pythia*




2.55




2.54





2.56. *S. interrupta,*
Pu43

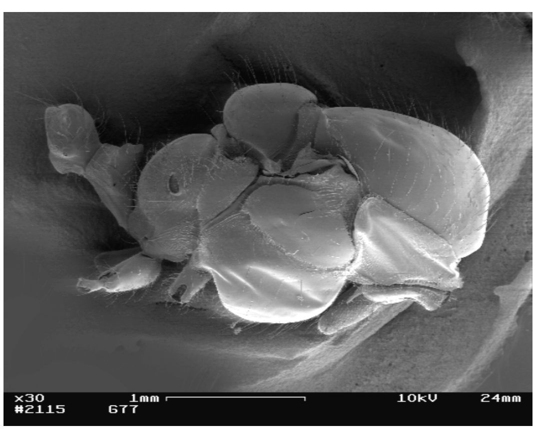
2.57. *S. interrupta,*
Pu43


2.58. *S. invicta,*
O56

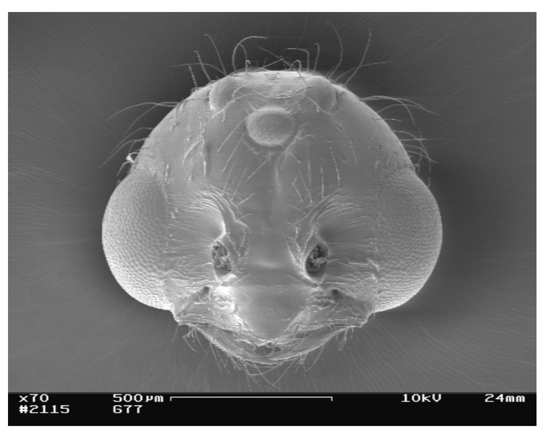

2.59. *S. invicta,*
O56


2.60. *S. macdonaghi,*
Pu28

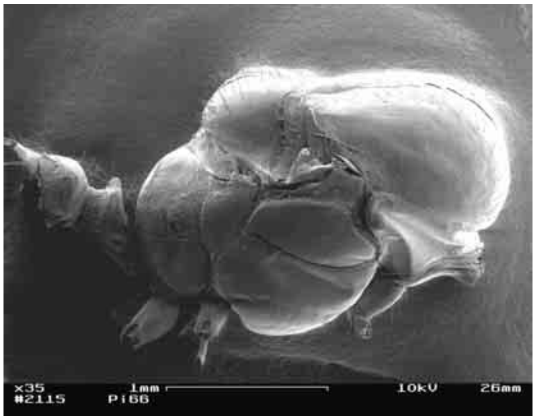

2.61. *S. macdonaghi,*
Pu28




2.62. *S. megergates,*
G77

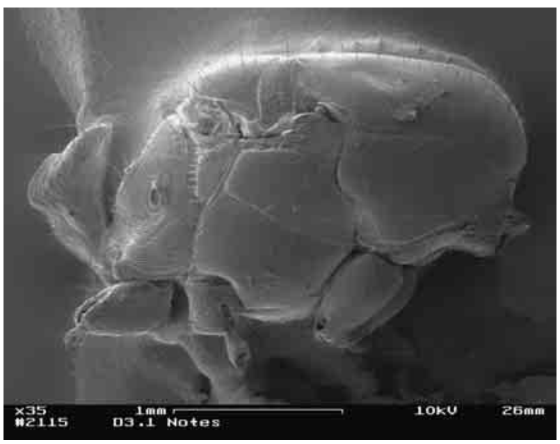



2.63. *S. megergates,*
G77




2.64. *S. pusillignis,*
Pi66


2.65. *S. pusillignis,*
Pi66




2.66. *S. quinquecuspis,*
Pu46


2.67. *S. quinquecuspis,*
Pu46

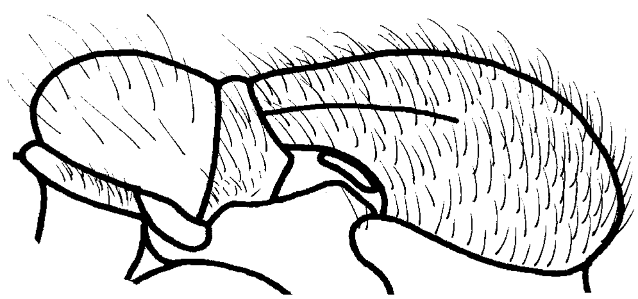

2.68. *S. richteri,*
Pu70


2.69. *S. richteri,*
Pu70

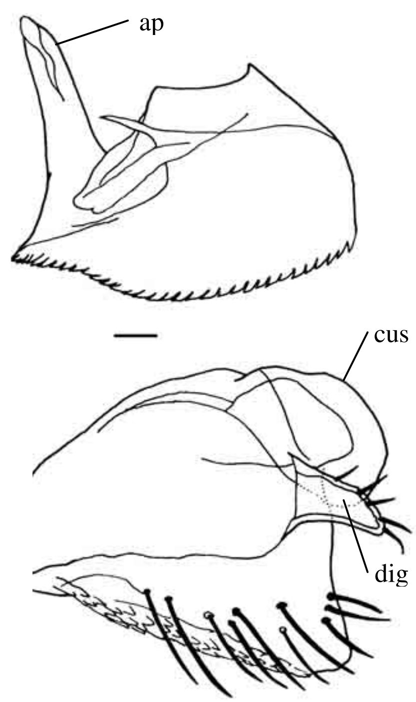

2.70. *S. saevissima,*
O5


2.71. *S. saevissima*,
O5

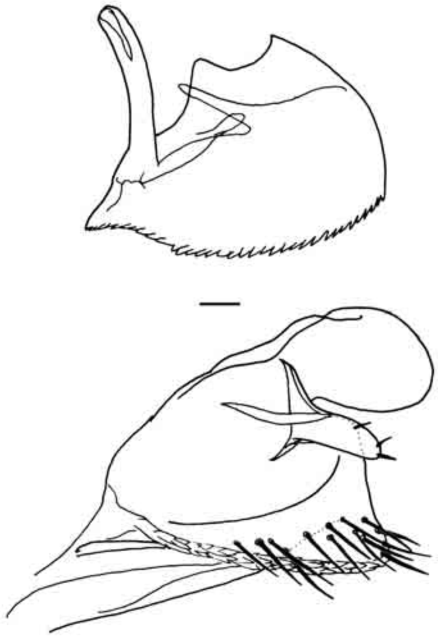
2.72. *S. saevissima*



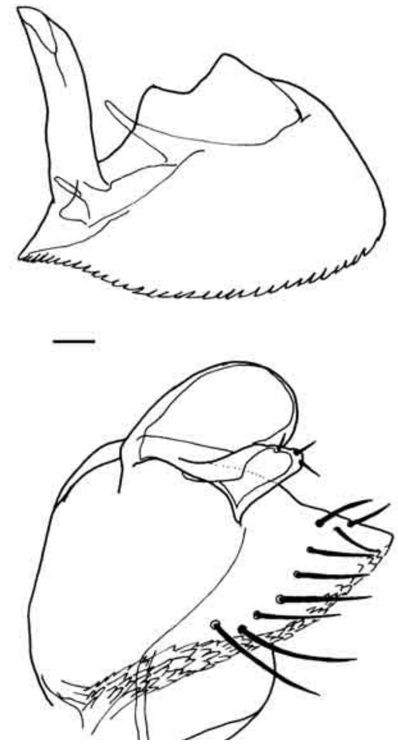
2.73. *S. interrupta*



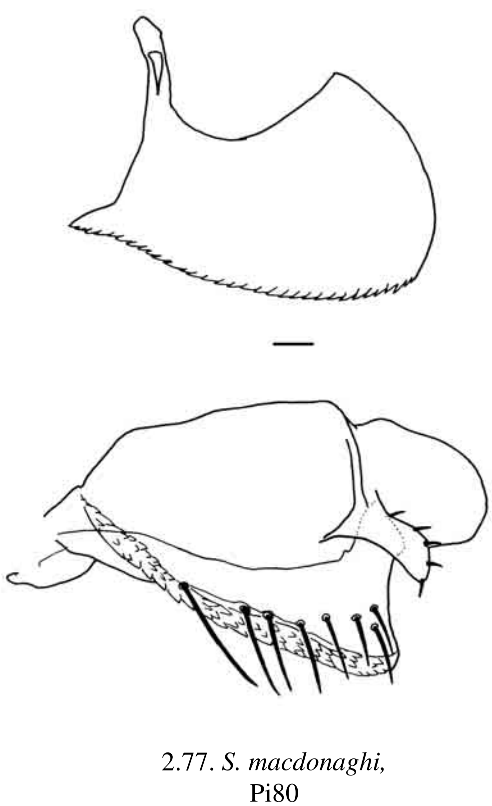

2.74. *S. interrupta*



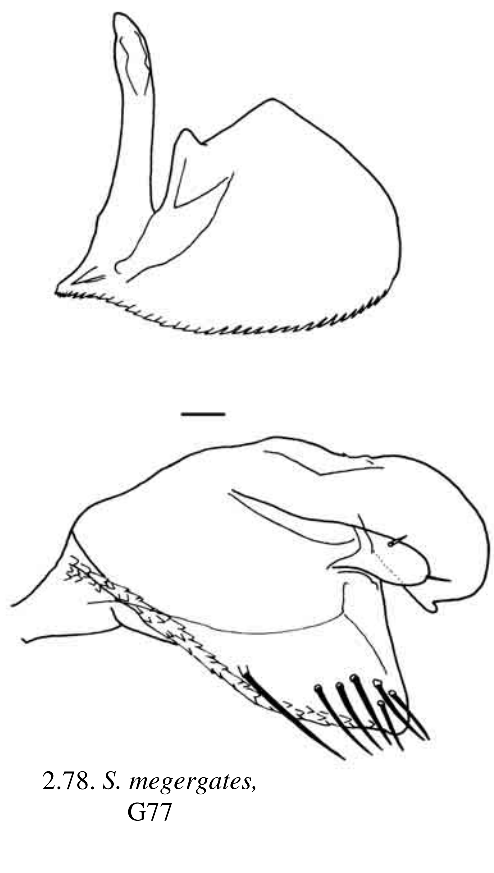
2.75. *S. invicta*



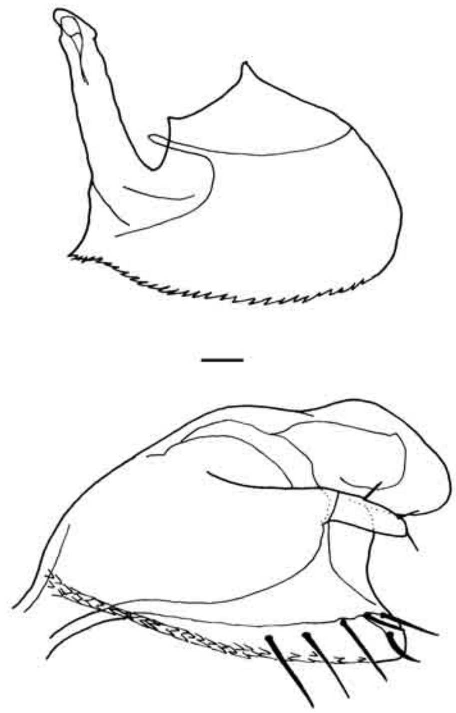
2.76. *S. macdonaghi,*
Pu28



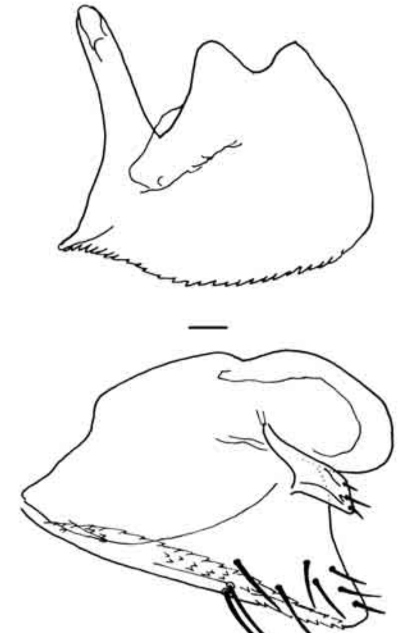
2.77. *S. macdonaghi,*
Pi80



2.78. *S. megergates,*
G77

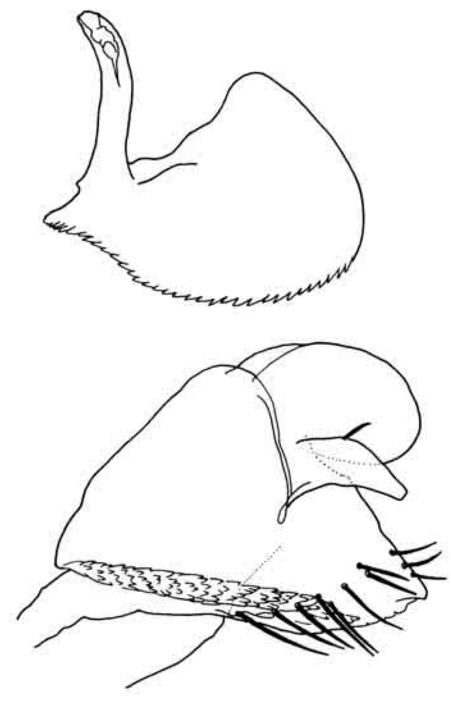


2.79. *S. megergates,*
G77

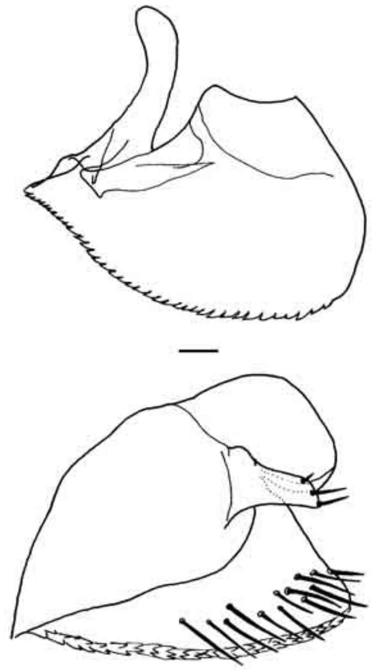


2.80. *S. pusillignis*

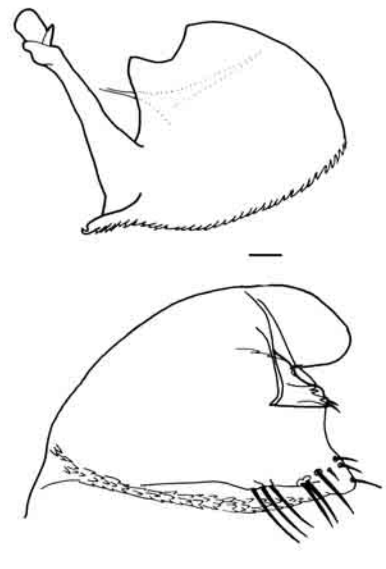
2.81. *S. quinquecuspis,*
G77



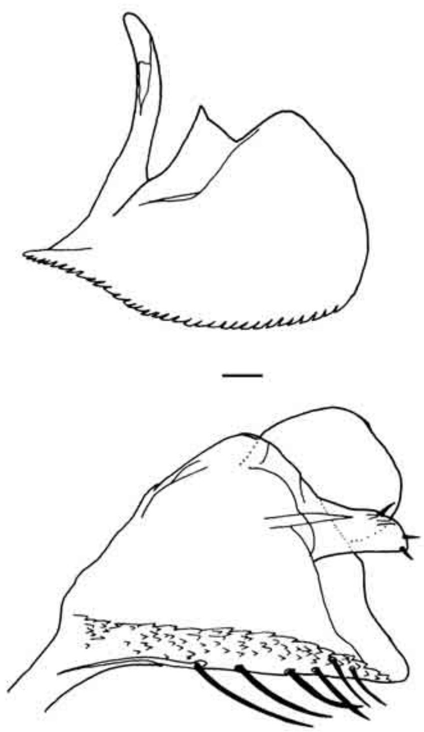
2.82. *S. richteri,*
Pu70



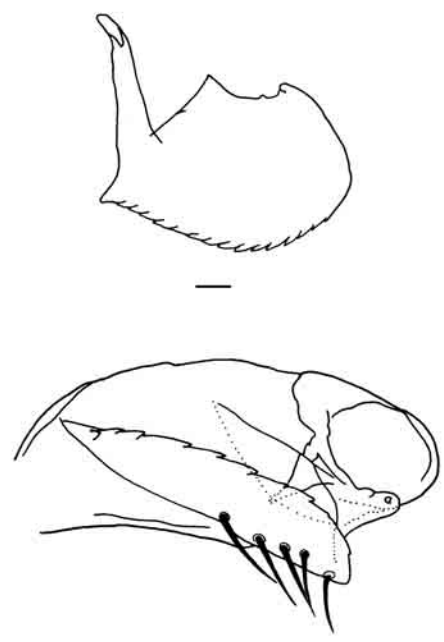
2.83. *S. richteri,*
Pu75



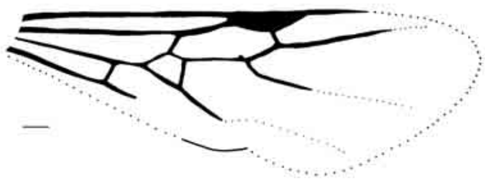
2.84. *S. saevissima*,
light form

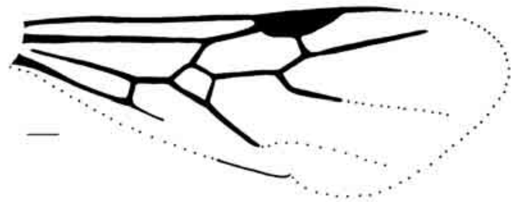


2.85. *S. saevissima,*
O5



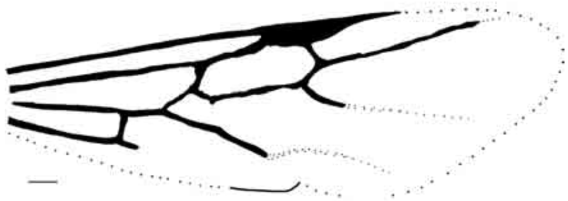
2.86. *S. daguerrei*



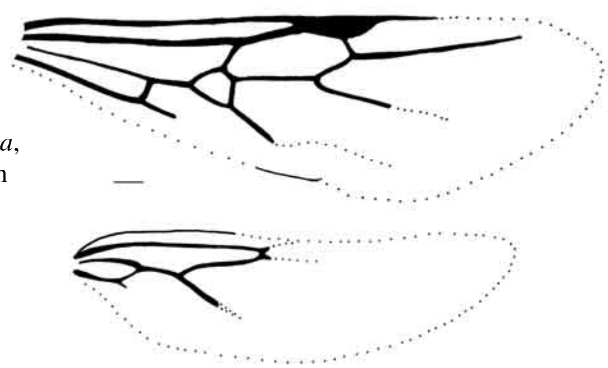


2.87. *S. pusillignis*,
queen

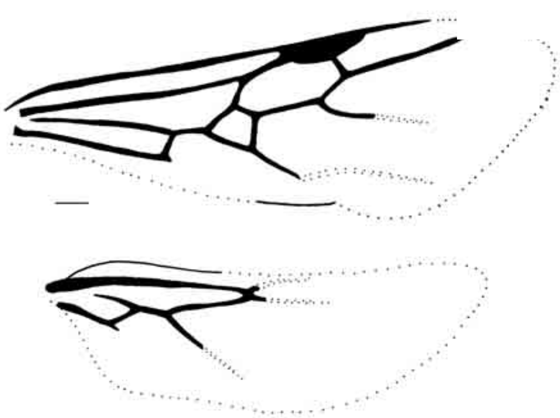
2.88. *S. pusillignis*,
male



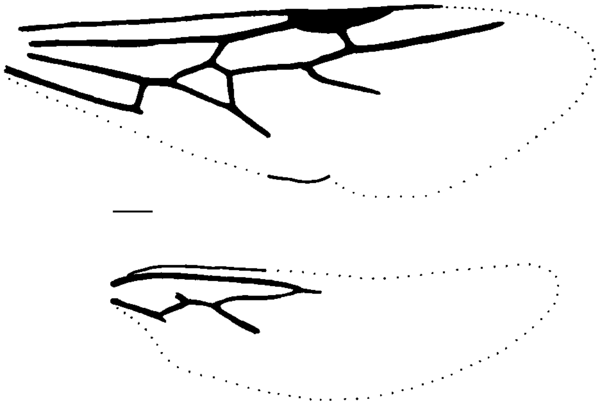
2.89. *S. altipunctata*, sp. nov.,
queen



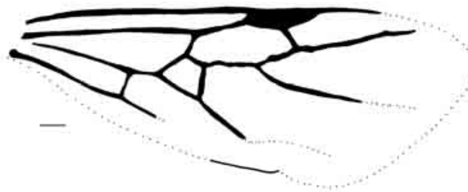
2.90. *S. saevissima*,
light form, queen



