SYSTEMATIC STUDIES OF FAMILY SCUTELLERIDAE (HEMIPTERA: HETEROPTERA) AND BIOLOGY OF AN ECONOMICALLY IMPORTANT SCUTELLERID BUG, SCUTELLERA PERPLEXA (WESTWOOD)

ABSTRACT

THESIS

SUBMITTED FOR THE AWARD OF THE DEGREE OF

Doctor of Philosophy

IN

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Submitted By

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Under the Supervision of

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ABSTRACT

The family Scutelleridae belongs to the superfamily Pentatomoidea and it is reported world wide especially in the tropics and subtropics (Kirkaldy, 1909; Lattin, 1964; Schuh & Slater, 1995). The taxon was first established by Leach as Scutellerida at suprageneric level. These are generally 5-25 mm in size and most of them with brilliant colour and sometimes vividly iridescent. Thus some scutellerids are among the most spectacularly coloured of all Heteroptera. They are commonly known as shield bug due to their enlarged scutellum which is covering or nearly covering entire abdomen. Although all species are phytophagous, only relatively few are reported as pests. One group of these i.e., Eurygaster spp., or sunn pests had been reported as devastating wheat crop in the Middle East and Near East. Scutelleridae as a family phytophagous feeding on a large number of plants and has wide host range; no group of genera appears to specialize on any particular group of plants; also there are variation in its preference for plant parts, like some species feeding on seed, others on somatic tissues, and others on fruits (Harris and Andre, 1934; Leston, 1973). Members of this family are generally with antennae 3 or 5 segmented, labium always 4 segmented, frena obsolete or lacking, strongly laminate, forewing membranous with numerous veins, tarsi composed of 3 segments, spiracles present generally on III-VII abdominal venter on each lateral side of abdomen and in some also on VIII paratergites, trichobothria always paired and on lateral and ventral aspect of abdomen, posterior to spiracle except VIII paratergites, metathoracic scent glands well developed with well organized external thoracic scent system i.e., ostiole, peritreme evaporatorium with variable shape and size.

The family is represented by almost 80 genera and 450-500 species from worldwide under 8 subfamilies viz., Elvisurinae, Eurygastrinae, Hoteinae, Pachycoreinae, Odontoscelinae, Odontotarsinae, Scutellerinae and Tectocorinae. Among these 6 subfamilies have been represented from India excluding Pachycorinae and Tectocorinae.

An up to date checklist of scutellerid species of India and adjoining countries has been prepared, which covers 61 species under 18 genera. The subfamilies


The description of all the species supplemented with morphometric ratios based on actual measurements of the following characters viz., body length, head length, head breadth, preocular distance, postocular distance, interocellar distance, interocular distance, length of all antennal segments, length of all labial segments, medial length of pronotum, distance between anterior pronotal angles, distance between lateral pronotal angles, scutellar length, scutellar breadth at base, length of femora and tibiae of fore, middle and hind leg, and length of abdomen at middle and breadth at base. The other morphological characters like shape of head, shape of antennal segments, extension of labium, extension of juga and tylus; shape of pronotum regarding the shape of anterior, lateral and posterior pronotal angles; shape and convexity of scutellum and abdomen; sulcation on thoracic sternum or abdomen; shape and size of ostiole, peritreme and evaporatorium of metathoracic scent gland etc; along with body colour, number and arrangement of patches over dorsal as well as on ventral surface; presence of absence of punctations and hairs; and detail of male...
genitalia like shape and size of pygophore, aedeagus and paramere along with the shape and texture of vesica and conjunctival appendages and female genitalia like shape and size of paratergites and gonocoxae and detailed structure of spermatheca like shape and size of spermathecal bulb, presence or absence of pump flanges, length and breath of the distal and proximal spermathecal duct, shape and size of spermathecal duct dilation and also the texture of dilation have also been included.

The morphological characters for each species has been presented with line diagrams and 325 such diagrams included; 45 coloured photographs of adults and male genitalia (27 adult; 22 male genitalia) and 14 SEM images of metathoracic scent gland provided in which the main focus was towards bringing out the shape and size of ostiole and peritreme, and the texture of surface and extension of the evaporatorium. All these above characters have been studied in approximately 475 specimens.

Each species of this family is remarkably different and with these contrasting characters development of key at different taxonomic levels viz., subfamilies, genera and species has been attempted through supplementing available one with updated terminology.

The biology of an economically important bug *Scutellera perplexa* (Westwood) has been investigated for two years under laboratory and field conditions. The species has been reported as a serious sucking pest of *Jatropha curcas* Linnaeus from Delhi and adjoining areas. It remained active throughout the year and severe damage to foliage and developing fruits was observed between July and March. Population density was highest between September and November. The complete life cycle takes about 63.3±3.07 days; egg period lasted for 6.67±0.87 days with 98.87±2.24 per cent hatchability and nympha1 durations of I, II, III, IV and V instar were 5.33±0.82, 7.95±0.68, 6.15±0.91, 7.54±0.76 and 9.69±1.18 days, respectively. A key to the identification of different nympha1 stages is provided which is unique among such heteropterans. Suitable line diagrams have been provided to indicate the development of stigmatic patches and extension of labium in consecutive stages, along with the structure of egg in dorsal, as well as lateral and dorsal view of
adult; coloured photographs have been provided to show the egg laying pattern, ovipositional sites and their behaviour.
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DEPARTMENT OF ZOOLOGY
ALIGARH MUSLIM UNIVERSITY
ALIGARH (INDIA)

2011
CERTIFICATE

This is to certify that Ms. Shama Parveen has completed her research work entitled “Systematic Studies of Family Scutelleridae (Hemiptera: Heteroptera) and Biology of an Economically Important Scutellerid Bug, Scutellera perplexa (Westwood)”, under my supervision for the degree of Doctor of Philosophy of Aligarh Muslim University, Aligarh. This amounts to original contribution and distinct addition to the existing knowledge of the subject. She is allowed to submit the work for Ph.D. degree of Aligarh Muslim University, Aligarh.

(Mohd. Kamil Usmani)
Dr. Sucheta Khokhar
Principal Scientist

CERTIFICATE

This is to certify that the thesis entitled “Systematic Studies of Family Scutelleridae (Hemiptera: Heteroptera) and Biology of an Economically Important Scutellerid Bug, Scutellera perplexa (Westwood)”, submitted to the Department of Zoology, Aligarh Muslim University, Aligarh, for the award of the degree of Doctor of Philosophy in Zoology, is a faithful record of bona fide research work carried out by Ms. Shama Parveen (Admission No. Ph.D-07-L-217) under my co-supervision. No part of the thesis has been submitted by her for any other degree or diploma.

All the assistance and help received during the course of investigation are duly acknowledged by her.

(Sucheta Khokhar)
Co-supervisor

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Dedicated to My Loving Parents
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I hereby submit my being to my creator, the Almighty with the humble acceptance that by HIS permission and mercy, my efforts are finally successful and embodied in this thesis work.

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Place: Allipur

(Shama Parveen)
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The family Scutelleridae falls under superfamily Pentatomoidea (Hemiptera: Heteroptera). The status of this family always remained a topic of controversy i.e., Leach (1815) established this group at supergeneric level, but Fieber (1861) and Stal (1867) recognized it as a family. Distant (1902, 1904) and Kirkaldy (1909) considered the group at subfamily level under Pentatomidae, but Reuter (1912) and Van Duzee (1917) upgraded it again to family. Pendergrast (1957), Kumar (1965), McDonald (1966), Gross (1975) and Schuh and Slater (1995) considered it as a family on the basis of range of characters. The family is represented by 8 subfamilies, more than 80 genera and almost 500 species (Cassis and Vanags, 2006), especially from tropics and subtropics (Kirkaldy, 1909; Lattin, 1964; Schuh and Slater 1995). In India, about 70 species are known under 18 genera and 6 subfamilies viz., Elvisurinae, Eurygastrinae, Hoteinae, Odontoscelinae, Odontotarsinae and Scutellerinae.

Commonly, the species of this family are known as shield bugs, ‘shield’ referring to the broad scutellum which covers the entire abdomen dorsally and wings beneath (or in few species nearly covers e.g., Eurygaster spp.). Its members are dull or brightly coloured and Schuh and Slater (1995) commented “Some scutellerids are among the most spectacularly coloured, of all heteropterans”. Scutellerids are known for their wide intraspecific colour variations (colour polymorphism), which are usually sex-related. Generally, adult females are polychromatic while adult males are monochromatic, and often show a wide range of colour patterns. These phenotypic variations would vary in their adaptive features and can be of significant consequences towards their evolutionary ecology.

Scutellerids are medium (8 mm) to large (25 mm) sized bugs and are ovoid to elongate-ovoid. The head is triangular and laterally sinuated in most of the species. The antennae are 3 to 5 segmented; labium 4 segmented; pronotum trapezoidal, generally with its lateral angles obtuse (e.g., Poecilocoris spp., Chrysocoris spp. etc.) or produced in spines (e.g., Cantao spp. and Lamprocoris spiniger). Scutellum is enlarged and covers almost whole of the abdomen and wings (except Eurygaster
spp.) and tarsi are 3 segmented with a pair of apical claws and pulvilli. The frena of forewing greatly reduced or absent while the corium and clavus are membranous, metathoracic glands are well developed along with their ostiole and peritreme (e.g., *Cantao* spp., *Lamprocoris* spp, etc.) except for some species where it is reduced or absent (*Alphocoris lixoides*, *Irochrotus incisus*, etc.). The paired spiracles are visible on III - VII abdominal segments ventro-laterally but in females of some species also located on VIII paratergites e.g., *Chrysocoris* spp., *Poecilocoris* spp. Trichobothria are paired and placed caudal to the spiracles on III to VII segments; some possess paired stridulatory organs, placed laterally of IV to V abdominal segments ventrally e.g., *Ellipsocoris* spp. and *Hotea* spp.; females with their VIII paratergites generally bigger than IX and males of some species possess strigils on their genital capsule e.g., *Calliphara* spp., *Chrysocoris* spp.

The species of this family are phytophagous, but none appears to specialize on a particular group of plants (Leston, 1953). These are generalist plant feeders and feed on wide array of plant parts viz., seeds, somatic tissues, or fruits (Harris and Andre, 1934; Mc Donald, 1960; Berenger and Lupoli, 1991). Some are economically important pests, e.g., *Eurygaster* spp. (Stemenkovic, 1976; Grigorov, 1989; Javahery, 1995), *Pachycoris* spp. (Grimm and Fuhrer, 1998), *Scutellera* spp. (Shankar and Dhyani, 2006).

