A Preliminary Study on the Mantid Fauna (Insecta: Mantodea) of Orissa, 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, aphids 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,
Nayagarh, Cuttack, Jagatsinghpur, Jajpur and Kendrapara were surveyed for mantid collections. The state of Orissa 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 \( \frac{1}{20} \) 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.1). 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 flexible 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 metathorax. 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. Structure 
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 families 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)

<table>
<thead>
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<th>State</th>
<th>Genera</th>
<th>Species</th>
<th>State</th>
<th>Genera</th>
<th>Species</th>
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<td>4</td>
<td>Andhra Pradesh (Thulsi</td>
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<td>26</td>
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<tr>
<td>Himachal Pradesh</td>
<td>10</td>
<td>15</td>
<td>Rao et al., 2005</td>
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<tr>
<td>Uttar Pradesh</td>
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<td>55</td>
<td>Orissa (Sureshan et al.,</td>
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<td>27</td>
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<td>20</td>
<td>current study</td>
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<td>25</td>
<td>Tamil Nadu</td>
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<td>44</td>
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<tr>
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<td>Andaman &amp; Nicobar Islands (Sureshan et al., 2004 a).</td>
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<td>Lakshadeep Islands</td>
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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*
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


*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 supra-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)


*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.


*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 often 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


*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


*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.


*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)


*Diagnostic characters*: Vertex with a small tubercle above ocelli (Fig. 20) marked with black spots, lateral lobes pointed; pronotum 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.


*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


*Diagnostic 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)


*Diagnostic characters*: Body green. Forewing dark green, opaque, 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, Orissa, Ganjam Dist, Gopalpur-on-sea, 14.xi.2006 (Reg. no. 3987), 5 F, 1 nymph, 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


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)


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.

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


Diagnostic 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


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


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


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


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 extended into sharp point; antennae simple in female and pectinate in male; pronotum slender.

One species E. guttula known from Orissa.

8. Empusa guttula (Thunberg)


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 segments 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


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)

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


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 foliaceous with ventrally transverse black marks.

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


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

10. Gongylus trachelophyllus Burmeister


Diagnostic characters: Similar to Gongylodes in morphology except for the following characters: Foliaceous portion 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 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 foliaceous.

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 ........................................ 5

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


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 species *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


*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*  

*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)


1927. *Humbertiella ceylonica* : Giglio-Tos.*Das Tierreich.*, **50**: 64.
Diagnosis 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 black; forewing in male longer than body, reaching up to 5-6 abdominal segments in female.


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


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.


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 habitations.

14. Humbertiella similis Giglio-Tos. (Plate III, Photo 1)


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. Bosses 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.


**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., 2006c). General colour of female darker. Frontal sclerite dark in males and paler in females. Normally found around human habitations.

**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


**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)


**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


**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)


**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, first time reported from Orissa.

17. *Heterochaetula tricolor* (Wood-Mason)


**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


**Diagnostic characters** : Frontal sclerite transverse, smooth, superior border arched in the middle; Metazona of pronotum longer than prozona, bosses 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)


*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.


*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 MANTININI**

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 ........................................... \textit{Mantis} Linnaeus
   — Claw groove of femora placed beyond middle ................................. \textit{Statilia} Stal

Genus \textit{Hierodula} Burmeister


\textit{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 \textit{H. doveri}, \textit{H. membranacea} and \textit{H. tenuidentata} are known from Orissa

1. Fore coxae with 15-17 external spines, gradually longer distally, pronotum long ................................................................. \textit{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 ................................................................................\textit{H. doveri} Chopard
   — Prosternum with two blackish transverse bands in posterior part .......................................................... \textit{H. tenuidentata} Saussure

19. \textit{Hierodula doveri} Chopard


\textit{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.


\textit{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.

\textit{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)


**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 species 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)


**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 coxae with 5 short spines and few spinules among them; both wings longer than body, costal area greenish, discoidal area hyaline.


**Material examined**: 1 F, Ganjam District, Gopalpur-on-Sea. 2.viii.2005 (Regn. No. 3933); 2 M, Gopalpur, 3.x.2006; 1 F 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


Diagnostic Characters: Frontal sclerite transverse, a little wider than high, bicornate 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


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.

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)


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.


**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)


**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.


**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


**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)


**Diagnostic characters**: Colour yellowish brown in female and brown in male. Forewing green. Frontal sclerite (Fig. 34) more than 2x as wide as high, bicaudate, 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.


**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 geniuncal 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 geniculate spines; cerci long, flat ................................................................. *Toxoderopsis* Wood-Mason

Genus *Aethalochroa* Wood-Mason


*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. Prontum 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 geniculate lobes, no geniculate spines; cerci foliaceous.

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

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


*Diagnostic Characters*: Body brown in colour, Eyes prominent, rounded with a very small tubercle. Frontal sclerite pentagonal. Forewings smoky, shorter than abdomen, subopaque 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 geniculate 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


**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)


**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.


**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).


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 Pradesh, Karnataka, Tamil 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 PARAMANTININI
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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REFERENCES


Figure 1. Area of collection
Figure 2. Humbertiella sp. Body dorsal 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
1. Humbertiella similis Giglio-Tos

2. Humbertiella ceylonica Saussure

3. Heterochaetula fissispinis Wood-Mason
PLATE 4

1. Gongylus gongylodes (Linnaeus)

2. Gimantia assamica (Giglio-Tos)
1. *Mantis religiosa religiosa* Linnaeus

2. *Statilia maculata* (Thunberg)

3. *Hestiasula brunneriana* Saussure
1. *Tenodera fasciata* (Olivier)

2. *Schizocephala bicornis* (Linnaeus)

3. *Hierodula (H) tenuidentata* Saussure

4. *Toxoderopsis taurus* (Wood-Mason)