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A Preliminary Study on the Mantid Fauna (Insecta : Mantodea) of Orissa, India

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ZOOLOGICAL SURVEY OF INDIA

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INTRODUCTION

Convention of Biodiversity commits signatory nations to undertake inventory of their biological diversity. Inventories provide fundamental information about the distribution and abundance of biodiversity and such data are necessary for the long-term sustainable management, use and conservation of biodiversity areas (Heywood, 1995). It is not feasible to attempt the inventory of all biota at once. So priorities are to be established in such studies and it is imperative to choose groups of greatest importance for inventorying. Order Mantodea (Insecta) is one such focal group for biodiversity inventorying, because they represent an economically important group of insects in the terrestrial ecosystem.

Mantids, popularly called 'Praying mantids are insects classified under the order Mantodea of class Insecta in Phylum Arthropoda. They are insects of economic importance, playing both positive and negative roles in the terrestrial ecosystem. They help in the control of noxious insect pests like grasshoppers, crickets, moths, butterflies, flies, ahpids etc which form their major groups of prey. Being an active predator they also destroy non injurious and beneficial insects. The two front legs of mantids are highly specialized for catching the prey and during hunting they assume a praying position, folding the front legs under their head, hence derived the name 'Praying Mantids'

Though India has a diverse fauna of mantids, taxonomic studies on this interesting group of insects were neglected but for scattered publications. It was Mukherjee *et al* (1995) who compiled the information on the mantid fauna of India. Recently there is an increasing interest in the taxonomic studies on mantids of India, supplemented by the description of some interesting new taxa (Ghate and Ranade, 2002, Ghate and Mukherjee, 2004, Thulsi Rao *et al.*, 2005, Sureshan *et al.*, 2004 a,b, 2006 a,b,c, Mukherjee *et al.*, 2005, Vyjayandi & Narendarn, 2003, 2005, Vyjayandi *et al*, 2006, Vyjayandi, 2007). The present work is an attempt of inventorying the mantid fauna of Orissa state based on the faunal exploration studies conducted by the Zoological Survey of India, Estuarine Biological Station, Gopalpur-on-sea during the years 2005 to 2007. Though collections for the present study were mainly made from Southern Orissa particularly from coastal districts, the mantid fauna known from the whole Orissa state is dealt with based on the information available in the literature.

STUDY AREA AND SCOPE OF THE PRESENT WORK

The present study is mainly based on the faunal exploration surveys conducted by Zoological Survey of India, Estuarine Biological Station, Gopalpur-on-Sea, Orissa during the years 2005 to 2007. Southern coastal districts of Orissa viz. Ganjam, Puri, Kurda,

Nayargarh, Cuttack, Jagatsinghpur, Jajpur and Kendrapara were surveyed for mantid collections. The state of Oirssa lies between 81° 27' to 87° 27' latitude and 17° 49' to 22° 34' N longitudes and has a total area of about 1,55,780 sq. km (Fig. 1). The state is bounded by the Bay of Bengal and the eastern arm of Andhra Pradesh in South, states of Bihar and Jharkand in North, Madhya Pradesh and Chatisgarh in West and West Bengal in the East. Orissa has a long coastline of about 480 km along the Bay of Bengal. The climate of the state is generally tropical with fairly good rainfall and moderately high temperature. The vegetation is mainly tropical and subtropical in nature and the fauna is mainly tropical and rich.

Despite of having a rich diversity in flora and fauna, entomofauna of Orissa is very poorly studied and the information on the mantid fauna is very fragmentary. Since mantids play a very important role in the ecosystem, the present study is initiated to provide basic taxonomic information on this group of insects from the state. By presenting this work it is hoped to facilitate increased studies on the taxonomy, ecology and biology of mantids from Orissa so allowing the better utilization of their biological control potentials in the fight against various insect pests.

METHODOLOGY OF COLLECTION AND IDENTIFICATION

The collections were mainly made from fields adjacent to the coastal line. Specimens (adults and nymphs) were collected from the field by sweeping over vegetations with an insect net. Adult mantids were also collected during late evenings which are attracted towards garden lights and other light sources. Nymphal stages were collected by rearing the ootheca collected from the field in the laboratory. Some hymenopteran parasitoids were also emerged while rearing the ootheca in the laboratory. The specimens were properly preserved and pinned following standard entomological procedures and observed under a Stereozoom trinocular microscope. The identifications were made following Mukherjee *et al.,* (1995) and for the recent classification Ehrmann (2002) was referred.

GENERAL ECOLOGY AND BEHAVIOUR OF MANTIDS

Mantids are commonly found in gardens, field crops, grass meadows, scrub jungles, forests and even visit home premises during late evenings. They are commonly occurring between the altitudes of 900 m to 1400 m, less common in colder and hotter parts of the earth. They are generally active in the forenoon during sunny days and less active during colder periods and their feeding and reproductive activities are extended to the afternoon hours also. Species inhabiting arid and semi arid regions become active after sunset to avoid dessication.

Mantids show interesting behavior patterns. They groom themselves frequently, using their fore legs they wipe their eyes and heads and clean their forelegs with their mouths. When faced with danger, most species attempt to run or fly away. They are good fliers and in species with reduced wing venation and awkward body structure movement is restricted. Mantids are generalist feeders and can catch and consume arthropods primarily of equal or smaller size. Nymphal stages of mantids usually feed on sedentary insects like aphids which are easily accessible. Mantids remain motionless for hours together with only the head moving to watch flying insects that serve as food. They have a neck that allows the head to rotate 180 degrees, while waiting for a meal to wander by. Camouflage coloration allows mantids to blend in with the background as they sit on twigs and stems waiting to ambush prey. They use front legs to strike out and capture their prey. Long sharp spines on the upper insides of their legs allow them to hold their prey firmly. The impaled prey is hold firmly in place while being eaten. Known for being cannibals, mantids consume each other if the opportunity arises. Large eyes and extraordinarily quick foreleg strikes enable them to capture prey in 1/20 of a second. Various observations were made on the ecology and predatory behaviour of mantids (Frederick *et al.*, 1999, Edmund, 1972, Kramer 1960).

REPRODUCTION

Life history of mantids coincides with different season in different climatic zones. In some parts of the country hatchings occur in winter while in others hatching occurs during monsoon or pre monsoon. During mating, smaller males often jump on the back of the larger female. Mating usually leads to the eating of male by female as the mantids are actively cannibalistic. If the female cannibalizes the male during copulation, he continues to mate with her even without his head. Once the male has inserted the sperm into female's body, she uses his sperm to fertilize the eggs. Copulation usually occurs during mid-day and continues for 2-3 hrs. After mating the female lays groups of 12-400 eggs (number varies with species) in a frothy liquid that turns to a hard protective shell, called ootheca. The shape of the ootheca varies in different species and with the size of the female mantid. The size and shape of the ootheca is of some value in the identification of the species (plate.I). Reproduction and courtship behaviour in mantids were studied in detail (Loxton, 1977, Mathur, 1934, Maxwell, 1999).

Mantids are good examples of insects that have gradual and incomplete metamorphosis. Development includes egg, nymph and adult stages. The number of nymphs hatching from an ootheca varies with the species as well as the size of the ootheca. Parasitism by Hymeoptera parasitoids also affects the number of hatchings. The time for development and incubation varies in different species and normally 7 instars are found in mantids. The nymph increases in size by replacing its outer body covering

with a sturdy and flexibe exoskeleton through periodic moulting. As the nymph grow, the wings develop on their backs and with each moult the wing bud increase in size. When the wings are fully developed the mantid become an adult. Some species are apterous or brachypterous, especially in the female sex.

MORPHOLOGY (Figs. 2-7)

Mantids are generally large insects ranging in size from 1 cm to more than 17 cm. Females are usually larger than males. The body of an adult mantid is divisible into head, thorax and abdomen. Head bears paired antenna, compound eyes, three ocelli and mouth parts. Thorax is divisible into prothorax, mesothorax and metathorx. Prothorax has two parts, the anterior prozona and the posterior metazona. Prozona bears the paired fore legs. Mesothroax and metathorax bears one pair of legs and one pair of wings each. Forewings (Tegmina) are hard and hind wings membraneous. Wing structure varies widely among mantid families, form apterous, brachypterous and to those having two pairs of fully developed wings. Legs are divisible into proximal coxa, followed by trochanter, femur, tibia and tarsus. Foreleg parts are usually spinous. The femur has three sets of spines, external, internal and discoidal. The abdomen has 10 segments and terminates with the genitalia and a pair of multi segmented anal cerci in female and in addition a pair of anal style in male. The Mantid taxonomy still greatly depends on morphological features of the vertex, frontal sclerite, pronotum, legs, fore and hind wings etc, but studies on the male genitalia also is useful for the identification. Stucture of genitalia is more diversified in male than in female (Figs. 8, 9) and studies on it is useful for the better understanding of species status.

SYSTEMATICS

Mantids were formerly placed under the order Dictyoptera in Class Insecta and later placed in a separate order Mantodea Burmeister (1838). Though Mantodea is an economically important group of insects with vast array of morphology, ethology and biology, the study of the group may still be regarded as being in its infancy. The order Mantodea comprises 15 families that contain 434 genera and 2300 species throughout the world (Ehrmann, 2002). Members of 10 families are known to occur in India. According to Mukherjee *et al.* (1995) 162 species of mantids under 68 genera and 6 famlies are known from India. Recent compilation by Vyjayandi (2007) provided a checklist of Mantodea from Indian subcontinent which included 154 species under 66 genera and 6 families. The checklist of Vyjayandi (2007) omitted 10 species under genera, *Pararivetina*, *Rivetinula* and *Tenodera* which were already treated by Mukherjee *et al.* (1995). When compared to other parts of the country mantid fauna of Maharashtra, Kerala, Tamil Nadu, West Bengal and Andhra Pradesh are better studied.

Mantid fauna of India (State wise) – (modified from Mukherjee *et al.*, 1995)

State	Genera	Species	State	Genera	Species
Jammu & Kashmir	4	4	Andhra Pradesh (Thulsi	23	26
Himachal Pradesh	10	15	Rao *et al.*, 2005)		
Uttar Pradesh	29	55	Orissa (Sureshan *et al.*,	18	27
Arunachal Pradesh	12	20	current study)		
Meghalaya	17	25	Tamil Nadu	36	44
Sikkim	12	16	Kerala (Vyjayandi, 2007)	29	40
Manipur	7	10	Karnataka	22	26
Assam	22	29	Gujarat	4	4
Tripura	2	2	Maharashtra (Sureshan	?	54
West Bengal	24	35	*et al.*, 2006 b)		
Bihar*	21	25	Goa	1	1
Madhya Pradesh	11	16	Punjab	3	3
			Rajasthan	7	8
			Andaman & Nicobar Islands	5	7
			(Sureshan *et al.*, 2004 a).		
			Lakshadeep Islands	1	1

CLASSIFICATION OF ORDER MANTODEA (UP TO SUBFAMILY LEVEL) (PROPOSED by EHRMANN, 2002)

(Taxa in bold italics represented in Indian subcontinent)

Kingdom : ANIMALIA
Phylum : ARTHROPODA
Class : INSECTA
Subclass : PTERYGOTA
Order : MANTODEA

Family : Acanthopidae
Subfamily Acanthopinae
Acontiothespinae
Stenophyllinae

* *(Sureshan & Sambath in press)*

Family : *Amorphoscelidae*

Amorphoscelinae
Paraoxypillinae
Perlamantinae

Family *Empusidae*

Blepharodinae
Empusinae

Family *Eremiaphilidae*

Eremiaphilinae

Family : Hymenopodidae

Acromantinae
Epaphroditinae
Hymenopodinae
Oxypilinae

Family : *Iridopterygidae*

Hapalomantinae
Iridopteryginae
Nanomantinae
Nilomantinae
Tropidomantinae

Family *Liturgusidae*

Liturgusinae

Family : *Mantidae*

Amelinae
Angelinae
Choeradodinae
Chroicopterinae
Deroplatyinae
Dystactinae
Mantinae
Miomantinae
Orthoderinae
Oxyothespinae
Paramantinae
Photininae
Phyllotheliinae
Schizocephalinae
Stagmomantinae
Vatinae

Family	:	Mantoididae	
Family	:	***Metallyctidae***	
Family	:	***Sibyllidae***	
		Subfamily :	Sibyllinae
Family	:	***Tarachodidae***	
		Subfamily :	***Caliridinae***
			Tarachodinae
Family	:	***Thespidae***	
			Hoplochoryphinae
			Miopteryginae
			Oligonicinae
			Pseudomioptriginae
			Haaniinae
			Thespinae
Family	:	***Toxoderidae***	
			Toxoderinae
Family	:	Chaeteessidae	

MANTID FAUNA OF ORISSA

According to Mukherjee *et al.* (1995) mantid fauna of Orissa is represented by 15 species under 10 genera, 3 families. Later Sureshan *et al.* (2006c) reported seven species for the first time from the state. According to the present work, Mantid fauna of Orissa is represented by 4 families, 10 subfamilies, 18 genera and 27 species (11 subfamilies and 6 families as per the classification by Erhmann, 2002) Specimens belonging to 20 species were actually collected from the southern coastal districts of Orissa and for the rest, information available in the literature were incorporated. The classification given by Mukherjee *et al.*, 1995 is followed in the present work and the new classification proposed by Ehrmann (2002) is followed in the checklist of Mantodea of Orissa.

FORM OF PRESENTATION

A dichotomous key to the families of Mantodea known from Orissa is given here followed by keys to the subfamilies, genera and species known from the state. For the preparation of various keys and systematic account, classification given by Mukherjee *et al.* 1995 is followed. The latest classification proposed by Ehrmann (2002) is

followed in the checklist of Mantodea of Orissa. Systematic account of the genera and species are provided under the respective families which included the diagnosis, measurements, material examined and distribution of the species. Some ecological and biological data about the species are also given under separate remarks. For those species which were not actually collected, details were provided based on the literature (Mukherjee *et al.*, 1995).

The following abbreviations are used in the text: FW – Forewing; M – Male; F – Female; PN – Pronotum; BL – Body length (in mm) (from anterior margin of head to tip of abdomen).

Key to the families of Mantodea known from Orissa

1. Pronotum only slightly longer than broad, almost squarish (Fig. 10), vertex with rounded protuberances; fore tibiae (Fig. 13) with only a terminal spine, ventral rows of spines absent ..... **Amorphoscelidae**

— Pronotum distinctly longer than broad and often much longer, some times with leaf like expansions, fore tibiae usually with two rows of ventral spines **2**

2. Antennae of male comb like. Internal spines of fore femora arranged alternatively 1 long and 3-4 shorter spines ..... **Empusidae**

— Antennae of male never comb like.Internal spines of fore femora arranged 1 long and 1 short alternatively **3**

3. External spines of fore tibiae numerous and very closely beset. Forewing often with eye like marks or spiral marks (Fig. 16) ..... **Hymenopodidae**

— External spines of fore tibiae straight, well separated and less in number. Forewing without any eye-like mark or spiral marks ..... **Mantidae**

SYSTEMATIC ACCOUNT

Family AMORPHOSCELIDAE

Small sized, bark dwelling mantids. Head with large rounded protuberances. Fore legs reduced, fore tibiae with only terminal claw.

One subfamily is known from India and Orissa.

Subfamily AMORPHOSCELINAE

Pronotum very little longer than wide; cerci expanded at distal end.

One genus is reported from Orissa.

Genus *Amorphoscelis* Stål

1871. *Amorphoscelis* Stål. Öfvers. *K. Vetensk Akad. Forb.*, **28** : 401. Type species : *Amorphoscelis annulicornis* Stål.

Diagnostic characters : Eyes prominent, round. Frontal sclerite transverse, narrow, arched and superior edge sinuate; lateral lobes of vertex tuberculate (Fig. 12). Pronotum (Fig. 10) nearly as long as wide, a transverse ridge near suprà-coxal groove; fore femora spineless at both edges, discoidal spine single; fore tibiae with only a terminal spine (Fig. 13); supra anal plate transverse, triangular; cerci flattened at distal segment (Fig. 11).

One species *A.annulicornis* is reported known from Orissa.

1. *Amorphoscelis annulicornis* Stål (Plate II, Photo 2)

1871. *Amorphoscelis annulicornis* Stal, *Öfvers. K.Vetensk Akad. Forh.*, **28** : 401.

1915. *Amorphoscelis indica* Giglio-Tos. *Bull. Soc. Entomol. Ital.*, **46** : 33.

1956. *Amorphoscelis keiseri* Beier. *Verh. Naturf. Ges. Basel.*, **67** : 33.

Diagnostic Characters : Body deep brownish, ventral side black. Frontal sclerite narrow, superior edge arched, sinuate on either side. Occiput produced into two large rounded tubercles, two tubercles on anterior and posterior border of pronotum (Fig. 10) transverse and longitudinal carinae distinct. Mid and hind tarsus with yellow and black rings. Distal segment of cerci racket shaped.

Measurements : BL : M 15-20, F 16-20; PN M 2-3.5, F 2-4, FW : M 13.5-14, F 13.5-15.