Although the members of this family are often large and attractively brightly coloured, still many taxa are poorly studied. Stal (1868) provided a key to the new world genera and in 1873, key to the species. Schouteden (1904, 1906) prepared key to the genera, and enlisted species along with colour plates of the African species. Lyal (1979) published a monograph on the Australian *Calliphara*, with the description of two new species. Kirkaldy (1909) provided catalogue of Scutelleridae at world level. Lodos et al. (1998) catalogued the Scutelleridae of Turkey, with brief biological notes. Distant in his series of publications (1902, 1907, 1918) of Fauna of British India including Ceylon and Burma briefly described different taxa in Scutellerinae (= Scutelleridae) under the Pentatomidae. He based the description of species and other related genera only on the basis of few external morphological characteristic features e.g., general colouration of body and appendages as well as the
number and position of spots, if any. Besides, he used similar characters in the
collection of keys up to tribal and generic levels. Some revisionary works had been
carried out on few genera and addition of new species. Ahmad and Kamaluddin
(1982) revised the genus *Poecilocoris* Dallas from Indo Pakistan subcontinent with
the description of 2 new species. Other studies comprise those on the genus *Tiridates*
Stal by Eger (1987) from Nicaragua, and on the genus *Deroplax* Mayr by Ahmad *et al.*
(1988) from the Oriental region with description of two new species. Eger and Lattin
(1995) proposed new combinations and synonyms for some scutellerids of America.
Cassis and Vanags (2006) described Australian genera of Scutelleraeidae. Agarwal and
Baijal (1984) studied the external morphology of *Scutellera perplexa*. Recently,
Parveen *et al.* (2010) studied the comparative structure of spermathecae of the Indian
species of the genus *Poecilocoris* Dallas.

Scrutiny of the literature indicates that although Scutelleraeidae is a small
economically important family and majority of its species are large sized and
attractively coloured, a comprehensive taxonomic study in the light of recent
advances in science has not been undertaken, in general and India in particular. Also
there is an impending need to update the status of various taxa. Considering their
biodiversity, abundance in diverse habitats and taxonomical importance, the present
investigations have been carried out with the following objectives:

- To explore and collect different species of Scutelleraeidae from different
  agroecosystems.
- To undertake biosystematic studies on the species of Scutelleraeidae.
- To construct the keys of different taxa.
- To prepare checklist of genera and species of Scutelleraeidae occurring in India
  and adjoining countries and
- To study the biology of an economically important scutellerid bug *Scutellera*
  *perplexa* (Westwood).
2.1 Taxonomy and faunistics

Scutelleridae is a family of Pentatomoidea, comprising of about 80 genera and 500 described species (Cassis and Vanags, 2006). This group was first established at suprageneric level by Leach (1815) and Fieber (1861), while Stal (1867) recognised it as a family. Distant (1902) and Kirkaldy (1909) considered it as a subfamily of the Pentatomidae, but again Reuter (1912) and Van Duzee (1917) restored its family status, an arrangement that was followed by many subsequent heteropterists (Pendergrast, 1957; Kumar, 1965; McDonald, 1966; Gross, 1975). Schuh and Slater (1995) confirmed its family status, with the four subfamilies viz., Eurygastrinae, Odontotarsinae, Pachycorinae and Scutellerinae. McDonald and Cassis (1984) erected a new subfamily, i.e., Tectocorinae and also accepted the Elvisurinae as valid. Recently, Carapezza (2009) introduced a new subfamily, Hoteinae to accommodate the genera *Deroplax* and *Hotea*, and also proposed a new generic name in subfamily Odontotarsinae i.e., *Ahmadocoris* to accommodate the Oriental species viz., *Deroplax acuticornis* (Ahmad et al., 1998), *D. dalbergiai* (Ahmad et al., 1988), *D. diffusus* (Walker, 1867), *D. serratus* (Ahmad et al., 1998) and *D. zahidae* (Ahmad et al., 1988).

Many genera and species of Scutelleridae had been established on the specimens collected from India e.g., Lamarck (1801) and Hahn (1834) established new genera viz., *Scutellera* and *Chrysocoris*, respectively. Guerin (1830) described a new species, *Scutellera rubropuncatum* from Assam which was subsequently transferred under a new genus *Solenosthedium* by Dallas (1851). Germar (1839) established *Alphocoris* as a genus based on the type species *A. lixoides* from North India, while Herrich-Schaeffer (1839) recorded *Pachycoris nepalensis* from Nepal which got later synonymised as *Poecilocoris hardwickii* Dallas (1851). White (1839) described *Tectocoris childreni* from Bhutan, which was later transferred to the newly established *Poecilocoris* by Dallas (1848). Simultaneously, he described three species under this genus viz., *P. hardwickii*, *P. latus* and *P. pulcher* from Khasi and Naga Hills, Assam and Malabar, respectively. Signoret (1861) described *Oxyprymna*
spinola from India while Stal (1871) described Brachyaulax rufomaculata and Hyperoncus punctellis from Philippines. In 1873, Stal described two species viz., Alphocoris incisus and Hyperoncus lineaticornis from India, and Distant (1901) described Poecilocoris crowleyi from Assam.

Kirkaldy (1909) published a catalogue and he followed the classification given by Distant (1902) on Indian Pentatomidae. Both considered Scutelleridae as a subfamily under Pentatomidae and recognized five tribes viz., Elvisurini, Odontotarsini, Scutellerini, Sphaerocorini and Tetyrini. This catalogue enlisted 405 species under 74 genera along with a list of their synonymy, distribution and host plants. Among these 56 species under 16 genera are enlisted from India. Further efforts for cataloguing were made which were restricted to some region or countries like those of Hoffmann (1932, 1935, 1948) of China and adjoining countries, Froeschner (1988) from North America and Maes (1994) catalogued the Pentatomoidea of Nicaragua. Similarly, Lodos et al. (1998) catalogued the Scutelleridae of Turkey, with brief biological notes. Many taxonomical studies like that of Stal (1868) supplemented keys to the new world genera. Schouteden (1903, 1904, 1906) provided monograph on the African fauna with keys, species lists and colour plates, while Lyal (1979) studied the Australian Calliphara and Froeschner (1988) contributed towards the fauna of North America. Eger and Lattin (1995) in their studies on Scutelleridae of America proposed few new combinations and synonyms. Cassis and Vanags (2006) studied Australian Scutelleridae and concluded it included 13 genera and 25 species. They described Hessiphara and also provided illustrations of male genitalia along with a species H. minuta from Western Australia and restored Calliscyta, and its synonymy with Choerocoris was clarified. They also described Australian species along with a key and description of two new species from Eastern Australia. viz., C. grossi and C. lattini; the validity of Lampromicra aerea (Distant) was brought out and its synonymy with L. senator (Fabricius) was justified and Calliphara nobilis (Linnaeus) recorded from Australia. Carapezza (2009) described Ellipsocoris pericarti from Azerbaijan, and Ellipsocoris kalashiani from Armenia and Turkey.
These earlier contributions reveal that this group does not receive the desired attention, and the revisionary studies were very limited. Few revisionary studies done were restricted to a specific region or on small groups of species, which is illustrated from the literature as given below:

Yang (1934) revised Chinese species of Scutelleridae while Alayo (1967) focussed on the Cuban species, Hoffmann (1971) of Virginia and de la Fuente (1973) contributed towards the Iberian species. Ahmad et al. (1979) revised the scutellerids of Pakistan and Bangladesh while the Palearctic Odontoscelis were revised by Kis (1979) and Gollner-Scheiding (1986). Lyal’s (1979) work was on the Australian Calliphara. Ahmad and Kamaluddin (1982) revised Poecilocoris from Indo-Pakistan subcontinent and described three new species viz., heissi, orientalis and pseudolatus, but later on P. heissi was synonymized with P. druraei by Tsai and Redei (2010).

Revisions of the fauna from the Oriental region include those of Ahmad et al. (1988) on the genus Deroplax Mayr from Pakistan and Bangladesh, and McDonald (1988) on the Asian species of Cantao Amyot and Serville. The Australian Theseus and the Neotropical Polytes were revised by Baehr (1989) and Eger (1987), respectively.


Some species of Scutelleridae were redescribed from time to time; e.g., Brachyaulax cyaneovitta (Walker) by Yang (1934); Cantao ocellatus (Thunberg) by

An appraisal of the above and the details so far reviewed from the literature would reveal that such studies are still lacking particularly from the Indian subcontinent.

2.2 Distribution and host plants

The literature available on the field biology details like host and distribution is summarized and tabulated below:

<table>
<thead>
<tr>
<th>Species</th>
<th>Host</th>
<th>Distribution</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cantao ocellatus (Thunberg)</td>
<td>Bischofia javanica Broussonetia papyrifera</td>
<td>Ryukyu Islands</td>
<td>Takara, 1957 Zhang, 1985</td>
</tr>
<tr>
<td>Chrysocoris pulchellus (Dallas)</td>
<td>Lantana</td>
<td>India</td>
<td>Beeson, 1941</td>
</tr>
<tr>
<td>C. stockerus (Linnaeus)</td>
<td>Santalum album</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chrysocoris pulchellus, C. stockerus, Hotea curculionoides (Herrich-Schaeffer), H. nigrorufa Walker, Scutellera perplexa (Westwood) and Solenosthedium</td>
<td>Sandal wood</td>
<td>India</td>
<td>Chatterjee, 1934</td>
</tr>
<tr>
<td></td>
<td>Species</td>
<td>Host Plant</td>
<td>Location</td>
</tr>
<tr>
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</tr>
<tr>
<td><strong>rubropunctatum</strong></td>
<td><em>Chrysocoris</em></td>
<td>Acacia auriculiformis</td>
<td>India, Madhya Pradesh</td>
</tr>
<tr>
<td></td>
<td>purpureus</td>
<td><em>Populus deltoides</em></td>
<td>India (Madhya Pradesh, Andhra Pradesh)</td>
</tr>
<tr>
<td></td>
<td>stockerus</td>
<td><em>Jatropha curcas</em> and <em>Ricinus communis</em></td>
<td>Malaysia</td>
</tr>
<tr>
<td></td>
<td>stollii</td>
<td><em>Calotropis procera</em> (Asclepiadaceae)</td>
<td>India</td>
</tr>
<tr>
<td></td>
<td>stollii</td>
<td><em>Emblica officinalis</em></td>
<td>India</td>
</tr>
<tr>
<td></td>
<td>stollii</td>
<td><em>Jatropha</em></td>
<td>India (Uttar Pradesh)</td>
</tr>
<tr>
<td></td>
<td>stollii</td>
<td><em>Adhatoda vasica</em></td>
<td>India</td>
</tr>
<tr>
<td></td>
<td>stollii</td>
<td><em>Costus speciosus</em></td>
<td>India</td>
</tr>
<tr>
<td></td>
<td>blackburniae</td>
<td><em>Acacia spp.</em></td>
<td>Hawai (USA)</td>
</tr>
<tr>
<td>White</td>
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<tr>
<td></td>
<td><em>Ahmadocoris</em></td>
<td><em>Delbergia sissi</em></td>
<td>Pakistan and Bangladesh</td>
</tr>
<tr>
<td>delbergia (Ahmad,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moizuddin and Mushtaq)</td>
<td></td>
<td></td>
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<tr>
<td>and <em>A. zahidae</em></td>
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<tr>
<td>(Ahmad, Moizuddin and</td>
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<tr>
<td>Mushtaq)</td>
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<tr>
<td></td>
<td><em>Dioecus</em></td>
<td><em>Rhizophora mangle</em></td>
<td>North America</td>
</tr>
<tr>
<td>irroratus (Fabricius)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Species</td>
<td>Host Plants</td>
<td>Location</td>
<td>References</td>
</tr>
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<tr>
<td>Dystus puberulus</td>
<td>Fig</td>
<td>Mexico</td>
<td>Cervantes, 2004</td>
</tr>
<tr>
<td>Eucorysses grandis (Thunberg)</td>
<td>Gardenia angusta and G. japonicans</td>
<td>Ryukyu Island (Japan)</td>
<td>Takara, 1957</td>
</tr>
<tr>
<td>Eurygaster Maura (Linnaeus)</td>
<td>Wheat and graminaceous plants</td>
<td>Pakistan</td>
<td>Ahmad and Moizuddin, 1978</td>
</tr>
<tr>
<td>Lamprocoris roylisi (Westwood)</td>
<td>Paulownia tomentosa</td>
<td>China</td>
<td>Lin et al., 1992</td>
</tr>
<tr>
<td>Lampromicra senator (Fabricius)</td>
<td>Cherry</td>
<td>Southern Queensland (Australia)</td>
<td>McDonald, 1963b</td>
</tr>
<tr>
<td>Pachycoris fabricii (Linnaeus)</td>
<td>Guava</td>
<td>Brazil</td>
<td>Panizzi, 1997</td>
</tr>
<tr>
<td>Pachycoris klugii Burmeister</td>
<td>Jatropha curcas</td>
<td>Mexico and Central America</td>
<td>Grimm and Guharay, 1998; Grimm and Somarriba, 1998</td>
</tr>
<tr>
<td>Species</td>
<td>Host Plants</td>
<td>Location</td>
<td>Reference</td>
</tr>
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</tr>
<tr>
<td><em>Pachycoris torridus</em> (Scopoli)</td>
<td><em>Cnidoscolus pubescens</em></td>
<td>Mexico and Central America</td>
<td>Santos <em>et al.</em>, 2005</td>
</tr>
<tr>
<td><em>Pachycoris</em> spp.</td>
<td>Euphorbiaceae plants</td>
<td>Brazil</td>
<td>Grimm and Maes, 1997a and b; Wink <em>et al.</em>, 2000; Williams III <em>et al.</em>, 2001</td>
</tr>
<tr>
<td><em>Pachycoris torridus</em></td>
<td><em>Sapium haematospermum</em> <em>Jatropha curcas</em> and <em>Malpighia glabra</em></td>
<td>Brazil</td>
<td>Hussey, 1934</td>
</tr>
<tr>
<td><em>Pachycoris torridus</em></td>
<td><em>Schinus terebinthifolius</em> <em>Anacardiaceae</em></td>
<td>Brazil</td>
<td>Sanchez <em>et al.</em>, 2004</td>
</tr>
<tr>
<td><em>Poecilocoris druraei</em> (Linnaeus)</td>
<td><em>Morus alba</em></td>
<td>China</td>
<td>Lin <em>et al.</em>, 1992</td>
</tr>
<tr>
<td><em>Scutellera fasciata</em> (Panzer)</td>
<td>Plum</td>
<td>Pakistan</td>
<td>Ahmad and Moizuddin, 1978</td>
</tr>
<tr>
<td><em>Scutellera perplexa</em></td>
<td><em>Phyllanthus distichus</em></td>
<td>India</td>
<td>Kavadia <em>et al.</em>, 1971</td>
</tr>
<tr>
<td><em>Scutellera perplexa</em></td>
<td>Cotton</td>
<td>India</td>
<td>Khokhar and Khokhar, 2004</td>
</tr>
<tr>
<td><em>Scutellera perplexa</em></td>
<td>Jatropha</td>
<td>India</td>
<td>Shankar and Dhyani, 2006; Ambika <em>et al.</em>, 2007</td>
</tr>
<tr>
<td><em>Solenosthedium bilunatum</em> (Lefebvre)</td>
<td><em>Arbutus unedo</em> and <em>Pistacia spp.</em></td>
<td>France</td>
<td>Dusoulier and Lupoli, 2006; Dusoulier and Lupoli, 2006</td>
</tr>
<tr>
<td><em>Tectocoris biopthalmus</em></td>
<td><em>Hibiscus rosa sinensis</em></td>
<td>Queensland</td>
<td>Gough and Hamacek, 1989</td>
</tr>
<tr>
<td><em>Tectocoris diopthalmus</em> (Thunberg)</td>
<td>Cotton</td>
<td>Australia</td>
<td>Ballard and Holdaway, 1926; Wilson <em>et al.</em>, 1983</td>
</tr>
<tr>
<td><em>Tetyra</em> spp.</td>
<td>Pine</td>
<td>USA and Southern Canada</td>
<td>Lariviere and Larochelle, 1988; Ebel <em>et al.</em>, 1975; Froeschner, 1988</td>
</tr>
</tbody>
</table>
Scutellerids show diversity in their host plant relationships, some feed on seeds, others on somatic tissues and still others on fruits (Harris and Andre, 1934; Leston, 1973; McDonald, 1960; Berenger and Lupoli, 1991). Overwintered adults and nymphs of *Eurygaster* spp., attack shoots and stems as well as the newly formed ears of wheat causing the plants to die before ear formation while the new generation of nymphs (II to V instars) and adults feed on the milky stage or mature grain, which reduces baking quality (Putschkov, 1961, 1965; Martin *et al*., 1969; Paulin and Popov, 1980; Javahery, 1995). During outbreak, infestation may cause 100% crop loss (Paulin and Popov, 1980; Javahery, 1992, 1995, 1996). *Tectocoris biophthalmus* also cause some bud fall in flowering of hibiscus (*Hibiscus rosa sinensis*) in Australia and Queensland (Gough and Hamacek, 1989).

### 2.3 External morphology, genitalia and internal anatomy

Detailed description of morphology of *Eurygaster integriceps* Puton was provided by Puton (1881), Makhotin (1947), Wagner (1951), Vodjdani (1954), Putschkov (1961), Lodos (1961) and Javahery (1994, 1995). External morphology of *Chrysocoris stockerus* (Linnaeus) was described by Mushtaq (1996) from Pakistan and its nympha! morphology was explained by Mushtaq *et al.* (1975).

Ahmad and Moizuddin (1980) described the internal anatomy of *Alphocoris lixoides* Germar from Pakistan with interpretation on its phylogenetic considerations. Various aspects of *Chrysocoris stollii* (Wolff) were dealt with by many workers including genetics of colour pattern (Singh and Sahni, 1965), nervous system (Singh, 1969), internal male genitalia and their development (Singh, 1971), external genitalia (Baijal and Agarwal, 1980), origin and composition of the egg’s yolk (Verma and Basiston, 1974) growth and differentiation of the female reproductive system (Ghosh *et al*., 1991) and copulatory behaviour (Dhiman and Kumar, 2008). Srivastava and Dogra (1969) studied the neurosecretory system of *Scutellera perplexa* (Westwood) with reference to the material in the aorta wall while the gross anatomy of its nervous system was explained by Mathur (1977). Abbasi and Rishi (1973) described *Solenosthedium rubropunctatum* Guerin, with special reference to its metathoracic scent gland ostiole and genitalia. Behavioural activity of the cotton harlequin bug *Tectocoris diophthalmus* (Thunberg) on cotton plants was studied by Wilson *et al.*
(1983). Microstructure of the cuticular hemielytron of *Poecilocoris lewisi* (Distant) was studied by Miyamoto and Kosaku (2002).

Some homologies of female genitalia of Heteroptera were discussed by Schaeffer (1968). Female genitalia in few Scutelleridae were studied by Southwood and Leston (1959), Brown and Eralp (1962), and Gaffour- Bensebbane (1994). Pruthi (1925) gave a comprehensive account of the male genitalia of Hemiptera. Freeman (1939) evaluated the genitalia in species of *Callidea* Laporte and revised the genus. Vidal (1949) evaluated the male genitalia of European species of subfamily Eurygastrinae and elaborated on the uniformity in its few characters. Male genitalia of *Eurygaster integriceps* was described by Vodjdani (1954). Putschkov (1961), Brown and Eralp (1962) and Javahery (1967, 1995) and Mohaghegh *et al.* (1991) studied species of *Eurygaster* from Iran, while Vinogradova (1959) illustrated the importance of claspers and vesica for their identification. McDonald (1961) described the male genitalia of 8 species of Scutelleridae from Queensland, and in 1963 evaluated the male genitalia of *Lampronica femorata* (Walker), *L. aerea* (Distant), *L. regia* (Bergroth), *Calliphara cruenta* Stal and *Calliscyta australis* Distant towards valuable conclusions.

Scudder (1959) utilized female genitalia excluding spermatheca for the systematics of Heteroptera, in defining the superfamilies. Verhoeff (1893) studied female genitalia and elaborated on arcus and triangulin. Scudder (1959) concisely described the female genitalia of the Heteroptera and evaluated its utility in definition of major families. Male genitalia details of Scutelleridae were supplemented through the work of McDonald (1961, 1963c), Singh (1971) and Agarwal and Baijal (1984), and female genitalia with that of McDonald (1963a) and Singh (1968a).

### 2.4 Metathoracic scent glands and their secretions

In Heteroptera the structural details of metathoracic scent glands provide useful taxonomic character for the identification at species level (Muir, 1907; Hamilton *et al.*, 1985). The chemical nature of secretion of these glands mainly provide defensive mechanism and the chemicals in their secretions advertise the bug’s unpalatability at long-range, protecting it from predators.
The secretions in Scutelleridae are very similar to those of Pentatomidae (Aldrich, 1988), perhaps with minor occurrence of alkanes. In *Tectocoris diophthalmus* (Thunberg) with smaller glands excrete mixture of trans-2-hexenal with trans-2-hexenyl and trans-2-octenyl acetates (Staddon et al., 1987), while species with larger glands viz., *Hotea gambiae* Westwood excrete mixture of trans-2-hexenal with trans-2-octenal, 4-oxo-trans-2-hexenal, trans-2-decenal, limonene and β-pinene (Hamilton et al., 1985). *Pachycoris stalii* secretes tridecane, trans-2-hexenal, trans-4-oxo-2-hexenal, trans-2-hexenyl acetate and dodecane; however, its lateral reservoirs are filled with pure trans-2-hexenal in females and 99% tridecane in males, with the rest of the chemicals located in median reservoir (Williams et al., 2001). Also, these results disagreed with established conception that aldehydes can be synthesized only in median reservoir (Aldrich, 1978). The secretions from the metathoracic and abdominal scent glands of many scutellerid species, of their nymph and adult stages had been analyzed (Ubik et al., 1975; Smith, 1978a, b; Kumari et al., 1984; Gough et al., 1985, 1986; Janaiah et al., 1988). The morphology and ultra structure of the metathoracic scent glands of *Eurygaster maura* was studied by Durak and Kalender (2007).

### 2.5 Biology

Due to economic status of *Eurygaster integriceps* detailed description of eggs, nymphs and adults were brought out by Puton (1881), Makhotin (1947), Wagner (1951), Vodjdani (1954), Lodos (1961), Putschkov (1961), Paulin and Popov (1980) and Javahery (1994, 1995). A brief note on the life history of *Cantao ocellatus* (Thunberg) was given by Ramakrishna (1920). Ballard and Holdaway (1926) studied the biology of *Tectocoris diophthalmus* (Thunberg) in detail, reporting it as a significant pest of cotton in Queensland. McDonald (1960) reported on the biology of *Choerocoris paganus* (Fabricius) listing numerous host plants, while in 1963 he described the immature stages of *Lampronicia senator* (Fabricius), *Scutiphora pedicellata* (Kirby) and *Cantao parentum* (White). The spermatheca and eggs of *Odontotarsus purpureolineatus* Rossi were explained by Candan et al. (2007). Biology of *Tetyra bipunctata* (Herrick and Schaeffer) was studied by many workers like Gilbert et al. (1967) of Wisconsin (U.S.A), Ebel et al. (1975) of Southern United
States and Cameron (1981) of Texas. The immature stages of *Scutellera amethystina* and *Eurygaster maura* were described by Ahmad and Moizuddin (1978). Bionomics of *Poecilocoris lewisi* Distant was explained by Li and Wang (2007) from China.