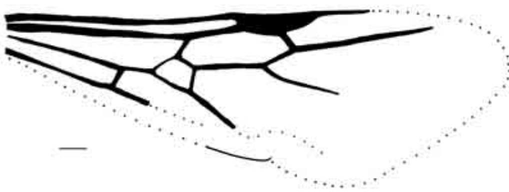
2.91. *S. saevissima*,
light form, male



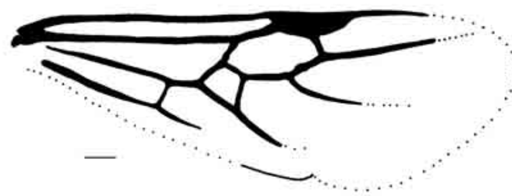
2.92. *S. interrupta*,
queen



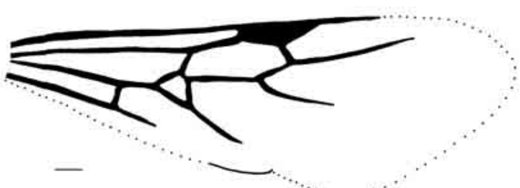
2.93. *Solenopsis interrupta*,
male



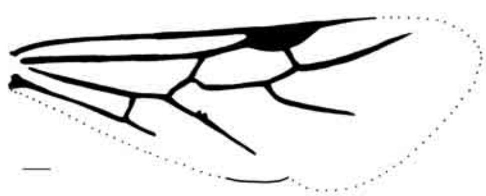
2.94. *Solenopsis invicta*,
queen



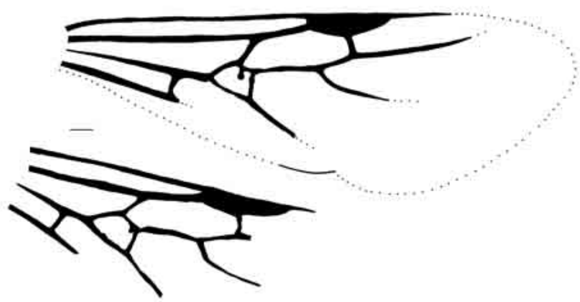
2.95. *Solenopsis invicta*,
male



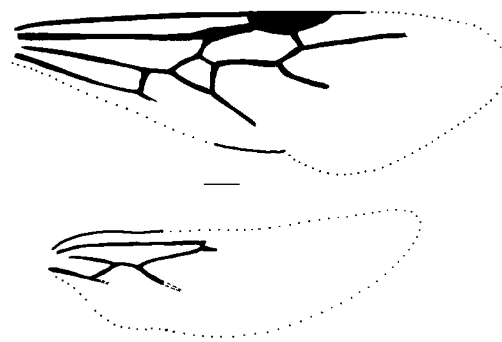
2.96. *Solenopsis macdonaghi*,
queen



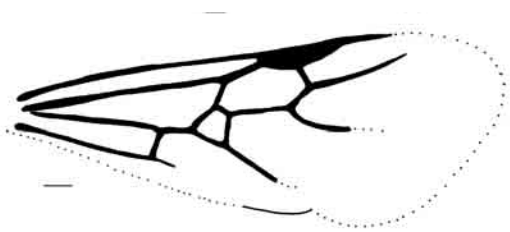
2.97. *S. macdonaghi*,
male



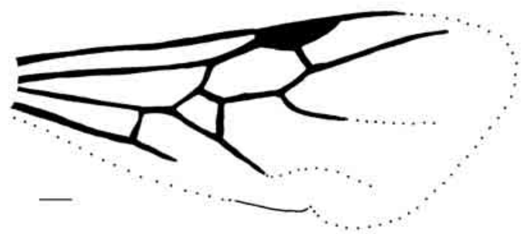
2.98. *S. megergates*,
queen



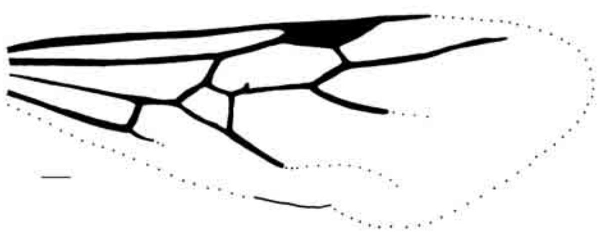
2.100. *S. quinquecuspis*,
queen



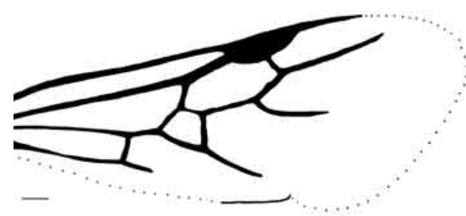
2.99. *S. megergates*,
male



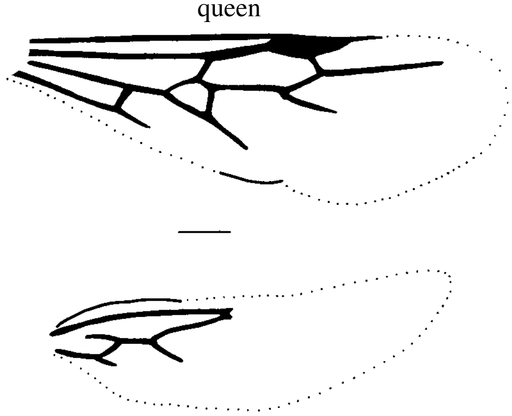
2.101. *S. quinquecuspis*,
male



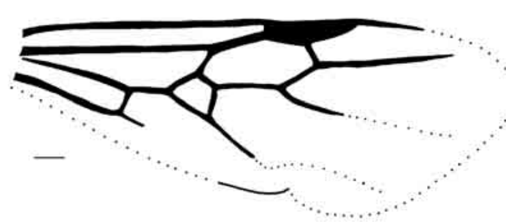
2.102. *S. richteri*,
queen



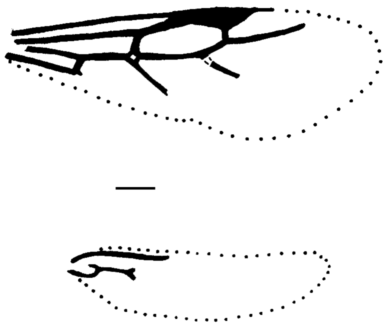
2.103. *S. richteri*,
male



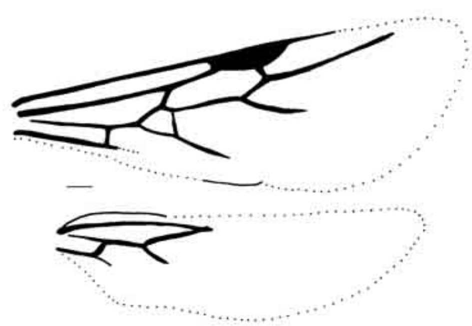
2.104. *S. saevissima*,
queen



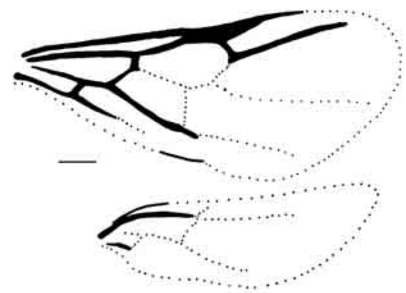
2.105. *S. saevissima*,
male



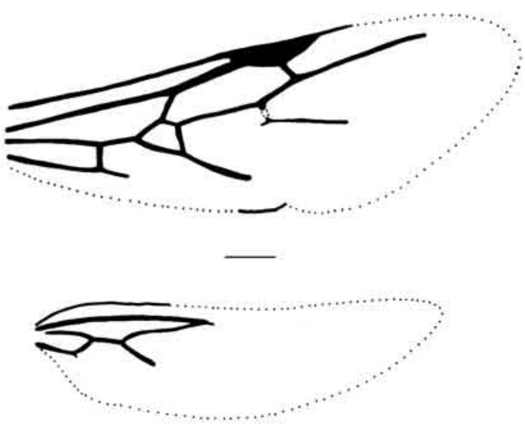
2.106. *S. daguerrei*,
queen



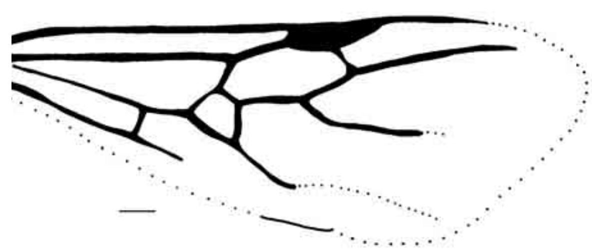
2.107. *S. electra*
queen



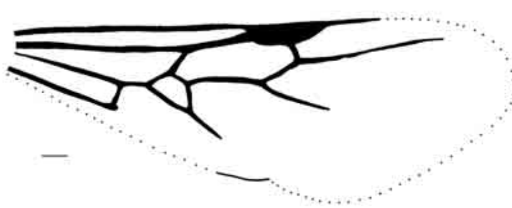
2.108. *S. daguerrei*,
male



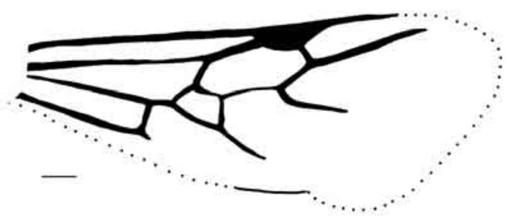
2.109. *S. geminata*,
queen



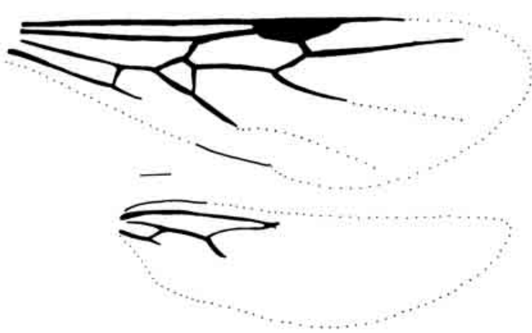
2.110. *S. geminata*,
male



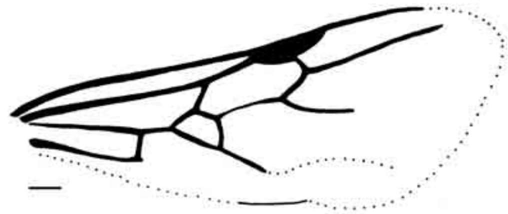
2.111. *S. xyloni*,
queen



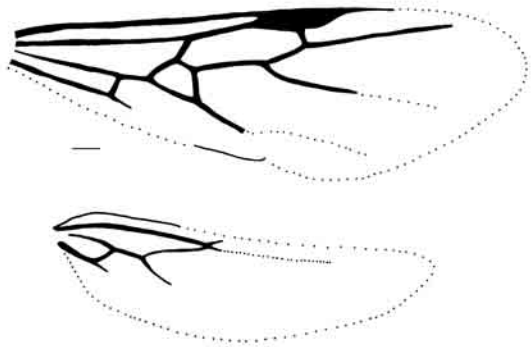
2.112. *S. xyloni*,
male



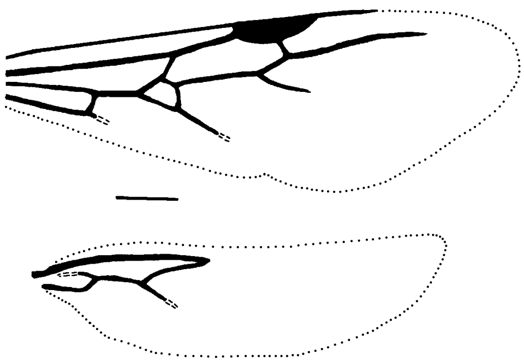
2.113. *S. amblychila*,
queen



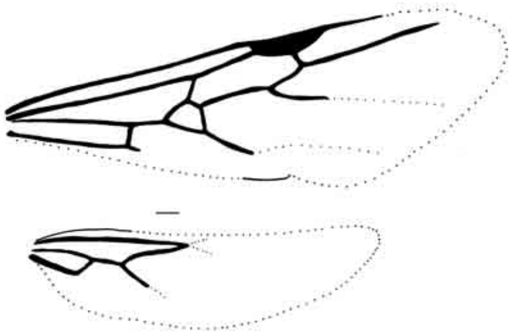
2.114. *S. amblychila*,
male



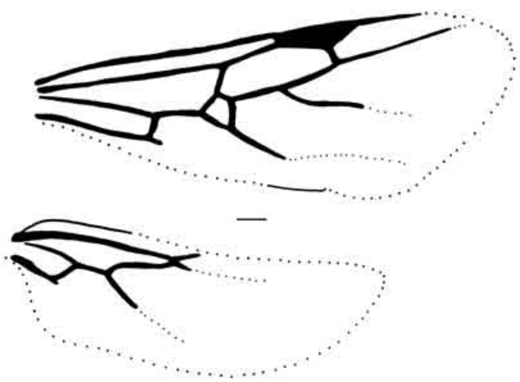
2.115. *S. tridens*,
queen



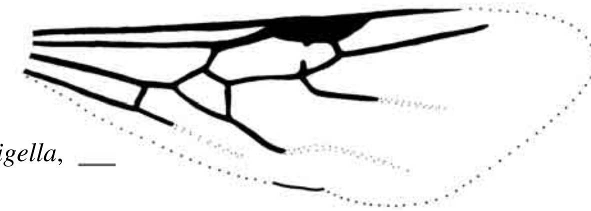
2.116. *S. aurea*,
queen



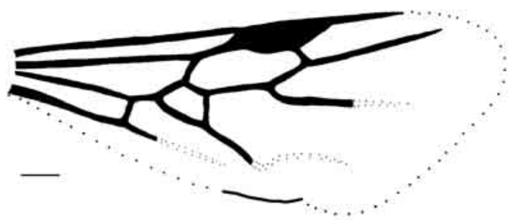
2.117. *S. substituta*,
queen



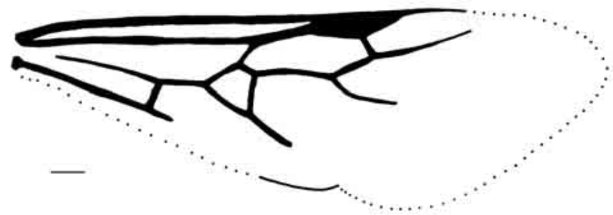
2.118. *S. substituta*,
male



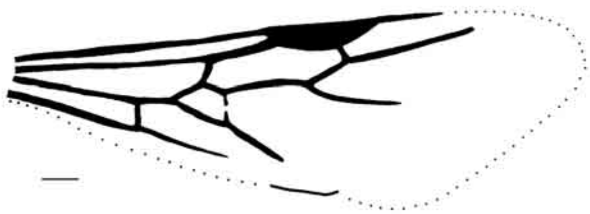
2.119. *S.* nr *nigella*,
queen



2.120. *S.* nr *nigella*,
male

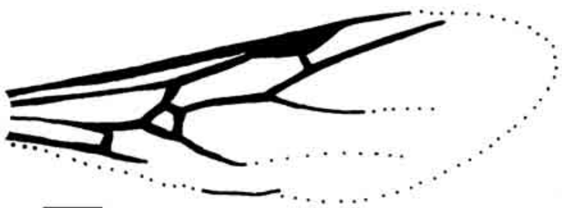


2.121. *S.* sp.,
"thief ant" queen



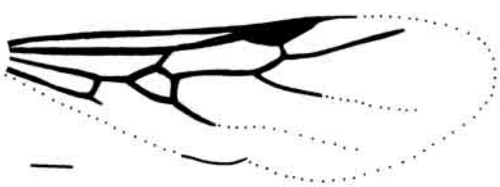
2.122. *S. gensterblumi,*
queen

2.123. *S. globularia littoralis*,
queen

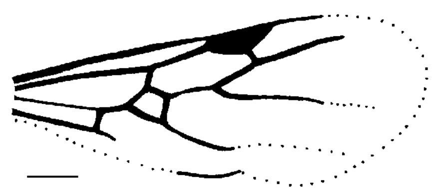


2.124. *S. picta*,
queen

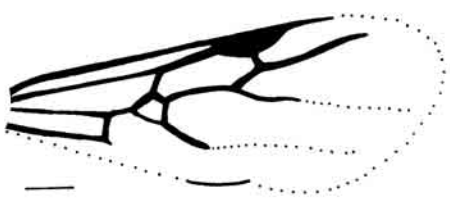
2.125. *S. picta*,
male



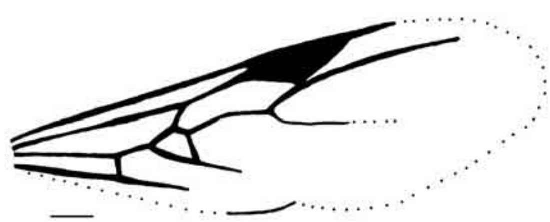
2.126. *S. abdita*,
queen



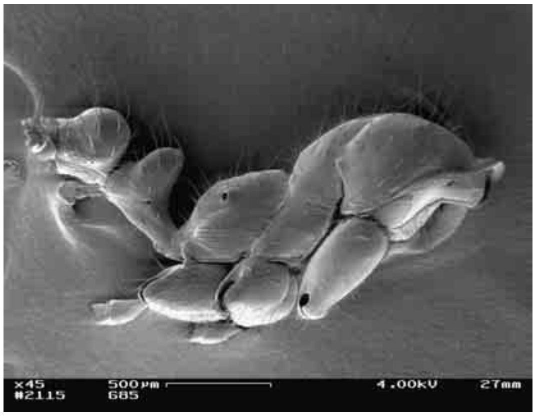
2.127. *S. tennesseensis,*
male



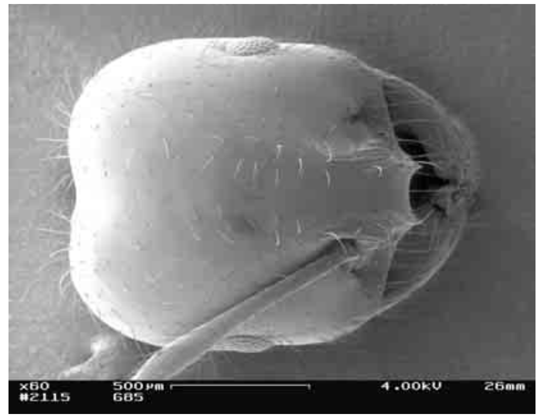
2.128. *S. abdita*,
male



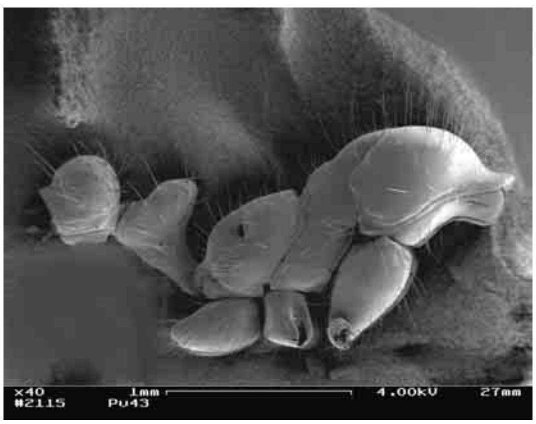
2.129. *S. carolinensis*,
queen




2.130. *S. altipunctata*,
sp. nov



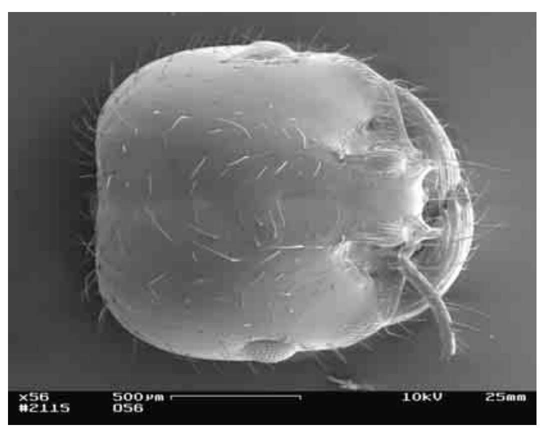

2.131. *S. altipunctata*,
sp. nov.



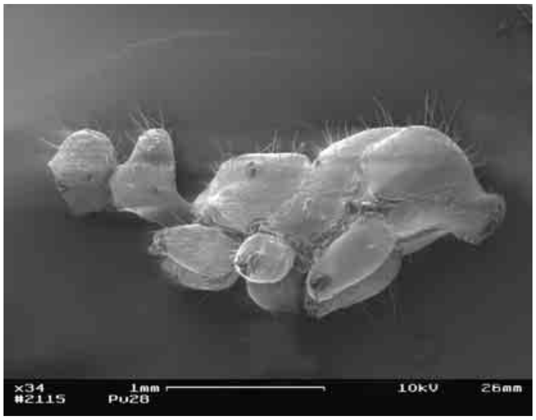

2.132. *S. interrupta,*
Pu43


2.133. *S. interrupta,*
Pu43

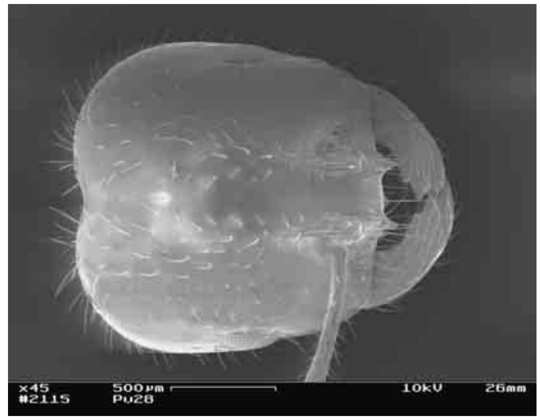

2.134. *S. invicta,*
O56



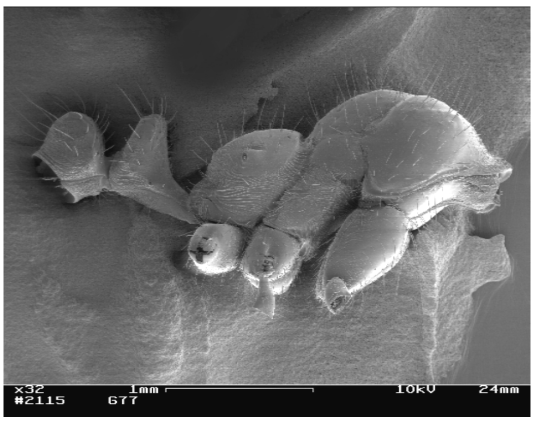

2.135. *S. invicta,*
O56



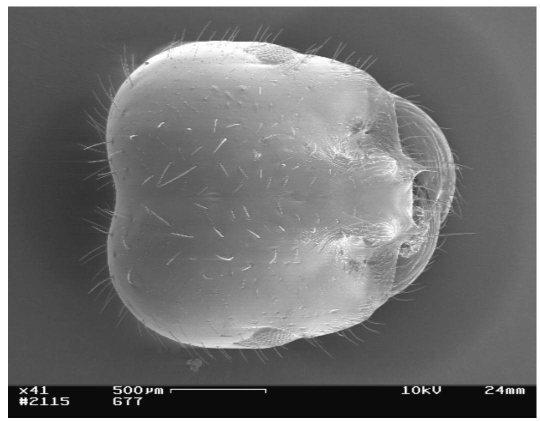

2.136. *S. macdonaghi,*
Pu28



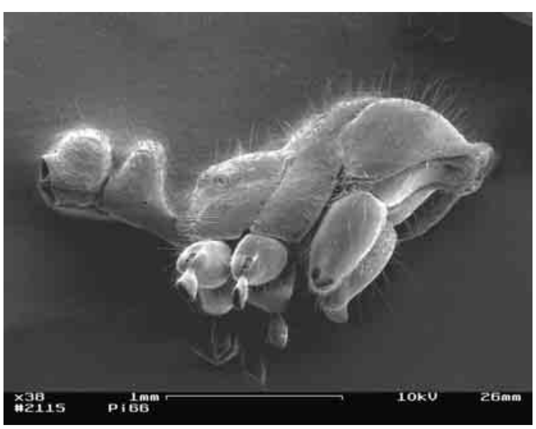

2.137. *S. macdonaghi,*
Pu28




2.138. *S. megergates,*
G77

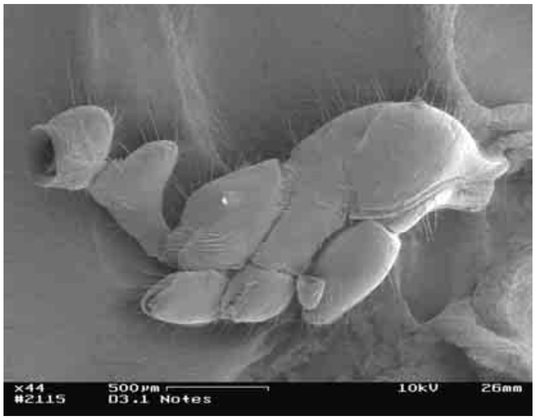



2.139. *S. megergates,*
G77




2.140. *S. pusillignis*,
Pi66


2.141. *S. pusillignis*,
Pi66

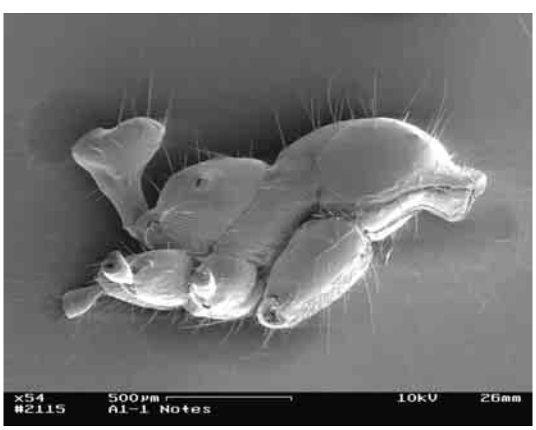



2.142. *S. quinquecuspis,*
Pu46


2.143. *S. quinquecuspis,*
Pu46

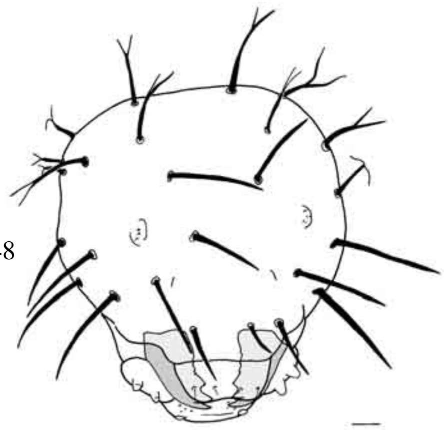

2.144. *S. richteri,*
Pu70


2.145. *S. richteri,*
Pu70




2.146. *S. saevissima,*
O5


2.147. *S. saevissima*,
O5

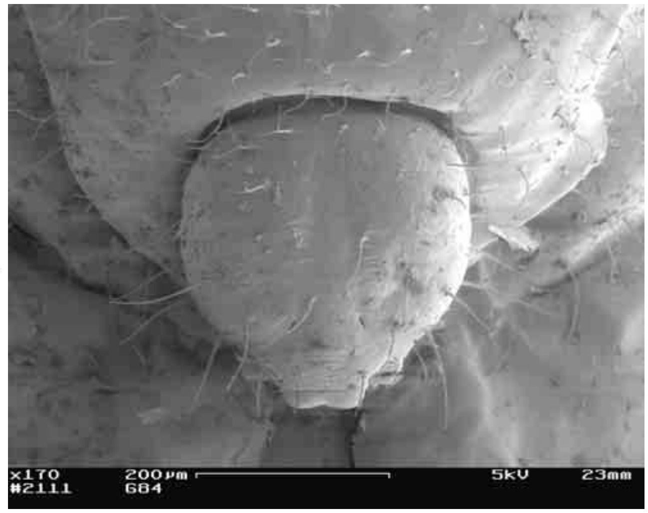


2.148

2.149

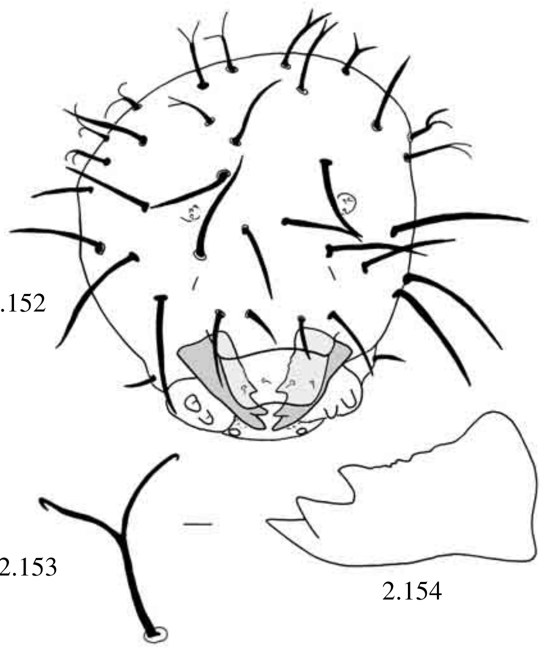
2.150

*S. altipunctata*,
sp. nov.