Material Examined : 5 M, Orissa, Ganjam District, Gopalpur, 3.x.2006, 10.xii.2006. P.M.Sureshan (other data as in Sureshan *et al.*, 2006c.).

Distribution : India : Assam, Bihar, Daman & Diu, Himachal Pradesh, Kerala, Meghalaya, Orissa, Tamil Nadu, West Bengal and Sri Lanka.

Remarks A common species occurring on tree trunks in all warmer parts of India. It displays darting movement of cerci.

Family HYMENOPODIDAE

Medium to small sized mantids often brightly coloured. Forewings often bearing curved bands; Fore femora often expanded, claw groove near base, fore tibiae with closely set and apparently fused external spines; middle and hind legs sometimes with flat lobules.

Two sub families are known from India, and are both occurring in Orissa.

Key to subfamilies

1. Eyes rounded, not bulging, within the circumference of head; frontal sclerite with flat disc and without wing like or excavated extensions on either side (Fig. 20) ..... **Acromantinae**

— Eyes conical, bulging (Fig. 15) and extending beyond the circumference of head; frontal sclerite with a concavity and its lateral edges elevated..... **Hymenopodinae**

Subfamily ACROMANTINAE

Frontal sclerite with flat disc and angular upper margin. Eyes rounded. Vertex often with a protuberance. External and discoidal spines of fore femora 4 in number. Fore and hind wings oftern coloured.

One tribe Acromantini is reported from India and Orissa.

Tribe ACROMANTINI

Vertex with protuberance; pronotum slender; fore and hind legs with or without lobulations.

Four genera are reported from Orissa.

Key to genera

1. Superior edge of fore femora arched and expanded 2

— Superior edge of fore femora simple and not expanded as above 3

2. Superior edge of fore femora strongly arched, foliaceous, oval, external border smooth, internally with 3 black spots along superior edge, another black spot in the middle little above the spines (Fig. 19); frontal sclerite with the superior margin produced into a blunt spine (Fig. 18) ..... ***Hestiasula*** Saussure

— Superior edge of fore femora arched, not much foliaceous as above, external border finely denticulate, internal black spot markings in the inferior border (Figs. 21, 23) ..... ***Ephestiasula*** Giglio-Tos

3. Frontal sclerite with angular upper edge and tubercle at each internal side ..... ***Odontomantis*** Giglio-Tos

— Frontal sclerite with arched upper edges and smooth on sides (Fig. 37) ..... ***Euantissa*** Giglio-Tos

Genus *Ephestiasula* Giglio-Tos

1915. *Ephestiasula* Giglio-Tos. *Bull. Soc. Entomol. Ital.*, **46** 101. Type species : *Ephestiasula pictipes* (Wood-Mason)

Diagnostic characters : Upper margin of vertex concave, lateral corners with a tubercle near the eyes. Frontal sclerite with a deep notch in the middle and an obtuse tubercular carina on either side laterally. External border of fore femora distinctly and finely denticulate.

Two species *E intermedia* and *E pictipes* are known from Orissa.

Key to species of *Ephestiasula* Giglio-Tos

1. Vertex without a tubercle above ocelli (Fig. 22) ..... ***E. intermedia*** Werner

— Vertex with a tubercle above ocelli (Fig. 20)..... ***E. pictipes*** (Wood-Mason)

2. *Ephestiasula intermedia* Werner

1930. *Ephestiasula intermedia* Werner. *Proc. Zool. Soc. London*, 689.

Diagnostic characters : Vertex without a small tubercle above ocelli (Fig. 22), ridges blackish, a black stripe on pronotum and vertex, posterior processes of vertex blunt and very short. Fore coxa orange on inner face, femora pinkish inside with a linear black line along superior margins, inferior margins with a black patch on claw groove area and it continues along bases of spines enclosing two whitish spots (Fig. 23). In fore wings, coastal area greenish yellow and opaque and irregularly reticulated.

Measurements : BL : M 19-21, F 21; FW : M 14-17.5, F 15; PN : M 2.6-3.1, F 5 (Mukherjee *et al.*, 1995).

Material Examined : Nil.

Distribution : India : Jammu & Kashmir, Karnataka, Madhya Pradesh, Rajasthan, Uttar Pradesh, Orissa.

Remarks : Known from Orissa based on one male specimen.The species shows very close resemblance with *E. pictipes* (Mukherjee *et al.*, 1995).

3. ***Ephestiasula pictipes*** *(Wood-Mason)*

1879. *Hestias pictipes* Wood-Mason. *Proc. Asiatic. Soc.* Bengal, 258.

1904. *Hestiasula pictipes* : Kirby. *Cat. Orth. Brit. Mus.*, **1** : 288.

1914. *Ephestiasula pictipes* : Giglio-Tos. *Bull. Soc. Entomol. Ital.*, **46** : 101.

Diagnostic characters : Vertex with a small tubercle above ocelli (Fig. 20) marked with black spots, lateral lobes pointed; prontoum dorso-medially black, outer margin of fore coxae with very minute spines, internal spines of fore femora (Fig. 21) black at tips, inferior internal lobes contain three pale yellow spots encased by black patches, black patch absent at upper border and very thin below near base; tarsi internally black.

Measurements : BL : M 17-21, F 21; FW : M 13-19, F 13; PN : M 3-4, F 3.8.

Material Examined : 1 F nymph. Cuttack dist. Bidarnasi, 25.xi.2005, 1 nymph, Jajpur dist., Sukuapoda, Nr. Lalitagiri, 15.iii.2007, coll. P.M. Sureshan.

Distribution : India : Madhya Pradesh, Orissa, Maharashtra, Uttar Pradesh.

Remarks : Reported earlier from Orissa based on 1 female specimen collected in 1884 (Mukherjee *et al.*, 1995).

Genus ***Euantissa*** Giglio-Tos

1927. *Euantissa* Giglio-Tos. *Das Tierreich*, **50** : 540. Type species : *Mantis pulchra* Fabricius.

Diagnositc characters : Body green. Lateral grooves of vertex extending beyond margin of eyes. Frontal sclerite transverse, upper edge arched. Pronotum almost as long as fore tibia, shorter than coxa, prozona narrowed anteriorly, metazona with almost parallel and denticulate margins. Fore femora not dilated; hind femora without lobes. Forewings opaque, hind wings coloured.

One species *Euantissa pulchra* known from Orissa.

4. ***Euantissa pulchra*** *(Fabricius)*

1787. *Mantis pulchra* Fabricius. *Mant. Ins.*, **1** : 229.

1927. *Euantissa pulchra* : Giglio-Tos. *Das Tierreich*, **50** : 541.

Diagnositc characters : Body green. Forewing dark green, opque, costal area yellow, rest green; hind wings transparent, basal part pink, posterior border with brown band. Frontal sclerite transverse, with two lateral grooves below widely arched superior border, lateral grooves of vertex extending beyond the margin of eyes (Fig. 37); fore femora with four external spines, four discoidal spines and twelve internal spines, all spines are black at tip only.

Measurements : BL, M 15-16, F 19-25 mm; PN, M 4-4.5, F 5-6.5 mm; FW, M 11-11.5, F 14-16 mm.

Material examined : 3 F, Orissa, Cuttack dist., Bidarnasi, 25.xi.2005 (Reg.no. 3988), 5 nymph, data same as above; 1 F, Orisssa, Ganjam Dist, Gopalpur-on-sea, 14.xi.2006 (Reg. no. 3987), 5 F, 1 nymh, Jajpur dist., Balchandrapur, Rukutipata village, 16.iii.2007, 6 F, 1 nymph, Kendrapara dist., Bhuinpur, 14.iii.07, 2 F nymph, Girango village, Nr.River luna, 12.iii.07; 1F, 1F nymph, Rajnagar, 11.iii.07; 5 F nymph, Indupur, Dhumata village, 13.iii.07; 1 F, Ganjam dist., Gopalpur, 14.xi.2006; 5 F nymph, Jajpur dist., Sukuapoda, Nr. Lalitagiri, 15.iii.07, coll. P.M. Sureshan.

Distribution : India : Eastern, North eastern and Southern parts.

Remarks : A common species found on bushes, the first instar nymphs look like ants.

Genus ***Hestiasula*** Saussure

1871. *Hestiasula* Saussure. *Mem. Soc. Phys. Hist. Nat. Geneve*, **21** : 330. Type species : *Hestiasula brunneriana* Saussure.

1927. *Hestiasula* : Giglio-Tos. *Das Tierreich*, **50** : 543.

Diagnostic characters : Frontal sclerite transverse, disc smooth; pronotum short, elliptical, superior border of fore femora strongly arched, foliaceous, oval, external border smooth; fore femora with 4 external and 4 discoidal spines. Middle and hind legs without any lobes.

One species *H. brunneriana* known from Orissa.

5. ***Hestiasula brunneriana*** Saussure (Plate V, Photo 3)

1871. *Hestiasula brunneriana* Saussure. *Mem. Soc. Phys. Hist. Nat. Geneva*, **21** : 330.

1927. *Hestiasula brunneriana* : Giglio-Tos. *Das Tierreich*, **50** : 545.

Diagnostic Characters : Body brownish. Frontal sclerite (Fig. 18) with the superior margin produced into a blunt angle; inferior border briefly arched and in the middle a faint groove on the surface; superior angle in female with a conical projection and the middle with a long protuberance, bilobed at apex and dotted black. Fore femora (Fig. 19) brown, foliacious oval, superior edge arched, outer face brown with few black spots, internally three black spots on the superior arch and one on the middle, a little above the spines; four discoidal spines, third one larger; 12 internal spines, entire black, 4 external spines black at tips only. Tibia and tarsi blackish internally. Mid coxae internally black. Fore legs pale brown in male and dark in female, and its face pale brown in male, and dark brown in female, with few black spots.

Measurements : BL : M 21.0-22, F 26-30; PN : M 3 - 4.5, F 4.7-5, FW : M 18-21, F 23-26.

Material examined (data as in Sureshan (2006c).

Distribution : India : Andhra Pradesh, Kerala, Orissa, Meghalaya, West Bengal; Bangladesh and Sri Lanka.

Remarks : The tubercle of vertex is more elongated in female with tip spatulate. Spots in the forewing of female prominent; colour generally darker in females.

Genus ***Odontomantis*** Saussure

1871. *Odontomantis* Saussure. *Mem. Soc. Hist. Nat. Geneve.* **21** : 32. Type species : *Mantis* (*Oxypilus*) *planiceps* Dettaan.

1927. *Odontomantis* : Giglio-Tos. *Das Tierreich*, **50** : 541.

Diagnositc characters : Frontal sclerite transverse, superior border terminating in a point; pronotum oblong, ovoid and a little wide; fore femora not dilated and superior border almost straight.

One species *O. montana* is known from Orissa.

6. ***Odontomantis montana*** Giglio-Tos

1915. *Odontomantis montana* Giglio-Tos. *Bull. Soc. Entomol. Ital.*, **46** : 100.

1927. *Odontomantis montana* : Giglio-Tos. *Das Tierreich*, **50** : 542.

Diagnostic characters Frontal sclerite narrowed in the form of a groove, superior border wavy, a little arched in the middle; inferior border with a slightly elevated ridge; margin of pronotum bearing small tubercular spines. In forelegs external spines of femora blackish near their tips and proximal two of them closer, tibiae with 10 internal spines of same colour.

Measurements : BL : F 20, PN F 5, FW F 15 (Mukherjee *et al.*, 1995).

Material examined : Nil.

Distribution India Orissa. Indonesia: Sumatra.

Remarks : Only known from Orissa based on one female specimen collected from the state by W.C. Taylor (no other data) (Mukherjee *et al.*, 1995).

Subfamily HYMENOPODINAE

Vertex with a protuberance above ocelli, Eyes conical and bulging; Frontal sclerite with a concavity and its lateral edges elevated. Supra coxal widening

strongly marked. Fore legs with 4 discoidal and 4 external spines, middle and hind femora with lobes.

One genus is reported from Orissa.

Genus ***Creobroter*** Audinet-Serville

1839. *Harpax* (*Creobroter*) Serville. *Hist. Nat. Ins. Orth.*, 160. Type species : *Creobroter discifera* (Servielle).

1869. *Creobotra* Saussure. *Mitt. Schweiz. Entomol. Ges.*, **3** : 59.

1927. *Creobroter* : Giglio-Tos. Das Tierreich, **50** : 555.

Diagnostic characters : Vertex above ocelli with a tubercle. Eyes conical. Frontal sclerite transverse, excavated and bicarinate. Pronotum short, saddle shaped, supra coxal dilation pronounced. Fore coxa with inner margin tuberculated, femora (Fig. 17) with 4 external and 4 discoidal spines, middle and hind femora with small pre apical lobes. Forewing with bands, hind wings coloured in female.

One species *C. apicalis* is known from Orissa.

7. ***Creobroter apicalis*** Saussure

1869. *Creobrota apicalis* Saussure. *Mitt.Schweiz.Entomol ges.* 3 : 73.

1927. *Creobroter apicalis* : Giglio-Tos. *Das Tierreich.* 50 : 558.

Diagnostic characters : Vertex with a spine (Fig. 15). Prozona granulate and pronotum with dentate lateral edges in female and smooth in male; forewing (Fig. 16) with yellow band bordered by two black semi circular rings like a eye spot and placed in the middle, this eye mark encloses black dots usually two; base of forewing with a yellow spot, hindwing pink at base, yellowish in costal area and brownish in discoidal and anal areas.

Measurements : BL : M 27, F 29-40; FW : M 24, F 24-28; PN : M 8, F 7.8-9 (Mukherjee *et al.*, 1995).

Material Examined : Nil.

Distribution : India: Assam, Karnataka, Manipur, Meghalaya, Orissa, Sikkim, W.Bengal, Kerala.

Remarks : Known from Orissa based on one male specimen collected from Sundargarh. Both sexes appear similar in general morphology (Mukherjee *et al.*, 1995).

Family EMPUSIDAE

Medium to large and slender mantids. Vertex with a process. Antennae combed in male. Fore femora with 5 external and 4-5 discoidal spines, internal spines arranged in groups of 3-4 smaller and then 1 larger spine. Abdominal segments usually with lobular expansions.

One subfamily is known from Orissa.

Subfamily EMPUSINAE

Pronotum slender, fore coxa with a spiniform projection at distal end.

Two genera are known from Orissa.

Key to the genera

1. Superior lobe of fore femora highly dilated; middle and hind femora with dorsal lobes ..... ***Gongylus*** Thunberg

— Fore femora without lobe and superior edge almost straight; middle and hind femora without dorsal lobes ..... ***Empusa*** Illiger

Genus ***Empusa*** Illiger

1798. *Empusa* Illiger. *Vers. Kaf. Preuss.*, 499. Type species : *Empusa pauperata* (Fabricius).

1927. *Empusa* : Giglio-Tos. *Das Tierreich.*, **50** : 635.

Diagnostic characters Vertex prolonged into a conical protuberance, armed medially and laterally by triangular sharp spines, apex little expanded and bifid. Frontal sclerite with a median carina extened into sharp point; antennae simple in female and pectinate in male; pronotum slender.

One species *E. guttula* known from Orissa.

8. ***Empusa guttula*** (Thunberg)

1815. *Gongylus guttulus* Thunberg. *Mem. Acad. Sci. St. Petersburg*, **5** : 294.

1927. *Empusa guttula* : Giglio-Tos. *Das Tierreich.*, **50** : 636.

Diagnostic characters : Body green. The process of vertex with 2 lateral blunt spines in middle in female, absent in male, apex bifid in both sexes. pronotum with lateral sharp spines at gaps, often becoming very shorter posteriorly from middle. Middle and hind femora with rounded apical lobes, marked by 2 transverse deep brown patches. Abdominal segements with lateral and ventro-median projections. Forewing little longer than body, stigma with 2 brown spots at corner, costal area green, opaque.

Measurements : BL. M. 50, F. 60; PN. M. 19, F. 24; FW. M. 29, F.35. (Mukherjee *et al.*, 1995).

Material examined : Nil.

Distribution : India: Andhra Pradesh, Orissa, Rajasthan, Uttar Pradesh.

Remarks : Known from one male specimen collected from Kurda district (S.Orissa) Balugaon and one female specimen from Chilka lake (Kurda district) (Mukherjee *et al.*, 1995).

Genus *Gongylus* Thunberg

1815. *Gongylus* Thunberg. *Mem. Acad. Sci. St. Petersburg*, **5** : 220. Type species : *Gongylus gongylodes* (Linnaeus).

1927. *Gongylus*. Giglio-Tos. Das *Tierreich.*, **50** : 634.

Diagnostic characters : Body bizarre shaped, color brown. Antennae filiform in female and pectinate in male. Vertex with protuberance. Pronotum slender, anterior part expanded and foliaceous Fore legs with coxae slender, superior distal angle prolonged in to a spiniform projection. Femora with 4 discoidal and 5 external spines. In middle and hind legs femur with distal triangular lobe dorsally and semicircular lobe ventrally. Forewing well developed. Abdominal segments laterally expanded.

Two species *G.gongylodes* and *G.trachelophyllus* occur in Orissa.