Eggs of Heteroptera were reviewed by Southwood (1956), Cobben (1968), and Hinton (1981). Egg surface structure in Heteroptera including Scutelleridae were elaborated upon by many workers; Esselbaugh (1946), Grigorov (1988), Javahery (1994), Suludere *et al.* (1999), Bundy and McPherson (2000), Candan *et al.* (2001, 2005), Wolf and Reid (2003, 2004) and Candan and Suludere (2003, 2006). The ovipositional behaviour that is similar to other heteropteran eggs *i.e.*, adhered to each other, as well as to each other as well as to the substrate in upright position with an adhesive secreted by the female was brought out by many workers (Southwood, 1956; Cobben, 1968; Hinton, 1981; Javahery, 1994; Candan and Suludere, 2006). Many species oviposit eggs either singly or in cluster (mass) of more than one, and egg numbers vary from species to species *e.g.*, *Agonosoma flavolineatum* Laporte, *Dystus puberulus* Stal, *Eurygaster maura* (Linnaeus) and *Tetyra bipunctata* (Herrich Schaeffer) oviposit on an average of 14 eggs in a cluster reported by Paleari (1992), Cervantes (2004), Candan and Suludere (2001, 2006) and Cameron (1981), respectively. *Pachycoris klugii* Burmeister lays on an average 81.4 eggs in almost 2.4 egg batches (Cervantes, 2002), while an average of 30 eggs was recorded in *Callidea* spp. (Javahery *et al.*, 2000).

The micropylar structures are raised from the chorion around the cap externally but in Acanthosomidae, Cydnidae, Scutelleridae and Thyrocoridae these tend to project from the insides of the shell (Javahery, 1994). Hinton (1981) described that the number of micropylar processes vary in species of *Eurygaster*. The aero-micropylar process has a central canal for the passage of sperm and serves for respiratory interchange in many species of Heteroptera (Southwood, 1956; Cobben, 1968; Hinton, 1981; Javahery, 1994).

The eggs and nymphal stages of some economically important species were described by Harris and Andre (1934), Kobayashi (1954, 1956, 1967), McDonald (1960, 1963b), Reid and Barton (1989), Critchley (1998), Javahery *et al.* (2000) and Ambika *et al.* (2007). Detailed study of eggs of *Eurygaster integriceps* include those
of Putschkova (1959) and Javahery (1994, 1995). Ahmad and Moizuddin (1978) described and illustrated the immature stages of *E. maura* (Linnaeus). Egg characteristics had been used in distinguishing these species (Grigorov, 1988). The immature stages of *Tectocoris diophthalmus* (Thunberg) were described by Ballard and Holdaway (1926) and McDonald (1963b), and the latter supplemented the description with a key to its instars. The immature stages of *E. integriceps* and *Scutellera amethystina* Germar were studied in detail by Ahmad and Moizuddin (1978) and those were recorded as a pests of wheat and plum (*Zizyphus numularia*), respectively from Pakistan. Cervantes (2004) studied the biology of *Dystus puberulus* Stal from Mexico.
MATERIAL AND METHODS

The present investigations have been carried out in the Insect Biosystematic Laboratory, Network Project on Insect Biosystematics, Division of Entomology, Indian Agricultural Research Institute, New Delhi. The specimens were obtained from National Pusa Collection (NPC), Division of Entomology, Indian Agricultural Research Institute, New Delhi; Division of Entomology, Forest Research Institute (FRI), Dehradun, Uttarakhand and Entomology Section, Department of Zoology, Aligarh Muslim University, Aligarh, Uttar Pradesh (DZAMU). In addition, specimens were collected from crops, vegetations and orchards from different agroecosystems under the auspices of the Network Project on Insect Biosystematics (NPIB). The bugs were collected from various states of India viz., Arunachal Pradesh, Delhi, Himachal Pradesh, Meghalaya, Uttarakhand, Uttar Pradesh and West Bengal and these deposited in the National Pusa Collection (NPC), Division of Entomology, Indian Agricultural Research Institute (IARI), New Delhi.

3.1 Collection, killing, drying, pinning and preservation

Collection of specimens from different agroecosystems was done by general sweeping with the help of insect net, hand picking method as well as light traps. Freshly collected insects were killed with the benzene or ethyl acetate and kept in butter paper envelopes, especially during the surveys. For pinning and stretching, these were relaxed in small air tight relaxing chambers with layers of wet cotton and covered with filter paper for 24 hrs. During stretching care was taken to expose the antennae and legs so as to reveal their characters of taxonomic importance. Adults were pinned on the right side of scutellum and kept in oven for 24 hrs at 60°C. The specimens were labeled with data of locality, host, date and name of the collector. The juvenile stages of the bugs were preserved in small air tight vials, having 70% alcohol with few drops of glycerol. The procedure to study the genitalia, includes treatment of abdomen in 10% KOH for 30 min to soften it, thereafter it was washed and dissected in distilled water opening the same with fine needle on the lateral sides, extracting the genitalic structure, and boiling in 10% KOH for 5 min at 100°C. The
genitalia were then transferred to glacial acetic acid for 15 min for dehydration, and studied by placing them on cavity slides. Mounting of genitalia on slides was avoided to prevent distortion of the structures. A cavity slide with a drop of glycerol was found most suitable medium for the study of genitalia from dorsal, ventral and lateral angles. These processed structures were studied and illustrated under Nikon MZ10 and Leica MZ16A stereozoom microscopes then stored in genitalia microvials containing few drops of glycerol, and pinned on to the respective specimens.

3.2 Taxonomic studies

The essential diagnostic characters of were examined under Nikon MZ10 fitted with a drawing tube and ocular micrometer and Leica MZ16A stereozoom microscopes; the former was used to make line diagrams of taxonomically important characters; and Leica’s EZ4 dissecting microscope was used for the dissection and study of genitalia. Photography was done under Leica MZ16A stereozoom microscope attached with Leica DFC425A, and Sony DSCH50 digital cameras.

3.3 Morphometric studies

Measurements of specimens as a whole and their body parts viz., head length and breadth (across eyes), pronotum length (medial) and breadth (between anterior and lateral pronotal angles), scutellum length (medially) and breadth (at base), abdominal length and breadth (at base) ventrally and their appendages like antennae, labium, legs were undertaken with the help of ocular and stage micrometers. Care was taken to ensure that the specimens were always in a level plane and set uniformly every time. For standardization, a trial run was made with five specimens for each species for every measurement chosen at a particular plane and angle to ensure uniformity and concordance of values. After standardizing the measurement procedure all selected characters were recorded. The scale shown in figures is 1 mm (Fig. 1b).

3.4 Scanning Electron Microscope studies

To study the structure of external thoracic scent efferent system of metathoracic scent glands, scanning electron microscope (SEM) studies were undertaken. Dried specimens were selected and washed with 0.1M phosphate buffer, repeated thrice, each for 15 min. After washing, dehydrated in series of 30%, 40%,
50%, 60%, 70%, 80%, 90%, 95% and 100% alcohol for 15 min. These were then ultrasonically cleaned and mounted on SEM stubs using double sided aluminium tapes. Palladium coatings were done of 15-18 nm of thickness in SC7620 Sputter coater at vacuum (1.19e-003 to 8.9e-004 Pa) and images taken with Zeiss EVO MA10 SEM under pressure of 10mbar/Pa and 15-20 kV.

3.5 Biology of *Scutellera perplexa*

To study the biology of *Scutellera perplexa*, adult males, females as well as nymphs were collected from jatropha plants grown in farm area of IARI, New Delhi. The collected individuals were kept in plastic jars (13.5× 10.5 cm), covered with muslin cloth for mass rearing, on tender shoots and unripe fruits. Freshly laid egg batches were shifted on to filter paper (5.0 cm dia) placed over wet cotton pads in petridishes (1× 5.5 cm) for recording different observations on eggs. Five neonates were shifted onto tender leaves placed in small jars (8.5× 8.5 cm) in ten replications and durations of instars were recorded. Newly emerged adults were separated in pairs (male and female) and placed in similar jars for recording the mating and ovipositional behaviour and durations. These studies were carried out at 24±2°C and 65±5% RH. The following biological parameters were observed:

a) Fecundity, per-cent hatchability, incubation period and ovipositional pattern.

b) Nymphal instars and durations.

c) Adults, mating behavior, longevity and sex ratio.

Illustration of juvenile and adult stages was accomplished and preservation of juvenile stages was done in small vials in 70% alcohol.

Males and females were sorted out carefully based on the external male genitalia. The terminology used is after Pendergrast (1957), Scudder (1959) and McDonald (1966). Breadth of head calculated across the eyes and the breadth of scutellum taken at the base. All morphometrics are in mm, and the scales shown in illustrations equivalent to 1.0 mm.

3.6 List of abbreviations:

The abbreviations used in different plates/ illustrations for body parts, appendages and genitalia are as follows:
Abd: abdomen; Ans: antennal segment; Anv: anal vein; Apa: anterior pronotal angle; Bl: blade; Cja: conjunctival appendage; Cl: claw; Clf: claval fracture; Clv: clavus; Co: corium; Cu: cubitus; Df: distal flange; Dsd: distal spermathecal duct; Emb: embolium; Ev: evaporatorium; Ey: eye; Fm: femur; Frl: fore leg; Gnx: gonocoxa; Gp: gonopore; Hl: hind leg; Iv: Intervenial vein; Ju: Jugum vein; Jul: jugal lobe; Lbs: Labial segment; Lpa: lateral pronotal angle; M: median vein; Mem: membrane; Ml: middle leg; Mt: metastemum; Oc: ocellus; Ost: ostiole; P: pump; Pct: proctiger Pf: proximal flange; Pr: paramere; Prm: pronotum; Prt: peritreme; Ps: Peritremal surface; Psd: proximal spermathecal duct; Ptg: paratergite; R+M: radio-median vein; Sb: spermathecal bulb; Scu: scutellum; Sd: spermathecal dilation; Se: setae; Spr: spiracle; St: sternite; Str: strigil; Tb: tibia; Th: theca; Trb: trichobothria; Trc: trochanter; Trs: tarsomeres; Ty: tylus; Ve: vesica; Vn: veins; Vt: Vittae and Wg: wing.