2.151. *S. altipunctata,* sp. nov.

2.152

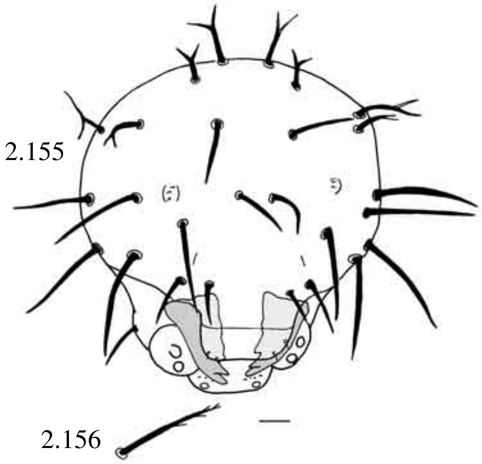


2.153

2.154

*S. interrupta*

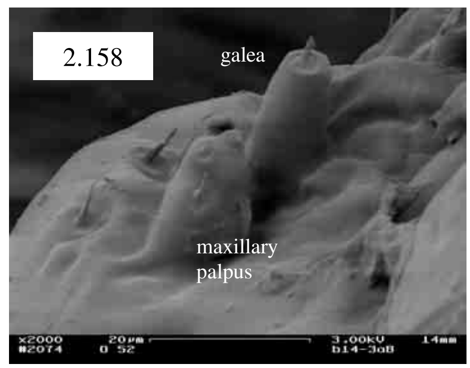
2.155

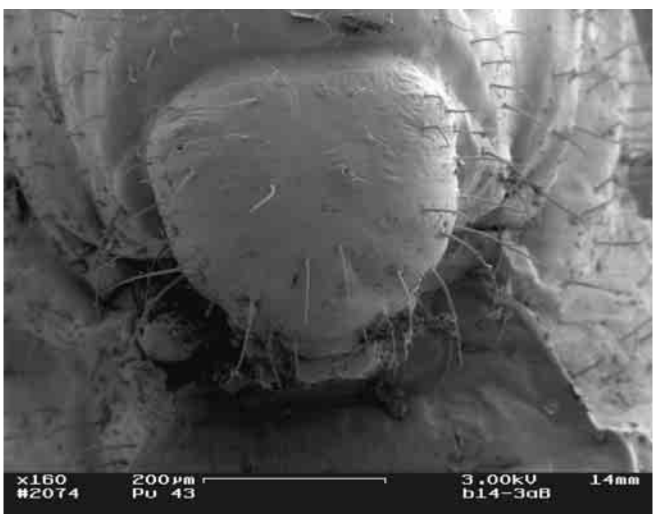


2.156

*S. saevissima*, light form

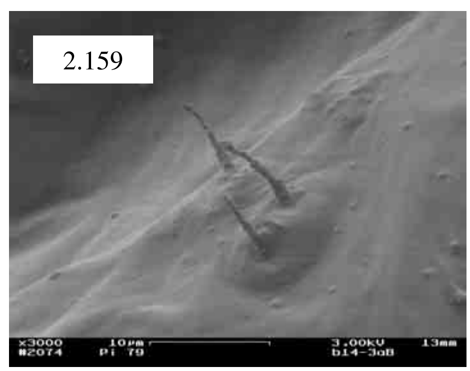
2.158



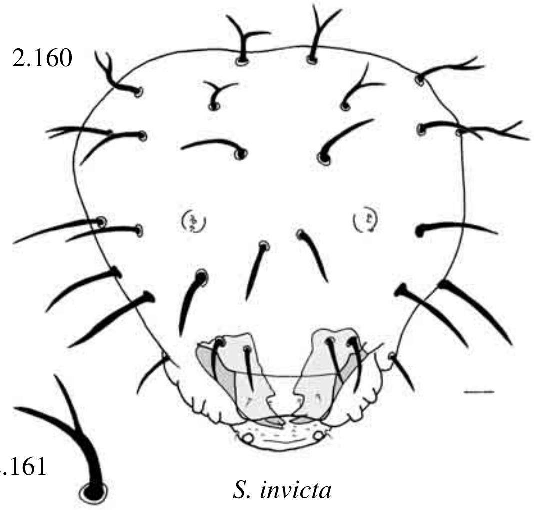




2.157. *S. interrupta*

2.159

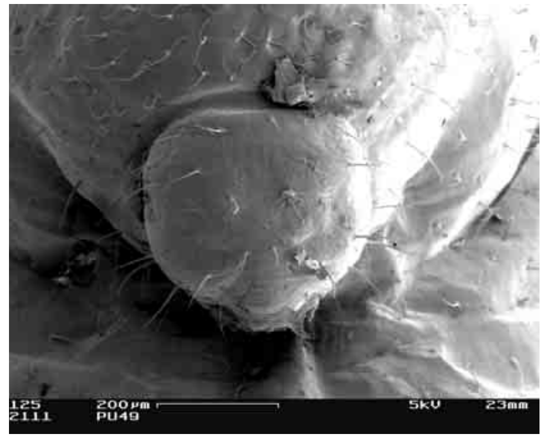


2.160

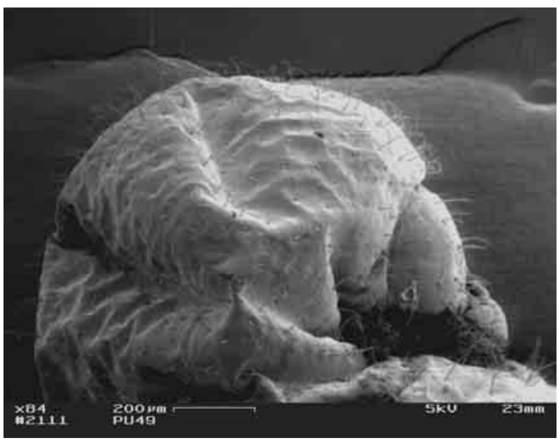


2.161

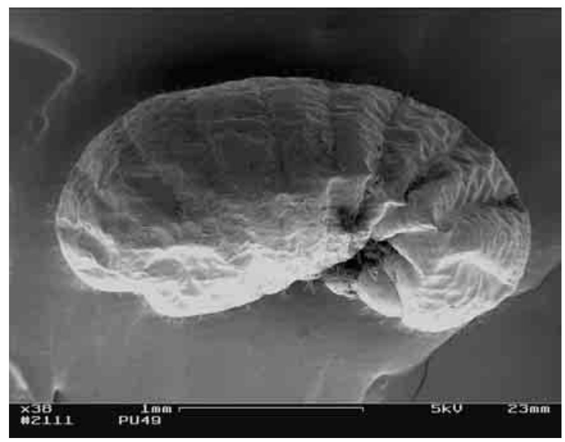
*S. invicta*




2.162. *S. invicta*

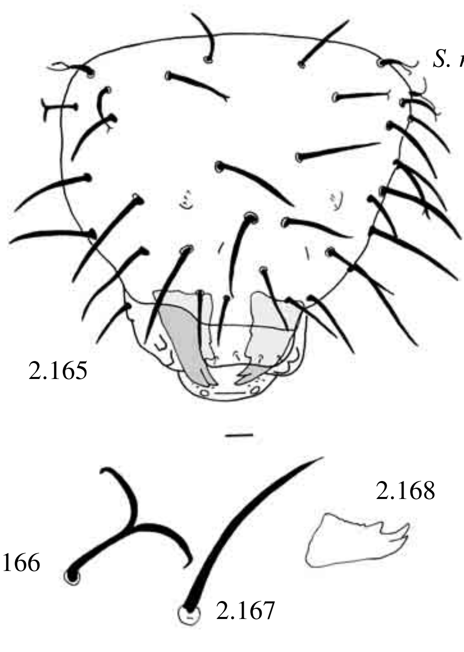



2.163. *S. invicta*




2.164. *S. invicta*

*S. macdonaghi*

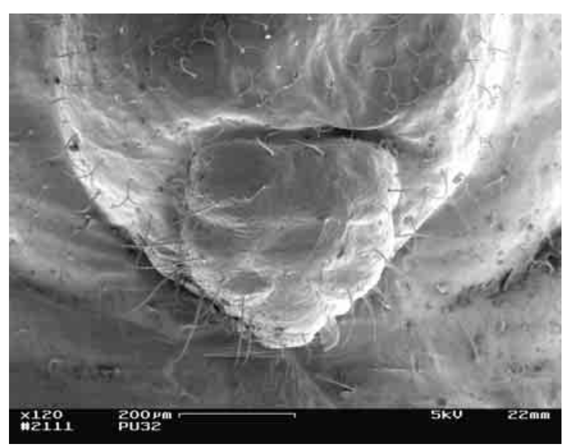


2.165

2.166

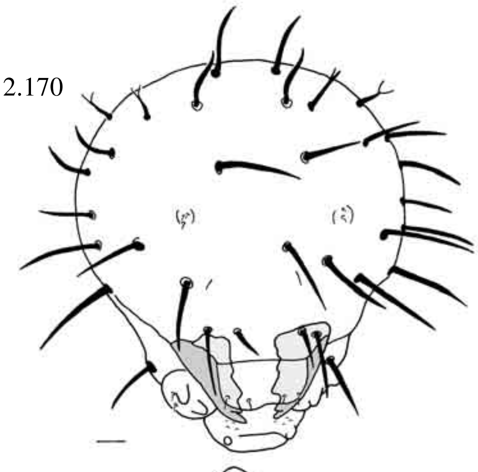
2.167

2.168

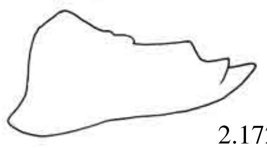



2.169. *S. macdonaghi*

2.170

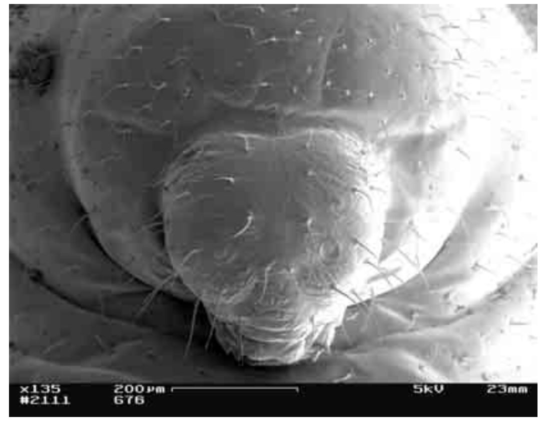


2.171

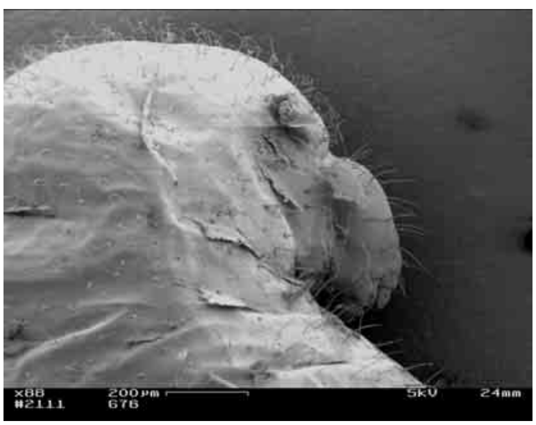


2.172

*S. megergates*

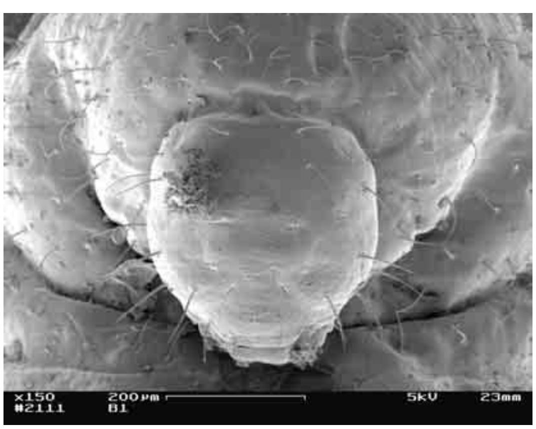



2.173. *S. megergates*

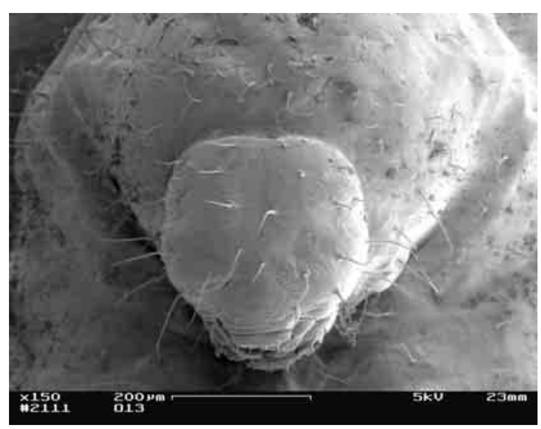



2.174. *S. megergates*


2.175. *S. megergates*

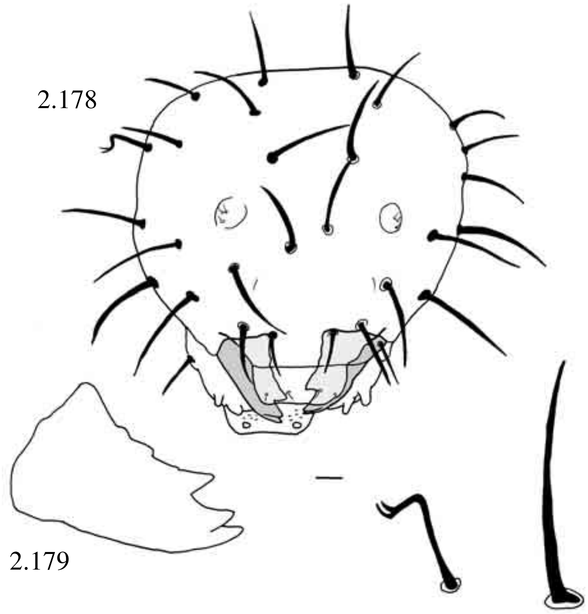



2.176. *S. quinquecuspis*




2.177. *S. saevissima*

2.178

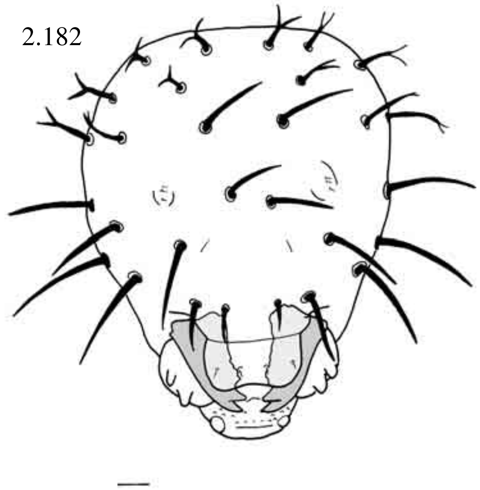


2.179

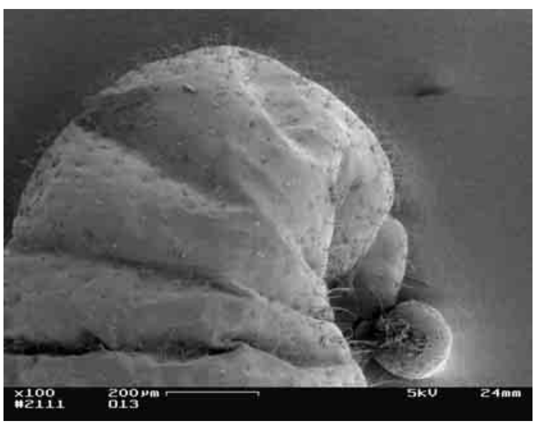
2.180 2.181

*S. quinquecuspis*

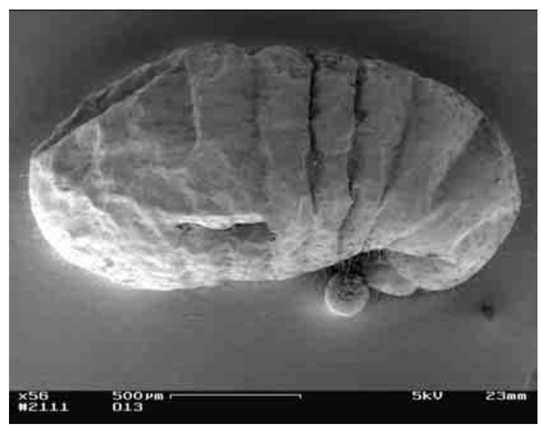
2.182



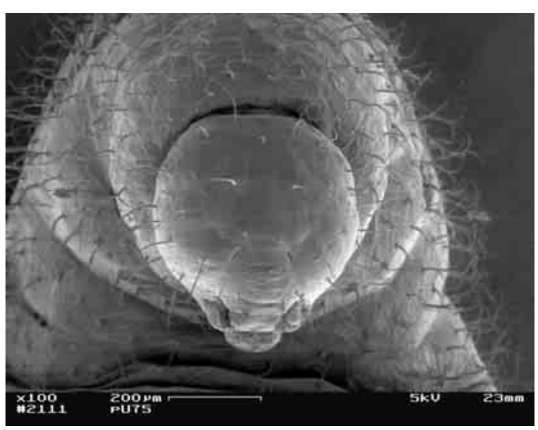
*S. saevissima*



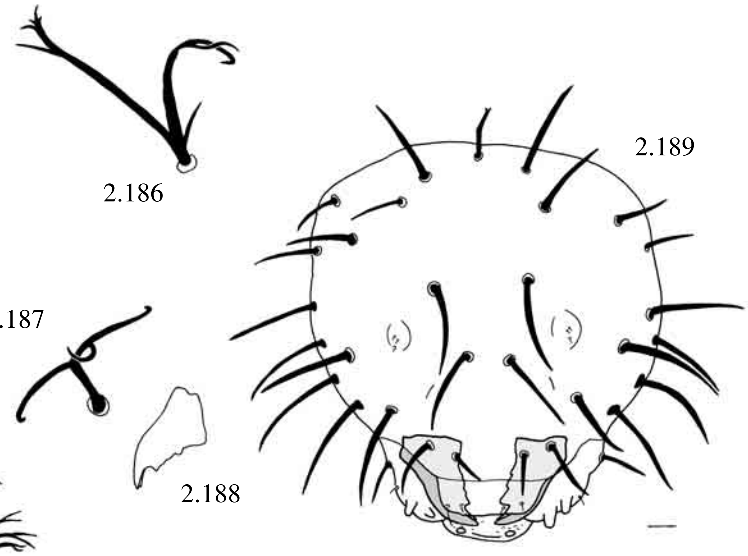

2.183. *S. saevissima*




2.184. *S. saevissima*




2.185. *S. richteri*



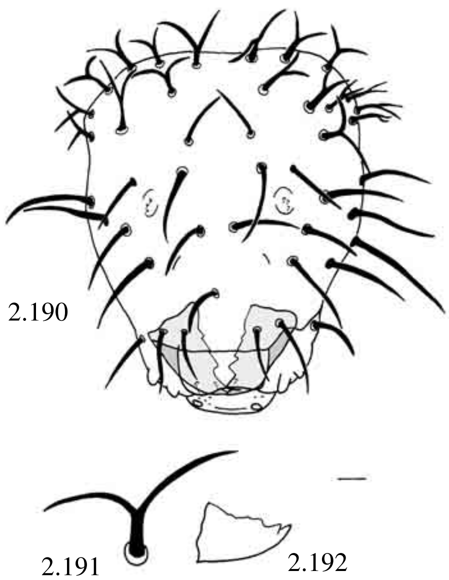
2.186

2.187

2.188

2.189

*S. richteri*

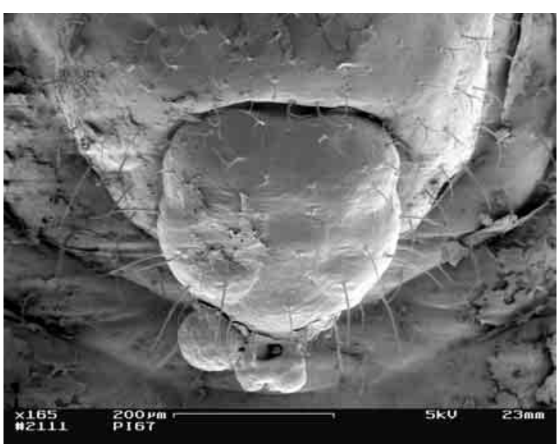


2.190

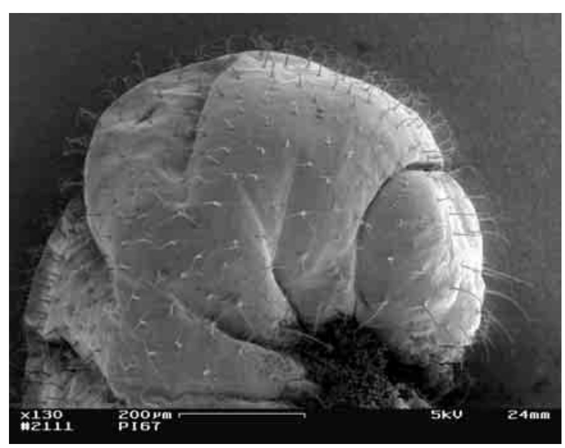
2.191

2.192

*S. pusillignis*

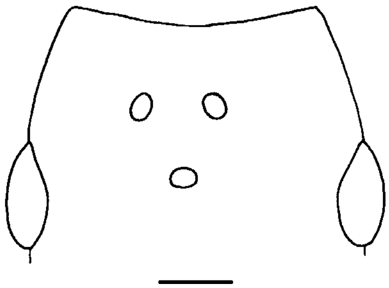



2.193. *S. pusillignis*

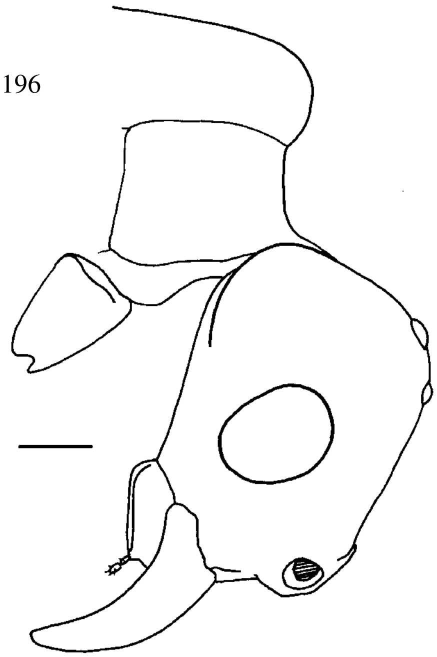



2.194. *S. pusillignis*

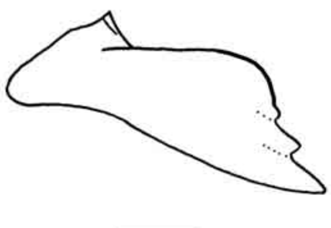
2.195



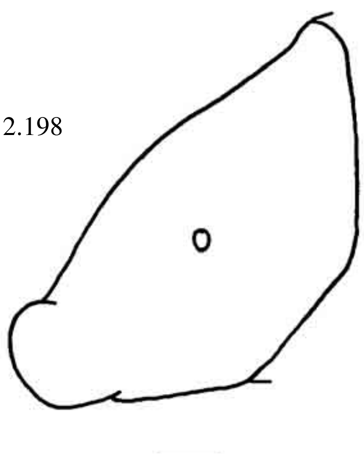
2.196



2.197

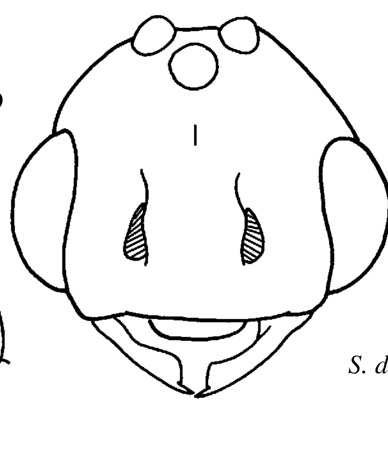


2.198

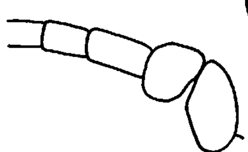


*S. daguerrei,*
queen

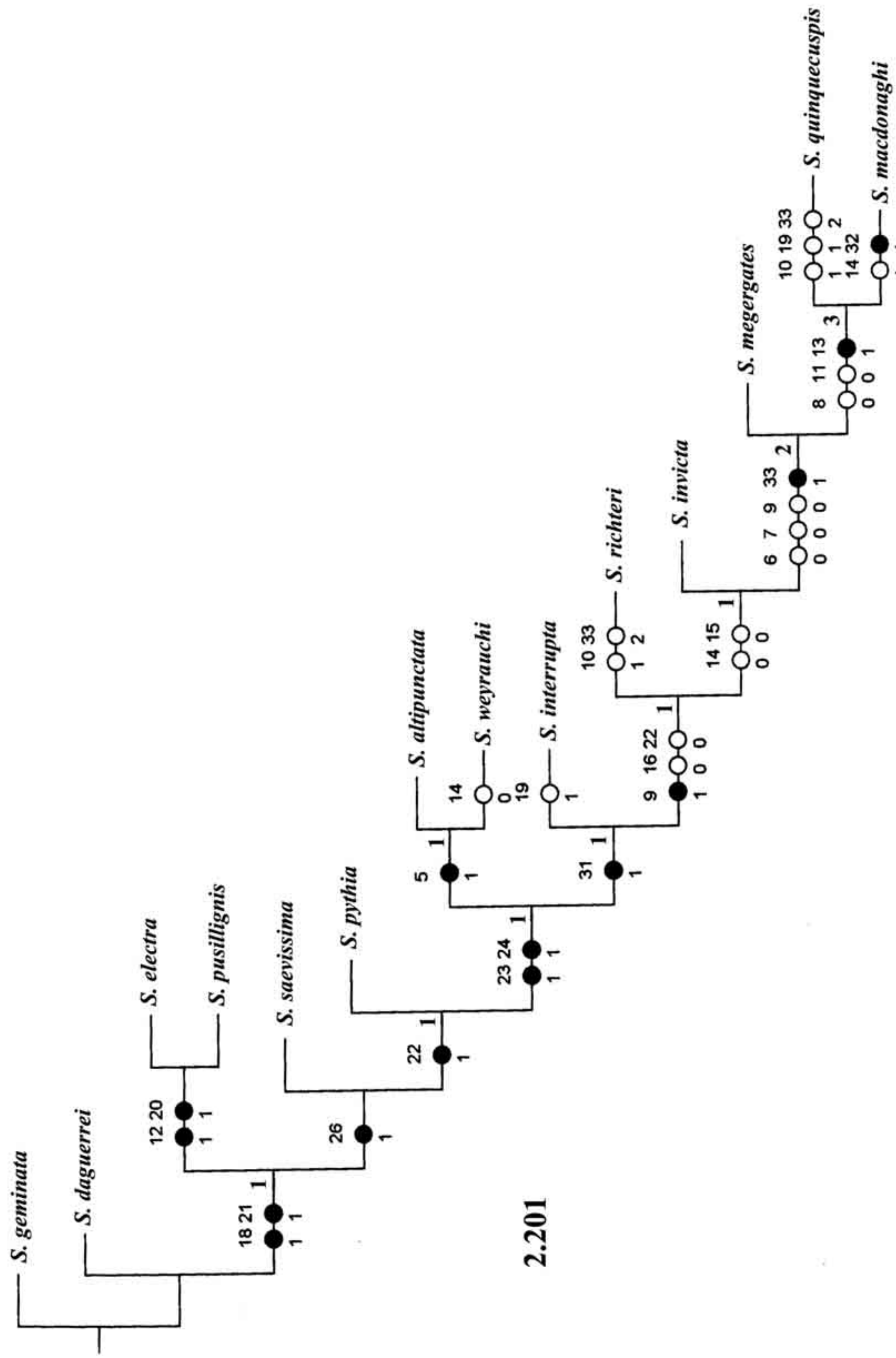
2.199



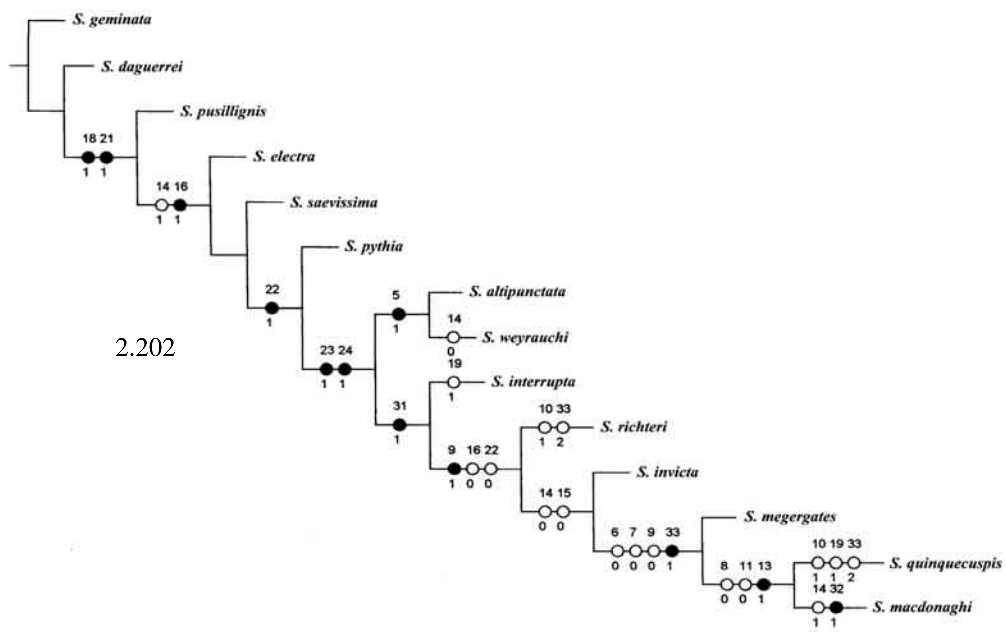
2.200



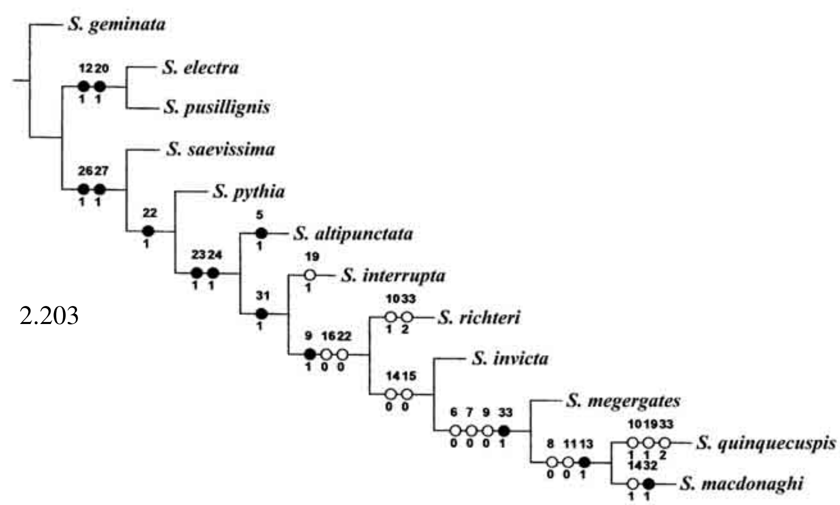
*S. daguerrei,*
male


S. geminata
S. daguerrei
S. electra
S. pusillignis
S. saevissima
S. pythia
S. altipunctata
S. weyrauchi
S. interrupta
S. richteri
S. invicta
S. megergates
S. quinquecuspis
S. macdonaghi

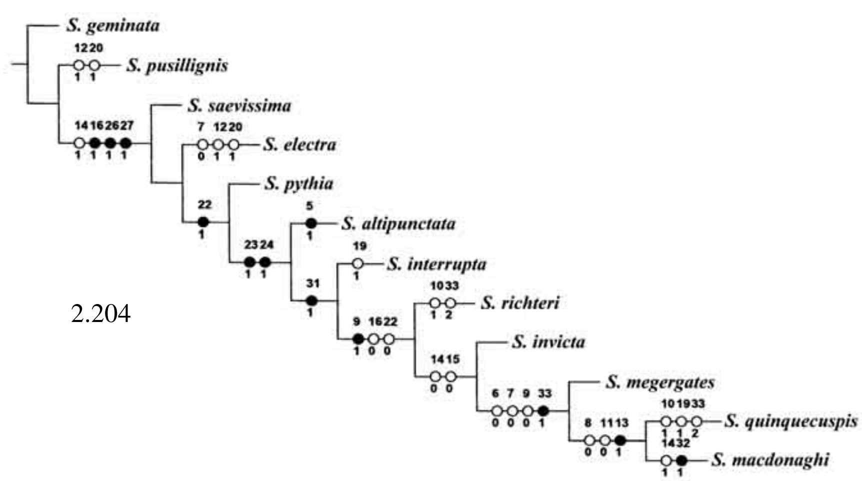
2.201



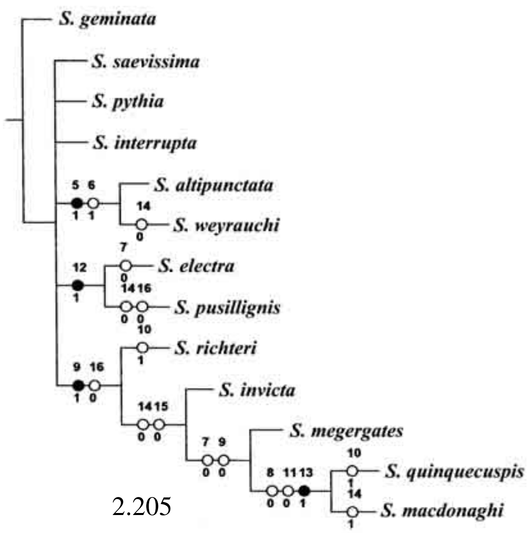

2.202



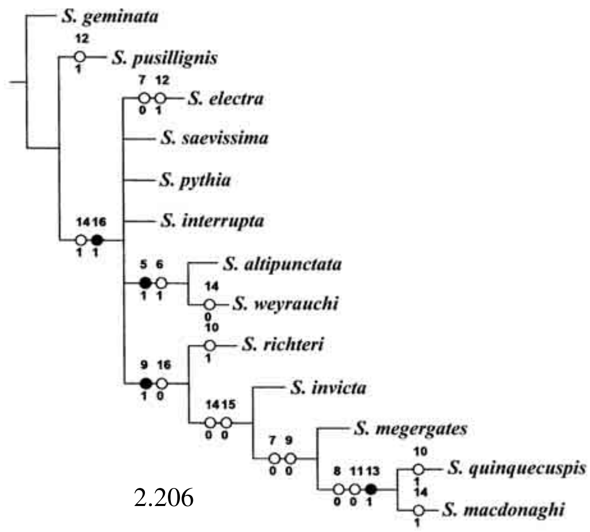

2.203



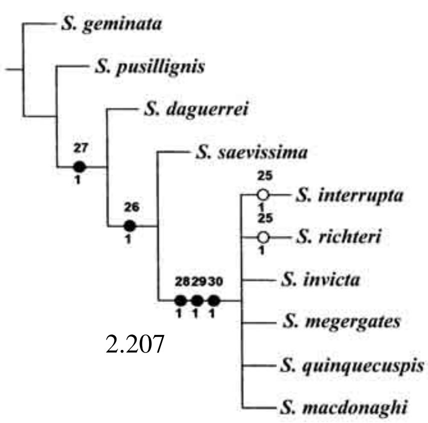

2.204



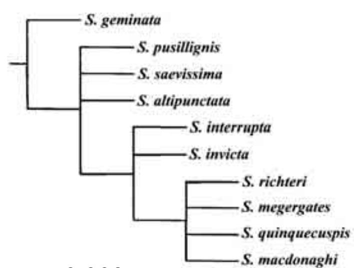

2.205



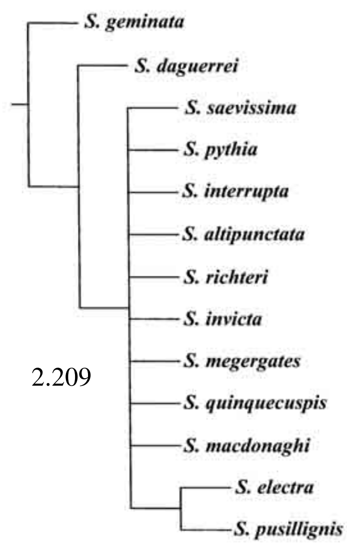

2.206



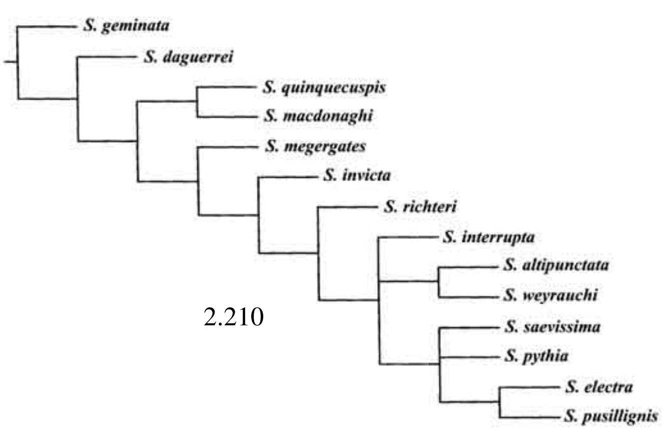

2.207



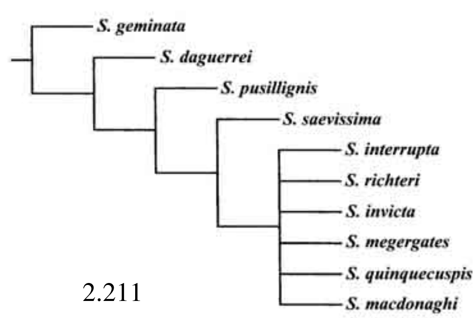

2.208




2.209




2.210




2.211

500 Km
500 Mi.
COLOMBIA
VENEZUELA
GUYANA
SURINAME
FRENCH GUIANA (FRANCE)
ECUADOR
PERU
BRAZIL
BOLIVIA
PARAGUAY
CHILE
ARGENTINA
URUGUAY
FALKLAND ISLANDS (U.K.)
SOUTH GEORGIA ISLAND (U.K.)
S. weyrauchi
S. altipunctata, sp. nov.
S. pythia
S. pusillignis


2.212


Barranquilla
Caracas
Ciudad Guayana
Cucuta
San Cristobal
Medellin
Bogota
Cali
VENEZUELA
Georgetown
GUYANA
Paramaribo
SURINAME
FRENCH GUIANA (FRANCE)
Cayenne
Boa Vista
COLOMBIA
Mitu
Quito
ECUADOR
Guayaquil
Iquitos
Piura
PERU
Trujillo
Lima
Ica
Cusco
Rio Branco
Porto Velho
BRAZIL
Porto Nacional
BOLIVIA
Trinidad
Cuiaba
Brasilia
Goiania
Arequipa
La Paz
Cochabamba
Santa Cruz
Sucre
Belo Horizonte
500 Km
500 Mi.
PARAGUAY
Antofagasta
Asuncion
CHILE
Resistencia
San Miguel de Tucuman
Cordoba
Porto Alegre
Salto
Rosario
URUGUAY
Mendoza
Valparaiso
Santiago
Montevideo
Buenos Aires
ARGENTINA
Concepcion
Mar del Plata
Bahia Blanca
Valdivia
San Carlosde Bariloche
Comodoro Rivadavia
FALKLAND ISLANDS (U.K.)
SOUTH GEORGIA ISLAND (U.K.)
S. saevissima
S. electra

2.213


500 Km
500 Mi.
COLOMBIA
VENEZUELA
GUYANA
SURINAME
FRENCH GUIANA (FRANCE)
ECUADOR
PERU
BRAZIL
BOLIVIA
PARAGUAY
CHILE
ARGENTINA
URUGUAY
FALKLAND ISLANDS (U.K.)
SOUTH GEORGIA ISLAND (U.K.)
S. invicta
S. interrupta

2.214


Barranquilla
Caracas
Ciudad Guayana
Cucuta
San Cristobal
Georgetown
GUYANA
Paramaribo
SURINAME
FRENCH GUIANA (FRANCE)
Cayenne
Medellin
VENEZUELA
Bogota
Cali
Boa Vista
COLOMBIA
Mitu
Macapa
Quito
ECUADOR
Guayaquil
Fonte Boa
Manaus
Santarem
Belem
Iquitos
Sao Luis
Fortaleza
Imperatriz
Teresina
Piura
PERU
Natal
Trujillo
Porto Velho
Rio Branco
Porto Nacional
Recife
BRAZIL
Lima
Aracaju
Cusco
BOLIVIA
Salvador
Ica
Trinidad
Cuiaba
Brasilia
Arequipa
La Paz
Goiania
Cochabamba
Arica
Santa Cruz
Sucre
Belo Horizonte
Vitória
500 Km
500 Mi.
PARAGUAY
Rio de Janeiro
Antofagasta
Sao Paulo
Asuncion
Curitiba
CHILE
San Miguel de Tucuman
Resistencia
Florianopolis
Cordoba
Porto Alegre
Salto
Rosario
Mendoza
URUGUAY
Valparaiso
Montevideo
Santiago
Buenos Aires
ARGENTINA
Concepcion
Mar del Plata
Bahia Blanca
Valdivia
San Carlosde Bariloche
Comodoro Rivadavia
FALKLAND ISLANDS (U.K.)
SOUTH GEORGIA ISLAND (U.K.)
S. daguerrei
S. richteri
S. richteri and S. quinquecuspis

2.215


S. megergates
S. macdonaghi
500 Km
500 Mi.
COLOMBIA
VENEZUELA
GUYANA
SURINAME
FRENCH GUIANA (FRANCE)
ECUADOR
PERU
BRAZIL
BOLIVIA
PARAGUAY
CHILE
ARGENTINA
URUGUAY
FALKLAND ISLANDS (U.K.)
SOUTH GEORGIA ISLAND (U.K.)

2.216

Table 2.1a. Tabular key to the major workers of the *Solenopsis saevissima* species-group

| **Major workers** | *altipunctata* | *electra* | *interrupta* | *invicta* |
|---|---|---|---|---|
| Median frontal streak | present, sometimes faint | absent | most often absent | present |
| Median ocellus | absent | absent, sometimes with pit present lacking lens | absent | absent |
| Head width (Trager 1991) | CI 0.90-0.95 | CI 0.86-0.99 | CI 0.89-1.01 | CI 0.89-1.01 |
| Mandibular costulae | present | present | present | present, obsolescent medially |
| Size of largest workers (Trager 1991) | small, DML < 1.70 mm | usually small, DML < 1.55 mm, northern populations larger (1.70 mm < DML < 2.00 mm) | moderate, DML > 1.75 mm, to 1.90 mm | moderate, DML > 1.75 mm, to 1.90 mm |
| Promesonotal suture | angulate medially | convex | angulate medially | convex |
| Piligerous foveolae of head and mesosomal dorsum | diameter approximately 0.01-0.003 mm | diameter approximately 0.003-0.005 mm | diameter approximately 0.003-0.005 mm | diameter approximately 0.003-0.005 mm |