Key to the species

1. Dilation of pronotum rhomboidal, width about one-third the length of pronotum, lateral angles sharp ..... ***G. gongylodes*** (Linnaeus)

— Dilation of pronotum cordiform, about as wide the length of pronotum; lateral angles rounded ..... ***G. trachelophyllus*** Burmeister

9. *Gongylus gongylodes* (Linnaeus) (Plate IV, Photo 1)

1758. *Gryllus* (*Mantis*) *gongylodes* Linnaeus. *Syst. Nat.*, **10** : 426.

1767. *Mantis gongylodes* : Linnaeus. *Syst. Nat.*, **2**(10) : 690.

1793. *Mantis flabellicornis* Fabricius. *Entomol. Syst.*, **2** : 16.

1927. *Gongylus gongylodes* : Giglio-Tos. *Das Tierreich*, **50** : 635.

Diagnostic Characters : Body greenish brown. Forewing extending beyond abdomen, wide; costal area abruptly widened at base and brownish opaque; discoidal area hyaline. Hind wing as long as fore wing, hyaline and brownish near apex. Vertex extended. Pronotum long, with rhomboidal expansion. In fore legs, coxae externally with brown bands, internally black, spinules are present externally; spine present near the trochanter.

Femora with brown bands, dilated, 5 external spines and 4 discoidal spines, all spines black at tip only. In mid and hind legs femora has lobes at the distal end, ventral one rounded and dorsal lobe triangular and two in number. Mid abdominal segments laterally foliacious with ventrally transverse black marks.

Measurements : M : BL : (excluding protuberance of vertex) 73-75; FW : 45-46; PN : 33- 35.

Material Examined : 1 F, Ganjam dist., Gopalpur, 21.vi.2006, 1F, nymph, Gopalpur, 3.x.2006, 1 F nymph, 3.x.2006, coll.P.M.Sureshan (other data as in Sureshan *et al.*, 2006 c).

Distribution : India Andhra Pradesh, Kerala, Tamil Nadu, West Bengal; Indonesia (Java); Sri Lanka.

10. ***Gongylus trachelophyllus*** Burmeister

1838. *Empusa (Gongylus) trachelophylla* Burmeister. *Handb. R Entomol.*, **2** : 54.

1871. *Gongylus trachelophyllus* Saussure. *Mem. Soc. Geneve.*, **21** : 186.

1927. *Gongylus trachelophyllus* Giglio-Tos. *Das Tierrieich.*, **50** : 635.

Diagnostic characters : Similar to *G.gongylodes* in morphology except for the following characters: Foliaceous protion of pronotum wider than long, extending more than one third length of pronotum, lateral angles rounded. In fore legs tibiae with 2 brownish bands externally, internally black at distal end, femora externally with 2-3 faint brownish bands. Protuberance of vertex longer than *G. gongylodes*.

Measurements : F : BL. 82-84; PN. 41-43; FW. 28-29. (Mukherjee *et al.*, 1995).

Material examined : Nil.

Distribution : India Bihar (Chotanagpur), Orissa (Balasore).

Remarks : Known form Orissa based on 1 female specimen collected from Balasore, N.Orissa. (Mukherjee *et al.*, 1995).

Family MANTIDAE

Small to large and robust mantids. Head mostly wider than long, antennae sometimes ciliated, not pectinate. Eyes globular or conical with or without spines. Fore legs with typical rows of spines, rarely reduced or with different lengths of spines; middle and hind legs sometimes, even fore legs with foliaceous lobes. Supra anal plate transverse, triangular or oval; cerci cylindrical or foliacious.

Six subfamilies are reported from Orissa.

Key to the subfamilies

1. Eyes bulging, round, their upper edge reaching level of vertex or extending further; mostly bark coloured; pronotum flat, tuberculated, hardly wider anteriorly ..... **Liturgusinae**

— Eyes small or large, not as above, colour different; pronotum varying 2

2. Fore femur with 4 external and 4 discoidal spines, body slender 3

— Fore femur with 4 to 7 external spines and 1 to 4 discoidal spines, body small or large and bizarre shaped 5

3. Eyes dorsolaterally projecting and bearing terminal spine, mid and hind legs shorter ..... **Oxyothespinae**

— Eyes rounded and spineless, mid and hind legs long 4

4. Antennae and anterior border of forewing setaceous in males; small mantids, bark coloured ..... **Amelinae**

— Antennae and anterior border of forewing not setaceous in male; moderate to large sized mantids, colour varying ..... **Mantinae**

5. Antennae thick at bases, body very long and slender, eyes anteriorly and dorsally conical, mid and hind legs long and without lobular structures ..... **Schizocephalinae**

— Antennae not thick at bases, body long and bizarre shaped, not as above, eyes not as above with or without spines; mid and hind legs with lobular expansions ..... **Toxoderinae**

Subfamily LITURGUSINAE

Small to medium sized, bark coloured mantids. Vertex straight, eyes bulging, round; pronotum short, trapezoid, tuberculated, lateral margins smooth; fore femur stout, with 4 external and 4 discoidal spines with wide ventral space. Both wings shortened in female.

One genus is known from Orissa.

Genus ***Humbertiella*** Saussure

1869. *Humbertiella* Saussure. *Mitt.Schweiz. Entomol. Ges.*, **3** : 55. Type species : *Humbertiella ceylonica* Saussure.

1927. *Humbertiella* Giglio-Tos. *Das Tierreich*. 50 : 64.

Diagnostic characters : Vertex with prominent lateral lobes. Eyes large and round. Pronotum longer than wide, a very little wider anteriorly, lateral margins smooth, disc

tuberculated. Fore femur stout, ventral gap wide, denticulated, fore tibia with regularly spaced 9 external spines.

Four speicies *H.affinis*, *H.ceylonica*, *H.similis* and *H. nigrospinosa* occur in Orissa.

Key to the species

1. Longer internal spines of fore femora completely black 2
— Longer internal spines of fore femora apically black 3
2. Frontal sclerite with a whitish mark in median curvature. Anal vein of fore wing 2-branched in female ..... ***H. nigrospinosa*** Sjostedt
— Frontal sclerite with a continuous black band. Anal vein of fore wing 3 branched in female ..... ***H. ceylonica*** Saussure
3. Frontal sclerite with less arched superior edges, middle almost straight ..... ***H. similis*** Giglio-Tos
— Frontal sclerite with more arched superior edge ..... ***H. affinis*** Giglio-Tos

11 ***Humbertiella affinis*** Giglio-Tos

1917. *Humbertiella affinis* Giglio-Tos. *Bull. Soc. Entomol. Ital.*, **48** : 83.

1927. *Humbertiella affinis* Giglio-Tos. *Das Tierreich.*, **50** : 65.

Diagnostic Characters : Body Brown. Frontal sclerite with narrow blackish stripe, superior edge more arched in the middle. Larger internal spines of fore femora black only at apices. Forewing with a less blackish oblique band, second anal vein 3 branched.

Measurements BL : F : 28-32; FW : 19-21; PN : F 6.5-7 (Mukherjee *et al.*, 1995).

Material Examined : Nil.

Distribution : India Orissa, Karnataka. Sri Lanka.

Remarks The species is recorded from Kurda district, Orissa based on two female specimens collected in 1883 (no other details). (Mukherjee *et al.*, 1995).

12. ***Humbertiella ceylonica*** **Saussure** (Plate III, Photo 2)

1869. *Humbertiella ceylonica* Saussure. *Mitt. Schweiz. Entomol. Ges.*, **3** : 62.

1891. *Theopompa sepentrionum* Wood-Mason. *A catalogue of the Mantodea.*, **2** : 64.

1927. *Humbertiella ceylonica* : Giglio-Tos.*Das Tierreich.*, **50** : 64.

Diagnostic Characters : Body deep brownish. Frontal sclerite black or blackish brown, superior margin less arched, usually brown in female and light brown or pale whitish in male; Longer internal spines of fore femur balck; forewing in male longer than body, reaching upto 5-6 abdominal segments in female.

Measurements : BL : F : 33; PN : 7-7.5; FW 20.

Material Examined : 2 F, Ganjam dist., Gopalpur, 9.i.2006, 1 F, 24.v.2006, coll. P.M.Sureshan.

Distribution : India: Orissa, Kerala, Karnataka, Tamil Nadu, Assam, Uttar Pradesh, West Bengal, Madhya Pradesh, Maharashtra; Myanmar, Sri Lanka.

Remarks : This is a common species found on tree trunks, soil and among litter. First record from Orissa.

13. ***Humbertiella nigrospinosa*** Sjostedt

1930. *Humbertiella nigrospinosa* Sjostedt. *Ark. Zool. Stockholm.*, **21A** (32).

Diagnostic Characters : Body color brown with black tinge. Superior edge of frontal sclerite arched well in the middle, black line on frontal sclerite narrow; median curvature whitish. Tubercles on pronotum well marked; longer internal spines of fore femur completely black, even smaller ones are brownish near bases. Forewing brownish with black patches, longer than body in male and shorter in female, second anal vein 3 branched in male and 2 branched in female.

Measurements : BL : M : 32, F : 33; FW : M : 33 F : 19; PN : M 6, F 7. (Mukherjee *et al.*, 1995).

Material Examined : Nil.

Distribution : India : Orissa, Uttar Pradesh.

Remarks : The species is recorded from Orissa based on one female specimen collected from Bolangir, Mahakhand forest (Mukherjee *et al.*, 1995). General colour of female lighter. Frontal sclerite dark in males and paler in females. Normally found around human inhabitations.

14. ***Humbertiella similis*** Giglio-Tos. (Plate III, Photo1)

1917. *Humbertiella similis* Giglio-Tos. *Bull. Soc. Entomol. Ital.*, **48** : 83.

1927. *Humbertiella similis* : Giglio-Tos. *Das Tierreich*, **50** : 65.

Diagnostic Characters Body color brownish, wings hyaline (light brown) smoky, longer than abdomen; veins of the wings have brown spots. Eyes rounded. Frontal

sclerite brown, superior edge almost straight in the middle. Bossles of pronotum moderately prominent. In foreleg, coxa has black line externally and one black spot near the trochanter, femora externally brown, internally with a black longitudinal line, often divided into two; black patches present on claw groove and inside of first external spine, longer internal spines black at their apical halves only; basal halves deep brown, but blackish only in the distal one or two internal spines only.

Measurements : BL : M : 27-30, F 28; FW : M : 24-27 F : 19-20; PN : M 5.5-6.5, F 4.

Material Examined : (details as in Sureshan *et al.*, 2006c)

Distribution : India : Himachal Pradesh, Kerala, Jammu, Madhya Pradesh, Orissa, Uttar Pradesh; Nepal and Sri Lanka.

Remarks : The species was earlier recorded from Orissa, collected from Padampur of Keonjhar district in 1972. (Mukherjee *et al.*, 1995). Further records from the state (Sureshan *et al.*, 2006 c). General colour of female darker. Frontal sclerite dark in males and paler in females. Normally found around human inhabitations.

Subfamily SCHIZOCEPHALINAE

Body very long and slender, frontal sclerite much higher than broad. Eyes anteriorly and dorsally conical, fore femur with 3 discoidal and 4 external spines, tibia short, hind metatarsus much longer than rest of the segments together. Forewing well developed in male, strongly reduced in female.

One genus is known from India and Orissa.

Genus ***Schizocephala*** Serville

1831. *Schizocephala* Serville. *Ann. Sci. Nat.*, **22** : 55. Type species : *Schizocephala bicornis* (Linnaeus).

1927. *Schizocepahla* : Giglio-Tos. *Das Tierreich.*, **50** : 237.

Diagnostic characters : Body very long, slender. Head narrow and long. Frontal sclerite much higher than wide with a median obtuse groove and two narrow lateral grooves. Eyes anteriorly prolonged into a cone and terminating into a spine. Pronotum very long and slender, supra coxal dilation less prominent. Fore coxa hardly half of metazona, internal apical lobes divergent, femur with 3 discoidal spines of which 2nd longest, 4 external spines of which middle two longer, tibiae shortened with 6 external spines. Supra anal plate long, triangular and carinate.

One species *S.bicornis* is reported from India and Orissa.

15. *Schizocephala bicornis* (Linnaeus) (Plate VI, Photo 2)

1758. *Gryllus* (*Mantis*) *bicornis* Linnaeus. *Syst. Nat.*, **1(10)** : 426.

1767. *Mantis bicornis* Linnaeus. *Syst. Nat.*, **2** (12) : 691.

1781. *Mantis oculata* Fabricius. *Spec. Ins.*, **1** : 348.

1792. *Mantis stricta* Olivier. *Ann. Sci. Nat.*, **22** : 56.

1927. *Schizocephala bicornis* Giglio-Tos. *Das.Tierreich*, 50 : 237.

Diagnostic characters : Body long and slender, colour green. Base of antenna thickened; frontal sclerite much higher than wide with a median obtuse groove and two narrow lateral grooves. Eyes anteriorly prolonged into a cone ending in a spine (Fig. 31). Fore femur (Fig. 32) with four external spines, three discoidal spines of which second longest; tibia shortened with six external spines. Forewing very small and opaque in female, well developed in male. Cerci long and sharp, supra anal plate long, triangular and carinate.

Measurements : BL, M 86-93, F 112-118; PN, M 32-36, F 44.5- 48; FW M 30-31.8, F 7-10.

Material examined : 1 F, Orissa, Ganjam Dist., Gopalpur-on-Sea, 11.vii.2006 (over small grass), P.M. Sureshan. (Reg. no. 5792).

Distribution : India : Madhya Pradesh, Maharashtra, Uttar Pradesh, Kerala, West Bengal, Orissa.

Remarks : The species was collected from grassy vegetation. The insects show sidewise rocking movement when at rest, and walk slowly when disturbed.

Subfamily OXYOTHESPINAE

Medium sized and slender mantids. Eyes laterally conical, bearing a terminal spine. Fore femur with 4 discoidal and 4 external spines; 2nd external spine longest of all. Mid and hind legs small with genicular spines, cerci foliaceous.

One genus is known from India and Orissa.

Genus *Heterochaetula* Wood-Mason

1889. *Heterochaetula* Wood-Mason. *J. Asiatic Soc. Bengal.*, **58** : 308. Type species : *Heterochaetula tricolor* Wood-Mason.

1927. *Heterochaetula* : Giglio-Tos. *Das Tierreich.*, **50** : 287.

Diagnostic characters : Body elongate; vertex extending beyond level of eyes, with 4 deep grooves. Frontal sclerite narrow and transverse. Pronotum slender, dilation not

prominent. Fore femur with 4 external and 4 discoidal spines, 2nd external spine longest; tibia with 9 external spines; supra anal plate transverse, truncated and rounded at apex.

Two species *H. fissispinis* and *H. tricolor* are known from India and Orissa.

Key to the species

1. Eyes with bifid spine (Fig. 33), apical lobes of middle and hind femora prolonged and sharp ..... ***H. fissispinis*** Wood-Mason

— Eyes with simple spine; apical lobes of middle and hind femora short ..... ***H. tricolor*** (Wood-Mason)

16. *Heterochaetula fissispinis* Wood-Mason (Plate III, Photo 3)

1889. *Heterochaetula fissispinis* Wood-Mason, *J. Asiatic Soc. Bengal,* **58** : 309.

1927. *Heterochaetula fissispinis* Giglio-Tos. *Das Tierreich.*, **50** : 288.

Diagnostic characters : Colour pale brown, body delicate; hind wing hyaline with a blackish violet oval patch near base of anal area, followed outwardly by 11-12 concentric rings of same colour. Spines of eye bifid (Fig. 33) upper lobe small; margins of pronotum finely denticulate. Forewing narrow, with parallel borders, extending beyond ¾ of fourth abdominal segment.

Phallic complex (dorsal view) (Fig. 8) : Titillator (Ti) with tip curved to left and directed upwards, half coiling. Phalloid apophysis (PA) sharply pointed at tip and curved to the right. The right plate (RP) (dorsal lobe of the complex) bears chitinisation as in the figure. The hypophallus (H) sharply pointed and bears tuft of setae, anterior end with chitinisation not strong.

Measurements BL, M.56-57, F 44.5-45.5; PN, M 13-16, F 13.5-14.5; FW, M 25-26, F 20.5-21.5.

Material examined : 1 M, Orissa, Ganjam dist., Gopalpur-on-sea, 2.xii.2006 (under light), (Reg. no. 5790).

Distribution : India: Andhra Pradesh, Karnataka, Maharashtra, Tamil Nadu, Orissa.

Remarks : Uncommon species, frist time reported from Orissa.

17. *Heterochaetula tricolor* (Wood-Mason)

1876. *Heterochaeta tricolor* Wood-Mason. *Ann. Nat. Hist.*, (4) **18** : 441.

1927. *Heterochaetula tricolor* : Giglio-Tos. *Das Tierreich.*, **50** : 287.