The abbreviations for the depositories of specimens examined are as follows:

**DZAMU**: Department of Zoology Aligarh Muslim University, Aligarh; **FRI**: Forest Research Institute, Dehradun; **IARI**: Indian Agricultural Research Institute, New Delhi; **NPC**: National Pusa Collection, Division of Entomology, Indian Agricultural Research Institute, New Delhi and **NPIB**: Network Project on Insect Biosystematics, Division of Entomology, New Delhi.
4.1 GENERAL MORPHOLOGY (Fig. 1-4)

**Head** (Fig. 1a) variable in form, usually opisthognathous and more or less triangular, porrect anteriorly and slightly deflected with prominent laterally projected compound eyes and a pair of variable sized, round to oval-shaped ocelli, placed near to posterior-inner sides of the compound eyes, tylus generally longer than jugal lobes except *Eurygaster* spp. **Antennae** (Fig. 2a) placed at the proximal side of the mandibular plates slightly close to compound eyes within antenniferous tubercles. All species bear 5 segmented antennae; colour and length of the antennal segments vary from species to species, but in majority varies from brown to black and its II segment smallest. **Compound eyes** (Fig. 1a) size varies, in some small (*Eurygaster* spp.) while in others large, and protruded laterally (*Chrysocoris* spp.); colour generally red, brown or black. **Ocelli** (Fig. 1a) are sensory organs located behind the compound eyes on the dorsal surface of the head capsule. These are small, round or oval shaped and are placed more distant to each other than to eyes; colour varies from pale to orange or red. **Labium** (Fig. 2b) originates from the under side of the head at apex between the bucculae comprises of four segments of unequal length and generally reaching beyond the posterior coxae extended to different length on to the abdominal segments or in some cases only upto the posterior coxae. The length and proportion of the labial segments are diagnostic characters. The basal segment is enclosed within bucculae, generally I segment smallest, II longest, III and IV subequal but, it is not static, and varies from species to species. A constriction present near the proximal end of the II segment, III segment broadest and the apical one narrowed with fine bristles.

**Thorax** with **pronotum** (Fig. 1a-b) dorsally shield like, anterior margin generally sinuated, a pair of callosity prominent in some species at antero-lateral position, termed as callus, anterior pronotal angles obtuse (*e.g.*, *Chrysocoris* spp., *Scutellera* spp.) while in *Poecilocoris* spp., slightly spinose, posteriorly convexed, in some species *e.g.*, *Cantao ocellatus* and *Lamprocoris spiniger*; lateral angles produced either in spines or obtuse in majority of the species, and obtuse, lateral
margins normal or slightly sinuated while in some species it is raised e.g., *Poecilocoris* spp., base convex or swollen and generally termed as disc.

**Scutellum** (Fig. 1a-b) is the largest part of the thorax and covers whole of the abdomen except some species (e.g., *Eurygaster* spp.), decorated with spots of different colour and size. In some species (e.g., *Chrysocoris* spp.) base slightly convexed, while in some (e.g., *Poecilocoris* spp.) convexity at middle, posteriorly ends obtusely but in *Cantao* spp., apically truncate.

**Forewings** (Fig. 2d) semisclerotized, a transverse semi-circular furrow divides it into two parts, proximal one sclerotized called corium (Co) and the distal part membranous called membrane (Me). This sclerotized portion is further divided into two areas usually referred to as embolium (Emb) and clavus (CIV); embolium occupies the costal margin, and is somewhat elongated, band-like and separated from the rest of the sclerotized portion by means of R+M, corium the largest, median and triangular area, next to embolium, is bound anteriorly by a radiomedian vein (R+M) and posteriorly by a claval furrow (Clf). The semicircular furrow marks off its outer margin from the apical membrane. The clavus inwardly located to the claval furrow, somewhat narrow, elongated and triangular plate and similar to corium and embolium in texture. The distal portion of the membrane contains a variable number of veins, and varies from five to nine in species belonging to different genera.

**Hindwings** (Fig. 2e) entirely membranous, their apical margin much thicker than the posterior, this gives the shape and also provides protection to the hind wings; anterior margin formed by costo-subcostal vein, next to this is an indistinct radio-median vein (R+M) running in the longitudinal axis. There are two incomplete wing folds and the first runs parallel to the second. Leston (1962) and Hamilton (1971, 1972a, b and c) discussed the terminologies of the wing veins and venational trends and phylogeny.

**Legs** (Fig. 2c) belong to pro, meso and metathoracic segments in pairs and each leg is composed of coxa, trochanter, femur, tibia and tarsal segments. On the basis of location or position, legs are generally termed as; prothoracic or fore legs, mesothoracic or middle legs and metathoracic or hind legs; tarsi composed of three segments, covered with fine bristles or hairs, first longest and second shortest. The distal tarsal segment is joined with pre-tarsus (Snodgrass, 1935) or post-tarsus (Fox
and Fox, 1964) which is composed of two large hooks like claws and sac like pulvillus in between. The prothoracic femora are dilated medially and shorter than the middle and hind femora while latter are longest amongst all. Tibiae flattened dorsoventrally and more dilated distally.

Metathoracic scent glands (Fig. 3a) occupy a ventral position in the hind part of metathorax (Staddon, 1979); odoriferous structure seen on each side of the metasternum and to the posterior coxa, the gland itself does not usually extend over the edge of the metathorax. It is associated with a cuticle of complicated structure called evaporatorium, usually situated on metapleura but can completely cover ventral parts of thorax. Although some authors suggest that its main function is improving evaporation (Carayon, 1971), it seems that it primarily prevents the secretion from overflowing the rest of the body, especially to the tracheal openings (Remold, 1963). For better effect, evaporatorium is covered by mushroom-shaped sculptures, holding the fluid, these sculptures complicated in structure, often being taxon-specific (Carayon, 1971; Hepburn and Yonke, 1971); their secretion mostly defensive, with sophisticated mechanism of functioning.

Abdomen (Fig. 3b) completely fused with metathorax and cannot be distinguished separately, II tergite also modified and reduced; III tergite is comparatively broader than that of II and anteriorly united with, and posteriorly with the margin of IV segment. Ventrally it is convex, and in many species breadth at base more than length. The I and II sternum fused; each sternal sclerite on its lateral side bear two structures, the one single spiracle and just below it a paired structure called trichobothria.

Male genitalia (Fig. 4a-c) having IX segment modified into a quadrangular structure known as the pygophore (Fig. 4a) and within the pygophore the organs of copulation are located. The pygophore has two openings, the anterior proximal and the dorso-posterior, distal or terminal. The latter larger and external and during copulation the appendages of aedeagus inflated through this opening (Bonhag and Wick, 1953). The X segment in the form of quadrangular structure, termed proctiger while the XI segment located within the proctiger and forms the anal ring which extends during the process of excretion. Pygophore generally broader than long with its dorsomedian
surface medially concave and cup-like. These characters appear to be of taxonomic importance. Aedeagus (Fig. 4b) is the main copulatory organ and consists of a proximal basal plate and a distal phallosoma or theca. The latter encloses the endosoma (Pruthi, 1925) or conjunctiva (Leston, 1955) and bears dorsal membranous conjunctival lobes, ventrolateral lobes and the thecal appendages. On either side of the proximal portion of aedeagus within the pygophore a pair of pointed structures connected with the basal plate occur and these presently called paramere (Fig. 4c), which are well developed and variously termed as claspers, gonostylus or herpagones (Ahmad and Southwood, 1964), and these probably help in grasping and copulation.

**Female genitalia** (Fig. 4d-e) is from the VIII and IX abdominal segments, these genital plates collectively called as **ovipositor** (4d); VIII paratergites and I pair of gonocoxae are the components of VIII segment, the latter is the only remnant of the VIII venter; generally VIII paratergite paired, but in some it is fused, triangular and some bears a spiracle on the antero-lateral surface, while IX paratergites comparatively small, elongated or lobe like. Spermatheca (Fig. 4e) simple, apically with a bulb, a pump with distal and proximal flanges and distal spermathecal duct. This duct leads to the median dilation which leads through a sclerotized median rod-like and visible duct. The proximal spermathecal duct leads to the female gonopore. The length of distal and proximal spermathecal duct vary between species.
4.2 CHECK LIST OF SPECIES (INDIA AND ADJOINING ORIENTAL REGION)

The scutellerids of India and adjoining countries are presently represented by 62 species belonging to 18 genera viz., Ahmadocoris, Alphocoris, Brachyaulax, Calliphara, Cantao, Chrysocoris, Eucorysses, Eurygaster, Hotea, Hyperonchus, Irochrotus, Lamprocoris, Melanodema, Phimodera, Poecilocoris, Scutellera, Solenosthedium and Tetrarthria. These belong to 6 subfamilies viz., Elvisurinae, Eurygastrinae, Hoteinae, Odontoscelinae, Odontotarsinae and Scutellerinae. The subfamily wise list of species from Inia and the adjoining oriental region is presented below:

Subfamily: Elvisurinae

I. Genus Solenosthedium Spinola, 1837
Solenosthedium Spinola, 1837: 360; Vollenhoven 1863: 4; Kirkaldy, 1909: 311
Type species: by subsequent designation (Reuter, 1888: 414): Cimex lynceus Fabricius, 1794
Solenostethium Amyot and Serville 1843: 26; Schouteden 1903: 8; 1904: 8
1. Solenosthedium rubropunctatum (Guerin)
   Scutellera rubropunctata Guerin, 1838: 157
   Solenostedium rubropunctatum Vollenhoven, 1863: 4; Kirkaldy, 1909: 311
   Solenostethium rubropunctatum Distant, 1902: 40
   Distribution: India, Myanmar

Subfamily: Eurygastrinae

II. Genus Eurygaster Laporte, 1832
Eurygaster Laporte, 1832: 67; Stal, 1873: 30; Jakovlev, 1885: 78; Schouteden, 1904: 71
Type species: Cimex hottentotta Fabricius, 1775: 699
   Bellocoris Hahn, 1834: 42; Spinola, 1837: 365
2. Eurygaster integriceps Puton, 1881
Eurygaster integriceps Puton, 1881: 119

**Distribution:** Pakistan

3. *Eurygaster maura* (Linnaeus, 1758)

*Cimex maurus* Linnaeus, 1758: 441

*Eurygaster maura* Saunders, 1892: 16; Distant, 1902: 68

*Cimex cinereus* Goeze, 1778: 276; Kirkaldy, 1909: 274

*Thyreocoris austriacus* Schrank, 1801: 68; Distant, 1902: 68


*Tetyra picta* Fabricius, 1803: 136; Illiger in Rossi, 1807: 363

**Distribution:** India, Pakistan

**Subfamily: Hoteinae**

### III. Genus *Hotea* Amyot and Serville, 1843

Amyot and Serville 1843, 41; Stal 1873, 24; Schouteden, 1903: 63, 64; Kirkaldy, 1909: 276

**Type species:** *Hotea gambiae* (Westwood, 1837: 11) by subsequent designation (Schouteden, 1903: 66)

4. *Hotea curculionoides* (Herrich-Schaeffer, 1836)

*Pachycoris curculionoides* Herrich-Schaeffer, 1836: 106; *Hotea curculionoides* Vollenhoven, 1863: 37; Distant, 1902: 65; Kirkaldy, 1909: 276

*Pachycoris punctulatus* Germar, 1839: 105; Dallas, 1851: 39; Kirkaldy, 1909: 276

*Hotea nasuta* Walker, 1867: 58; Kirkaldy, 1909: 276

**Distribution:** India, Myanmar, Sri Lanka

5. *Hotea nigrorufa* Walker, 1867

*Hotea nigrorufa* Walker, 1867: 57; Distant, 1902: 66

**Distribution:** India

**Subfamily: Odontoscelinae**

### IV. Genus *Irochrotus* Amyot and Serville, 1843

*Irochrotus* Amyot and Serville, 1843: 39.
Type species: *Cimex lanatus* Pallas, 1773: 729.