| Pronotal shape dorsal view | flat to weakly convex medially, pronotum lacking posterorlateral bosses | flat to weakly convex medially, pronotum lacking posterorlateral bosses | flat to weakly convex medially, pronotum lacking posterorlateral bosses | flat to weakly convex medially, pronotum lacking posterorlateral bosses |
| Area posteroventral to propodeal spiracle | glabrous | striato-punctate | glabrous | glabrous |
| Area posterodorsal to propodeal spiracle | glabrous | glabrous | glabrous | glabrous |
| Postpetiole sculpture | sculpture present on lower 1/4; upper 3/4 nitid | sculpture present on lower 0.66; upper 0.33 nitid | sculpture present on lower 1/2 or more; dorsum nitid | sculpture present on lower 0.66 or more; dorsum nitid |
| Postpetiole shape (as seen from behind) | height equal to or greater than width | height equal to or greater than width | height equal to or greater than width | width much greater than heigth |
| Coloration | ranging from yellow orange with brown metasoma and with T1-T4 lighter anteriorly to brown red dorsally with ventral portion of head and legs orange, and T1 with apical margin orange; some specimens with darker medial portions of leg segments | color of head, legs, antennae generally red yellow; mesosoma and gaster dark brown; T1 yellow anteriorly | color generally red yellow to brown yellow, with head and mesosoma dorsum darker; gaster dark brown; T1 with maculation red yellow to brown yellow | color generally with head and mesosoma from yellow red to dark red brown, gaster brown, T1 with maculation yellow red to concolorous with surrounding integument |
| Distribution | Fig. 2.212 | Fig. 2.213 | Fig. 2.214 | Fig. 2.214 |

Table 2.1b. Tabular key to the major workers of the *Solenopsis saevissima* species-group

| **Major workers** | *macdonaghi* | *megergates* | *pusillignis* | *pythia* |
|---|---|---|---|---|
| Median frontal streak | absent | absent | absent | most often absent |
| Median ocellus | usually present | present | absent | absent |
| Head width (Trager 1991) | CI 0.90-1.02 | CI 0.87-1.06 | CI 0.85-0.98 | CI 0.87-0.96 |
| Mandibular costulae | absent | present, less often absent | present | present |
| Size of largest workers (Trager 1991) | large, DML > 1.75 mm, to 2.21 mm | large, DML > 1.75 mm, to 2.33 mm | small, DML < 1.81 mm | very small, DML < 1.47 mm |
| Promesonotal suture | angulate medially | angulate medially | convex | convex |
| Piligerous foveolae of head and mesosomal dorsum | diameter approximately 0.01 mm, sometimes elongate | diameter approximately 0.01 mm, circular | diameter approximately 0.005-0.008 mm | diameter approximately 0.01 mm |
| Pronotal shape dorsal view | flat to weakly convex medially, pronotum lacking posterorlateral bosses | flat to weakly convex medially, pronotum lacking posterorlateral bosses | flat to weakly convex medially, pronotum lacking posterorlateral bosses | flat to weakly convex medially, pronotum lacking posterorlateral bosses |
| Area posteroventral to propodeal spiracle | glabrous | glabrous | striato-punctate | glabrous |
| Area posterodorsal to propodeal spiracle | glabrous | glabrous | striato-punctate | glabrous |
| Postpetiole sculpture | sculpture present on lower 1/2, obsolecent laterally; densely punctate throughout | sculpture present on lower 3/4 | sculpture present on throughout | sculpture present on lower 0.33 to 1/2 |
| Postpetiole shape (as seen from behind) | width much greater than heigth | width much greater than heigth | height equal to or greater than width | height equal to or greater than width |
| Coloration | color generally red yellow to brown yellow, gaster dark brown, T1 with red yellow to brown yellow maculation | color of head, mesosoma, legs and T1 maculation red brown; color of metasoma excluding maculation dark brown | color generally brown yellow to darker yellow brown with brown gaster | color generally orange brown, with frons, clypeus and venter yellow brown |
| Distribution | Fig. 2.216 | Fig. 2.216 | Fig. 2.212 | Fig. 2.212 |

Table 2.1c. Tabular key to the major workers of the *Solenopsis saevissima* species-group

| **Major workers** | *quinquecuspis* | *richteri* | *saevissima* | *weyrauchi* |
|---|---|---|---|---|
| Median frontal streak | present, sometimes faint | present | absent | present |
| Median ocellus | present | absent | absent | absent |
| Head width (Trager 1991) | CI 0.89-1.01 | CI 0.82-0.96 | CI 0.83-0.96 | CI 0.85-0.92 |
| Mandibular costulae | present, sometimes absent | present, obsolescent medially | present | present |
| Size of largest workers (Trager 1991) | large, DML > 1.75 mm, to 2.12 mm | small, DML < 1.84 mm | small, DML < 1.83 mm | small, DML < 1.67 mm |
| Promesonotal suture | angulate medially | convex | convex | convex |
| Piligerous foveolae of head and mesosomal dorsum | diameter approximately 0.01 mm, sometimes elongate | diameter approximately 0.003-0.008 mm | diameter approximately 0.003-0.005 mm | diameter approximately 0.005-0.01 mm |
| Pronotal shape dorsal view | flat to weakly concave medially, pronotum usually with posterorlateral bosses | convcave medially, posterorlateral margins appear quadrate due to pronotal bosses | flat or convex medially, pronotum lacking posterorlateral bosses | flat or convex medially, pronotum lacking posterorlateral bosses |
| Area posteroventral to propodeal spiracle | glabrous | glabrous | glabrous | glabrous |
| Area posterodorsal to propodeal spiracle | glabrous | glabrous | glabrous | glabrous |
| Postpetiole sculpture | sculpture present on lower 3/4 or more; dorsum rarely nitid | sculpture present on lower 0.33 to 1/2 | sculpture present on lower 0.33 to 1/2 | sculpture present on lower 1/2 to 3/4 |
| Postpetiole shape (as seen from behind) | width much greater than heigth | height equal to or greater than width | height equal to or greater than width | height equal to or greater than width |
| Coloration | color generally with head, mesosoma, and petiole medially brown to dark brown; gaster dark brown; frons, clypeus, and T1 maculation brown orange | color generally black with mandibles, clypeus laterally, antennal fossae, mesosomal sutures, and T1 maculations dark brown to yellow brown | color generally red brown to dark brown | color of head, mesonotum and T1 maculation red yellow; remainder of gaster black brown; propodeum and dorsum of petiolar nodes yellow brown; sometimes rear portion of head, frons around median streak, and pronotum yellow brown; T1 maculations with 2 small anterolateral brown spots |
| Distribution | Fig. 2.215 | Fig. 2.215 | Fig. 2.213 | Fig. 2.212 |