Diagnostic characters Body pale grey and delicate, head depressed and pentagonal; eyes dorso-ventrally little compressed and laterally with a short simple spine, a small

tubercle between base of antennae and eyes; frontal sclerite very flat, superior edge almost straight. Pronotum elongate, lateral margins finely denticulate. Middle and hind femora with lateral, short, conical granular lobes, and a long genicular spine. Forewing extending a little beyond 3rd abdominal segment, hind wings with a violet oval patch near base of anal area followed outwardly by 10-11 concentric rings of yellow-brown and hyaline. Abdomen slender, supra anal plate short transverse, apex truncated, cerci oval, broadly foliaceous.

Measurements : F.BL.50, PN 14.5, FW.23.5. (Mukherjee *et al.*, 1995).

Material examined : Nil.

Distribution India : Bihar, Maharashtra, Orissa, W. Bengal.

Remarks : Known from Orissa with no further details. (Mukherjee *et al.*, 1995).

Subfamily AMELINAE

Small sized mantids, usually bark coloured with small elliptical pronotum which is shorter than fore coxa. Antennae thick, long with rosettes of bristles at the junction of two segments. Fore femora with 4 external and 4 discoidal spines and the external edge crenulated in between the spines; middle and hind femora without spines. Wings longer than abdomen, surface and border setaceous.

One tribe and one genus known from Orissa

Tribe AMELINI

Genus *Gimantis* Giglio-Tos

1915. *Gimantis* Giglio-Tos. *Bull. Soc. Entomol. Ital.*, **46** : 161. Type species : *Gimantis authaemon* (Wood-Mason)

1927. *Gimantis* : Giglio-Tos. *Das Tierreich.*, **50** : 175.

Diagnostic characters : Frontal sclerite transverse, smooth, superior border arched in the middle; Metazona of pronotum longer than prozona, bossles of pronotum widely rounded. Fore femora stout with 4 external spines placed at equal distance, the 2nd and 3rd smaller than other two, fore tibiae with 11 external spines.

One species *G. assamica* is known from Orissa.

18. ***Gimantis assamica*** (Giglio-Tos) (Plate IV, Photo 2)

1915. *Eumantis assamica* Giglio-Tos. *Bull. Soc. Entomol. Ital.*, **46** : 161.

1927. *Eumantis assamica* : Giglio-Tos. *Das Tierreich*, **50** : 175.

1995. *Eumantis assamica* Mukherjee *et al. Oriental Ins.*, **29** : 270.

2002. *Gimantis assamica* (Giglio-Tos) in : Ehrmann, Mantodea, 157.

Diagnostic Characters : Body color brown, wings hyaline and smoky. Frontal sclerite black, often in the form of band in male (Figs. 26, 28). Pronotum short. In fore legs (Fig. 27) coxae and femora brown with black dots; tibiae triannulated by brownish black bands and femora brown with black dots; 1st segment of fore tarsi triannulated; others widely blackish near distal parts, femora has 4 discoidal and 4 external spines, internal spines are 10. First two external spines very close. Fore wing brown opaque, oval in shape. Abdominal tergum with black band at posterior margin.

Measurements : BL : M 20-21; FW : 19; PN : 4.

Material Examined : 3M, Ganjam dist. Gopalpur, 9.vi.2006, 10.xii.2006, coll. P.M. Sureshan (other details as in Sureshan, 2006c).

Distribution : India : Assam, Tamil Nadu, Orissa.

Remarks In India the species is so far only known from Tamil Nadu, Assam and Orissa. Colour of fore legs yellowish brown with black dots and bands not prominent in some specimens.

Subfamily MANTINAE

Medium to large sized mantids, without any process on vertex; fore femora with 4-5 external spines and 3-4 discoidal spines; tibiae with normal spines.

One tribe and Four genera are known from Orissa

Tribe MANTINI

Fore femur with 4 discoidal and 4 external spines; wings usually longer than abdomen.

Key to the genera

1 Hind femora with an apical spine (Fig. 25) 2

— Hind femora without an apical spine 3

2. Frontal sclerite at least twice wider than high..... ***Tenodera*** Burmeister

— Frontal sclerite mostly higher than width or very little wider (Fig. 24) ..... ***Hierodula*** Burmeister

3. Claw groove of femora in the middle ..... ***Mantis*** Linnaeus

— Claw groove of femora placed beyond middle ..... ***Statilia*** Stal

Genus ***Hierodula*** Burmeister

1838. *Hierodula* Burmeister. *Handb. Entomol.*, **2** : 536. Type species : *Hierodula membranacea* (Burmeister)

1927. *Hierodula* Giglio-Tos. *Das Tierrreich.*, **50** : 435.

Diagnostic characters : Frontal sclerite usually higher than wide, no tubercles between eyes and antennae. Fore coxae with internal apical lobe contiguous, femora with 4 discoidal and 4 external spines, middle and hind femora with rounded genicular lobes and apical spines, Costal area of forewing densely reticulated. Supra anal plate transverse, triangular, cerci conical, cylindrical.

Three species *H.doveri, H.membranacea and H.tenuidentata* are known from Orissa

1. Fore coxae with 15-17 external spines, gradually longer distally, pronotum long ..... ***H. membranacea*** (Burmeister)

— Fore coxae with 5-6 tubercular spines and few spinules among them **2**

2. Prosternum with two pairs of brownish dots and a median strip of same colour ..... ***H. doveri*** Chopard

— Prosternum with two blackish transverse bands in posterior part ..... ***H. tenuidentata*** Saussure

19. ***Hierodula doveri*** Chopard

1924. *Hierodula doveri* Chopard. *Rec. Indian. Mus.*, **26** : 175.

Diagnostic characters : Frontal sclerite pentagonal, bicarinate, almost as wide as high, upper margin widely angular. Pronotum narrow and longer than anterior coxa. Prosternum with two basal pairs of oval brown spot separated by almost transverse patch. Fore coxa armed with 6 tubercular premarginal spines, femora with seven long and seven short spines, shorter spines are black at tip. Forewing with costal area yellow-green and densely reticulate.

Measurements : BL : F 63-65, M 50-60; FW : F 55-56, M 47-49; PN : M 18-19, F 20-21.

Material examined : 2 F. Ganjam District, Gopalpur-on-Sea. 2.viii.2005 (Reg.No. 3933); 1 M, Gopalpur, 6.iii.07, Coll. P.M. Sureshan.

Distribution : India : Karnataka, W. Bengal, Kerala, Orissa, Tamil Nadu.

Remarks : Morphologically this species is very close to *Hierodula unimaculata* (Olivier) except for blackish spines on fore femora and transverse band on prosternum (Mukherjee, *et al.*, 1995).

20. ***Hierodula membranacea*** (Burmeister)

1838. *Mantis* (*Hierodula*) *membranacea* Burmeister. *Handb. Entomol.*, **2** : 536.

1870. *Stagmatoptera veneratoria* Saussure. *Mitt. Schweiz. Entomol. Ges.*, **3** : 232.

1871. *Hierodula membranacea* : Saussure. *Mem. Phys. Hist. Nat. Soc.* Geneva, **21** : 84.

1871. *Hierodula birivia* Stoll. *Mem. Mex.*, 1(4) : 89.

Diagnostic characters : Body color green. Frontal sclerite higher than wide, upper margin arched. Fore wing green in colour with opaque discoidal area. Pronotum long, gradually narrowed posteriorly and coxal dilation oval, much elongate. In fore legs, coxae with 15-17 spines gradually longer distally; femora with 4 discoidal spines and 4 external spines, spines of femora black at tips only.

Measurements : BL : F 84; FW : 50; PN : 32.5.

Material examined : 1 F. Ganjam District : ZSI, EBS Campus, Gopalpur-on-Sea. 2.viii.2005 (Regn. No. 3933). Coll. P.M. Sureshan.

Distribution : India : Kerala, Orissa, Tamil Nadu; Indonesia, Java; China and Sri Lanka.

Remarks : The speices is distinct from other species by its semicircular upper margin of frontal sclerite, spines of fore coxa and long metazona. (Mukherjee *et al.*, 1995).

21. ***Hierodula tenuidentata*** Saussure (Plate VI, Photo 3)

1869. *Hierodula tenuidentata* Saussure. *Mitt.Schweiz. Entomol.* Ges., **3** : 68.

1927. *Hierodula* (*Hierodula*) *tenuidentata* : Giglio-Tos. *Das Tierreich.*, **50** : 444.

Diagnostic characters : Frontal sclerite a little wider than high; pronotum narrower after dilation and then almost parallel except near base. Prosternum with 2 blackish transverse bands in posterior part; Fore coxe with 5 short spines and few spinules among them; both wings longer than body, costal area greenish, discoidal area hyaline.

Measurements : BL : F 63-65, M 50-60; FW : F 55-56, M 47-49; PN : M 18-19, F 20-21.

Material examined 1 F. Ganjam District, Gopalpur-on-Sea. 2.viii.2005 (Regn. No. 3933); 2 M, Gopalpur, 3.x.2006; 1F nymph, Kendrapara dist., Girango village, 12.iii.2007, Coll. P.M. Sureshan.

Distribution : India : Andamans, Bihar, Lakshadeep, Madhya Pradesh, Kerala, Orissa, Maharashtra.

Remarks : The balckish band of prosternum is less distinct in old preserved specimens.

Genus *Mantis* Linnaeus

1758. *Gryllus* (*Mantis*) Linnaeus. *Syst. Nat.*, **10** : 425. Type species : *Mantis religiosa* Linnaeus.

1927. *Mantis*. Giglio-Tos. *Das Tierreich.*, **50** : 405.

Diagnostic Characters : Frontal sclerite transverse, a little wider than high, bicarinate or smooth, superior border a little angular or arched. Supra coxal dilation of pronotum not profound, fore coxa with internal apical lobes divergent, without marginal spines, fore femora with 4 external and 4 discoidal spines, internally with a yellow spot medially, claw groove placed in middle. Supra anal plate transverse, triangular.

Two species *M.religiosa inornata* and *M.religiosa religiosa* are known from Orissa.

Key to the species

1. Fore coxa internally with a basal black spot which often encloses an oval yellow spot, a distinct transverse pink line on the vertex, prominent in fresh specimens ..... ***M. religiosa religiosa*** Linnaeus

— Fore coxa internally without black spot, other characters different ..... ***M. religiosa inornata*** Werner

22. *Mantis religiosa inornata* Werner

1930. *Mantis inornata* Werner. *Proc. Zool. Soc. London*, 1930 : 689.

2002. *Mantis religiosa inornata* Werner in : Ehrmann, Mantodea, 216.

Diagnostic Characters : Body green in colour. Fore wings green, anterior half of costal area reddish brown and hyaline in discoidal area. Hind wings hyaline. Frontal sclerite with distinct median groove, superior margin arched. Pronotum long, metazona carinate, with two whitish spots ventrally. In fore legs coxal borders with 6-7 minute spines and few spinules; no callous spots, internal apical lobes divergent; claw groove of femora with yellow patch. Fore femora have 4 discoidal spines, 4 external spines and 15 internal spines, black at tips.

Measurements : BL : M 59.9 F : 56-72.5; FW : M 48.9 F : 41-50; PN : M 18.0 F 18-25.

Material Examined : 1F nymph, Jajpur dist. Balchandrapur, Rukutipata village, 16.iii.07, coll.P.M.Sureshan (other data as in Sureshan *et al.*, 2006 c).

Distribution India : Uttar Pradesh, Orissa, Maharashtra.

Remarks Mukherjee *et al.*, 1995, mentioned about the callous spots on fore coxae internally.

23. ***Mantis religiosa religiosa*** Linnaeus (Plate V, Photo 1)

1758. *Gryllus (Mantis) religiosa, Syst. Nat.*, **10** : 426.

1767. *Mantis religiosa* : Linnaeus, 1767. *Syst. Nat.*, **12(2)** : 690.

1927. *Mantis religiosa* : Giglio-Tos, 1927. *Das Tierreich*, **50** : 406.

Diagnostic Characters : Body greenish. Fore wings semi-hyaline in female; stigma marked with an elongate, cream coloured spot. Both wings little shorter than body in male. Anterior border of hind wing blackish opaque near apex. Superior margin of frontal sclerite angular with flat carinae, not distinct in smaller specimens. There is a distinct transverse pink line on the vertex, more prominent in the fresh specimens. Costal area of fore wing and lateral borders of pronotum also with pink shades. Prosternum with two small rounded tubercles near base (not very prominent). Metazona carinate. In fore legs, coxae with divergent internal apical lobes; internally with callous spots, absent in some female specimens; a black spot at base which often encloses an oval yellow spot; anterior edge with 6-8 spines and few spinules between them; claw groove of femora yellow, longer internal spines entirely black.

Measurements : BL : M 53.9-56 F 53-70; FW : M 36-41 F 37-53; PN M 15-17 F 17.9-23.

Material Examined : (data as in Sureshan *et al.*, 2006 c)

Distribution : India : Karnataka, Kerala, Madhya Pradesh, Manipur, Uttar Pradesh, West Bengal; Asia; Europe; Africa; Australia.

Remarks This species is now recognized to be composed of several sub species. The present specimen is close to *Mantis religiosa religiosa* Linnaeus (see Ehrmann 2002 for further details). The species shows aggressive display when disturbed and was found voraciously feeding on other insects, mainly grasshoppers.

Genus ***Statilia*** Stal.

1877. *Statilia* Stal. *Bih. K. Svenska Vetensek. Akad. Handl.*, **4(10)** : 36. Type species : *Statilia nemoralis* (Saussure).

1927. *Statilia* : Giglio-Tos. *Das Tierreich.*, **50** : 410.

Diagnostic Characters : Frontal sclerite (Fig. 35) transverse, superior margin arched, angular. Internal apical lobes of fore coxae contiguous, claw groove of fore femora situated above middle, 4 external and 4 discoidal spines, inner disc with pale yellow and black patches; tibiae with 7 external spines; wings as long as abdomen.

One species *S,maculata* is known from Orissa.

24. ***Statilia maculata*** **(Thunberg)** (Plate V, Photo 2)

1784. *Mantis maculata* Thunberg. *Nov. Ins. Spec.*, **3** : 61.

1897. *Statilia maculata* : Bolivar. *Ann. Soc. Entomol. France*, **66** : 309.

1927. *Statilia maculata* : Giglio-Tos. *Das Tierreich*, **50** : 410.

Diagnostic characters : Body brownish, Forewing with costal area opaque, discoidal area semi-opaque, smoky. Brownish towards upper margin and tip. Vertex with blackish markings on dorsal surface. Prosternum near coxal joint with black patch. In fore legs, coxae (Fig. 36) with 6-7 triangular whitish spines and few spinules and also with internal black patch, femora with shining yellow patch, often bordered by a black patch, larger internal spines of femora not entirely black.

Measurements : BL : M 56, F 42-53; FW : M 35, F 32-34; PN : M 15, F 14-16.5.

Material Examined : 2 M, Ganjam dist., Gopalpur, 5.xii.2006 (other data as in Sureshan et al, 2006 c).

Distribution : India : Andhra Pradesh, Kerala, Arunachal Pradesh, Tamil Nadu, West Bengal, Assam, Bihar, Himachal Pradesh, Madhya Pradesh, Sikkim, Uttar Pradesh; Eastern Asia.

Remarks : Colouration of hind wings varies in specimens.

Genus ***Tenodera*** Burmeister

1838. *Tenodera* Burmeister. *Handb. Entomol.*, **2** : 534. Type species : *Tenodera fasciata* (Olivier).

1904. *Paratenodera* Rehn. *Proc.Acad.Philad.*, **55** : 705.

1927. *Tenodera* : Giglio-Tos. *Das Tierreich.*, **50** : 412.

Diagnostic Characters : Body long and slender; vertex with convex superior margin, a little above the eyes. Frontal sclerite about 2-3 times wider than high; Pronotum long,

dilation well marked, forewing long and narrow; fore femora with 4 discoidal and 4 external spines; supra anal plate transverse or triangularly elongate.

One species *T. fasciata* is known from Orissa.

25. *Tenodera fasciata* (Olivier) (Plate VI, Photo 1)

1792. *Mantis fasciata* Olivier. Enc. Meth., **7** : 640.

1838. *Mantis* (*Tenodera*) *fasciata*. Burmeister. *Handb. Entomol.*, **2** : 534.

1912. *Tenodera fasciata* Giglio-Tos. *Bull. Soc. Entomol. Ital.*, **43** : 45.

Diagnostic characters : Colour yellowish brown in female and brown in male. Forewing green. Frontal sclerite (Fig. 34) more than 2x as wide as high, bicarinate, superior margin angular in middle and little sinuate on either sides. Metazona carinate in female, indistinctly in male; prosternum of metazona with a pair of whitish spots and a pair of tubercular whitish spots. Fore coxa with fine serrations in female, smooth in male. Costal area of forewing opaque. Hind wing hyaline, costal area with deep reddish or blood red colored transverse veinlets.

Phallic complex (dorsal view) (Fig. 9) Titillator (Ti) with tip slightly curved to left and directed downwards, no coiling. Phalloid apophysis (PA) strong at base and curved to the right. The right plate (RP) (dorsal lobe of the complex) bears a strong chitinisation as in the figure. The hypophallus (H) without any lobe at tip and with spines, anterior end with strong chitinous structure which is bifid at apex.