*Arctocoris* Stal, 1873: 31; Jakovlev, 1884:162; Kirkaldy, 1909: 263

6. *Irochrotus incisus* (Stal, 1873)

*Arctocoris incisus* Stal, 1873: 31; Kirkaldy, 1909: 263

*Irochrotus incisus* Reuter, 1900: 209; Kirkaldy, 1909: 263

**Distribution:** India

7. *Irochrotus indicus* Schouteden, 1904

*Irochrotus indicus* Schouteden, 1904: 305

**Distribution:** India

Subfamily: Odontotarsinae

V. Genus *Ahmadocoris* Carapezza, 2009

*Ahmadocoris* Carapezza, 2009: 208

**Type species:** by original designation: *Hotea? diffusa* Walker, 1867

*Deroplax* Mayr, 1864: 905; Stal, 1873: 25; Schouteden, 1903: 68; 1904: 62, partim.

8. *Ahmadocoris delbergiae* (Ahmad, Moizuddin & Mushtaq, 1988)

*Deroplax delbergiae* Ahmad, Moizuddin & Mushtaq, 1988: 261; Carapezza, 2009: 208

**Distribution:** Pakistan

9. *Ahmadocoris diffusa* (Walker, 1867)

*Hotea diffusa* Walker, 1867: 67

*Deroplax diffusa* Distant, 1902: 66; Carapezza, 2009: 208

**Distribution:** India, Pakistan


*Deroplax zahidae* Ahmad, Moizuddin & Mushtaq, 1988, 261; Carapezza, 2009: 208

**Distribution:** Bangladesh, Pakistan

VI. Genus *Alphocoris* Germar, 1839

*Alphocoris* Germar, 1839: 58; Stal, 1873: 26; Schouteden 1903: 80

**Type species:** *Alphocoris lixoides* Germar 1839: 59

11. *Alphocoris lixoides* Germar, 1839

*Alphocoris lixoides* Germar, 1839: 59; Distant, 1902: 67; Schouteden, 1903: 81
**Distribution:** India, Pakistan

**VII. Genus Melanodema** Jakovlev, 1880

*Melanodema* Jakovlev, 1880: 205; Schouteden, 1904: 80

**Type species:** *Melanodema carbonarium* Jakovlev, 1880: 206 by monotypy.

12. *Melanodema apicifera* Distant, 1899

*Melanodema apicifera* Distant, 1899: 46

**Distribution:** India

**VIII. Genus Phimodera** Germar, 1839

*Phimodera* Germar, 1839: 60; Jakovlev, 1884: 175; Reuter, 1905: 1

*Phymatodera* Kolenati, 1846: 7

*Phymodera* Spinola, 1850: 30

**Type species** by subsequent designation (Schouteden, 1904: 84): *Podops galgulinus* Herrich-Schaeffer, 1837: 29

13. *Phimodera rupshuensis* Hutchinson, 1934

*Phimodera rupshuensis* Hutchinson, 1934: 119

**Distribution:** Indian Tibet

Subfamily: Scutellerinae

**IX. Genus Brachyaulax** Stal, 1871

*Brachyaulax* Stal, 1871: 616; Schouteden, 1904: 23

**Type species:** *Brachyaulax rufomaculata* Stal, 1871: 616

14. *Brachyaulax cyaneovitta* (Walker, 1867)

*Scutellera cyaneovitta* Walker, 1867: 16

*Tectocoris oblonga* (non Westwood, 1837): Distant, 1899: 35, 50; 1902: 52

**Distribution:** India

**X. Genus Calliphara** Germar, 1839

*Calliphara* Germar, 1839: 122; Schouteden, 1904: 31


*Lamprophora* Stal, 1865: 34; Schouteden, 1904: 30; Kirkaldy, 1909: 297

*Chrysophara* Stal, 1873: 17

**Type species:** by subsequent designation (Distant, 1902: 53); *Calliphara nobilis* (non Linnaeus, 1763); Germar, 1839 (= *Tetyra excellens* Burmeister, 1834)
15. **Calliphara excellens** (Burmeister, 1834)

*Tetyra excellens* Burmeister, 1834: 287

*Tectocoris obscura* Westwood, 1837: 14; Kirkaldy, 1909: 298

*Callidea nobilis* Germar, 1839: 117; Kirkaldy, 1909: 298

*Calliphara obscura* Sharp, 1890: 412; Kirkaldy, 1909: 298

*Calliphara excellens* Distant, 1902: 53

**Distribution:** India, Nepal

16. **Calliphara nobilis** (Linnaeus, 1763)

*Cimex nobilis* Linnaeus, 1763: 400

*Cimex pustulatus* Panzer, 1798: 111; Kirkaldy, 1909: 298

*Scutellera buquetii* Guerin, 1838: 159; Kirkaldy, 1909: 298

*Calliphara buquetii* Stal, 1866: 153; Kirkaldy, 1909: 298

*Calliphara nobilis* Distant, 1902: 53; Schouteden, 1904: 33; Kirkaldy, 1909: 298

**Distribution:** India, Myanmar

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**XI. Genus Cantao** Amyot and Serville, 1843

*Cantao* Amyot and Serville, 1843: 29; Dallas, 1851: 3, 17; Stal, 1865: 33; Mayr, 1866: 14; Stal, 1873: 10; Atkinson, 1887: 149; Lethierry and Severin, 1893: 18; Distant, 1902: 42; Schouteden, 1903: 27; 1904: 18 Kirkaldy, 1909: 307

*Iostethus* Stal, 1873: 10

**Type species** by subsequent designation (Kirkaldy, 1909: xxxv); *Calitea parentum* White, 1839

17. **Cantao ocellatus** (Thunberg, 1784)

*Cimex ocellatus* Thunberg, 1784: 60

*Cimex dispar* Fabricius, 1794: 81; Dallas, 1851: 17; Kirkaldy, 1909: 308

*Callidea dispar* Herrich-Schaeffer, 1836: 99; 1836: 99; Westwood, 1837: 16; Kirkaldy, 1909: 308

*Callidea ocellata* Westwood, 1842: 47; Kirkaldy, 1909: 308

*Cantao dispar* Amyot and Serville, 1843: 29; Dallas, 1851: 17

*Cantao rufipes* Dallas, 1851: 17; Walker, 1867: 14; Kirkaldy, 1909: 308

*Cantao inscitus* Walker, 1868: 506; Lethierry and Severin, 1893: 18

*Cantao conscitus* Walker, 1868: 507; Lethierry and Severin, 1893: 18

*Cantao ocellatus* Dallas, 1851: 17; Kirkaldy, 1909: 308

**Distribution:** India, Bangladesh, Pakistan, Myanmar, Sri Lanka
XII. Genus *Chrysocoris* Hahn, 1834

*Chrysocoris* Hahn, 1834: 38; Stal, 1865: 34; Schouteden, 1904: 34

**Type species:** by monotypy *Chrysocoris stollii* (non Wolff, 1801): Hahn, 1834

(*= Scutellera abdominalis* Westwood, 1837)

*Galostha* Amyot and Serville, 1843: 33; Distant, 1902: 54; Kirkaldy, 1909: 292

18. *Chrysocoris andamanensis* Atkinson, 1887

*Chrysocoris andamanensis* Atkinson, 1887: 177; Distant, 1902: 60

**Distribution:** India, Myanmar

19. *Chrysocoris atriventris* Atkinson, 1887

*Chrysocoris atriventris* Atkinson, 1887: 11; Distant, 1902: 56

**Distribution:** India

20. *Chrysocoris dilaticollis* (Guerin, 1830)

*Scutellera dilaticollis* Guerin, 1830: 164

*Callidea dilaticollis* Dallas, 1851: 28

*Chrysocoris stollii* Hahn, 1834: 39

*Callidea abdominalis* Westwood, 1837: 15

*Galostha stockerus* Amyot and Serville, 1843: 34

**Distribution:** India

21. *Chrysocoris eques* (Fabricius, 1794)

*Cimex eques* Fabricius, 1794: 79; Mayr, 1866: 24; Kirkaldy, 1909: 292

*Tetyra eques* Fabricius, 1803: 131; Mayr, 1866: 24

*Callidea formosa* Westwood, 1837: 15; Mayr, 1866: 24

*Callidea dorsalis* White, 1842: 80.

*Galostha eques* Amyot and Serville, 1843: 33; Kirkaldy, 1909: 292

*Chrysocoris eques* Distant, 1902: 61

**Distribution:** India, Myanmar

22. *Chrysocoris fascialis* White, 1842

*Chrysocoris fascialis* White, 1842: 86; Distant, 1902: 60

**Distribution:** India, Myanmar

23. *Chrysocoris marginellus* (Westwood, 1837)

*Callidea marginella* Westwood, 1837: 15

*Callidea caelestis* Stal, 1855: 181; Kirkaldy, 1909: 293

*Chrysocoris nilgiriensis* Atkinson, 1889: 343; Kirkaldy, 1909: 293
Chrysocoris marginellus Stal, 1873: 21; Distant, 1902: 59

**Distribution:** India

24.  *Chrysocoris nicobarensis* Distant, 1892

*Chrysocoris nicobarensis* Distant, 1892: 96; and 1902: 56

**Distribution:** India

25.  *Chrysocoris ornatus* (Dallas, 1851)

*Callidea ornata* Dallas, 1851: 27

*Chrysocoris ornatus* Stal, 1873: 21; Sharp, 1890: 412; Distant, 1902: 59; Kirkaldy, 1909: 293

**Distribution:** India

26.  *Chrysocoris patricius* (Fabricius, 1798)

*Cimex patricius* Fabricius, 1798: 527

*Callidea bengalensis* Westwood, 1837: 15

*Callidea basilica* Germar, 1839: 117; Kirkaldy, 1909: 294

*Chrysocoris patricius* Stal, 1873: 20; Distant, 1902: 57

**Distribution:** India, Myanmar

27.  *Chrysocoris pulchellus* (Dallas, 1851)

*Callidea pulchella* Dallas, 1851: 25

*Callidea rama* Kirby, 1891: 76; Kirkaldy, 1909: 294

*Chrysocoris pulchellus* Distant, 1902: 59

**Distribution:** India, Sri Lanka

28.  *Chrysocoris purpureus* (Westwood, 1837)

*Callidea purpurea* Westwood, 1837: 15

*Chrysocoris viridis* Atkinson, 1887: 175; Kirkaldy, 1909: 294

*Chrysocoris purpureus* Stal, 1868: 10; Distant, 1902: 58

**Distribution:** India

29.  *Chrysocoris simplex* Atkinson, 1889

*Chrysocoris simplex* Atkinson, 1889: 343; Distant, 1902: 58

**Distribution:** India

30.  *Chrysocoris spilogaster* (Walker, 1867

*Callidea spilogaster* Walker, 1867: 30

*Chrysocoris spilogaster* Distant, 1902: 56

**Distribution:** Sri Lanka
31. *Chrysocoris stockerus* (Linnaeus, 1758)

*Cimex stockerus* Linnaeus, 1758: 441; *Chrysocoris stockerus* Stal, 1873: 20; Distant, 1902: 57

*Callidea taprobanensis* Westwood, 1837: 15; Kirkaldy, 1909: 294

*Callidea erichsoni* Germar, 1839: 113

*Callidea pupureus* Stal, 1868: 10; and 1873: 21; Distant, 1902: 57

**Distribution:** India, Pakistan

32. *Chrysocoris stollii* (Wolff, 1801)