Table 2.2a. Tabular key to the queens of the *Solenopsis saevissima* species-group

| **Queens** | *altipunctata* | *electra* | *interrupta* | *invicta* |
|---|---|---|---|---|
| Median frontal streak | absent | absent | present | absent, sometimes present |
| CI | 1.2 | 0.90-1.00 | 1.14-1.15 | 0.95-1.15 |
| OI | 2.72 | 2.01-2.13 | 2.22-2.26 | 2.10-2.25 |
| OOI | 0.85 | 0.60-0.75 | 1.30-1.47 | 1.55-1.75 |
| Mandibular costulae | 7-8 coarse, distinct costulae present throughout | 5-8 coarse, distinct costulae present throughout | 6-8 coarse, distinct costulae present throughout | lower 0.75 finely striate, granulate throughout |
| Head sculpture | piligerous foveolae large, width 0.01-0.03 mm | piligerous foveolae small, sparse, width <0.01 mm | piligerous foveolae moderate to small, sparse, width 0.01-0.025 mm on head | piligerous foveolae small, sparse, width <0.01 mm |
| Mesonotal maculations | Maculations present anteromesally and around parapsidal lines | absent | maculations present anteromesally and around parapsidal lines | maculations often present anteromesally and around parapsidal lines |
| DML | 2.34-2.51 mm | 2.15-2.31 mm | 2.49-2.62 mm | 2.42-2.73 mm |
| Postpetiole sculpture | lower 0.25 of posterior face of postpetiole granulate to striato-granulate, upper 0.75 of surface polished | lower 0.50 with fine striae, dorsum polished | posterior surface with middle 0.50 striate (with 7-10 striae), finely granulate, lower 0.25 coarsely granulate | 9-11 fine, distinct, costulae, sometimes costulae obsolescent mesally |
| T1 maculations | 0.25 base orange blending to dark brown apically | T1 with basal 0.50 yellow, remaining segments yellow anterolaterally | present, sometimes with posterior margin of orange maculation of T1 distinct | bases of T1 and S1 are somewhat orange blending to brown apically. |
| Coloration | brown orange, dorsal transverse band on pronotum and mesopleuron dark brown; metasoma dark brown, except petiole ventrally, and T1 and S1 0.25 base orange blending to dark brown apically; leg segments orange, brown mesally; sometimes T1 base completely dark brown | color yellow with gaster red brown; T1 with basal 0.50 yellow, remaining segments yellow anterolaterally | two color varieties: 1) dark form brown with katepisternum, metasoma and mesally on legs dark brown; light form orange to yellow orange, except vertex and T2-4, T1 laterally and apically and sternites apically dark brown; 2) light form with posterior margin of orange maculation of T1 distinct; both color forms with dark brown maculations anteriorly on pronotum, sometimes on median area of axillae, anteromedian and triangular posteromedian area of scutellum, mesally on anepisternum, and mesally and laterally on propodeum | color varies from red brown with dorsum of head, dorsum of thorax, and katepisternum of mesopleuron to brown red; gaster brown; sometimes on lighter colored individuals, bases of T1 and S1 are somewhat orange blending to brown apically |
| Distribution | Fig. 2.212 | Fig. 2.213 | Fig. 2.214 | Fig. 2.214 |

Table 2.2b. Tabular key to the queens of the *Solenopsis saevissima* species-group

| **Queens** | *macdonaghi* | *megergates* | *pusillignis* | *pythia* |
|---|---|---|---|---|
| Median frontal streak | absent | absent, less often present | absent | absent |
| CI | 1.06-1.16 | 1.12-1.20 | 1.05 | 1.26-1.30 |
| OI | 2.22-2.38 | 2.34-2.40 | 2.91 | 1.72-1.75 |
| OOI | 1.78-1.82 | 1.29-1.67 | 0.73 | 1.40-1.45 |
| Mandibular costulae | 10-12 fine, distinct costulae present throughout | 5-7 coarse, distinct costulae present obsolescent mesally | 9-11 fine, distinct costulae present throughout | several coarse, distinct costulae present throughout |
| Head sculpture | piligerous foveolae small, sparse, width <0.01 mm | piligerous foveolae moderate, width 0.005-0.025 mm | piligerous foveolae small, sparse, width <0.01 mm | piligerous foveolae large, conspicuous, width 0.010-0.020 mm |
| Mesonotal maculations | maculations absent on parapsidal lines, sometimes present anteromesally | maculations present on anteromesally and on parapsidal lines, usually black to dark brown, sometimes only slightly discernable from surrounding integument | absent | present |
| DML | 2.48-2.84 mm | 2.51-2.82 mm | 2.20 mm | 2.28-2.44 mm |
| Postpetiole sculpture | striations on lower 0.75 of surface somewhat coarser, 7-9 striae, finely granulate, dorsum polished (Fig. 2.41) | lower 0.50 with 12-16 striations, dorsum finely granulate to polished | lower 0.50- 0.75 finely striate, lower 0.75 granulate, dorsum polished (Fig. 2.45) | striato-rugulose throughout, sometimes extreme dorsum glabrous |
| T1 maculations | basal orange of T1 blends evenly to brown apically | absent | absent | basal orange of T1 blends evenly to brown apically |
| Coloration | color orange to dark orange, legs orange to yellow orange, T1-T4 brown laterally and apically; basal orange of T1 blends evenly to brown apically | color varies from red brown to brown orange; ocellar triangle sometimes darkly pigmented legs sometimes lighter than body, yellow brown, usually red brown | color orange with mandibles and antennae orange brown; apical and lateral margins of metasoma segments 3-6 brown | color yellow orange with medial area of mesonotum, parapsidal lines, lateral margins of T1 and preapical transverse areas on gaster segments brown |
| Distribution | Fig. 2.216 | Fig. 2.216 | Fig. 2.212 | Fig. 2.212 |

Table 2.2c. Tabular key to the queens of the *Solenopsis saevissima* species-group

| **Queens** | *quinquecuspis* | *richteri* | *saevissima* | *weyrauchi* |
|---|---|---|---|---|
| Median streak | present | absent | absent | ? |
| CI | 1.08-1.14 | 1.11-1.14 | 1.12-1.34 | ? |
| OI | 2.30-2.50 | 2.63-2.83 | 1.98-2.18 | ? |
| OOI | 1.12-1.20 | 0.80-1.00 | 0.86-1.55 | ? |
| Mandibular costulae | 10-12 fine costulae, present throughout | several coarse, distinct costulae, obsolescent mesally | 9-11 fine, distinct costulae present throughout. | ? |
| Head sculpture | piligerous foveolae small, sparse, width <0.01 mm | piligerous foveolae small, sparse, width <0.01 mm | piligerous foveolae small, sparse, width <0.01 mm | ? |
| Mesonotal maculations | present | present | absent | ? |
| DML | 2.50-2.70 mm | 2.46-2.73 mm | 2.53-2.81 mm | ? |
| Postpetiole sculpture | median striae of postpetiole appear obsolescent laterally, normally 11-13 striae present (Fig. 2.43) | with 0.75 of lower surface finely striate, 12-14 striae present, median striae sometimes obsolescent laterally | with 0.75 of lower surface with coarse striae, 4-7 striae present, median striae weak to obsolescent laterally, dorsum polished | ? |
| T1 maculations | dark brown; T1 orange on basal 0.50 of disk, blending to red brown apically | present, sometimes with posterior margin of orange maculation of T1 distinct | sometimes T1 orange on basal 0.50 of disk, blending to brown apically | ? |
| Coloration | color red brown, venter of head, frons and coxae orange yellow; gaster dark brown; T1 orange on basal 0.50 of disk, blending to red brown apically; S1 orange anteriorly, sometimes gaster orange anteriorly | two color forms exist: 1) dark form is dark brown except scapes black, flagellum brown to orange, both T1 and S1 with medial orange maculation, other sternites brown with dark brown apices, and petiole sometimes orange with dark brown dorsum; maculations on T1 and S1 are well defined laterally and apically; 2) Light form is orange with vertex, around compound eyes, T1 apically, and remaining tergites preapically brown; both forms have with dark brown maculations anteriorly on pronotum, sometimes on median area of axillae, anteromedian and triangular posteromedian area of scutellum, mesally on anepisternum, and mesally and laterally on propodeum | color varies from dark brown with front of head, mesonotum laterally, mandibles, mesosternum, gaster segments apically, and appendages paler to pale yellow with vertex, interior margins of ocelli, medial area of mesonotum, parapsidal lines, lateral margins of T1 and preapical transverse areas on metasomal segments brown | ? |
| Distribution | Fig. 2.215 | Fig. 2.216 | Fig. 2.213 | Fig. 2.212 |

Table 2.3a. Tabular key to the males of the *Solenopsis saevissima* species-group

| **Males** | *altipunctata* | *electra* | *interrupta* | *invicta* |
|---|---|---|---|---|
| OOI | ? | ? | 1.44-1.58 | 2.40-2.45 |
| DML | ? | ? | 2.30-2.51 mm | 2.27-2.64 mm |
| Head sculpture | ? | ? | sometimes shagreened | sometimes shagreened |
| Gena sculpture | ? | ? | granulate | coarsely rugose to coarsely striato-granulate |
| Mesonotal pubescence | ? | ? | dense | dense |
| Postpetiole spiracle | ? | ? | weakly to not tuberculate | sometimes tuberculate, often not |
| Mandibular color | ? | ? | brown | brown, sometimes yellow |
| Body coloration | ? | ? | color red brown to dark brown | color red brown to black with antenna completely yellow, sometimes scape and pedicel of antennae brown |
| Distribution | Fig. 2.212 | Fig. 2.213 | Fig. 2.214 | Fig. 2.214 |

Table 2.3b. Tabular key to the males of the *Solenopsis saevissima* species-group

| **Males** | *macdonaghi* | *megergates* | *pusillignis* | *pythia* |
|---|---|---|---|---|
| OOI | 1.85-2.70 | 2.16-2.26 | 0.80-1.26 | ? |
| DML | 2.28-2.80 mm | 2.35-2.44 m | 2.15-2.30 mm | ? |
| Head sculpture | never shagreened | never shagreened | never shagreened | ? |
| Gena sculpture | coarsely granulate, less often rugose anterior to occipital carina, never rugose throughout | striato-granulate | smooth to weakly granulate | ? |
| Mesonotal pubescence | dense | dense | sparse | ? |
| Postpetiole spiracle | distinctly tuberculate to not tuberculate | postpetiolar spiracles distinctly tuberculate to not tuberculate | distinctly tuberculate to not tuberculate | ? |
| Mandibular color | brown, sometimes yellow | brown | yellow | ? |
| Body coloration | color red brown to black, antennae and legs yellow brown | color red brown to brown, antennae and legs brown yellow | head and gaster red brown; clypeus, mandibles, petiole and postpetiole lighter; antennae and legs yellow; mesosoma yellow to brown with median longitudinal stripe, area around parapsidal lines and scutellum red brown; sometimes mesosoma yellow and parapsidal lines only slightly darker than surround integument | ? |
| Distribution | Fig. 2.216 | Fig. 2.216 | Fig. 2.212 | Fig. 2.212 |

Table 2.3c. Tabular key to the males of the *Solenopsis saevissima* species-group

| **Males** | *quinquecuspis* | *richteri* | *saevissima* | *weyrauchi* |
|---|---|---|---|---|
| OOI | 1.50-2.45 | 1.00-1.33 | 2.50-3.50 | ? |
| DML | 2.36-2.53 mm | 2.40-2.62 mm | 2.10-2.82 mm | ? |
| Head sculpture | never shagreened | never shagreened | never shagreened | ? |
| Gena sculpture | weakly granulate, sometimes striato-granulate | granulate, sometimes weakly striato-granulate | weakly striate | |
| Mesonotal pubescence | dense | dense | sparse | ? |
| Postpetiole spiracle | distinctly tuberculate | distinctly tuberculate to not tuberculate, sometimes tubercle height greater than 1.5X base width, glabrous | distinctly tuberculate to not tuberculate | |
| Mandibular color | brown | brown | yellow | ? |
| Body coloration | color dark brown to black, legs brown | color red brown to black, antennae and legs yellow brown | color red brown to yellow brown, antennae and legs pale yellow | ? |
| Distribution | Fig. 2.215 | Fig. 2.215 | Fig. 2.213 | Fig. 2.212 |

Table 2.4. New Classification of the *Solenopsis geminata* species-group of Trager (1991)

| New Classification | | Trager (1991) | | |
|---|---|---|---|---|
| *S. tenuis* species-group[2] | | *S. virulens* complex | | |
| | *S. virulens* | | | *S. virulens* |
| *S. tridens* species-group | | *S. tridens* complex | | |
| | *S. substituta* | | | *S. substituta* |
| | *S. tridens* | | | *S. tridens* |
| *S. geminata* species-group | | *S. geminata* complex | | |
| | | | *S. geminata* subcomplex | |
| | *S. geminata* | | | *S. geminata* |
| | | | *S. xyloni* subcomplex | |
| | *S. amblychila* | | | *S. amblychila* |
| | *S. aurea* | | | *S. aurea* |
| | *S. xyloni* | | | *S. xyloni* |
| | | | *S. gayi* subcomplex | |
| | *S. bruesi* | | | *S. bruesi* |
| | *S. gayi* | | | *S. gayi* |
| *S. saevissima* species-group | | *S. saevissima* complex | | |
| | | | *S. saevissima* subcomplex | |
| | *S. interrupta* | | | *S. interrupta* |
| | *S. invicta* | | | *S. invicta* |
| | *S. macdonaghi* | | | *S. macdonaghi* |
| | *S. megergates* | | | *S. megergates* |
| | *S. pythia* | | | *S. pythia* |
| | *S. quinquecuspis* | | | *S. quinquecuspis* |
| | *S. richteri* | | | *S. richteri* |
| | *S. saevissima* | | | *S. saevissima* |
| | *S. weyrauchi* | | | *S. weyrauchi* |
| | | | *S. electra* subcomplex | |
| | *S. electra* | | | *S. electra* |
| | *S. pusillignis* | | | *S. pusillignis* |
| | | Not assigned a subcomplex | | |
| | *S. daguerrei* | | | *S. daguerrei* |
| | *S. hostilis* | | | *S. hostilis* |

[2] This is a preexisting species-group that includes species from Creighton's (1930) *Basalis-tenuis* group as well as *S. globularia, S. solenopsidis,* and *S. succinea*.

Table 2.5. Data matrix showing characters and character states used in a cladistic analysis of the *Solenopsis saevissima* species-group

Character No.

| **Species** | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *S. geminata* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *S. electra* | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 2 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | ? | ? | ? | ? | ? | ? | ? | ? |
| *S. pusillignis* | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 2 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *S. daguerrei* | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | - | - | - |
| *S. saevissima* | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 2 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *S. pythia* | 1 | 1 | 1 | 1 | 1 | 0 | 0&1 | 1 | 1 | 2 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | ? | ? | ? | ? | ? | ? | ? | ? |
| *S. interrupta* | 1 | 1 | 1 | 1 | 1 | 0 | 0&1 | 1 | 1 | 2 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| *S. altipunctata, sp. nov.* | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | ? | ? | ? | ? | ? | 0 | 0 | 0 |
| *S. weyrauchi* | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | ? | ? | ? | ? | ? | ? | ? | ? | ? | ? | ? | ? | ? | ? | ? | ? | ? |
| *S. richteri* | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| *S. invicta* | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0&1 | 0 | 1 | 0 | 0&1 | 0&1 | 0 | 1 | 1 | 0&1 | 1 | 1 | 1 | 0 | 0 |
| *S. megergates* | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0&2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0&1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 |
| *S. quinquecuspis* | 1 | 1 | 1 | 1 | 1 | 0 | 0&1 | 0 | 0 | 0&2 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| *S. macdonaghi* | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0&1 | 0 | 1 | 1 | 0&1 | 1 | 1 | 1 | 1 | 1 |

Table 2.6. Morphometric indices for queens of *Solenopsis saevissima* species-group

| Indices | *altipunctata* | *electra* | *interrupta* | *invicta* | *macdonaghi* | *megergates* | *pusillignis* | *pythia* | *quinquecuspis* | *richteri* | *saevissima* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CI | 1.2 | 0.90-1.00 | 1.14-1.15 | 0.95-1.15 | 1.06-1.16 | 1.12-1.20 | 1.05 | 1.26-1.30 | 1.08-1.14 | 1.11-1.14 | 1.12-1.34 |
| OI | 2.72 | 2.01-2.13 | 2.22-2.26 | 2.10-2.25 | 2.22-2.38 | 2.34-2.40 | 2.91 | 1.72-1.75 | 2.30-2.50 | 2.63-2.83 | 1.98-2.18 |
| REL | 0.3 | 0.30-0.34 | 0.33-0.35 | 0.28-0.38 | 0.32-0.35 | 0.33-0.34 | 0.25 | 0.41-0.47 | 0.30-0.33 | 0.27-0.36 | 0.38-0.39 |
| REL2 | 0.25 | 0.32-0.35 | 0.30-0.31 | 0.28-0.35 | 0.30-0.32 | 0.28-0.30 | 0.24 | 0.33-0.36 | 0.28-0.30 | 0.24-0.30 | 0.28-0.35 |
| OOI | 0.85 | 0.60-0.75 | 1.30-1.47 | 1.55-1.75 | 1.78-1.82 | 1.29-1.67 | 0.73 | 1.40-1.45 | 1.12-1.20 | 0.80-1.00 | 0.86-1.55 |
| VI | 0.62 | 0.82-0.88 | 0.64-0.66 | 0.50-0.65 | 0.62-0.70 | 0.60-0.70 | 0.67 | 0.54-0.57 | 0.60-0.63 | 0.72-0.80 | 0.33-0.61 |
| FCI | 0.1 | 0.14-0.17 | 0.13-0.14 | 0.11-0.18 | 0.13-0.14 | 0.13-0.16 | 0.13 | 0.13-0.14 | 0.12-0.15 | 0.16-0.18 | 0.14-0.17 |
| CDI | 0.17 | 0.11-0.13 | 0.14-0.15 | 0.11-0.18 | 0.12-0.13 | 0.14-0.16 | 0.12 | 0.15-0.16 | 0.12-0.15 | 0.12-0.14 | 0.14-0.16 |
| SI | 0.68 | 0.62-0.70 | 0.69-0.66 | 0.60-0.75 | 0.67-0.71 | 0.67-0.71 | 0.7 | 0.57-0.62 | 0.65-0.73 | 0.66-0.78 | 0.61-0.72 |
| S12 | 2.72 | 2.05-2.14 | 2.23-2.25 | 2.10-2.20 | 2.22-2.40 | 2.34-2.40 | 2.91 | 1.72-1.75 | 2.30-2.50 | 2.63-2.83 | 1.98-2.18 |
| S13 | 12.6 | 11.4-12.1 | 10.0-11.0 | 10.2-10.8 | 9.8-12.00 | 10.8-12.3 | 11.9 | 8.3-9.4 | 10.4-11.9 | 10.6-12.6 | 10.9-11.7 |
| FI | 0.2 | 0.20-0.25 | 0.22-0.24 | 0.20-0.25 | 0.21-0.22 | 0.21-0.23 | 0.24 | 0.22-0.23 | 0.22-0.25 | 0.20-0.27 | 0.21-0.25 |
| NI | 0.92 | 0.80-0.85 | 0.86-0.88 | 0.80-0.92 | 0.82-0.84 | 0.82-0.89 | 0.83 | 0.82-0.89 | 0.80-0.85 | 0.67-0.86 | 0.75-0.83 |
| PLI | 0.92 | 0.95-1.02 | 0.89-1.00 | 0.85-0.90 | 0.82-0.93 | 0.87-1.05 | 0.98 | 0.77-0.82 | 0.95-1.08 | 0.79-1.00 | 0.86-0.96 |
| PHI | 1.92 | 1.65-1.85 | 1.79-1.92 | 1.90-2.41 | 1.80-1.95 | 1.86-2.08 | 1.77 | 1.52-1.62 | 2.33-2.60 | 1.55-1.65 | 1.55-1.97 |
| PWI | 0.69 | 0.78-0.85 | 0.82-1.16 | 0.84-0.92 | 0.82-0.94 | 0.79-0.89 | 0.61 | 0.68-0.79 | 0.78-1.07 | 0.79-0.95 | 0.76-1.02 |
| PPWI | 2.27 | 1.80-1.90 | 1.85-1.96 | 2.12-2.64 | 1.90-2.05 | 1.95-2.45 | 1.85 | 1.58-1.64 | 2.33-2.43 | 1.50-1.65 | 1.77-2.11 |
| PPWB | 1.66 | 1.20-1.46 | 1.28-1.71 | 1.40-2.40 | 1.76-1.87 | 1.45-1.56 | 1.36 | 1.36-1.79 | 1.45-1.64 | 1.60-1.85 | 1.39-1.68 |

Table 2.7. Morphometric indices for males of *Solenopsis saevissima* species-group

| Indices | *interrupta* | *invicta* | *macdonaghi* | *megergates* | *pusillignis* | *quinquecuspis* | *richteri* | *saevissima* |
|---|---|---|---|---|---|---|---|---|
| CI | 1.28-1.31 | 1.30-1.36 | 1.26-1.35 | 1.35-1.45 | 1.25-1.30 | 1.33-1.40 | 1.22-1.41 | 1.34-1.40 |
| OI | 0.40-0.42 | 0.35-0.44 | 0.33-0.35 | 0.36-0.43 | 0.30-0.36 | 0.36-0.46 | 0.36-0.45 | 0.34-0.36 |
| REL | 0.52-0.54 | 0.50-0.64 | 0.54-0.57 | 0.60-0.62 | 0.50-0.60 | 0.58-0.62 | 0.48-0.60 | 0.65-0.68 |
| REL2 | 0.40-0.42 | 0.40-0.48 | 0.42-0.44 | 0.42-0.45 | 0.46-0.47 | 0.44-0.46 | 0.39-0.44 | 0.47-0.50 |
| OOI | 1.44-1.58 | 2.40-2.45 | 1.85-2.70 | 2.16-2.26 | 0.80-1.26 | 1.50-2.45 | 1.00-1.33 | 2.50-3.50 |
| VI | 0.34-0.49 | 0.32-0.37 | 0.33-0.36 | 0.32-0.34 | 0.36-0.42 | 0.35-0.37 | 0.35-0.43 | 0.36-0.39 |
| FCI | 0.15-0.17 | 0.12-0.19 | 0.12-0.14 | 0.12-0.15 | 0.11-0.12 | 0.11-0.14 | 0.10-0.16 | 0.15-0.17 |
| CDI | 0.22-0.23 | 0.25-0.30 | 0.23-0.24 | 0.22-0.25 | 0.23-0.24 | 0.23-0.25 | 0.23-0.29 | 0.25-0.26 |
| SI | 0.15-0.17 | 0.15-0.21 | 0.14-0.15 | 0.16-0.18 | 0.14-0.17 | 0.17-0.20 | 0.16-0.17 | 0.16-0.18 |
| S12 | 0.40-0.42 | 0.40-0.42 | 0.33-0.35 | 0.36-0.43 | 0.30-0.36 | 0.37-0.44 | 0.37-0.44 | 0.34-0.36 |
| S13 | 1.06-1.21 | 1.20-1.65 | 1.07-1.20 | 1.34-1.56 | 1.03-1.25 | 1.36-1.61 | 1.16-1.25 | 1.32-1.44 |
| FI | 0.19-0.24 | 0.13-0.21 | 0.15-0.18 | 0.16-0.19 | 0.14-0.19 | 0.16-0.18 | 0.14-0.17 | 0.14-0.16 |
| NI | 0.88-0.92 | 0.85-0.90 | 0.85-0.94 | 0.90-0.94 | 0.90-0.94 | 0.85-0.88 | 0.90-0.94 | 0.89-0.93 |
| PLI | 0.71-0.73 | 0.70-0.80 | 0.69-1.04 | 0.78-0.80 | 0.62-0.65 | 0.39-0.44 | 0.83-0.91 | 0.65-0.99 |
| PHI | 1.22-1.53 | 2.15-2.30 | 1.65-2.00 | 1.69-2.22 | 1.44-1.48 | 0.90-0.94 | 1.75-2.18 | 1.29-1.75 |
| PWI | 0.96-0.99 | 0.90-1.03 | 0.83-1.13 | 0.88-1.00 | 0.75-0.83 | 0.84-0.87 | 1.01-1.13 | 0.72-1.77 |
| PPWI | 1.97-1.99 | 2.75-3.05 | 2.30-2.42 | 2.34-2.82 | 1.98-2.18 | 2.04-2.44 | 2.35-2.50 | 1.55-2.71 |
| PPWB | 2.85-2.89 | 2.81-4.05 | 2.33-2.50 | 2.45-2.56 | 3.17-3.85 | 2.05-2.80 | 3.85-4.70 | 1.59-3.15 |

# CHAPTER 3

# GYNANDROMORPHISM IN *SOLENOPSIS QUINQUECUSPIS* FOREL (HYMENOPTERA: FORMICIDAE)[1]

[1] Pitts, J.P. To be submitted to *Entomological News.*

ABSTRACT: Two gynandromorphs of *Solenopsis quinquecuspis* were collected near Roldan, Argentina. One specimen shows bilateral gynandromorphism by being male on the left half and queen on the right half. The other specimen exhibits mosaic gynandromorphism and is mostly feminine.