Measurements BL, M 81, F 83; PN, M 30, F 28, FW. M 51, F 52.

Material examined : 1F, Orissa, Jagatsingpur dist., Paradip (collected over tall grass at mouth of Mahanadi estuary). 26.xi.2005 (Reg. no. 3998); 1 M, Ganjam Dist., Gopalpur-on-Sea, 14.xi.2006 (under light) (Reg. no. 5791), 7 nymph (ex. Ootheca), Kendrapara dist, Bhuinpur, 14.iii.2007, coll. P.M. Sureshan.

Distribution : India : Assam, Manipur, Meghalaya, West Bengal, Orissa.

Remarks : Uncommon species.

Subfamily TOXODERINAE

Body long, bizarre shaped, brownish. Eyes conical or oval. Pronotum long and narrow. Fore tibiae thin with distal spines; femora with 3-4 discoidal spines and 4-6 external spines; middle and hind legs with lobulated structures. Anterior abdominal segments with projections; cerci flat.

Two genera are known from Orissa.

Key to the genera

1. Middle and hind tibiae dorsally carinate, eyes with a very small dorsal tubercle, Upper edge of vertex concave, middle and hind femora without geniuclar spines, cerci foliaceous ..... ***Aethalochroa*** Wood-Mason

— Middle and hind tibiae not carinate; eyes with a distinctly projecting spine, median lobe of vertex higher than laterals (Fig. 29) ; middle and hind femora with genicular spines; cerci long, flat ..... ***Toxoderopsis*** Wood-Mason

Genus *Aethalochroa* Wood-Mason

1877. *Arsacia* Stal. *Bih. K. Svenska Veternsk Akad. Handl.*, **4**(10) : 70. Type species : *Arsacia ashmoliana* (Westwood).

1877. *Aethalochroa* Wood-Mason. *Ann.Nat.Hist.London*, (4) **19** : 308.

1927. *Aethalochroa* Giglio-Tos. *Das Tierreich.*, **50** : 620.

Diagnostic Characters : Long slender, dark coloured, eyes sometimes protuberant with a spine; Upper edge of vertex concave extending over eyes with two grooves. Frontal sclerite pentagonal, transverse. Prontoum long narrow. Fore coxa little dilated at apex of anterior edge, femora slender with 5 external and 3 discoidal spines, a pit between 1st and 2nd external spines, tibiae slender with 4-5 external and 7-8 internal spines, middle and hind legs with genicular lobes, no genicular spines; cerci foliaceous.

One species *A.ashmoliana* is known from Orissa.

26. *Aethalochroa ashmoliana* (Westwood) (Plate II, Photo 1)

1841. *Vates ashmoliana* Westwood. *Ann. Nat. Hist.*, **8** : 272

1871. *Popa (?) ashmoliana* : Saussure. *Mem. Soc. Phys. Hist. Nat. Geneva*, **21** : 161.

1877. *Arsacia ashmoliana* : Stal. *Bih. K. Svenska Vetensk Akad. Handl.*, **4**(10) : 75.

1877. *Aethalocroa ashmoliana* : Wood-Mason. *Ann. Nat. Hist.*, **19**(4) : 308.

Diagnostic Characters : Body brown in colour, Eyes prominent, rounded with a very small tubercle. Frontal sclerite pentagonal. Forewings smoky, shorter than abdomen, sub-opaque in the upper margin, and distal area hyaline. Hind wings hyaline, upper margin dark brown. In fore legs superior edge of femora little concave. 5 external spines and 8 internal spines. Mid and hind legs short, femora with genicular lobes without spines. Distal segment of cerci wide, round at apex and longer than width.

Measurements BL : M 87-97, F 120; FW : M 50-45.5, F 68; PN : M 33-34, F 43.

Material Examined : Data as in Sureshan *et al.*, 2006c.

Distribution : India : Maharashtra, Orissa, Kerala, West Bengal.

Remarks : Commonly occurring in southern coastal districts of Orissa.

Genus ***Toxoderopsis*** Wood-Mason

1889. *Toxoderopsis* Wood-Mason. *J. Asiatic Soc. Bengal.*, **58** : 317. Type species : *Toxoderopsis spinigera* Wood-Mason.

1927. *Toxoderopsis* : Giglio-Tos. *Das Tierreich.*, **50** : 568.

Diagnostic Characters : Body bizarre shaped. Median lobe of vertex higher than laterals, a short distinct projection above ocelli. Eyes pronounced with lateral spine, extending over lateral lobes of vertex. Middle and hind femora with genicular spines and with two small dorsal and one foliaceous ventral lobe. First six abdominal segments ventrally with thread like processes and excised in the middle, cerci foliaceous.

One species *T. taurus* is known from Orissa.

27. ***Toxoderopsis taurus*** Wood-Mason (Plate VI, Photo 4)

1889. *Toxoderopsis taurus* Wood-Mason. *J. Asiatic Soc. Bengal*, 58 : 320.

1927. *Toxoderopsis taurus* : Giglio-Tos. *Das Tierreich*, 50 : 569.

Diagnostic Characters : Body slender, black brown in colour. Frontal process bifid in females, truncated in males. Vertex (Fig. 29) situated little below level of eyes, with median lobe more elevated than the laterals. Eyes prominent, rounded, with a spine. Pronotum granulate, metazona carinate. In fore legs, coxae blackish internally, at the distal end a lamella like structure is present, serrated and blackish; internally black longitudinal line along the entire length. Internal apical lobes divergent. Femora black, external spines 6, internal spines 11, discoidal spines 3. Tibiae with 4 external and 6 internal spines. Mid and hind legs have 3 genicular lobes with long genicular spines. Forewings sub-opaque in the costal region (tip only), distally hyaline. Hind wings hyaline. Cerci flat (Fig. 30) long 3-crested at tip.

Measurements : BL : M 89, F 90; FW : M 40, F 42; PN : M 23.1 F 24.5.

Material Examined : 2 exx. Orissa : Ganjam District : ZSI, EBS Campus, Gopalpur-on-Sea. 14.xi.2005 (3974, F 3975, M). Coll. P.M. Sureshan.

Distribution : India : Bihar, Orissa; Pakistan.

Remarks : Uncommon species.

CHECKLIST OF MANTODEA OF ORISSA

(Classification proposed by Erhmann, 2002)

Class INSECTA

Order MANTODEA

Family AMORPHOSCELIDAE

Sub-family AMORPHOSCELINAE

Genus ***Amorphoscelis*** Stal, 1871

Amorphoscelis annulicornis Stal, 1871 (India : Assam, Bihar, Damn & Diu, Himachal Pradesh, Kerala, Orissa, Meghalaya, Tamil Nadu, West Bengal) Sri Lanka.

Family HYMENOPODIDAE

Sub-family ACROMANTINAE

Tribe ACROMANTINI

Genus ***Ephestiasula*** Giglio-Tos, 1915

Ephestiasula intermedia Werner, 1930. (India : Jammu & Kashmir, Karnataka, Madhya Pradesh, Rajasthan, Uttar Pradesh, Orissa).

Ephestiasula pictipes (Wood-Mason), 1879. (India : Madhya Pradesh, Orissa, Maharashtra, Uttar Pradesh)

Genus ***Euantissa*** Giglio-Tos, 1927

Euantissa pulchra (Fabricius), 1787. (India : Kerala, Eastern and North Eastern India, Maharashtra).

Genus ***Hestiasula*** Saussure, 1871

Hestiasula brunneriana Saussure, 1871 (India : Andhra Pradesh, Meghalaya, West Bengal, Orissa; Bangladesh; Sri Lanka).

Genus ***Odontomantis*** Saussure, 1871

Odontomantis montana Giglio-Tos, 1915. (India : Orissa; Indonesia; Sumatra).

Sub-family HYMENOPODINAE

Tribe HYMENOPODINI

Genus ***Creobroter*** Serville, 1839

Creobroter apicalis Saussure, 1869. (India : Orissa, Assam, Karnataka, Kerala, Manipur, Meghalaya, Sikkim).

Family LITURGUSIDAE

Sub-family LITURGUSINAE

Genus ***Humbertiella*** Saussure, 1869

Humbertiella affinis Gigio-Tos, 1917. (India Karnataka, Kerala, Orissa; Sri Lanka).

Humbertiella ceylonica Saussure, 1869. (India: Kerala, Orissa, Assam, Bihar, Karnataka, Madhya Pradesh, Maharashtra, Tamil Nadu, Uttar Pradesh, West Bengal; Myanmar, Sri Lanka.

Humbertiella nigrospinosa Sjostedt, 1930. (India : Orissa, Uttar Pradesh).

Humbertiella similis Gilglio-Tos, 1897 (India : Himachal Pradesh, Jammu, Kerala, Madhya Pradesh, Orissa, Uttar Pradesh) (Nepal, Sri Lanka).

Family MANTIDAE

Sub-family OXYOTHESPINAE

Tribe OXYOTHESPINI

Genus ***Heterochaetula*** Wood-Mason, 1889

Heterochaetula tricolor (Wood-Mason), 1876. (India : Bihar, Maharashtra, Orissa, West. Bengal).

Heterochaetula fissispinis Wood-Mason, 1889 (India : Andhra Pradhesh, Karnataka, Tami Nadu, Orissa).

Sub-family SCHIZOCEPHALINAE

Genus ***Schizocephala*** Serville, 1831

Schizocephala bicornis (Linnaeus), 1758. (India Kerala, Orissa, Madhya Pradesh, Maharashtra, Uttar Pradesh, West Bengal; Sri Lanka).

Sub-family AMELINAE

Tribe AMELINI

Genus ***Gimantis*** Giglio-Tos, 1915

Gimantis assamica (Giglio-Tos), 1915. (India : Orissa, Assam, Tamil Nadu).

Sub-family MANTINAE

Tribe POLYSPILOTINI

Genus ***Tenodera*** Burmeister, 1838

Tenodera fasciata (Olivier), 1792. (India Orissa, Assam, Manipur, Meghalaya, West Bengal.)

Sub-family PARAMANTINAE

Tribe PARAMANTINI

Genus ***Hierodula*** Burmeister, 1838

Hierodula doveri Chopard, 1924. (India : Karnataka, Kerala, Orissa, Tamil Nadu).

Hierodula membranacea (Burmeister), 1838. (India : Kerala, Orissa, Tamil Nadu; Indonesia, Java, China).

Hierodula tenuidentata Saussure, 1869. (India : Orissa, Andamans, Bihar, Kerala, Lakshadweep, Kerala, Madhya Pradesh, Uttar Pradesh, West Bengal; Indonesia, Kalimantan, West Asia).

Tribe MANTINI

Genus ***Mantis*** Linnaeus, 1758

Mantis religiosa inornata Werner, 1930 (India : Orissa, Uttar Pradesh).

Mantis religiosa religiosa Linnaeus, 1758. (India : Karnataka, Kerala, Madhya Pradesh, Manipur, Uttar Pradesh, West Bengal; Asia, Europe, Africa, Australia).

Genus ***Statilia*** Stal, 1877

Statilia maculata (Thunberg) 1784 (India : Orissa, Andra Pradesh, Arunachal Pradesh, Assam, Bihar, Himachal Pradesh, Kerala, Madhya Pradesh, Meghalaya, Sikkim, Uttar Pradesh, West Bengal).

Family TOXODERIDAE

Sub-family TOXODERINAE

Tribe AETHALOCHROAINI

Genus ***Aethalochroa*** Wood-Mason, 1877

Aethalochroa ashmoliana (Westwood), 1841. (India : Kerala, Orissa, Maharashtra, West Bengal).

Tribe TOXODEROPSINI

Genus ***Toxoderopsis*** Wood-Mason, 1889

Toxoderopsis taurus Wood-Mason, 1889. (India : Bihar, Orissa).

Family EMPUSIDAE

Sub-family EMPUSINAE

Tribe EMPUSINI

Genus ***Empusa*** Illiger, 1798

Empusa guttula (Thunberg), 1815. (India : Andhra Pradesh, Orissa, Rajasthan, Uttar Pradesh).

Genus ***Gongylus*** Thunberg, 1815

Gongylus gongylodes (Linnaeus), 1758. (India : Orissa, Andhra Pradesh, Kerala,Tamil Nadu, West Bengal).

Gongylus trachelophyllus Burmeister, 1838. (India : Bihar, Orissa).

SUMMARY

The present study reveals the occurrence of 27 species of Mantodea belonging to 18 genera, 10 subfamilies and 4 families in Orissa (11 subfamilies and 6 families as per the classification by Erhmann, 2002). The study is partly based on specimens collected from the southern districts of Orissa during the years 2005-2007 and partly on the information available in the literature on mantid fauna of India. (Mukherjee *et al.*, 1995). The study reveals that the mantid fauna of Orissa is rich but not explored fully. Many genera having a wider distribution in India are also occurring in the state. Species like *Humbertiella affinis*, *Humbertiella nigrospinosa*, *Gimantis assamica*, *Tenodera fasciata*, *Toxoderopsis taurus*, *Gongylus trachelophyllus*, *Odontomantis montana* etc which have limited distribution in India are known from Orissa. Families like Eremiaphilidae and Metallyticidae and subfamilies Blepharodinae, Iridopteryginae, Caliridiane, Choeradodinae, Deroplatinae, Photininae, Phyllothelinae, Tarachodinae, Thespinae, Angelinae etc are not yet represented from Orissa. Among the known taxa, maximum representation is from the family Mantidae, followed by Hymenopodidae and Empusidae. Subfamilies like Acromantinae, Amelinae and Toxoderinae are poorly represented in the state. The poor representation of various taxa of mantodea in Orissa is due to the poor field exploration and collection of specimens from the state. Being an active predatory group of insects with lot of biocontrol potential, mantids form a highly rewarding group of insects for detailed systematic and biological studies. As there have been no specific surveys undertaken for the collection of Mantodea from Orissa, the present is the first attempt of such a study from the state. Though the present study covers only a small part of the state some interesting taxa are reported here. Further serious attempts of field exploration and collections of mantodea throughout the state, especially from the rich ecosystems of Eastern ghats in different seasons will provide many further informations on their distribution, endemism, intra-specific variations, biocontrol potential etc.

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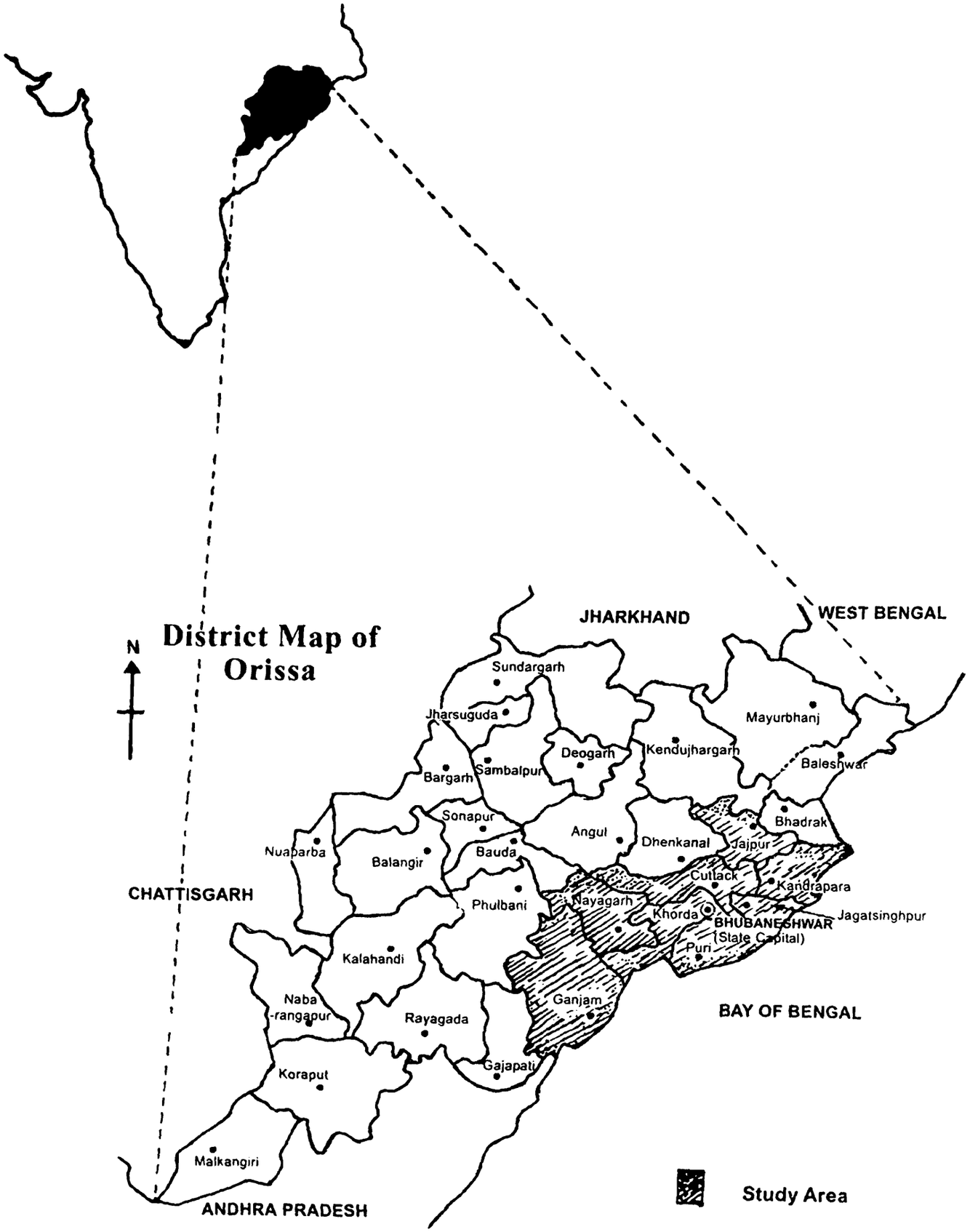