*Cimex stollii* Wolff, 1801: 48; *Chrysocoris stollii* Stal, 1873: 21; Distant, 1902: 58

*Scutellera stockerus* Guerin, 1838: 159, 161; Kirkaldy, 1909: 294

*Callidea stockerus* Westwood, 1842: 48; Kirkaldy, 1909: 294

*Callidea porphyricola* Walker, 1867: 29; Kirkaldy, 1909: 294

**Distribution:** India, Myanmar, Sri Lanka

### XIII. Genus *Eucorysses* Amyot & Serville, 1843

*Eucorysses Amyot & Serville, 1843: 31. Type species by monotypy: Eucorysses pallens Amyot & Serville, 1843 (= Cimex grandis Thunberg, 1783: 46)

33. *Eucorysses grandis* (Thunberg, 1758)

*Cimex grandis* Thunberg, 1783: 31

*Cimex baro* Fabricius, 1798: 528

*Calliphara iris* Germar, 1839: 128

*Eucorysses superbus* Uhler, 1860: 221; Kirkaldy, 1909: 295

*Callidea distinguenda* Uhler, 1861: 286; Kirkaldy, 1909: 295

*Chrysocoris grandis* Stal, 1873: 21; Distant, 1902: 54

**Distribution:** India, Myanmar

34. *Eucorysses superbus* (Dallas, 1851)

*Callidea superba* Dallas, 1851: 23

*Chrysocoris superbus* Stal, 1873: 18; Distant, 1902: 55

**Distribution:** India, Sri Lanka

### XIV. Genus *Lamprocoris* Stal, 1865

*Lamprocoris* Stal, 1865: 34; Schouteden, 1904: 27

**Type species** by subsequent monotypy (Stal, 1866): *Lamprocoris lateralis* (Guerin-Meneville, 1838: 159)
35.  *Lamprocoris lateralis* (Guerin-Meneville, 1838)
Scutella lateralis Guerin-Meneville, 1838: 159; Kirkaldy, 1909: 301
*Callidea lateralis* Vollenhoven, 1863: 32; Kirkaldy, 1909: 301
*Callidea contraria* Walker, 1867: 30; Distant, 1902: 63; Kirkaldy, 1909: 301
*Lamprocoris lateralis* Distant, 1902: 63
**Distribution:** India, Myanmar

36.  *Lamprocoris roylii* (Westwood, 1837)
*Callidea roylii* Westwood, 1837: 16; *Lamprocoris roylii* Distant, 1902: 63
*Callidea histeroides* Walker, 1867: 28
*Callidea scripta* Walker, 1867: 28
*Callidea gibbula* Walker, 1867: 28
**Distribution:** India

37.  *Lamprocoris spiniger* (Dallas, 1849)
*Callidea spiniger* Dallas, 1849: 186; *Lamprocoris spiniger* Distant, 1902: 64
**Distribution:** India, Myanmar

XV. Genus *Poecilocoris* Dallas

*Poecilocoris* Dallas, 1848: 100; Stal, 1864: 33; Mayr, 1866: 17; Schouteden, 1904: 20
*Poecilochroma* White, 1842: 84
*Loglena* Stal, 1873: 12; Kirkaldy, 1909: 305
**Type species:** by monotypy *Cimex druraei* Linnaeus, 1771: 534

38.  *Poecilocoris anisopilus* Walker, 1867
*Poecilocoris anisopilus* Walker, 1867: 9
**Distribution:** India

39.  *Poecilocoris balteatus* (Distant, 1892)
*Poecilochroma balteata* Distant, 1892: 96
**Distribution:** India

40.  *Poecilocoris childreni* (White, 1839)
*Tectocoris childreni* White, 1839: 542; 1842: 84
*Poecilocoris childreni* Distant, 1902: 46
**Distribution:** India, Bhutan

41.  *Poecilocoris crowleyi* Distant, 1901
*Poecilocoris crowleyi* Distant, 1901: 61; 1902: 46
Distribution: India

42. *Poecilocoris druraei* (Linnaeus, 1771)

*Cimex druraei* Linnaeus, 1771: 534; *Poecilocoris druraei* Dallas, 1848: 103; Distant, 1902: 45

*Poecilocoris obsoletus* Dallas, 1848: 104

*Poecilocoris drurayi* Lethierry & Severin, 1893: 20

*Poecilochroma drurayi* Stal, 1873: 12

*Poecilocoris heissi* Ahmad and Kamaluddin, 1982: 271

Distribution: India, Myanmar

43. *Poecilocoris hardwickii* (Westwood, 1837)

*Tectocoris hardwickii* Westwood, 1837: 13; Dallas, 1851: 13; Distant, 1902: 45

*Pachycoris nepalensis* Herrich-Schaeffer, 1839: 339; Dallas, 1851: 13

*Scutellera hardwickii* Germar, 1839: 135; Dallas, 1851: 13; Distant, 1902: 45

*Poecilocoris hardwickii* Dallas, 1848: 107; Dallas, 1851: 13

*Poecilocoris anisopilus* walker, 1867: 9; Distant, 1902: 45

Distribution: India

44. *Poecilocoris interruptus* (Westwood, 1837)

*Tectocoris interrupta* Westwood, 1837: 14; Dallas, 1851: 12

*Scutellera interrupta* Herrich-Schaeffer, 1839: 73; Dallas, 1851: 12; Kirkaldy, 1909: 306

*Poecilochroma interrupta* Stal, 1873: 13; Kirkaldy, 1909: 306

*Poecilocoris interruptus* Dallas, 1848: 102; Distant, 1902: 48; Kirkaldy, 1909: 306

Distribution: India, Myanmar

45. *Poecilocoris latus* Dallas, 1848

*Poecilocoris latus* Dallas, 1848: 101

*Poecilochroma lata* Sharp, 1890: 412; Kirkaldy, 1909: 305

*Poecilocoris latus* Distant, 1902: 44

Distribution: India, Myanmar

46. *Poecilocoris lewisi* (Distant, 1883)

*Poecilochroma lewisi* Distant, 1883: 419

*Poecilocoris lewisi* Yang, 1934:266

*Poecilocoris separabilis* Yang 1934: 260

Distribution: India, Pakistan
47. *Poecilocoris nepalensis* Herrich-Schaeffer, 1837

*Pachycoris nepalensis* Herrich-Schaeffer, 1837: 339

*Tectocoris hardwickii* Westwood, 1837: 13; Kirkaldy, 1909: 305

*Tectocoris affinis* Westwood, 1837: 13; Kirkaldy, 1909: 306

*Poecilocoris hardwickii* Dallas, 1848: 107; Sharp, 1890: 413; Distant, 1902: 45; Kirkaldy, 1909: 305

*Poecilochroma hardwicki* Stal, 1873: 12; Kirkaldy, 1909: 305

*Poecilocoris hardwicki* Schouteden, 1904: 21; Kirkaldy, 1909: 305

Distribution: India, Myanmar

48. *Poecilocoris obesus* Dallas, 1851

*Poecilocoris obesus* Dallas, 1851: 13; Distant, 1902: 47

Distribution: India

49. *Poecilocoris ornatus* Dallas, 1851

*Poecilocoris ornatus* Dallas, 1851: 15; Distant, 1902: 48

Distribution: India

50. *Poecilocoris pulcher* Dallas, 1848

*Poecilocoris pulcher* Dallas, 1848: 105; Vollenhoven, 1863: 5

Distribution: India

51. *Poecilocoris purpurascens* (Westwood, 1837)

*Tectocoris purpurascens* Westwood, 1837: 14

*Poecilocoris purpurascens* Dallas, 1848: 103; Distant, 1902: 47

Distribution: India

52. *Poecilocoris orientalis* Ahmad and Kamaluddin, 1982

*Poecilocoris orientalis* Ahmad and Kamaluddin, 1982: 278

Distribution: Nepal

53. *Poecilocoris rufigenis* Dallas, 1851

*Poecilocoris rufigenis* Dallas, 1851: 14; Distant, 1902: 49

Distribution: India, Myanmar

54. *Poecilocoris pseudolatus* Ahmad and Kamaluddin, 1982

*Poecilocoris pseudolatus* Ahmad and Kamaluddin, 1982: 281

Distribution: India, Bangladesh
XVI. Genus *Scutellera* Lamarck, 1801

*Scutellera* Lamarck, 1801: 293; Dallas, 1851: 4; Stal, 1864: 33; Schouteden, 1904: 22

**Type species:** *Cimex nobilis* (non Linnaeus, 1763): Fabricius, 1775 (= *Tectocoris perplexa* Westwood, 1837: 4)

55. *Scutellera amethystina* Germar, 1839

*Scutellera amethystina* Germar, 1839: 124

*Cimex fasciatus* Panzer, 1797: 108

*Calliphara amethystina* Germar, 1839: 124

*Tectocoris nepalensis* Germar, 1839: 125

*Scutellera fasciata* Distant, 1902: 50

**Distribution:** India, Myanmar, Pakistan

56. *Scutellera fasciata* (Panzer, 1797)

*Cimex fasciata* Panzer, 1797: 108; Dallas, 1851: 19

*Tectocoris nepalensis* Westwood, 1837: 19

*Callidea lanius* Stal, 1854: 231

*Scutellera amethystina* Vollenhoven, 1863: 12

**Distribution:** India, Pakistan

57. *Scutellera perplexa* (Westwood, 1837)

*Cimex nobilis* Fabricius, 1775: 697

*Tectocoris perplexa* Westwood, 1837: 4

*Scutellera nobilis* Distant, 1902: 51

*Scutellera brevirostris* Breddin, 1909: 258 synonymized by Distant, 1918:116

**Distribution:** India, Myanmar,Sri Lanka

XVII. Genus *Tetrarthria* Dallas, 1851

*Tetrarthria* Dallas, 1851: 20; Vollenhoven, 1863: 13; Schouteden, 1904: 22

**Type species:** *Tetrarthria variegata* Dallas, 1851: 20

58. *Tetrarthria variegata* Dallas, 1851

*Tetrarthria variegata* Dallas, 1851: 20; Stal, 1870: 616; Breddin, 1900: 278; Distant 1902: 49

**Distribution:** India, Myanmar

XVIII. Genus *Hyperoncus* Stal, 1870

*Hyperoncus* Stal, 1870: 615; Schouteden, 1904: 11 (type *punctellus*)

**Type species:** *Hyperoncus punctellus* Stal, 1870: 615
59. *Hyperoncus lateritius* (Westwood, 1837)
*Sphaerocoris lateritia* Westwood, 1837: 13

*Hyperoncus lateritius* Distant, 1902: 41

**Distribution:** India

60. *Hyperoncus lineaticornis* Stal, 1873

*Hyperoncus lineaticornis* Stal, 1873: 7

**Distribution:** India

61. *Hyperoncus uniformis* Distant, 1901

*Hyperoncus uniformis* Distant, 1901: 60

*Hyperoncus uniformis* Distant, 1901: 60

**Distribution:** Sri Lanka
4.3 TAXONOMIC STUDIES

The species of Scutelleridae range in length from 5-25 mm and often known as shield bugs due to their greatly enlarged convex scutellum that usually entirely covers the abdomen; antennae 3-5 and labium 4 segmented; frena obsolete or lacking; membrane with many veins; tarsi 3 segmented; trichobothria paired and located posterior to spiracle. The present study on the Scutelleridae included 6 subfamilies viz., Elvisurinae, Eurygastrinae, Hoteinea, Odontoascelinae, Odontotarsinae and Scutellerinae. Under these six subfamilies 11 genera have been selected which are mainly reported from India and adjoining countries. A key to the subfamilies, key to the genera and their species studied are provided herein.