As in most other Hymenoptera, unfertilized eggs of ants become males and fertilized eggs become females. This type of haplodiploidy system of sex determination lends itself to certain genetic defects or gynandromorphism. Gynandromorphism is a condition in which the body of an ant is composed of various male characteristics combined with those of one of the female castes. The worker-male combination is called an ergatandromorph. A gynandromorph is a queen-male combination, whereas a dinergatandromorph is a soldier-male combination (Donisthorpe 1929, Wheeler 1937). The division of the gynandromorph body may occur laterally, dorsoventrally, anteroposteriorly, or in mosaics.

Berndt and Kremer (1982) have given a clue to what may cause the abnormality to take place in nature. In experiments with *Monomorium pharaonis* colonies in which these ants were exposed to 54°C (129°F), both gynandromorphs and ergatandromorphs were produced by the colonies. Heat shock is now postulated as one of the likely causes of gynandromorphism.

Gynandromorphism has been reported in many species of ants (Donisthorpe 1929, Wheeler 1937). Most recently, ergatandromorphism has been reported for *Odontomachus clarus* (Rodrigues-Garza 1997). For the genus *Solenopsis*, gynandromorphy has been only reported for *S. fugax* (Donisthorpe 1929). This represents the second report of gynandromorphism for *Solenopsis* and the first report for *S. quinquecuspis.*

For *S. quinquecuspis*, the males and queens differ dramatically. The queens have large quadrate heads with large mandibles bearing four teeth. They are larger than males, approximately 8 mm in length, and are colored brown and orange. The males are smaller (6.5 mm in length) have small, trapezoid to circular heads with small, bidentate mandibles that bear a very small third tooth, and are completely black. Also, the size of the ocelli and antennae are quite different between the sexes. In the male, the dense, white, antennal pubescence completely obscures the integument, and the flagellomeres and scape are small compared to the antenna of the queen.

Two gynandromorphic specimens were collected (by K.G. Ross, M.C. Mescher, D.D. Shoemaker, and L. Keller) at Roldan in Sante Fe Province, Argentina. The gynandromorphic condition was not noted at the time of collection, so no uncharacteristic behavior was observed. The specimens are deposited into the entomological collection at the University of Georgia, Collection of Arthropods, Athens, Georgia, USA.

One specimen is bilaterally gynandromorphic with the left side being male and the right side being queen. The head and body are distorted by the diminution of the left side. The right side of the head including the eye, lateral ocellus, antenna, and mandible, appear as a normal queen (Fig. 3.1). The median ocellus is conspicuously male, as is the remaining portion of the head (Fig. 3.1). The left antenna is masculine by having a short scape, globose pedicel and an 11-segmented flagellum (Fig. 3.1). The length of the two terminal segments, however, is much shorter than in a normal male antenna (Fig. 3.1). The left mandible is bidentate and short, which allows observation of the hypopharynx and maxilla.

The other gynandromorphic specimen exhibits a mosaic condition by having various characters of each sex distributed throughout the body. The front of the head looks like that of an ordinary queen but the antennae are greatly altered. The antennae are reduced in size, and the club is not distinct. The right flagellum is masculine dorsally and feminine ventrally. The pedicel is globose, yet less so than that of a normal male. However, the pedicel has sparse pubescence similar to a queen. The scape is masculine ventrally, but dorsally is feminine with a large apical lobe. The left flagellum and pedicel are like the right. However, the gender of the left scape is opposite to that of the right, being feminine ventrally with a large apical lobe and masculine dorsally. The gena is darkened and sculptured as that of males. The left side of the mesonotum and scutellum are masculine, as evidenced by being swollen and having dense pubescence. The remainder of the thorax is feminine. The mesosoma is feminine, except for the right side of the third segment is darkened as in a male, and male genitalia extrude from the terminal end of the metasoma.

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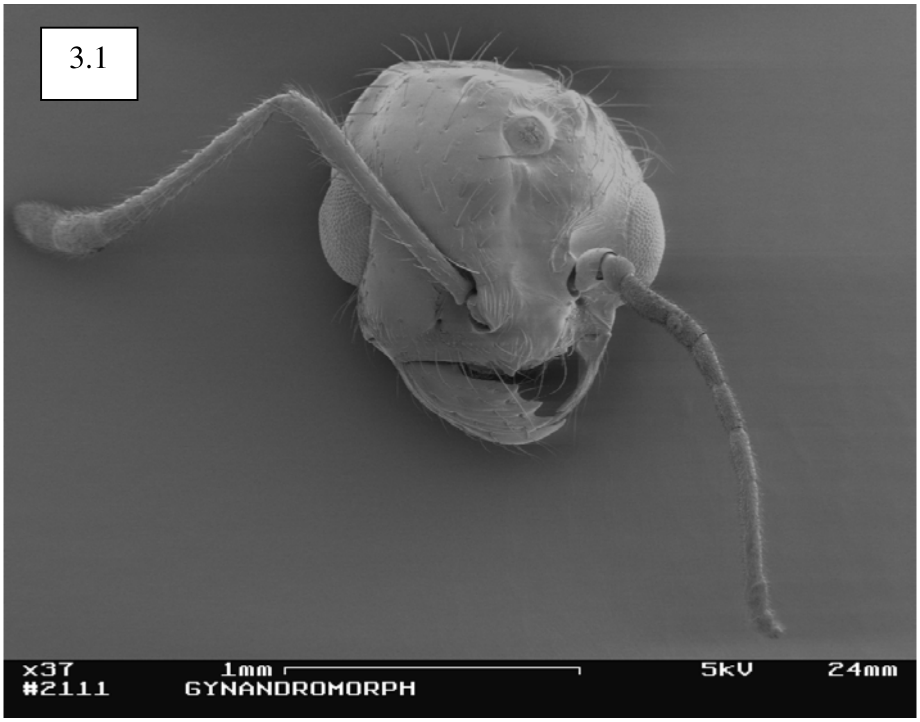
# FIGURE LEGENDS

Figure 3.1. Head of bilateral gynandromorph of *Solenopsis quinquecuspis*, dorsal view.


3.1
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GYNANDROMORPH

# CHAPTER 4

# A NEW HOST RECORD FOR *PSEUDACTEON CRAWFORDI* (DIPTERA: PHORIDAE)[1]

[1] Pitts, James P. and T. L. Pitts-Singer. 2001. Florida Entomologist. 84: 310. Reprinted here with permission of publisher.

The biology of the phorid fly *Pseudacteon* was reviewed by Porter (1998). The female fly oviposits into the thorax of its ant host. After hatching, the larva works its way into the host's head capsule where it continues to grow and ultimately decapitates the host. The fully grown larva then uses the head capsule of the host as a pupal case. Because of their parasitic lifestyle, flies of this genus are of great interest as potential biocontrol agents against the imported fire ants, *Solenopsis invicta* Buren and *Solenopsis richteri* Forel, in North America.

Four species of *Solenopsis* fire ants are native to North America: *S. amblychila* Wheeler, *S. aurea* Wheeler, *S. geminata* (Fab.) and *S. xyloni* (MacCook). All four of these species overlap in their ranges in the southwestern United States, mainly in Arizona and Texas (Trager 1991). *Pseudacteon crawfordi* was described by Coquillett in 1907 and is known to be parasitic on *S. geminata* (Disney 1994) and *S. xyloni* (Feener 1987). Here we report that *P. crawfordi* attacks *S. aurea*. *Solenopsis aurea* is a species of fire ant that occurs in xeric conditions in the southwestern United States and is found mainly in Texas and Arizona (Trager 1991).

Collection: Near dusk, on August 3, 1999, a nest of *S. aurea* was excavated. The nest was located close to mile marker 13 north of Portal, Arizona on Speed Road. Foragers from the colony were initially found under a pile of semi-moist cow manure. The nest was located close to a pool of water created by a leaking irrigation line. Shortly after the cow manure was disturbed and the ants were uncovered, six female phorid flies were seen hovering around and attacking intermediate-sized workers. A series of the phorid flies was collected with the ants. *Solenopsis aurea* workers were also collected the next day from 0800-1200 hrs, but no phorid flies were seen. The phorid flies were identified as *Pseudacteon crawfordi* by Sanford Porter (Medical and Veterinary Entomology Research Laboratory, USDA-ARS, Gainesville, Florida) and the fire ants were identified as *S. aurea* by senior author (JPP). This represents a new host record for *Pseudacteon crawfordi.*

Voucher specimens of both the ants and flies are deposited in the University of Georgia, Collection of Arthropods, Athens, Georgia, USA.

Summary

*Solenopsis aurea* in Arizona is reported as a new host species for *Pseudacteon crawfordi*.

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# CHAPTER 5

# CONCLUSION

The genus *Solenopsis* is not a taxonomic favorite. *Solenopsis* species generally have workers small in size, and the morphology is very similar between species. Even the fire ant species with larger workers are difficult to identify. Emery called the group the *crux myrmecologorum* "cross of the myrmecologist's" (Creighton, 1930). After Creighton' s 1930 revision of *Solenopsis*, Creighton said, "the group is still a heavy cross to bear." Later in 1950 after completing his treatise on the ants of North America, Creighton grumbled, "The student of North American ants may count himself fortunate that so few species of this difficult genus occur in our latitudes." Indeed, the apparent recent radiation of the group lends itself to a nightmare.

The difficult taxonomy of the South American fire ants greatly impedes field identification of these species for biological studies in many parts of their native environment. Despite the taxonomic difficulties, however, molecular, ecological, and pest management studies are conducted at high rate. A literature search revealed that at least 1,278 papers had been published on *Solenopsis* (966 specifically dealing with *S. invicta*) since 1982. Many of these studies were done in the United States were *Solenopsis* species are easily identified. Only recently have scientists traveled extensively to South America to perform biological studies. It is in these studies that the taxonomic difficulty of this group rears its ugly head. For instance, when I examined voucher specimens from an Argentine study on "*S. invicta*" conducted by other researchers, only 17% of the specimens had been identified correctly.

Further problems are just now arising with molecular data showing that *S. invicta* may be paraphyletic. For any viable control plan for *S. invicta* to be developed in the United States, the source populations for the species introduced into North America must be identified correctly. In the past, scientists have used only the morphology of the worker caste in their taxonomic work. This has proven to be ineffective for field determinations. The future may necessitate the use of molecular analysis for ease of identification. If cryptic species are found in the future, this will further add to the difficulty of the group.

The vigor and tenacity required to digest, decipher, and divulge distinguishing characteristics of species within a group such as *Solenopsis*, may dismay and discourage the undertaking of a thorough taxonomic study. Without the alpha taxonomy, molecular and evolutionary studies may lack explanation or even validity when addressing phylogenetic relationships. With my dissertation, I have added my contribution to widening our breath of knowledge in both the alpha taxonomy and phylogenetic relationships of the *S. saevissima* species-group as well as in the evolution of social parasitism.

As with any problem group, this will not be the definitive, end-all taxonomic paper, nor will I be the last to have the nightmare.

# REFERENCES CITED


Creighton, W.S. 1930. The new world species of the genus *Solenopsis* (Hymenoptera: Formicidae). *Proceedings of the American Academy of Arts and Sciences*, 66: 39-151.

Creighton, W. S. 1950. The ants of North America. *Bulletin of the Museum of Comparative Zoology at Harvard College,* 104: 1-585.