Figure 1. Area of collection

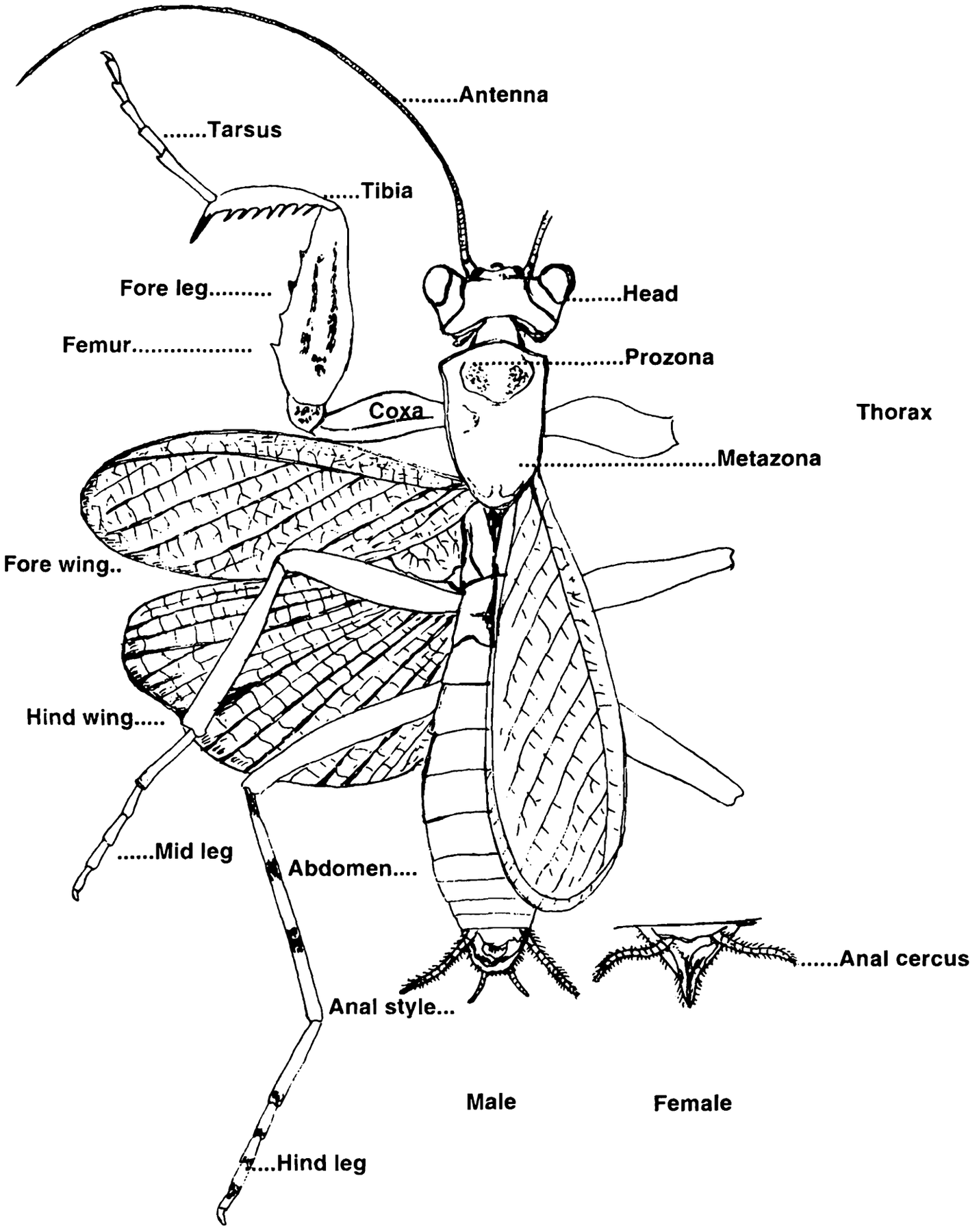


Figure 2. *Humbertiella* sp. Body dorsal view

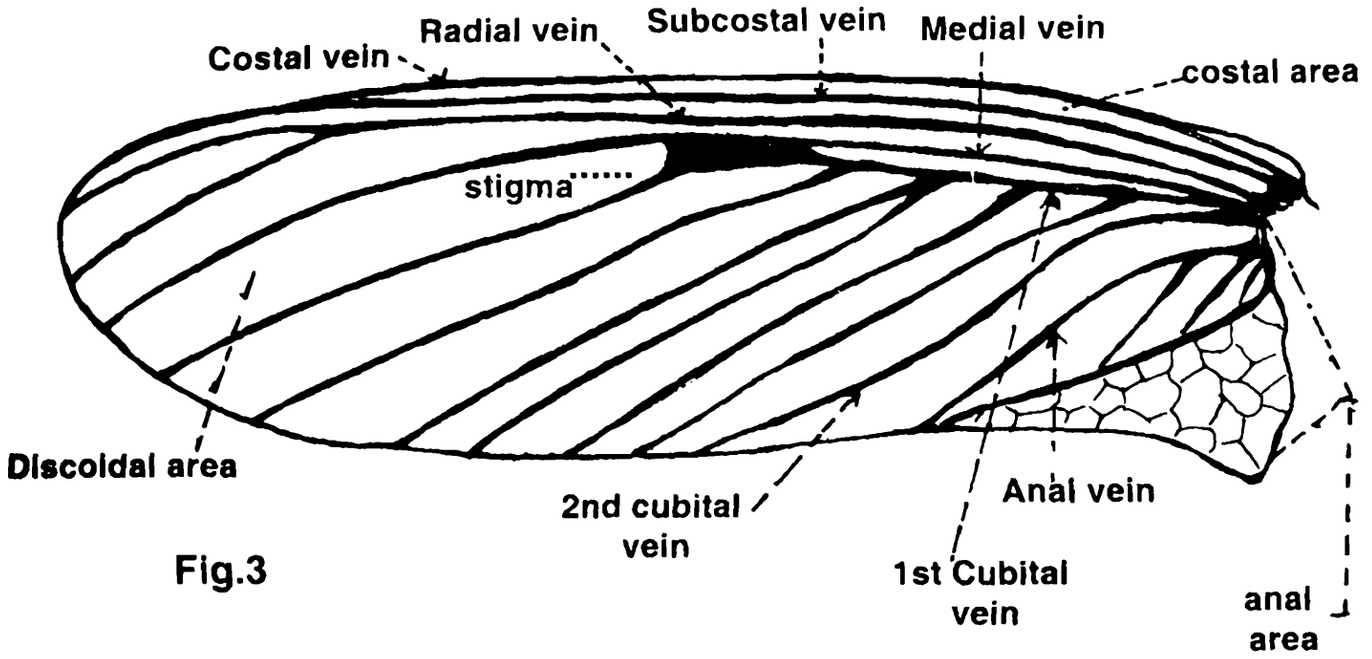


Fig.3

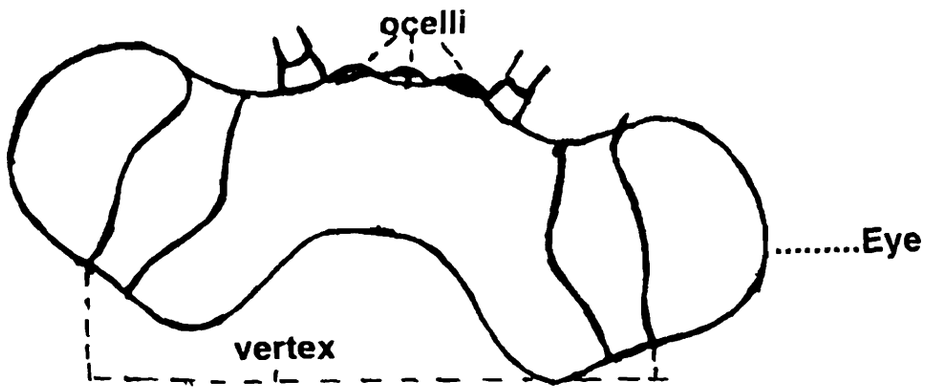


Fig.4

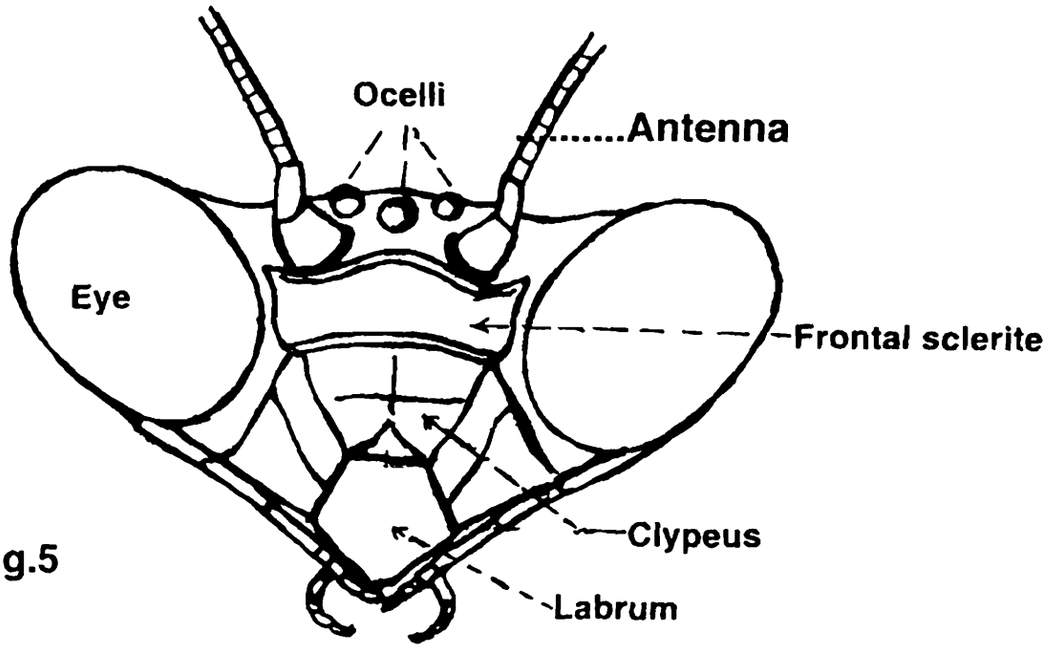
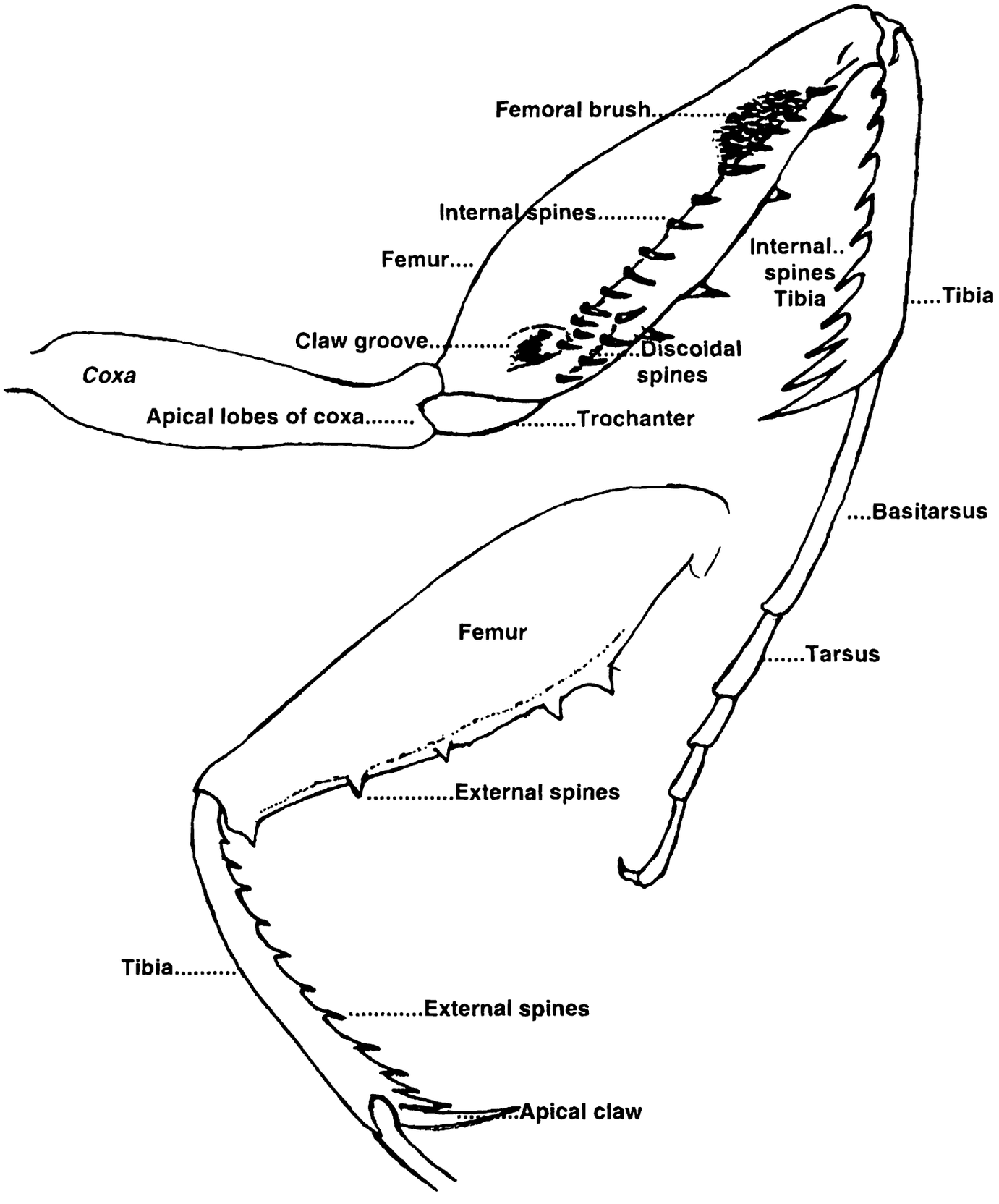
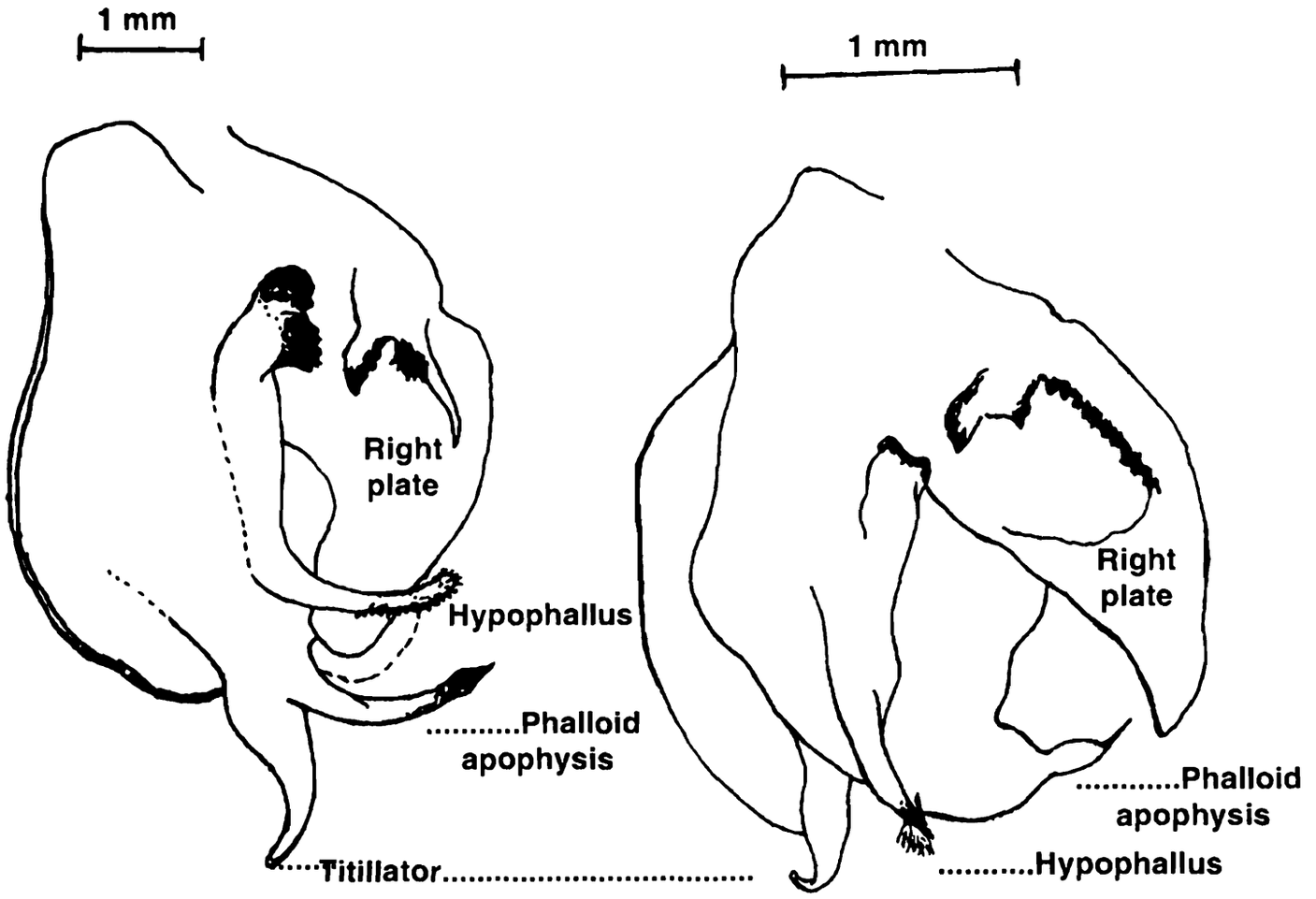


Fig.5

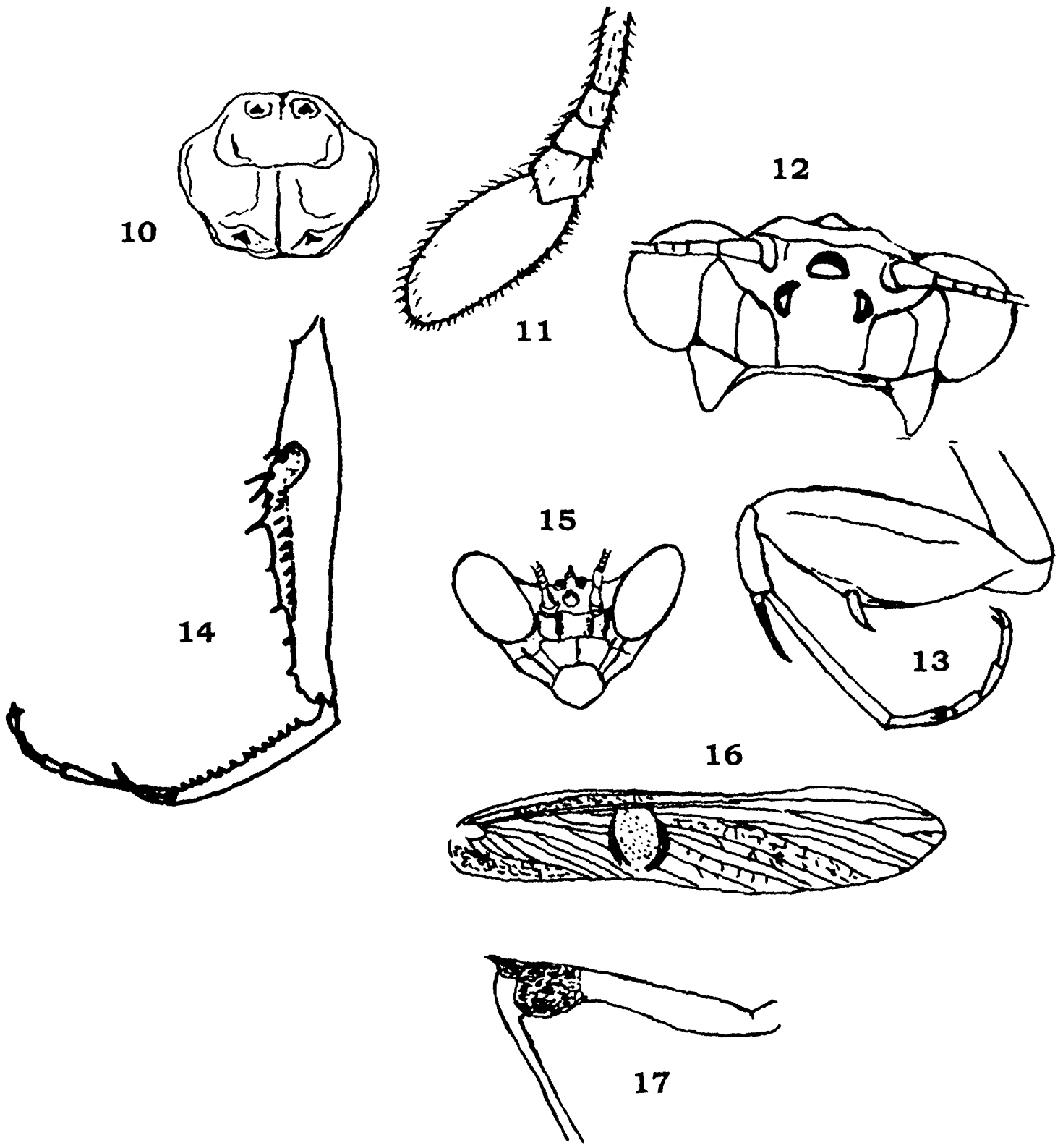
Figures 3–5. *Humbertiella* sp., 3. Forewing; 4. Head dorsal view; 5. Head front view



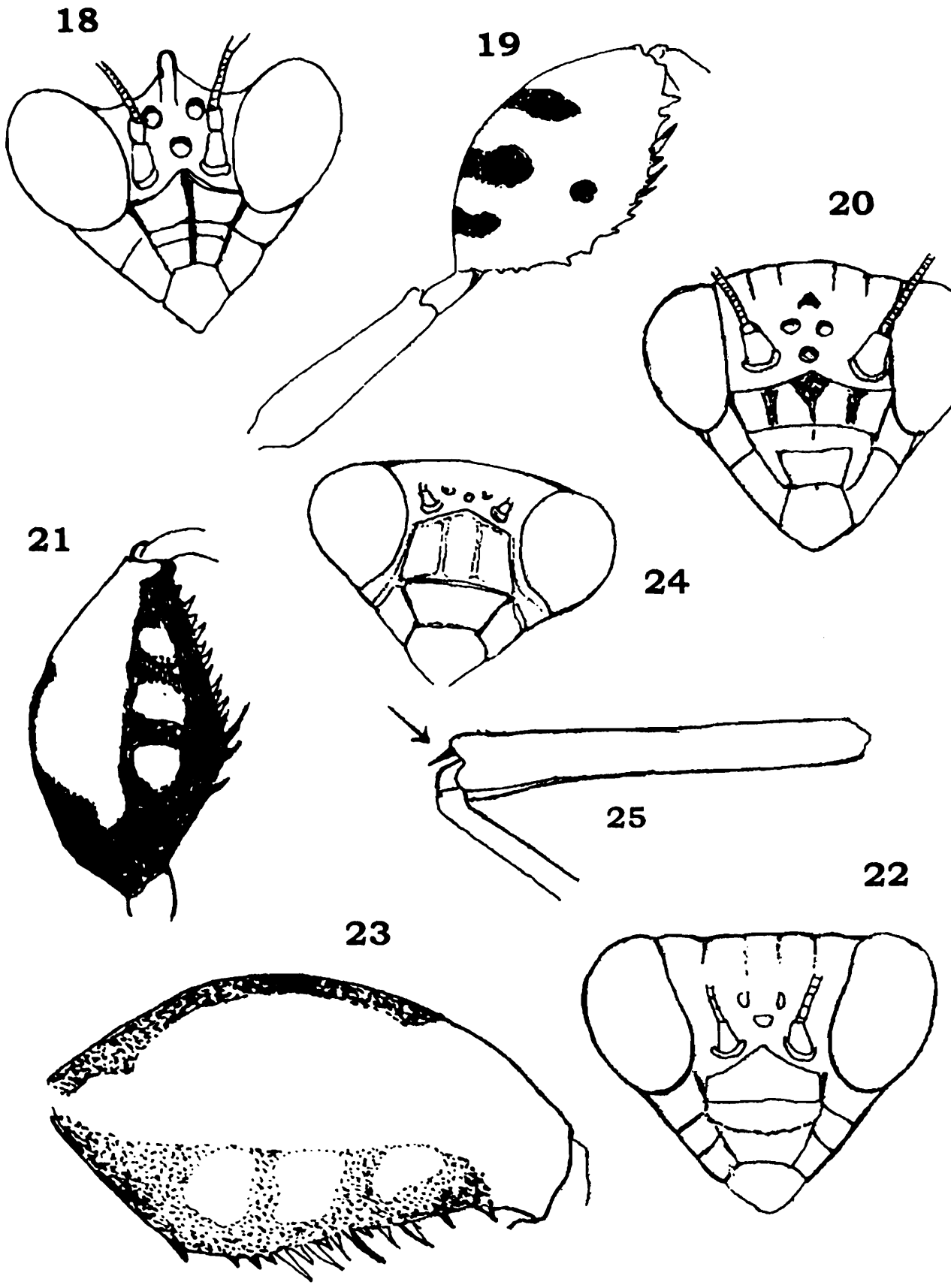
Figures 6–7. *Humbertiella* sp., 6. Fore leg ventral view; 7. Fore leg dorsal view



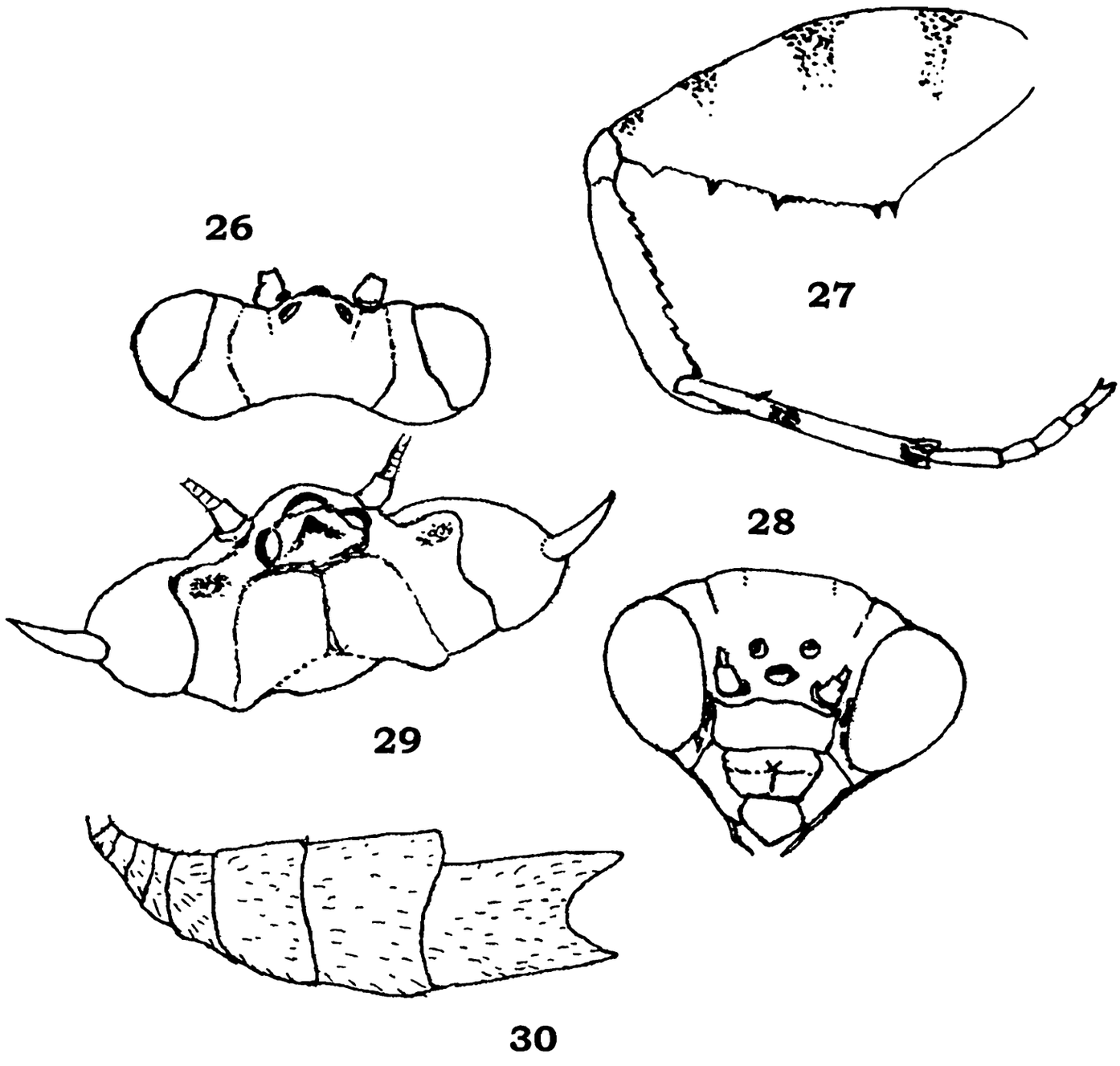
Figures 8–9. Phallic complex dorsal view. 8. *Heterochaetula fissispinis* Wood-Mason; 9. *Tenodera fasciata* (Olivier)



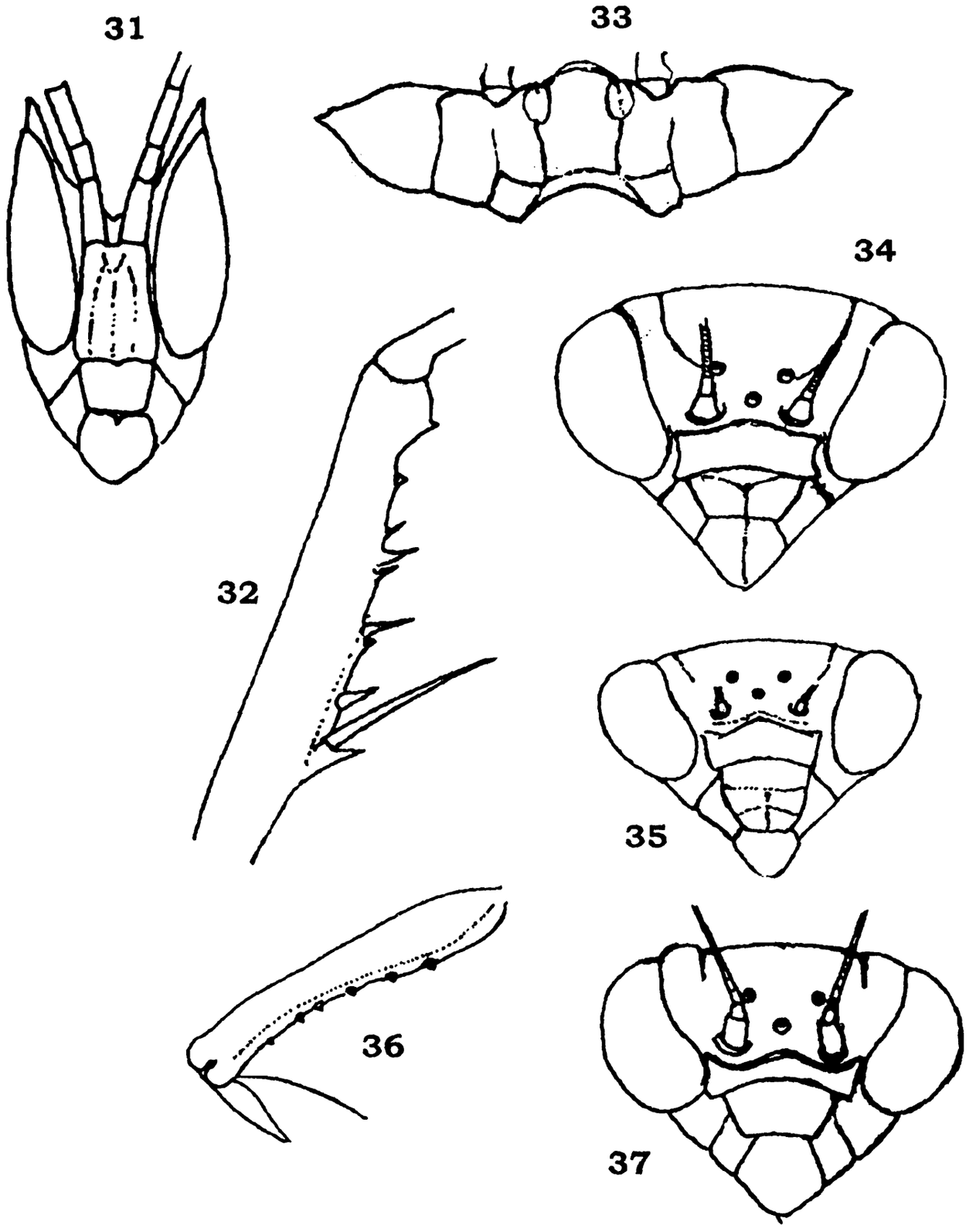
Figures 10–13. *Amorphoscelis annulicornis* : 10. thorax dorsal view; 11. anal cercus; 12. head dorsal view; 13. fore leg (without coxa); 14. *Mantis religiosa inornata*, fore leg (without coxa); **15–17** *Creobroter apicalis* : 15. head front view; 16. forewing; 17. middle femora and tibia