# APPENDICES

# APPENDIX A. COLLECTION DATA FOR 1998.

| country | locality | state | nest ID | species | nest or other description | worker larvae | adults worker | adults queen | adults male | notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | E of Belo Horizonte; Rt 262 @ KM 434 | Minas Gerais | **O-1** | *S. saevissima* | Large nest | x | x | x | x | |
| Brazil | E of Belo Horizonte; Rt 262 @ KM 425 | Minas Gerais | **O-2** | *S. saevissima* | | x | x | x | x | |
| Brazil | E of Belo Horizonte; Rt 262 intersection w/ Rt 381; near Ipatinga | Minas Gerais | **O-2; top** | *S.* sp. thief ant | Thief ant queens collected without workers or brood from an odd-looking nest | | | x | | |
| Brazil | W of Belo Horizonte; Rt 381 @ Betim | Minas Gerais | **O-3** | *S. saevissima* | | | x | x | x | |
| Brazil | W of Belo Horizonte; Rt 381 @ Betim | Minas Gerais | **O-4** | *S. saevissima* | Monogyne | x | x | x | x | |
| Brazil | W of Belo Horizonte; Rt 262 @ KM 386 | Minas Gerais | **O-5** | *S. saevissima* | Monogyne nest | x | x | x | x | |
| Brazil | W of Belo Horizonte; Rt 262 @ KM 470 | Minas Gerais | **O-6** | *S. saevissima* | Monogyne nest | x | x | x | x | |
| Brazil | W of Belo Horizonte; Rt 262 @ KM 512 | Minas Gerais | **O-7** | *S. saevissima* | Probably queenless nest | | x | 1 | 1 | |
| Brazil | W of Belo Horizonte; Rt 262 @ KM 560 | Minas Gerais | **O-8** | *S. saevissima* | | | x | | | |
| Brazil | W of Belo Horizonte; Rt 262 @ KM 560 | Minas Gerais | **O-9** | *S. saevissima* | Large nest | x | x | x | x | |
| Brazil | W of Belo Horizonte; Rt 262 @ KM 628; near Ibia | Minas Gerais | **O-10** | *S. saevissima* | Large nest | x | x | x | x | |
| Brazil | W of Belo Horizonte; Rt 262 @ KM 657 | Minas Gerais | **O-11** | *S. saevissima* | Large nest | x | x | x | x | |
| Brazil | on northern outskirts of Uberaba | Minas Gerais | **O-12** | *S. saevissima* | young nest - no sexuals | x | x | | | |
| Brazil | Rt 452 @ KM 59; ca 60 km SE of Rio Verde; near Maurilandia | Goias | **O-13** | *S. saevissima* | | x | x | x | x | 2 beetle spp. collected |
| Brazil | Rt 452 @ KM 59; ca 60 km SE of Rio Verde; near Maurilandia | Goias | **O-14** | *S. saevissima* | no sexuals | x | x | | | 2 beetle spp. collected |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-15** | *S. invicta* | Monogyne? nest | x | x | x | x | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-16** | *S. invicta* | Monogyne? nest | **x** | **x** | **x** | **x** | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-17** | *S. invicta* | Monogyne? nest | **x** | **x** | **x** | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-18** | *S. invicta* | Monogyne? nest | **x** | **x** | **x** | **x** | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-19** | *S. invicta* | Monogyne? nest | **x** | **x** | **x** | **x** | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-20** | *S. invicta* | Monogyne? nest | **x** | **x** | **x** | **x** | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-21** | *S. invicta* | Monogyne? nest | **x** | **x** | **x** | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-22** | *S. invicta* | Possible polygyne? nest | **x** | **x** | **x** | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-23** | *S. invicta* | | **x** | **x** | **x** | **x** | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-24** | *S. invicta* | 3 closely-spaced nests (1 sampled) - polygyne? | **x** | **x** | **x** | **x** | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-25** | *S. invicta* | Polygyne nest? | **x** | **x** | | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-26** | *S. invicta* | | **x** | **x** | **x** | **x** | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-27** | *S. invicta* | | **x** | **x** | | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-28** | *S. invicta* | | **x** | **x** | **x** | **x** | 2 different beetles collected |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-29** | S. invicta | | **x** | **x** | | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-30** | *S. invicta* | | **x** | **x** | **x** | **x** | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-31** | *S. invicta* | | **x** | **x** | | **x** | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-32** | *S. invicta* | | **x** | **x** | | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-33** | *S. invicta* | | **x** | **x** | **x** | **x** | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-34** | *S. invicta* | Polygyne nest? | x | x | x | x | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-35** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-36** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-37** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-38** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-39** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-40** | *S. invicta* | | x | x | | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-41** | *S. invicta* | Nest in new sod by swimming pool at club - may be recently introduced | x | x | | x | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-42** | *S. invicta* | | x | x | | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-43** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-44** | *S. invicta* | | x | x | | x | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-45** | *S. invicta* | | x | x | | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-46** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-47** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-48** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-49** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-50** | *S. invicta* | | x | x | | x | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-51** | *S. invicta* | | x | x | x | x | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-52** | *S. invicta* | | x | x | | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-53** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-54** | *S. invicta* | Polygyne? | x | x | x | x | several parasitoids captured hovering over nest (Eucharitidae) |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-55** | *S. invicta* | | x | x | | x | 1 parasitoid captured walking on nest (Eucharitidae) |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-56** | *S. invicta* | | x | x | x | x | several parasitoids captured hovering over nest (Eucharitidae) |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-57** | *S. invicta* | Polygyne? - several mounds in very close proximity (1/2 meter) | x | x | x | x | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-58** | *S. invicta* | | x | x | | x | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-59** | *S. invicta* | Polygyne? - multiple apparent dealates | x | x | x | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-60** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-61** | *S. invicta* | | x | x | | x | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-62** | *S. invicta* | | x | x | | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-63** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-64** | *S. invicta* | | x | x | | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-65** | *S. invicta* | | | x | | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-66** | *S. invicta* | | | x | | | Termites in nest |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-67** | *S. invicta* | | x | x | | | Termite in nest |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-68** | *S. invicta* | | x | x | | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-69** | *S. invicta* | | x | x | x | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-70** | *S. invicta* | | **x** | **x** | | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-71** | *S. invicta* | | **x** | **x** | | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-72** | *S. invicta* | Polygyne colony - several dealates | **x** | **x** | **x** | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-73** | *S. invicta* | | | **x** | | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-74** | *S. invicta* | | **x** | **x** | | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-75** | *S. invicta* | | **x** | **x** | | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-76** | *S. invicta* | | **x** | **x** | | | |
| Brazil | Rt 364 @ Pedra Preta; ca 30 km E of Rondonopolis | Mato Grosso | **O-77** | *S. invicta* | | **x** | **x** | | | |
| Brazil | Rt 163; 1 km E of Sao Pedro da Cipa, near Jaciara | Mato Grosso | **O-78** | *S. invicta* | | **x** | **x** | | | |
| Brazil | Rt 163; 1 km E of Sao Pedro da Cipa, near Jaciara | Mato Grosso | **O-79** | *S. invicta* | | **x** | **x** | **x** | | Beetle and termite in nest collected |
| Brazil | Rt 060 S of Cuiaba; just north of Pocone | Mato Grosso | **O-80** | *S. invicta*? | | **x** | **x** | **1 wing** | | |
| Brazil | Rt 060 S of Cuiaba; just north of Pocone | Mato Grosso | **O-81** | *S. invicta?* | | **x** | **x** | | **x** | |
| Brazil | Rt 060 S of Cuiaba; just north of Pocone | Mato Grosso | **O-82** | *S. invicta?* | | **x** | **x** | | | |
| Brazil | N of Cuiaba in town of Jangada | Mato Grosso | **O-83** | *S. invicta?* | | **x** | **x** | | **x** | Isopod in nest collected |
| Brazil | 90 km W of Cuiaba at intersection of Rt 070 and road to Cangas | Mato Grosso | **O-84** | *S. invicta?* | | **x** | **x** | **x** | **x** | |
| Brazil | 90 km W of Cuiaba at intersection of Rt 070 and road to Cangas | Mato Grosso | **O-85** | *S. invicta?* | | **x** | **x** | **x** | **x** | |
| Brazil | Rt 070 @ KM 34; ca 30 km W of Caceres and 15 km E of Mirassol d'Oeste | Mato Grosso | **O-86** | *S. invicta* | | | **x** | | **x** | |
| Brazil | Rt 070 W of Caceres, ca 8 km E of Porto Esperidiao | Mato Grosso | **O-87** | *S. invicta* | | **x** | **x** | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 070 W of Caceres, ca 8 km E of Porto Esperidiao | Mato Grosso | **O-88** | *S. invicta* | | x | x | | | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **O-89** | *S. invicta* | | x | x | | | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **O-90** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **O-91** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **O-92** | *S. invicta* | | x | x | | | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **O-93** | *S. invicta* | | x | x | | | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **O-94** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **O-95** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **O-96** | *S. invicta* | | x | x | | | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **O-97** | *S. invicta* | | x | x | | | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **O-98** | *S. invicta* | Polygyne nest? | x | x | x | x | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **O-99** | *S. invicta* | | x | x | | | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **O-100** | *S. invicta* | | x | x | | | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **Pi-1** | *S. invicta* | | x | x | | | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **Pi-2** | *S. invicta* | | x | x | | | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **Pi-3** | *S. invicta* | Looks like queenless nest | | x | | x | 3 sexual (male) larvae |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **Pi-4** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **Pi-5** | *S. invicta* | | x | x | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **Pi-6** | *S. invicta* | | **x** | **x** | | **x** | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **Pi-7** | *S. invicta* | | **x** | **x** | | **x** | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **Pi-8** | *S. invicta* | | **x** | **x** | | | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **Pi-9** | *S. invicta* | | **x** | **x** | **x** | **x** | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **Pi-10** | *S. invicta* | | **x** | **x** | **x** | **x** | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **Pi-11** | *S. invicta* | | **x** | **x** | **x** | | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **Pi-12** | *S. invicta* | | **x** | **x** | | **x** | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **Pi-13** | *S. invicta* | | **x** | **x** | | **x** | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **Pi-14** | *S. invicta* | | **x** | **x** | | | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **Pi-15** | *S. invicta* | | **x** | **x** | | **x** | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **Pi-16** | *S. invicta* | | **x** | **x** | **x** | **x** | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **Pi-17** | *Paratrechina* sp. | | **x** | **x** | | | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **Pi-18** | *Paratrechina* sp. | | **x** | **x** | **dealates** | | |
| Brazil | Rt 174 ca 90 km NW of Pontes E Lacerda; between Pontes E Lacerda and Comodoro | Mato Grosso | **Pi-19** | *S. invicta* | | **x** | **x** | **x** | | |
| Brazil | Rt 174 at Comodoro | Mato Grosso | **Pi-20** | *S. invicta* | | **x** | **x** | | | |
| Brazil | Rt 174 at Comodoro | Mato Grosso | **Pi-21** | *S. invicta* | | **x** | **x** | | | Termites in nest |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **Pi-22** | *S. invicta* | | **1** | **x** | **x** | **x** | |
| Brazil | Rt 070 at town of Pontes E Lacerda | Mato Grosso | **Pi-23** | *S. invicta* | Nest looks queenless | | **x** | | **x** | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 163 @ KM 47; ca 80 km S of Rondonopolis | Mato Grosso | **Pi-24** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 163 @ KM 47; ca 80 km S of Rondonopolis | Mato Grosso | **Pi-25** | *S. invicta* | Probably monogyne queenless nest | | x | x | | |
| Brazil | Rt 163 @ KM 821; ca 85 km N of Coxim | Mato Grosso do Sul | **Pi-26** | *S. invicta* | | x | x | | | |
| Brazil | Rt 163 @ KM 821; ca 85 km N of Coxim | Mato Grosso do Sul | **Pi-27** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 163 @ KM 725; at town of Coxim | Mato Grosso do Sul | **Pi-28** | *S. invicta* | Polygyne nest? | x | x | x | | |
| Brazil | Rt 163 @ KM 725; at town of Coxim | Mato Grosso do Sul | **Pi-29** | *S. invicta* | Polygyne nest? | x | x | | x | |
| Brazil | Rt 163 @ KM 633; ca 90 km S of Coxim | Mato Grosso do Sul | **Pi-30** | *S. invicta* | Looks like very dark invicta | x | x | | x | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-31** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-32** | *S. invicta* | | x | x | | | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-33** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-34** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-35** | *S. invicta* | | x | x | | | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-36** | *S. invicta* | | x | x | | x | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-37** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-38** | *S. invicta* | | x | x | | | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-39** | *S. invicta* | | x | x | | x | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-40** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-41** | *S. invicta* | | x | x | x | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-42** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-43** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-44** | *S. invicta* | | x | x | | x | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-45** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-46** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-47** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-48** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-49** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-50** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-51** | *S. invicta* | Dealates collected - polygyne? | x | x | x | | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-52** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-53** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-54** | *S. invicta* | | x | x | | x | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-55** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-56** | *S. invicta* | | x | x | | x | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-57** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-58** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-59** | *S. invicta* | | x | x | x | x | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-60** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 163 at town of Sao Gabriel do Oeste | Mato Grosso do Sul | **Pi-61** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 262 @ KM 630; ca 90 km SE of Corumba | Mato Grosso do Sul | **Pi-62** | *S. pusillignis* | | | x | x | x | |
| Brazil | Rt 262 @ KM 630; ca 90 km SE of Corumba | Mato Grosso do Sul | **Pi-63** | *S. pusillignis* | | x | x | | x | |
| Brazil | Rt 262 @KM 666; ca 60 km SE of Corumba | Mato Grosso do Sul | **Pi-64** | *S. invicta* | Nest looks polygyne | x | x | x | | |
| Brazil | Rt 262 @KM 666; ca 60 km SE of Corumba | Mato Grosso do Sul | **Pi-65** | *S. invicta* | Probably polygyne (high mound density) | x | x | x | x | |
| Brazil | city of Corumba | Mato Grosso do Sul | **Pi-66** | *S. pusillignis* | | x | x | x | x | |
| Brazil | city of Corumba | Mato Grosso do Sul | **Pi-67** | *S. pusillignis* | | x | x | | | |
| Brazil | city of Corumba | Mato Grosso do Sul | **Pi-68** | *S. pusillignis* | | x | x | | x | |
| Brazil | Rt 262 @ KM 529; at Miranda | Mato Grosso do Sul | **Pi-69** | *S. pusillignis* | | | x | | | |
| Brazil | Rt 262 @ KM 451; ca 79 km SE of Miranda | Mato Grosso do Sul | **Pi-70** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 262 @ KM 451; ca 79 km SE of Miranda | Mato Grosso do Sul | **Pi-71** | S. invicta | Dark *S. invicta* | x | x | | x | |
| Brazil | Rt 262 ca 5 km NW of Campo Grande | Mato Grosso do Sul | **Pi-72** | *S. invicta* | Dark *S. invicta* | x | x | | | Newly-mated queens collected also at this locality |
| Brazil | Rt 163 @ KM 365; at Nova Alvorada do Sul | Mato Grosso do Sul | **Pi-73** | *S. invicta* | Dark *S. invicta* - may be polygyne (closely-spaced mounds) | x | x | x | | Termites in nest |
| Brazil | Rt 163 @ KM 365; at Nova Alvorada do Sul | Mato Grosso do Sul | **Pi-74** | *S. invicta* | Dark *S. invicta* - may be polygyne | x | x | | x | |
| Brazil | Rt 163 at Dourados | Mato Grosso do Sul | **Pi-75** | *S. invicta* | Dark *S. invicta* - several dealates but may be queenless monogyne nest | x | x | x | x | |
| Brazil | Rt 163 at Dourados | Mato Grosso do Sul | **Pi-76** | *S. invicta* | Dark *S. invicta* - two dealates? polygyne? | x | x | x | x | |
| Brazil | Rt 163 at Caarapo | Mato Grosso do Sul | **Pi-77** | *S. invicta* | Dark *S. invicta* | x | x | x | x | Odd pupae in brood pile and adult staphylinid in nest collected |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 163 at Caarapo | Mato Grosso do Sul | **Pi-78** | *S. invicta* | Light orange color; collected right next to Pi-77 | **x** | **x** | | **?** | Beetle in nest collected |
| Brazil | Rt 141 at Navirai | Mato Grosso do Sul | **Pi-79** | *S. invicta* | Light orange color | **x** | **x** | **x** | **x** | |
| Brazil | Rt 141 @ KM 81; at Itaquirai | Mato Grosso do Sul | **Pi-80** | *S. macdonaghi* | Very large and orange | **x** | **x** | **x** | **x** | |
| Brazil | Rt 141 @ KM 81; at Itaquirai | Mato Grosso do Sul | **Pi-81** | *S. macdonaghi* | Very large and orange | **x** | **x** | | | Termites in nest collected (workers carrying some) |
| Brazil | Rt 141 @ KM 81; at Itaquirai | Mato Grosso do Sul | **Pi-82** | *S. invicta* | | **x** | **x** | **x** | | |
| Brazil | Rt 141 at Mundo Novo | Mato Grosso do Sul | **Pi-83** | *S. invicta* | | **x** | **x** | **x** | **x** | |
| Brazil | at town of Guaira | Parana | **Pi-84** | *S. invicta* | | **x** | **x** | **x** | **x** | |
| Brazil | at town of Guaira | Parana | **Pi-85** | *S. invicta* | Looks like dark *S. invicta* or robust *S. saevissima* | **x** | **x** | **x** | | *S. daguerrei* (with dealate) & termites collected |
| Brazil | at town of Toledo | Parana | **Pi-86** | *S. invicta* | Dark *S. invicta* | **x** | **x** | **x** | | |
| Brazil | 1 km N of town of Cascavel | Parana | **Pi-87** | *S. saevissima* | | **x** | **x** | **x** | | |
| Brazil | 1 km N of town of Cascavel | Parana | **Pi-88** | *S. invicta* | Dark *S. invicta* | **x** | **x** | **x** | **x** | |
| Brazil | Rt 277 at Ceu Azul | Parana | **Pi-89** | *S. invicta* | Looks polygyne | **x** | **x** | **x** | **x** | |
| Brazil | Rt 277 at Ceu Azul | Parana | **Pi-90** | *S. invicta* | Looks polygyne | **x** | **x** | **x** | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **Pi-91** | *S. invicta* | Looks polygyne | **x** | **x** | | | Beetle in nest collected |
| Brazil | Rt 277 at Ceu Azul | Parana | **Pi-92** | *S. invicta* | Looks polygyne | **x** | **x** | **x** | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **Pi-93** | *S. invicta* | Looks polygyne | **x** | **x** | **x** | **x** | |
| Brazil | Rt 277 at Ceu Azul | Parana | **Pi-94** | *S. invicta* | Looks polygyne | **x** | **x** | | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **Pi-95** | *S. invicta* | Looks polygyne | **x** | **x** | | **x** | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 277 at Ceu Azul | Parana | **Pi-96** | *S. invicta* | Looks polygyne | x | x | | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **Pi-97** | *S. invicta* | Looks polygyne | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **Pi-98** | *S. invicta* | Looks polygyne | x | x | | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **Pi-99** | *S. invicta* | Looks polygyne | x | x | | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **Pi-100** | *S. invicta* | Looks polygyne | x | x | | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-1** | *S. invicta* | Looks polygyne | x | x | x | x | Termites in nest collected |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-2** | *S. invicta* | Looks polygyne | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-3** | *S. invicta* | Looks polygyne | x | x | | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-4** | *S. invicta* | Looks polygyne | x | x | | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-5** | *S. invicta* | Looks polygyne | x | x | | | Termites in nest collected |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-6** | *S. invicta* | Looks polygyne | x | x | x | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-7** | *S. invicta* | Looks polygyne | x | x | | | Termites in nest collected |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-8** | *S. invicta* | Looks monogyne | x | x | x | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-9** | *S. invicta* | Looks monogyne | x | x | x | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-10** | *S. invicta* | Looks polygyne | x | x | | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-11** | *S. invicta* | Looks polygyne | x | x | | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-12** | *S. invicta* | Looks polygyne | x | x | | x | Two different beetles in nest collected |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-13** | *S. invicta* | Looks polygyne | x | x | x | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 277 at Ceu Azul | Parana | **G-14** | *S. invicta* | Looks polygyne | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-15** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-16** | *S. invicta* | Looks polygyne | x | x | | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-17** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-18** | *S. invicta* | | x | x | | x | Termites in nest collected |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-19** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-20** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-21** | *S. invicta* | Looks polygyne | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-22** | *S. invicta* | | x | x | | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-23** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-24** | *S. invicta* | | x | x | | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-25** | *S. invicta* | | x | x | | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-26** | *S. invicta* | | x | x | | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-27** | *S. invicta* | Looks polygyne | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-28** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-29** | *S. invicta* | Looks polygyne - many partial dealates in addition to full dealates | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-30** | *S. invicta* | | x | x | | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-31** | *S. invicta* | Looks polygyne | x | x | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 277 at Ceu Azul | Parana | **G-32** | *S. invicta* | Looks polygyne | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-33** | *S. invicta* | Looks polygyne | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-34** | *S. invicta* | Looks polygyne | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-35** | *S. invicta* | Looks monogyne | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-36** | *S. invicta* | | x | x | | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-37** | *S. invicta* | | x | x | | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-38** | *S. invicta* | Looks polygyne | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-39** | *S. invicta* | | x | x | | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-40** | *S. invicta* | | x | x | | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-41** | *S. invicta* | | x | x | x | x | 1 brachypterous queen |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-42** | *S. invicta* | | x | x | | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-43** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-44** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-45** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-46** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-47** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-48** | *S. invicta* | | x | x | | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-49** | *S. invicta* | | x | x | x | x | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 277 at Ceu Azul | Parana | **G-50** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-51** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-52** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-53** | *S. invicta* | | x | x | x | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-54** | *S. invicta* | | x | x | | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-55** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-56** | *S. invicta* | Looks monogyne | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-57** | *S. invicta* | Looks monogyne | x | x | | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-58** | *S. invicta* | Looks monogyne | x | x | x | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-59** | *S. invicta* | Looks monogyne | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-60** | *S. invicta* | Looks monogyne | x | x | x | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-61** | *S. invicta* | Looks monogyne | x | x | x | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-62** | *S. invicta* | Looks monogyne | x | x | | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-63** | *S. invicta* | Looks monogyne | x | x | x | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-64** | *S. invicta* | | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-65** | *S. invicta* | Looks monogyne | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-66** | *S. invicta* | Looks monogyne | x | x | x | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-67** | *S. invicta* | Looks monogyne | x | x | x | x | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 277 at Ceu Azul | Parana | **G-68** | *S. invicta* | Looks monogyne | x | x | x | x | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-69** | *S. invicta* | Looks monogyne | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-70** | *S. invicta* | Looks monogyne | x | x | x | | |
| Brazil | Rt 277 at Ceu Azul | Parana | **G-71** | *S. invicta* | Looks monogyne | x | x | | x | |
| Brazil | Rt 277 @ KM 493; near Guaraniacu | Parana | **G-72** | *S. invicta* | Polygyne - many partial and several full dealates collected | x | x | x | | |
| Brazil | Rt 277 @ KM 493; near Guaraniacu | Parana | **G-72b** | *S. invicta* | Polygyne - 3 partial dealates collected | | | | | |
| Brazil | Rt 277 near Cantagalo | Parana | **G-73** | *S. invicta* | Dark *S. invicta* or *S. saevissima* | x | x | x | x | |
| Brazil | Rt 277 @ KM 317; at junction with Rt 373 | Parana | **G-74** | *S. megergates* | Dark *S. invicta* or *S. saevissima* | x | x | x | x | |
| Brazil | Rt 277 @ KM 193; ca 22 km W of Palmeira | Parana | **G-75** | *S. megergates* | | x | x | x | | Mound thatched with grass |
| Brazil | Rt 277 @ KM 193; ca 22 km W of Palmeira | Parana | **G-76** | *S. megergates* | | x | x | x | | Mound thatched with grass |
| Brazil | Rt 277 @ KM 193; ca 22 km W of Palmeira | Parana | **G-77** | *S. megergates* | | | x | | x | Mound thatched with grass |
| Brazil | Rt 116 ca 5 km S of Curitiba | Parana | **G-78** | *S. invicta* | Dark *S. invicta* | x | x | x | | Mound not thatched with grass |
| Brazil | Rt 116 ca 5 km S of Curitiba | Parana | **G-79** | *S. megergates* | | x | x | | x | Mound thatched with grass |
| Brazil | Rt 116 at Rio Negro | Parana | **G-80** | *S. invicta* | Light/medium colored *S. invicta* | x | x | x | x | Mound not thatched with grass |
| Brazil | Rt 116 at Rio Negro | Parana | **G-81** | *S. megergates* | | x | x | x | x | Mound not thatched with grass |
| Brazil | Rt 116 at Rio Negro | Parana | **G-82** | *S. saevissima* | | x | x | x | x | Mound not thatched with grass |
| Brazil | Rt 116 ca 22 km N of Santa Cecilia | Santa Catarina | **G-83** | *S. altipunctata*, sp. nov. | Small yellow fire ant; elevation 1200 m; new species | x | x | | | |
| Brazil | Rt 116 ca 22 km N of Santa Cecilia | Santa Catarina | **G-84** | *S. altipunctata*, sp. nov. | Small yellow fire ant; elevation 1200 m; new species | x | x | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 116 ca 22 km N of Santa Cecilia | Santa Catarina | **G-85** | *S. altipunctata*, sp. nov. | Small yellow fire ant; elevation 1200 m; new species | x | x | | | |
| Brazil | Rt 116 ca 22 km N of Santa Cecilia | Santa Catarina | **G-86** | *S. altipunctata*, sp. nov. | Small yellow fire ant; elevation 1200 m; new species | x | x | x | | |
| Brazil | Rt 116 at Correia Pinto | Santa Catarina | **G-87** | *S. invicta* | | x | x | | | |
| Brazil | Rt 116 at Correia Pinto | Santa Catarina | **G-88** | *S. invicta* | Probably dark *S. invicta* (or *S. saevissima*?) | x | x | x | | |
| Brazil | Rt 116 at Correia Pinto | Santa Catarina | **G-89** | *S. invicta* | Probably dark *S. invicta* | x | x | x | x | |
| Brazil | Rt 116 at Correia Pinto | Santa Catarina | **G-90** | *S. invicta* | Probably dark *S. invicta* | x | x | x | | |
| Brazil | Rt 116 at Lages | Santa Catarina | **G-91** | *S. invicta* | Light *S. invicta* – polygyne | x | x | x | x | Staphylinid in nest collected |
| Brazil | Rt 116 at Lages | Santa Catarina | **G-92** | *S. invicta* | Light *S. invicta* - probably polygyne | x | x | x | x | |
| Brazil | Rt 116 just south of town of Vacaria | Rio Grande do Sul | **G-93** | *S. invicta* | Probably dark *S. invicta* | x | x | x | x | |
| Brazil | Rt 116 ca 10 km N of Nova Petropolis | Rio Grande do Sul | **G-94** | *S. invicta* | Probably dark *S. invicta* - in newly planted sod | x | x | x | x | |
| Brazil | Rt 116 @ KM 99; at Porto Allegre | Rio Grande do Sul | **G-95** | *S. invicta* | Probably dark *S. invicta* | x | x | x | x | 8 more *invicta* nests found at this site |
| Brazil | Rt 116 @ KM 99; at Porto Allegre | Rio Grande do Sul | **G-96** | *S. richteri* | | x | x | x | x | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **G-97** | *S. richteri* | | x | x | x | x | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **G-98** | *S. megergates* | Another ant associate with workers and males found in nest | x | x | x | x | Ant associate in nest collected |
| Brazil | Rt 290 ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **G-99** | *S. megergates* | Alate queen very large | x | x | | | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **G-100** | *S. invicta* | Polygyne | x | x | x | x | Mating flights occurring around 2:30 pm |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-1** | *S. invicta* | Polygyne | x | x | x | x | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-2** | *S. invicta* | Polygyne | x | x | x | x | |

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| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-3** | *S. invicta* | Polygyne | x | x | x | x | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-4** | *S. invicta* | Polygyne | x | x | x | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-5** | *S. invicta* | Monogyne | x | x | | x | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-6** | *S. invicta* | Polygyne | x | x | x | x | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-7a** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-7b** | *S. invicta* | Polygyne | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-7c** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-7d** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-7e** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-7f** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-7g** | S. invicta | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-7h** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-7i** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-7j** | *S. invicta* | Monogyne? | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-7k** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-7L** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-7m** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-7n** | *S. invicta* | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-7o** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-7p** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-7q** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-7r** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-7s** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-7t** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-7u** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-7v** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8** | *S. invicta* | | **x** | **x** | **x** | **x** | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8a** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8b** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8c** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8d** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8e** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8f** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8g** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8h** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8i** | *S. invicta* | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8j** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8k** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8L** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8m** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8n** | *S. invicta* | | | | | | *Atta* workers in nest (not attacked by fire ants)-collected |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8o** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8p** | *S. invicta* | Polygyne - some dealates and partial dealates | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8q** | *S. invicta* | Polygyne? | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8r** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8s** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8t** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8u** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8v** | *S. invicta* | Looks monogyne | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8w** | *S. invicta* | Looks monogyne | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8x** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 225; ca 33 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-8y** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-9** | *S. invicta* | | **x** | **x** | **x** | **x** | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-9a** | *S. invicta* | Looks monogyne | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-9b** | *S. invicta* | Looks monogyne | | | | | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-9c** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-9d** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-9e** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-9f** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-9g** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-9h** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-9i** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-9j** | *S. invicta* | Polygyne | | | | | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-9k** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-10** | *S. invicta* | | **x** | **x** | **x** | **x** | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-10a** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-10b** | *S. invicta* | Polygyne | | | | | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-10c** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-10d** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-10e** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-10f** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-10g** | *S. invicta* | | | | | | |

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| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-10h** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-10i** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-10j** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-10k** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-10L** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 219; 39 km E of Rinco dos Cabrais | Rio Grande do Sul | **Pu-10m** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-11a** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-11b** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-11c** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-11d** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-11e** | *S. richteri* | Looks like *S. richteri* with light color | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-11f** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-11g** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-11h** | *S. invicta* | In same field as all the *S. richteri* nests | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-11i** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-11j** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-11k** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-11L** | *S. richteri* | | | | | | |

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| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-11m** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-11n** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-11o** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-12** | *S. richteri* | Another ant associate found nesting SEPARATELY in the fire ant mound | x | x | x | x | Ant associate in nest collected (workers, males, queens) |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-12a** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-13a** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-13b** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-13c** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-13d** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-13e** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-13f** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-13g** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-13h** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-13i** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-13j** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-13k** | *S. richteri* | | | | | | Beetles in nest collected |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-13L** | *S. richteri* | | | | | | Beetle in nest collected |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-13m** | *S. richteri* | | | | | | Mites in nest collected |

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| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-13n** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-13o** | *S. richteri* | | | | | | Staphylinid beetles in nest collected |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-13p** | *S. richteri* | | | | | | Staphylinid beetles and mites in nest collected |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-13q** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-13r** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-13s** | *S. richteri* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-13t** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14a** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14b** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14c** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14d** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14e** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14f** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14g** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14h** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14i** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14j** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14k** | *S. invicta* | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14L** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14m** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14n** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14o** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14p** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14q** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14r** | *S. invicta* | | | | | | Beetle captured in nest |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14s** | *S. invicta* | | | | | | Termites in nest frozen |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14t** | *S. invicta* | | | | | | Termites in nest frozen |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14u** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14v** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14w** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14x** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14y** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-14z** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-15a** | *S. invicta* | | | | | | Beetle in nest frozen |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-15b** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-15c** | *S. invicta* | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-15d** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-15e** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-15f** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-15g** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-15h** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-15i** | *S. invicta* | | | | | | Beetles in nest frozen |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-15j** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-15k** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-15L** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-15m** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-15n** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-15o** | *S. invicta* | | | | | | |
| Brazil | Rt 290 @ KM 130; ca 16 km E of Arroio dos Ratos | Rio Grande do Sul | **Pu-15p** | *S. invicta* | | | | | | |
| Brazil | Rt 386 @ KM 243; at Soledade | Rio Grande do Sul | **Pu-16** | *S. invicta* | | **x** | **x** | **x** | **x** | |
| Brazil | Rt 386 at Lajeado do Bugre | Rio Grande do Sul | **Pu-17** | *S. invicta* | Looks like large, dark *S. invicta* or polygyne *S. megergates* | **x** | **x** | **x** | | |
| Brazil | Rt 282 at Sao Miguel d'Oeste | Santa Catarina | **Pu-18** | *S. invicta* | | | **x** | **x** | | |
| Brazil | on Brazil/Argentina border near Planalto | Parana | **Pu-19** | *S. invicta* | Many *S. daguerrei* present in nest | **x** | **x** | **x** | | |
| Argentina | Rt 12 at Posadas | Missiones | **Pu-20** | *S. invicta* | | **x** | **x** | **x** | **x** | |

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| Argentina | Rt 12 @ KM 1227; 46 KM E of Ita Ibate | Corrientes | **Pu-21** | *S. invicta* | | x | x | x | x | |
| Argentina | Rt 12 @ KM 1122; 43 KM E of Itati | Corrientes | **Pu-22** | *S. invicta* | Small and reddish *S. invicta* | x | x | x | x | |
| Argentina | Rt 12 S of Corrientes in town of Empedrado | Corrientes | **X-1** | *S. invicta* | Dealate queens from polygyne nest - no nest ID given | | | | | |
| Argentina | Rt 12 @ KM 1122; 43 km E of Itati | Corrientes | **Pu-23** | *S. macdonaghi* | | x | x | | | |
| Argentina | Rt 12 @ KM 1122; 43 km E of Itati | Corrientes | **Pu-24** | *S. invicta* | | x | x | | | |
| Argentina | Rt 12 at airport runway in Corrientes | Corrientes | **Pu-25** | *S. invicta* | Looks like hybrid *S. macdonaghi* / *S. invicta* | x | x | | | |
| Argentina | Rt 12 at airport runway in Corrientes | Corrientes | **Pu-26** | *S. invicta* | Polygyne nest with several dealates (nest=P-B7-S9) | x | x | x | | *S. daguerrei* |
| Argentina | Rt 12 at airport runway in Corrientes | Corrientes | **Pu-27** | *S. invicta* | Monogyne nest? (nest=M-B5-S1) | x | x | x | | |
| Argentina | Rt 12 at airport runway in Corrientes | Corrientes | **Pu-28** | *S. macdonaghi* | | x | x | x | x | |
| Argentina | Rt 12 at airport runway in Corrientes | Corrientes | **Pu-29** | *S. invicta* | Nest=P-oppsign-R; nest has *S. daguerrei* | x | x | | x | *S. daguerrei* |
| Argentina | Rt 11 @ KM 1047; 50 km S of Velaz | Chaco | **Pu-30** | *S. invicta* | Polygyne nest? | x | x | x | x | |
| Argentina | Rt 11 @ KM 1149; 20 km S of Formosa | Formosa | **Pu-31** | *S. invicta* | Very orange *S. invicta*; polygyne? | x | x | x | x | |
| Argentina | Rt 12 S of Corrientes in town of Empedrado | Corrientes | **Pu-32** | *S. macdonaghi* | | x | x | | | |
| Argentina | Rt 16 W of Resistencia @ KM 41; 12 km E of Makalle | Chaco | **Pu-33** | *S. invicta* | Dark and odd-looking *S. invicta* | x | x | x | x | |
| Argentina | Rt 16 W of Resistencia @ KM 41; 12 km E of Makalle | Chaco | **Pu-34** | *S. invicta* | Polygyne - dealate queens found; also, live dealates from ca. 15 nests collected here | x | x | x | | |
| Argentina | Rt 16 W of Resistencia @ KM 41; 12 km E of Makalle | Chaco | **Pu-35** | *S. invicta* | Many *S. daguerrei* present (parasites seen mating in nest) | x | x | | | *S. daguerrei* collected |
| Argentina | Rt 89 at Charata | Chaco | **Pu-36** | *S. invicta* | | x | x | | x | |
| Argentina | Rt 89 @ KM 390; at Quimili | Santiago del Estero | **Pu-37** | *S. macdonaghi* | | x | x | | x | |

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| Argentina | Rt 50 at Suncho Corral | Santiago del Estero | **Pu-38** | *S. invicta* | | x | x | | | |
| Argentina | in town of Santiago del Estero | Santiago del Estero | **Pu-39** | *S. invicta* | | x | x | x | | |
| Argentina | in town of Santiago del Estero | Santiago del Estero | **Pu-40** | *S. invicta* | | x | x | | | |
| Argentina | Rt 9 @ KM 1108; 33 km N of Va San Martin | Santiago del Estero | **Pu-41** | *S. interrupta* | No obvious mound, just a hole in the ground | x | x | x | | |
| Argentina | Rt 9 @ KM 1108; 33 km N of Va San Martin | Santiago del Estero | **Pu-42** | *S. interrupta* | Very inconspicuous mound | x | x | | x | |
| Argentina | Rt 9 @ KM 1070; 6 km S of Va San Martin | Santiago del Estero | **Pu-43** | *S. interrupta* | In desert | x | x | x | x | |
| Argentina | Rt 9 @ KM 986; at Cerrito | Santiago del Estero | **Pu-44** | *S. interrupta* | In desert | 1 | x | x | x | |
| Argentina | Rt 9 at Vila del Totoral | Cordoba | **Pu-45** | *S. interrupta* | | x | x | x | x | |
| Argentina | Rt 9 @ KM 520; 6 km NW of Morrison | Cordoba | **Pu-46** | *S. interrupta* | Pasture with many mounds | x | x | x | x | |
| Argentina | Rt 9 at Tortugas | Santa Fe | **Pu-47** | *S. interrupta* | Polygyne nest | x | x | x | x | 1 large and 1 small dealate |
| Argentina | Rt 9 at Roldan (junction with Loop A012) | Santa Fe | **Pu-48** | *S. quinquecuspis* | | x | x | x | | |
| Argentina | Rt 9 at Roldan (junction with Loop A012) | Santa Fe | **Pu-49** | *S. invicta* | | x | x | x | x | |
| Argentina | Rt 9 at Roldan (junction with Loop A012) | Santa Fe | **Pu-50** | *S. invicta* | | x | x | x | | |
| Argentina | Rt 9 at Roldan (junction with Loop A012) | Santa Fe | **Pu-51** | *S. quinquecuspis* | | x | x | x | | |
| Argentina | Rt 9 at Roldan (junction with Loop A012) | Santa Fe | **Pu-52** | *S. invicta* | | x | x | x | x | |
| Argentina | Rt 9 at Roldan (junction with Loop A012) | Santa Fe | **Pu-53** | *S. invicta* | | x | x | x | | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-54** | *S. quinquecuspis* | | x | x | ? | | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-55** | *S. quinquecuspis* | | x | x | x | x | |