Figures 18–19. *Hestiasula brunneriana* : 18. head front view; 19. fore coxa and femora; **20–21** *Ephestiasula pictipes* : 20. head front view; 21. fore femora; **22–23** *Ephestiasula intermedia* : 22. head front view; 23. fore femora; **24–25** *Hierodula* sp. 24. head front view; 25. tip of hind femora

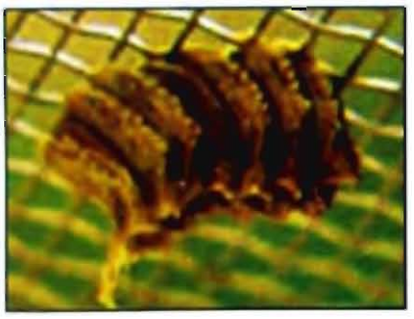


Figures 26–28. *Gimantis assamica* : 26. head dorsal view; 27. fore leg (without coxa); 28. head front view; **29–30.** *Toxoderopsis taurus* : 29. head dorsal view; 30. anal cercus



Figures 31–32. *Schizocephala bicornis* 31. head front view; 32. fore femora; 33. *Heterochaetula fissispinis*, head dorsal view; 34. *Tenodera fasciata*, head front view; **35–36** *Statilia maculata* : 35. head front view; 36 fore coxa; 37. *Euantissa pulchra*, head front view

PLATE 1 : Ootheca of Mantids



Gongylus gongylodes

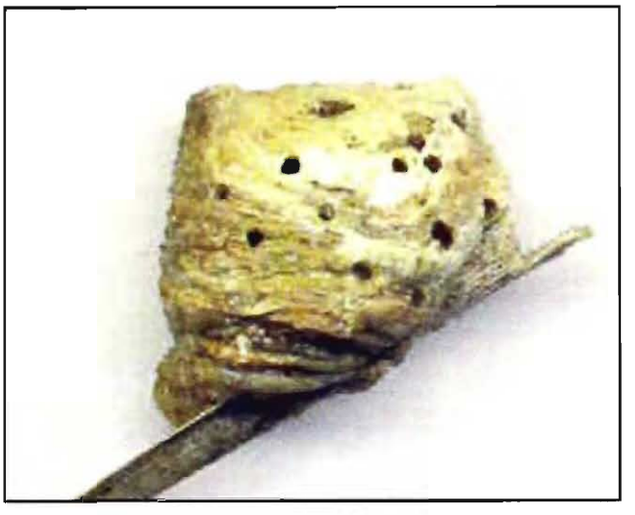
Mantis religiosa

Unknown mantid

Tenodera sp.

Euantissa pulchra

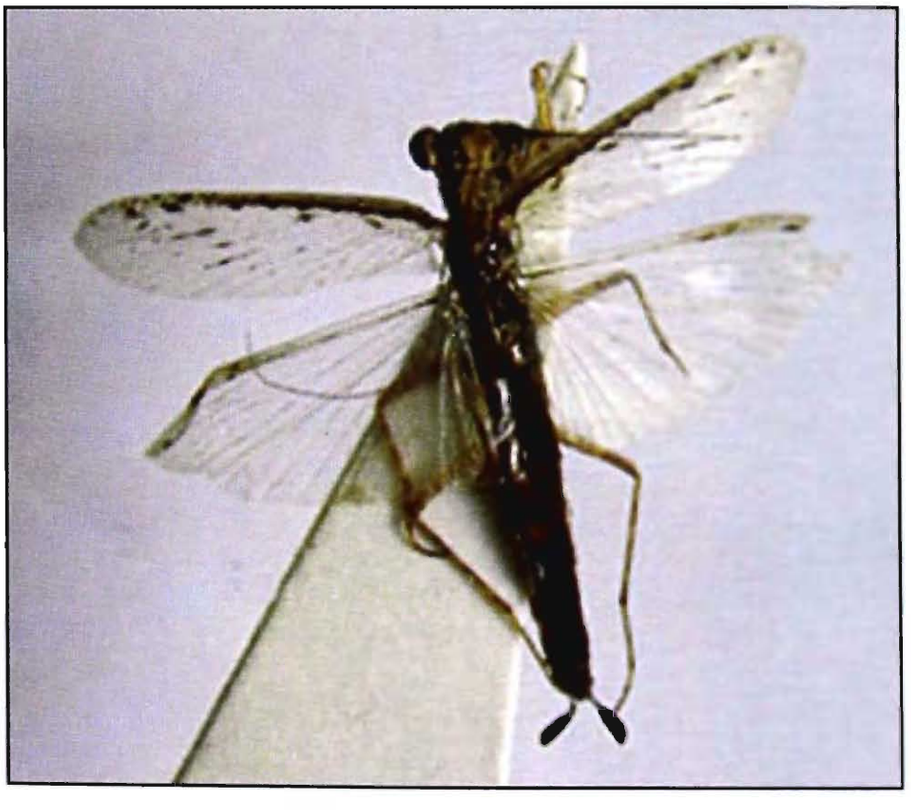
Hierodula tenuidentata



Tenodera fasciata (parasitised)

PLATE 2

1. *Aethalochroa ashmoliana* (Westwood)

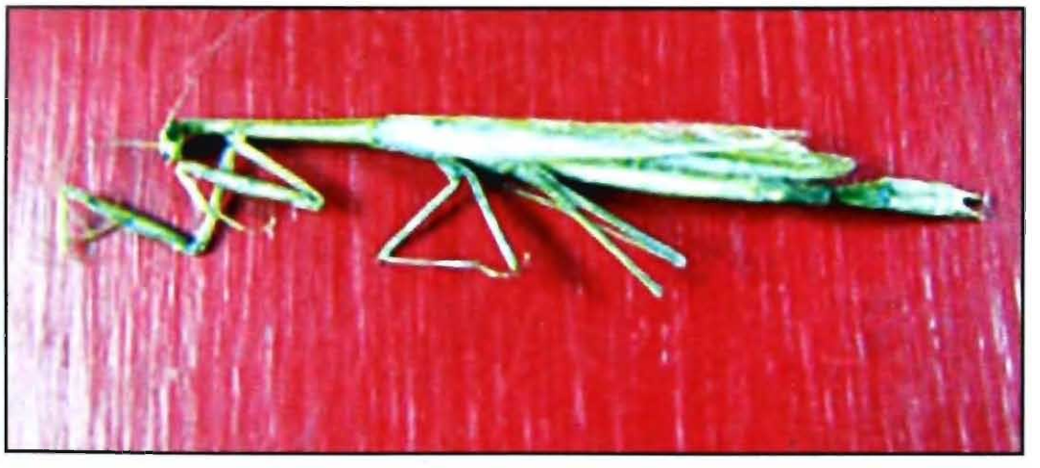


2. *Amorphoscelis annulicornis* Stal

PLATE 3

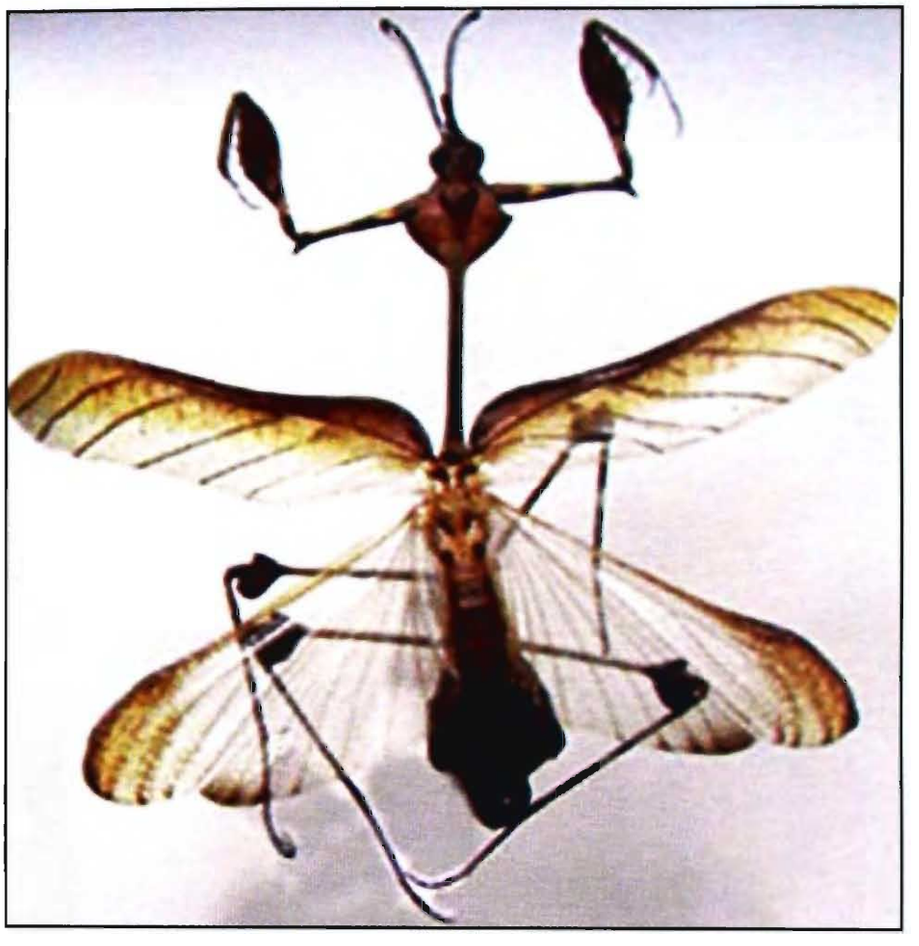
1. *Humbertiella similis* Giglio-Tos

2. *Humbertiella ceylonica* Saussure

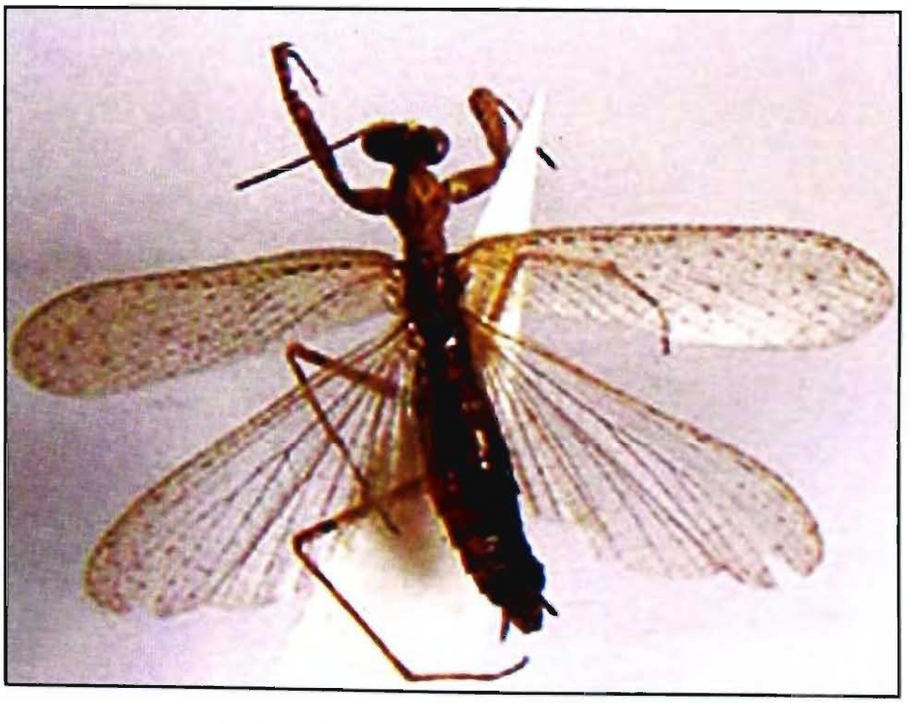


3. *Heterochaetula fissispinis* Wood-Mason

PLATE 4

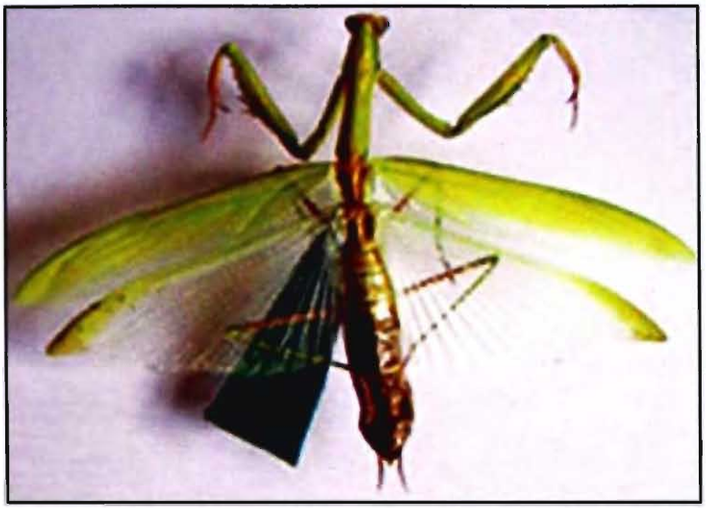


1. *Gongylus gongylodes* (Linnaeus)

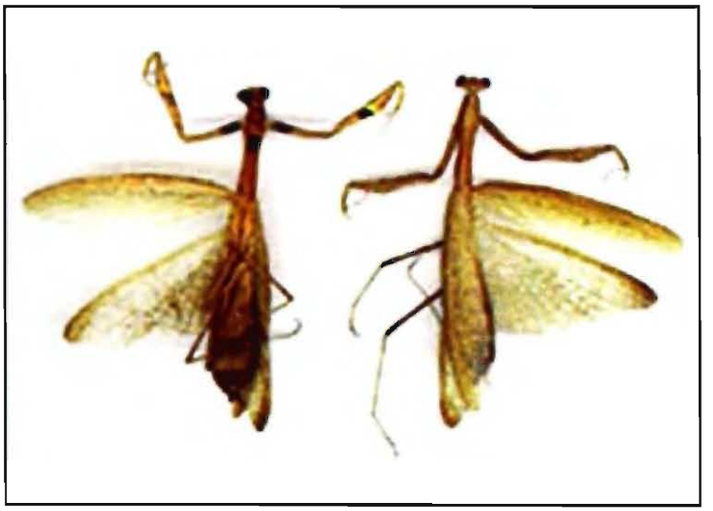


2. *Gimantis assamica* (Giglio-Tos)

PLATE 5



1. *Mantis religiosa religiosa* Linnaeus

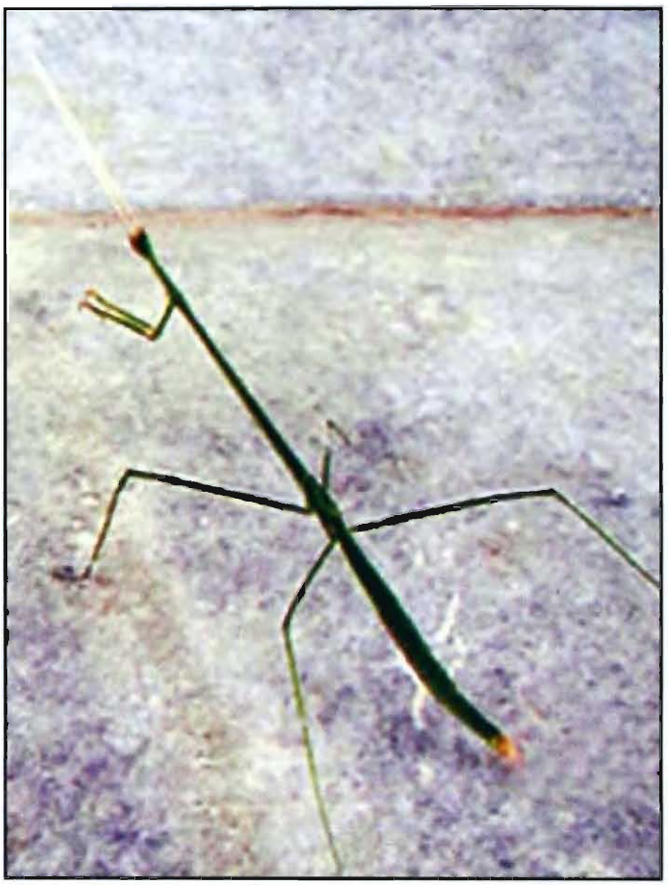


2. *Statilia maculata* (Thunberg)

3. *Hestiasula brunneriana* Saussure

PLATE 6

1. *Tenodera fasciata* (Olivier)



2. *Schizocephala bicornis* (Linnaeus)

3. *Hierodula (H) tenuidentata* Saussure

4. *Toxoderopsis taurus* (Wood-Mason)