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| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-56** | *S. quinquecuspis* | | | x | x | | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-57** | *S. quinquecuspis* | | x | x | | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-58** | *S. quinquecuspis* | | 1 | x | x | | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-59** | *S. quinquecuspis* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-60** | *S. quinquecuspis* | | x | x | x | x | Hemiptera nymphs in nest collected |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-61** | *S. quinquecuspis* | Maybe very orange *S. quinquecuspis* | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-62** | *S. quinquecuspis* | Very dark *S. quinquecuspis* | x | x | | | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-63** | *S. quinquecuspis* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-64** | *S. quinquecuspis* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-65** | *S. quinquecuspis* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-66** | *S. quinquecuspis* | Odd mix of workers in this nest; some *S. quinquecuspis*-like and some *S. macdonaghi-like* | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-67** | *S. quinquecuspis* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-68** | *S. quinquecuspis* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-69** | *S. richteri* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-70** | *S. richteri* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-71** | *S. richteri* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-72** | *S. richteri* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-73** | *S. richteri* | | x | x | x | x | |

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| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-74** | *S. richteri* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-75** | *S. richteri* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-76** | *S. richteri* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-77** | *S. richteri* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-78** | *S. richteri* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-79** | *S. richteri* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-80** | *S. richteri* | | | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-81** | *S. richteri* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-82** | *S. richteri* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-83** | *S. richteri* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-84** | *S. richteri* | | x | x | x | | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-85** | *S. richteri* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-86** | *S. richteri* | | | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-87** | *S. richteri* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-88** | *S. richteri* | | x | x | x | | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-89** | *S. richteri* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-90** | *S. richteri* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-91** | *S. richteri* | | x | x | x | x | |

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| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-92** | *S. richteri* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-93** | *S. richteri* | | x | x | x | | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-94** | *S. richteri* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-95** | *S. quinquecuspis* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-96** | *S. quinquecuspis* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-97** | *S. richteri* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-98** | *S. quinquecuspis* | | x | x | x | | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-99** | *S. quinquecuspis* | | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **Pu-100** | *S. quinquecuspis* | Odd mix of orange and dark workers | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **B-1** | *S. quinquecuspis* | Polygyne nest - live dealates collected | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **B-2** | *S. quinquecuspis* | Odd mix of orange and dark workers; polygyne!! | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **B-3** | *S. quinquecuspis* | Odd mix of orange and dark workers; polygyne | x | x | x | x | |
| Argentina | Loop A012 4 km S of junction with Rt 9 at Roldan | Santa Fe | **B-4** | *S. quinquecuspis* | Odd mix of orange and dark workers | x | x | x | x | |
| Argentina | Rt 9 at Roldan (junction with Loop A012) | Santa Fe | **B-5** | *S. invicta* | | x | x | x | x | |
| Argentina | Rt 9 at Roldan (junction with Loop A012) | Santa Fe | **B-6** | *S. invicta* | | x | x | x | | |
| Argentina | Rt 9 at Roldan (junction with Loop A012) | Santa Fe | **B-7** | *S. invicta* | | **?** | x | x | x | |
| Argentina | Rt 9 at Roldan (junction with Loop A012) | Santa Fe | **B-8** | *S. invicta* | | x | x | x | x | |
| Argentina | Rt 9 at Roldan (junction with Loop A012) | Santa Fe | **B-9** | *S. invicta* | | x | x | x | x | |

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| Argentina | Rt 9 at Roldan (junction with Loop A012) | Santa Fe | **B-10** | *S. invicta* | | x | x | x | | |
| Argentina | Rt 9 at Roldan (junction with Loop A012) | Santa Fe | **B-11** | *S. invicta* | | x | x | x | x | |
| Argentina | Rt 9 at Roldan (junction with Loop A012) | Santa Fe | **B-12** | *S. invicta* | | x | x | x | x | |
| Argentina | Rt 9 at Roldan (junction with Loop A012) | Santa Fe | **B-13** | *S. quinquecuspis* | *S. invicta* / *S. quinquecuspis* hybrid? | x | x | x | x | |
| Argentina | Rt 9 at Roldan (junction with Loop A012) | Santa Fe | **B-14** | *S. invicta* | | | x | x | | |
| Argentina | Rt 9 at Roldan (junction with Loop A012) | Santa Fe | **B-15** | *S. invicta* | | x | x | x | | |
| Argentina | Rt 9 at Roldan (junction with Loop A012) | Santa Fe | **B-16** | *S. quinquecuspis* | *S. invicta* / *S. quinquecuspis* hybrid? | x | x | x | | |
| Argentina | Rt 9 at Roldan (junction with Loop A012) | Santa Fe | **B-17** | *S. quinquecuspis* | *S. invicta* / *S. quinquecuspis* hybrid? – polygyne | x | x | x | | |
| Argentina | Rt 9 at Roldan (junction with Loop A012) | Santa Fe | **B-18** | *S. quinquecuspis* | *S. invicta* / *S. quinquecuspis* hybrid? | x | x | x | x | |
| Argentina | Rt 9 at Roldan (junction with Loop A012) | Santa Fe | **B-19** | *S. quinquecuspis* | *S. invicta* / *S. quinquecuspis* hybrid? | x | x | x | | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-20** | *S. invicta* | | x | x | | | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-21** | *S. invicta* | | x | x | x | x | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-22** | *S. invicta* | | x | x | | | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-23** | *S. invicta* | | x | x | | x | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-24** | *S. invicta* | | x | x | | x | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-25** | *S. invicta* | | x | x | x | x | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-26** | *S. invicta* | | x | x | x | x | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-27** | *S. invicta* | | x | x | x | x | |

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| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-28** | *S. invicta* | | **x** | **x** | **x** | **x** | Termites in nest collected |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-29** | *S. invicta* | | **x** | **x** | **x** | **x** | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-30** | *S. invicta* | | **x** | **x** | **x** | | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-31** | *S. invicta* | | **x** | **x** | **x** | | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-32** | *S. invicta* | | **x** | **x** | **x** | **x** | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-33** | *S. invicta* | | **x** | **x** | **x** | **x** | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-34** | *S. invicta* | | **?** | **x** | **x** | **x** | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-35** | *S. invicta* | | **x** | **x** | **x** | **x** | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-36** | *S. invicta* | | **x** | **x** | | | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-37** | *S. invicta* | | **x** | **x** | **x** | | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-38** | *S. invicta* | | **x** | **x** | **x** | **x** | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-39** | *S. invicta* | | **x** | **x** | | **x** | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-40** | *S. invicta* | | **x** | **x** | **x** | **x** | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-41** | *S. quinquecuspis* | May be *S. richteri*, *S. quinquecuspis*, or hybrid between them | **x** | **x** | **x** | | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-42** | *S. invicta* | | **x** | **x** | | | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-43** | *S. invicta* | | **x** | **x** | **x** | **x** | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-44** | *S. invicta* | | **x** | **x** | **x** | | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-45** | *S. invicta* | Queenless? recent queen turnover? | **x-males?** | **x** | **x** | | May be recent turnover of queens judging from brood pattern |

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|---|---|---|---|---|---|---|---|---|---|---|
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-46** | *S. invicta* | | x | x | x | x | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-47** | *S. invicta* | | x | x | | | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-48** | *S. invicta* | | x | x | x | | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-49** | *S. invicta* | | x | x | x | | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-50** | *S. invicta* | | x | x | x | x | |
| Argentina | Loop A012 junction with Rt 11; N of Rosario | Santa Fe | **B-51** | *S. quinquecuspis* | May be *S. macdonaghi* or very orange *S. quinquecuspis* | x | x | | | |
| Argentina | Rt 18 @ KM 48; 3 km N of Santa Teresa | Santa Fe | **B-52** | *S. richteri* | | x | x | x | x | |
| Argentina | Rt 18 @ KM 48; 3 km N of Santa Teresa | Santa Fe | **B-53** | *S. richteri* | | x | x | | 1 | |
| Argentina | Rt 18 @ KM 48; 3 km N of Santa Teresa | Santa Fe | **B-54** | *S. richteri* | | x | x | x | x | |
| Argentina | Rt 8 at Pergamino | Buenos Aires | **B-55** | *S. quinquecuspis* | | x | x | x | x | |
| Argentina | Rt 8 at Pergamino | Buenos Aires | **B-56** | *S. richteri* | | x | x | | | |
| Argentina | Rt 8 at Pergamino | Buenos Aires | **B-57** | *S. quinquecuspis* | Unthatched mound | x | x | x | x | |
| Argentina | Rt 8 at Pergamino | Buenos Aires | **B-58** | *S. quinquecuspis* | Unthatched mound | x | x | x | x | |
| Argentina | Rt 8 at Arrecifes | Buenos Aires | **B-59** | *S. richteri* | | x | x | | | |
| Argentina | Rt 8 at Arrecifes | Buenos Aires | **B-60** | *S. quinquecuspis* | Unthatched mound | x | x | x | | |
| Argentina | Rt 8 at Arrecifes | Buenos Aires | **B-61** | *S. quinquecuspis* | Unthatched mound | x | x | x | x | |
| Argentina | Rt 8 at Arrecifes | Buenos Aires | **B-62** | *S. quinquecuspis* | | x | x | x | | |
| Argentina | Rt 8 at San Antonio de Areco | Buenos Aires | **B-63** | *S. richteri* | Mound thatched | | x | x | x | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Argentina | Rt 8 at San Antonio de Areco | Buenos Aires | **B-64** | *S. richteri* | Mound thatched | x | x | x | | |
| Argentina | Rt 8 at San Antonio de Areco | Buenos Aires | **B-65** | *S. richteri* | Mound thatched | x | x | x | x | |
| Argentina | Rt 8 @ KM 62; 8 km NW of Pilar | Buenos Aires | **B-66** | *S. quinquecuspis* | | ? | x | x | x | |
| Argentina | Rt 8 @ KM 62; 8 km NW of Pilar | Buenos Aires | **B-67** | *S. quinquecuspis* | | x | x | x | x | |
| Argentina | Rt 7 at Grnl Rodrigez | Buenos Aires | **B-68** | *S. quinquecuspis* | | x | x | x | x | |
| Argentina | Rt 7 at Grnl Rodrigez | Buenos Aires | **B-69** | *S. richteri* | Mound thatched | x | x | x | x | |

# APPENDIX B. COLLECTION DATA FOR 2001.

| country | locality | state | nest ID | species | nest or other description | worker larvae | adults: worker | adults: queen | adults: male | notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 262 @ São Gonçalo do Rio Abaixo | Minas Gerais | W (white)-1 | *S. saevissima* | | x | x | 2 | | |
| Brazil | Jct. of Rt 262 and Rt 116 @ Realeza | Minas Gerais | W-2 | *S. saevissima* | | x | x | | | |
| Brazil | Rt 262, 5 km E of Ibatiba | Espírito Santo | W-3 | *S. saevissima* | | | x | 2 | | Silverfish collected in nest |
| Brazil | Rt 262 nr. Aracê | Espírito Santo | W-4 | *S. saevissima* | | x | x | x | | |
| Brazil | Rt 262, 15 kmE of Domingos Martins | Espírito Santo | W-5 | *S. saevissima* | | x | x | x | x | |
| Brazil | Rt 101, 5 kmS of Jacupemba | Espírito Santo | W-6 | *Ephemomyrmex* | | | | | | |
| Brazil | Rt 101, Sooretama | Espírito Santo | W-7 | *S. geminata* | | x | x | 1 | x | |
| Brazil | Rt 101 @ Monte Pascoal | Bahia | W-8 | *S. substituta* | Nest in apparently xeric area, small fire-ant-like mound in base of small bush (minimal working of surface, difficult to spot) | x | x | 4 | 2 | |
| Brazil | Rt 101,10 kmS of Camacã | Bahia | W-9 | *S. saevissima* | | x | x | 1 | x | |
| Brazil | Rt 101, 5 km S of Jussari | Bahia | W-10 | *S. geminata* | Also 2 nest-founding queens collected | x | x | x | | Social parasites present |
| Brazil | Rt 101, in Buerarema | Bahia | W-11 | *S. saevissima* | | x | x | x | | |
| Brazil | Rt 101, 20 kmN of Ubaitaba | Bahia | W-12 | *Solenopsis* parasites in *Pheidole* nest | *Solenopsis* in *Pheidole* nest | | | x | x* | * maybe host and parasite males |
| Brazil | Rt 101, 20 kmN of Ubaitaba | Bahia | W-13 | *S. geminata* | With *Solenopsis* sp. (thief ant) | x | x | * | | * one small dealate queen, parasite |
| Brazil | Ferry Rd., 13 kmW of Nazaré | Bahia | W-14 | *S. saevissima* | | x | x | 2* | 3 | * *Crematogaster* queen in nest |
| Brazil | Rt 99, 25 kmS of Conde | Bahia | W-15 | *S. substituta* | | 2 | x | | | |
| Brazil | Jct. Rt 99 and Rt 101 nr. Estância | Sergipe | W-16 | *S. saevissima* | | x | x | 1 | | |
| Brazil | Rt 101, 10 kmN of Aracaju | Sergipe | W-17 | *S. saevissima* | | x | x | 3 | x | Isopod in nest |
| Brazil | Rt 101 in Propriá | Sergipe | W-18 | *S. saevissima* | | x | x | 2 | | Isopod in nest |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 101 in São Sebastião | Alagoas | W-19 | ? | | x | x | x | 2 | |
| Brazil | Rt 101 in São Sebastião | Bahia | W-20 | *S. geminata* | | x | x | | | |
| Brazil | Rt 101 in Recife | Peranambuco | W-21 | *S. substituta* | Nest not found | | 2 | | | |
| Brazil | Rt 101, 25 kmS of João Pessoa | Paraíba | W-22 | *S. saevissima* | | x | x | | | Isopod in nest |
| Brazil | Rt 101, 9 kmS of State Border | Paraíba | W-23 | *S. substituta* | Monomorphic | x | x | | | |
| Brazil | Rt 101, 9 kmS of State Border | Paraíba | W-24 | *S. substituta* | Monomorphic | x | x | | | |
| Brazil | Rt 101, 25 kmN of state border | Rio Grande do Norte | W-25 | *S. substituta* | Monomorphic | x | x | | | |
| Brazil | Rt 101, 20 kmS of Natal | Rio Grande do Norte | W-26 | *S. substituta* | Monomorphic | x | x | | | |
| Brazil | Rt 304, 5 kmW of Macaiba | Rio Grande do Norte | W-27 | *S. substituta* | Monomorphic | x | x | | | |
| Brazil | Rt 304, 5 kmE of Aracati | Ceará | W-28 | *S. substituta* | Monomorphic | 3 | x | | | |
| Brazil | Rt 304, 40 kmW of Aracati | Ceará | W-29 | *S. substituta* | Monomorphic | x | x | | | |
| Brazil | Rt 116 @ Chorozinho | Ceará | W-30 | *S. substituta* | Monomorphic | x | x | | | |
| Brazil | Rt 222, 10 kmW of Fortaleza | Ceará | W-31 | *S. saevissima* | | x | x | x | | Multiple dealates found in nest |
| Brazil | Rt 222, 10 km W of Fortaleza | Ceará | W-32 | *S. saevissima* | *Camponotus* and *Pheidole* nesting very close | | x | 3 | | One dealate |
| Brazil | Rt 222, 10 kmW of Itapagé | Ceará | W-33 | *S. substituta* | Monomorphic | x | x | | | Samples taken of workers from 2 nests within 10 m of W-33 - nests occur in clusters |
| Brazil | Rt 222, 10 kmW of Tianguá | Ceará | W-34 | *S. tridens* | Black, Monomorphic | x | x | | | |
| Brazil | Rt 222, 7 kmW of São João da Fronteira | Piauí | W-35 | *S. substituta* | Black, Monomorphic | x | x | | | |
| Brazil | Rt 343, 5 kmW of Teresina | Piauí | W-36 | *S. saevissima* | | x | x | 2 | 3 | Beetle and silverfish in colony; * callow |
| Brazil | Rt 316, 10 kmW of Timon, nr. Teresina | Maranhão | W-37 | *S. saevissima* | | x | x | 3 | | |
| Brazil | Rt 316, 30 kmW of Caxias | Maranhão | W-38 | *S. tridens* | Monomorphic, small nest | x | x | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt MA 122, 5 kmE of Pedreiras | Maranhão | W-39 | *S. saevissima* | | x | x | x | x | |
| Brazil | Rt Ma 119 @ Lago da Pedra | Maranhão | W-40 | *S. saevissima* | | x | x | 1 | x | |
| Brazil | Rt 316, 20 kmE of Santa Inês | Maranhão | W-41 | *S. substituta* | Monomorphic, small nest | x | x | | | |
| Brazil | Rt 316 @ Zé Doca | Maranhão | W-42 | *S. saevissima* | | x | x | | x | |
| Brazil | Rt 316, 25 kmE of State Border | Maranhão | W-43 | *S. saevissima* | | x | x | 2 | | |
| Brazil | Rt 316 @ Capanema | Pará | W-44 | *S. saevissima* | | x | x | 3 | | |
| Brazil | Rt 316, 50 kmE of Castanhal | Pará | W-45 | *S. geminata* | | x | x | | | |
| Brazil | Belém | Pará | W-46 | *S. saevissima* | | x | x | | | |
| Brazil | Rt 316, 5 kmE of Castanhal | Pará | W-47 | *S. saevissima* | | x | x | x | x | |
| Brazil | Rt 010, 5 kmS of São Miguel do Guama | Pará | W-48 | *S. saevissima* | | x | x | 3 | x | |
| Brazil | Rt 010, 20 kmS of Ipixuna do Pará | Pará | W-49 | *S. saevissima* | | x | x | x | x | |
| Brazil | Rt 010, 45 kmN of Ulianópolis | Pará | W-50 | *S. saevissima* | Darker than the honey color | x | x | x | x | |
| Brazil | Rt 010, 10 kmS of Imperatriz | Maranhão | W-51 | *S. saevissima* | | x | x | | 3 | |
| Brazil | Rt 010, 20 kmS of Estreito | Maranhão | W-52 | *S. tridens* | Nest in xeric habitat. Sandy clay soil. No nest structure above ground, only a single circular entrance observed. | x | x | | | |
| Brazil | Rt 230 in Riachão | Maranhão | W-53 | *S. saevissima* | | x | x | x | x | |
| Brazil | Rt 230, 5 kmW of São Raimundo das Mangabeiras | Maranhão | W-54 | *S. saevissima* | Trail found but not nest | | x | | | |
| Brazil | Rt 230, 5 kmW of São Raimundo das Mangabeiras | Maranhão | W-55 | *S. tridens* | Monomorphic workers - nest not found | | x | | | |
| Brazil | Rt 230 in São Raimundo das Mangabeiras | Maranhão | W-56 | *S. saevissima* | | x | x | | x | |
| Brazil | Rt 230 in São Domingos do Azeitão | Maranhão | W-57 | *S. saevissima* | | x | x | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 230 in São Domingos do Azeitão | Maranhão | W-58 | *S. saevissima* | Nest in same field as W-57 | x | x | | | |
| Brazil | Rt 230, 10 kmW of Floriano | Maranhão | W-59 | *S. geminata* | | x | x | | | |
| Brazil | Rt 230 in Floriano | Piauí | W-60 | *S. saevissima* | | x | x | x | | |
| Brazil | Rt PI 140, 70 kmS of Floriano | Piauí | W-61 | *S. substituta* | | x | x | 1 | x | |
| Brazil | Rt PI 140, 70 kmS of Floriano | Piauí | W-62 | *S. substituta* | Nest 10 m from W-61 | | x | | | |
| Brazil | Rt BR 324, 60 kmW of Canto do Buriti | Piauí | W-63 | *S. geminata* | | x | x | | | |
| Brazil | Rt 135, 70 kmN of Cristino Castro | Piauí | W-64 | *S. substituta* | | x | x | 1 | 1 | |
| Brazil | Rt 135, 70 kmN of Cristino Castro | Piauí | W-65 | *S. substituta* | Nest probably queenless - located 5 m from W-64 | | x | | x | |
| Brazil | Rt 135, 10 kmN of Cristino Castro | Piauí | W-66 | *S. substituta* | | x | x | | 2 | |
| Brazil | Rt 135 in Cristino Castro | Piauí | W-67 | *S. saevissima* | | x | x | | | Hemipteran myrmecophile |
| Brazil | Rt 135 in Corrente | Piauí | W-68 | *S. saevissima* | | x | x | | x | |
| Brazil | Rt 135, 80 kmN of Barreiras | Bahia | W-69 | *S. substituta* | Nest found at dusk | | x | | | |
| Brazil | Rt 020, 71 km W of Barreiras | Bahia | W-70 | *S. saevissima* | | x | x | x | | |
| Brazil | Rt 202, 45 kmS of Luis Eduardo Magalhães | Bahia | W-71 | *S. tridens* | Nest in shade by side of dirt road - cup-shaped mound of excavated soil; higest on one side of the entrance; entrance hole in center | x | x | 1 | x | |
| Brazil | Rt 020, 60 kmN of Posse | Goiãs | W-72 | *S. saevissima* | | x | x | x | x | |
| Brazil | Rt BR 060, 25 kmSW of Brasilia | Distrito Federal | W-73 | *S. saevissima* | | x | x | | | |
| Brazil | Rt BR 060 in Acreuna | Goiãs | W-74 | *S. saevissima* | | x | x | 1 | | Two beetles in nest |
| Brazil | Rt GO? (nr BR 158) in Lagoa Santa | Goiãs | W-75 | *S. saevissima* | At Lagoa Santa Hotel | x | x | x | | |
| Brazil | Rt 262, 50 kmE of Campo Grande | Mato Grosso do Sul | W-76 | *S. invicta* | No fire ants found in area between W-75 and W-76 | x | x | 1 | x | |
| Brazil | Rt 262 in Pedro Celestino | Mato Grosso do Sul | W-77 | *Solenopsis* sp. nov. nr *nigella* | Nest not found, only foragers | | x | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| Brazil | Rt 262, 10 kmW of Pedro Celestino | Mato Grosso do Sul | W-78 | *Solenopsis* sp. nov. nr *nigella* | Both small yellow workers and larger brown workers in same nest in a log with termites; using termite galleries backed with wings… | **2** | **x** | **1*** | **x** | * dealate |
| Brazil | Rt 262, 10 kmW of Pedro Celestino | Mato Grosso do Sul | W-79 | *Solenopsis* sp. nov. nr *nigella* | Nest in soil underneath a fallen log with termites (apparently in termite galleries) | **1** | **x** | | **2** | Same sp. As W-78 |
| Brazil | Rt 262, 30 kmW of Aquidauana | Mato Grosso do Sul | W-80 | *S. invicta* | Large nest w/ polymorphic workers | **x** | **x** | | | |
| Brazil | Rt 262, 34 kmW of Aquidauana | Mato Grosso do Sul | W-81 | *S. invicta* | | **x** | **x** | | | |
| Brazil | Rt 060, 15 kmS of Campo Grande | Mato Grosso do Sul | W-82 | *S. invicta* | | **x** | **x** | | | |
| Brazil | Rt 262, 100 kmW of Aqua Clara | Mato Grosso do Sul | W-83 | *S. substituta* | Nest basically just hole in the ground on small sand hill; monomorphic; different coloration than *S. substituta* | **x** | **x** | | | |
| Brazil | Rt 262, 50 kmE of Aqua Clara | Mato Grosso do Sul | W-84 | *S. saevissima* | | **x** | **x** | | **x** | |
| Brazil | Rt SP 300, 15 kmE of Tres Lagoas | São Paulo | W-85 | *S. saevissima* | | **x** | **x** | **1** | **1** | |
| Brazil | Rt SP 310, 18 kmE of Ilha Solteira | São Paulo | W-86 | *S. saevissima* | | **x** | **x** | | **x** | |
| Brazil | Rt MS 310, @ Research Farm, Selvíria | Mato Grosso do Sul | W-87 | *S. gensterblumi* | Nest under log on side of road in woodland by river - no evidence of mound; workers polymorphic | **x** | **x** | **3** | | |
| Brazil | Rt MS 310, @ Research Farm, Selvíria | Mato Grosso do Sul | W-88 | *S.gensterblumi* | Same nest situation as W-87 | | **x** | **x** | | |