Key to the subfamilies (modified after Distant, 1902)

1. Body not remarkably convexed dorsally; second antennal segment curved; scutellum not covering whole of the abdomen, connexivum exposed. Eurygastrinae

2. Body setose or pilose; pronotum anteriorly distinctly broader than head, lateral margins round, metathoracic scent gland with indistinct peritreme; first pair of conjunctival appendages apically membranous and thickly folded; spermatheca with bulb very small and dilation very big, flanges indistinct. Odontoscelinae

3. Head with tylus remarkably extended beyond jugal lobes; first antennal segment curved; first pair of conjunctival appendages serrate; distal spermathecal flange indistinct. Hoteinea

4. Head elongated; preocular distance more than 4x to postocular distance; anterior margin of prosternum covering the base of antenna; ventral abdominal segment with stridulatory patch/vittae; spermathecal duct very long and tortuous and without any dilation; vesica very long and coiled. Hoteinea

5. Metathoracic scent gland with reduced peritreme; meso and metasterna with a deep medial groove with prominent raised margins; first pair of gonocoxae narrow. Elvisurinae

6. Metathoracic scent gland with well developed peritreme; meso and metasterna without any medial groove; first pair of gonocoxae large with variable shape. Scutellerinae
Elvisurinae

**Diagnosis:** Tylus slightly extended beyond jugal lobes; II antennal segment straight and shorter than I; labium with the II segment much shorter than the two apical segments together and a little longer than the apical segments; pronotum and scutellum moderately convexed at base, meso and metasterna with a central broad longitudinal groove, margins prominently raised, metathoracic scent gland with reduced peritreme; abdomen medially grooved on ventral surface; first pair of gonocoxae narrow; spermatheca with elongated bulb; paramere with apex narrow and subtruncate.

**Genus Solenosthedium** Spinola, 1837

*Solenosthedium* Spinola, 1837: 360; Vollenhoven 1863: 4; Kirkaldy, 1909: 311

Type species by subsequent designation (Reuter, 1888:414): *Cimex lynceus* Fabricius, 1794

*Solenostethium* Amyot and Serville 1843: 26; Schouteden 1903: 8; 1904: 8

**Diagnosis:** Body obovate, antennae five segmented with III segment double or more than 2x of II segment; preocular distance more than twice of its postocular distance, meso and metasterna with a central broad longitudinal groove with margins prominently raised; sternum and abdomen sulcated, abdomen ventrally flat; I and II conjunctival appendages fused basally, distally divided into two branches; spermatheca with well developed distal and proximal pump flanges.

*Solenosthedium rubropunctatum* (Guerin, 1838)

(Fig. 5; Plate. I, VIII & X)

*Scutellera rubropunctata* Guerin, 1838: 157

*Solenostedium rubropunctatum* Vollenhoven, 1863: 4; Kirkaldy, 1909: 311

*Solenostethium rubropunctatum* Distant, 1902: 40

**Body colouration** dorsally purplish brown or dark castaneous; I antennal and labial segment, head beneath, sternum, coxae, femora and abdomen ochraceous brown, rest of the antennal and labial segments, tibiae and tarsomeres black, generally with green tinge, dense and fine green punctures on dorsal body surface.
Head (Fig. 5a) triangular, with jugal lobes longer than tylus, lateral margins slightly sinuated; breadth (4.14±0.15) 1.2x to length (3.58±0.13), preocular distance (1.9±0.12) 2.5x as postocular (0.76±0.05), eyes placed near to eyes as compared to each other, interocular distance (2.5±0.2) 1.7x to interocellar (1.5±0.14). Antennae five segmented, attached near to eyes on ventral side; I antennal segment 0.82±0.07 long; II smallest (0.62±0.06) and 0.75x to I; III (1.44±0.11) 2.4x to II; IV (1.72±0.13) and V subequal (1.74±0.09) but, generally later one slightly longer, and so it is the longest amongst all and almost 3x as II segment, total length 6.36±0.44. Labium four segmented; I labial segment smallest; II longest and 2.34x as I; III slightly bigger than IV and 2.2x to I; total labial length 9.28±0.74 and extended upto V or VI abdominal segment.

Pronotum (Fig. 5b) slightly convexed; anterior margin sinuate, with angles acute and anteriorly produced, lateral margins straight, distance between lateral angles (10.68±0.63) and almost 2.56x as anterior angles (4.26±0.2), medial length 4.86±0.13 and 0.45x to lateral breadth, lateral angles obtuse, seven round, orange to brown spots on the surface, one near each anterior angle and two on each lateral side more towards margins and one at middle, posterior margin straight.

Scutellum (Fig. 5c-d) slightly convexed, length (10.68±0.35) and breadth (9.86±0.5) subequal, anterior margin straight with lateral angles produced anteriorly, apical end round, they show sexual dimorphism only in case of scutellum, in females (Fig. 5c) number of spots only 8 while in males 10 (Fig. 5d); 6 near basal margin and rest, at middle.

Legs with hind femora longest and 1.26x to fore and 1.1x to middle femora, in case of tibia the hind tibia is longest which is 1.17x to middle and 1.27x to fore tibia.

Exterior of metathoracic scent gland (Fig. 5e) with ostiole broad in triangular or disc shaped; peritreme very short and in flap like structure, restricted to the ostiolar region; evaporatorial surface highly wrinkled and extends upto the half region of mesothorax.

Sternum deeply furrowed, from anterior to posterior and it is strongly keeled, labium rests in furrow at resting phase.
Abdomen (Fig. 5f) with breadth (9.44±0.46) 1.23x to the length (8.02 ±0.4), sulcated medially up to the VI venter, spiracles located on III to VII segment and also on VIII paratergite, a pair of trichobothria located posterior to spiracles on each lateral side except at VIII paratergite, abdomen possessed a band of thick and small hairs on sublateral side.

Male genitalia (Fig. 5g-j) having pygophore (5g-h) with ventral surface densely pubescent distally and margin more or less broadly truncated, dorsal border sclerotized and laterally darkened with a small subterminal sclerotized tooth-like projections (Fig. 5g), beyond which it is densely pilose. Aedeagus (Fig. 5i) with phallotheca short, with a constriction about a third from base. First and second conjunctival appendages fused basally for about two third their length, common base stout, sclerotized, first appendage distally divided into two branches, dorsal branch long with sclerotized, sharp apex, ventral branch short, third conjunctival appendages heavily sclerotized, pointed and recurved into a small hook. Vesica fairly long, apical portion leading to gonopore, laterally flattened and basally bears a circular ejaculatory reservoir. Paramere (Fig. 5j) with a basal stem and apical hook, stem swollen towards apex, hook considerably flattened, apex narrowed and subtruncate.

Female genitalia (Fig. 5k-l) having ovipositor (Fig. 5k) with VIII paratergite bigger than IX, a spiracle present, near to lateral margin and near to anterior angle, IX leaf shaped, anterior margin swollen, first pair of gonocoxae narrow, small hairs present on the ovipositor. Spermatheca (Fig. 5l) with bulb elongated and medially depressed slightly, distal and proximal flanges separate and disc shaped, distal duct constricted at middle and only 0.2x to proximal, dilation spherical and translucent through which sclerotized rod can be seen, proximal duct long and membranous.

Body size: Female 19.75 and male 18.9±0.55 long.

Material examined (NPC): 1♀ and 4♂, INDIA: ASSAM, Goalpara, 1♀, 1♂, v.1906, collector and host unknown; SIKKIM, 2500 ft, 1♂, 9.iv.1957, coll. Baldev P.S, orange; UTTARAKHAND: Dehradun, 1♂, 8.iii.1918, coll. F.Z., host unknown; TAMIL NADU: Kalakad, 1♂, coll. Dr. Sahayaraj, host unknown.
Eurygastrinae

**Diagnosis:** Tylus and jugal almost of the same length, remarkably broad head, II antennal segment somewhat curved and longer than I segment, pronotum and scutellum remarkably not convexed; meso and metasterna without any median groove; metathoracic ostiole distinct and peritreme with anterior and posterior margins crenulate; abdomen without any groove on ventral surface; first pair of gonocoxae large and subquadrat; spermatheca with bulb rounded; parameres T-shaped, vesica simple, membranous, without and supporting appendages; females with spermatheca having elongated sclerotized dilation.

**Genus Eurygaster** Laporte, 1832

*Eurygaster* Laporte, 1832: 67; Stal, 1873: 30; Jakovlev, 1885: 78; Schouteden, 1904: 71


*Bellocoris* Hahn, 1834: 42; Spinola, 1837: 365

**Diagnosis:** Body oval or ovate, broad, colouration varies from yellow-brown to dark brown, red or black with dark markings on the lighter shades. Head flat, jugal lobes equal or slightly extends to tylus, II antennal segments somewhat curved; scutellum U-shaped and much narrower than abdomen so that connexivum exposed, tibiae sulcated above; males always with T-shaped paramere and spermatheca of females with elongated and sclerotized dilation.

**Eurygaster maura** (Linnaeus, 1758)

(Fig. 6; Plate. I, VIII & X)

*Cimex maurus* Linnaeus, 1758: 441

*Eurygaster maura* Saunders, 1892: 16; Distant, 1902: 68

*Cimex cinereus* Goeze, 1778: 276; Kirkaldy, 1909: 274

*Thyreocoris austriacus* Schrank, 1801: 68; Distant, 1902: 68


*Tetyra pica* Fabricius, 1803: 136 synonymized by Illiger, 1807: 363

**Body colouration** variegated, colour from fulvous brown without markings to luteous with stripes and shades of brown, suffused with dark or purple brown and
thickly and darkly punctuate; antennae yellowish-red, IV antennal segment piceous towards the apex, V segment piceous or black, both these segments covered with very short hairs, labium yellow to brown excepts IV segment black luteous, smooth, slightly shining.

**Head** (Fig. 6a) apex broad, with breadth \((3.3\pm0.17)\) 1.4x to length \((2.28\pm0.08)\), tylus and jugal lobes subequal, tylus not elevated, lateral margins slightly sinated near to eyes, preocular distance \((1.22\pm0.12)\) 2.55x to postocular \((0.75\pm0.09)\), interocular distance \((2.5\pm0.11)\) 1.9x to interocellar, ocellus placed a little to eyes, eyes small and projected laterally; head thikly and densely punctured above and beneath. **Antenna** (Fig. 6b) with five segments, inserted near the eyes, I stout and cylindrical and \(0.75\pm0.09\) long; II curved medially and 1.12x to I; III smallest \((0.56\pm0.08)\) and only 0.67x to II; IV 1.3x to III; V longest \((1.2\pm0.05)\) and 1.6x to IV and tapered distally; total antennal length \(4.1\pm0.42\). **Labium** four segmented; I \(0.94\pm0.1\) long; II longest \((1.95\pm0.13)\) and 2x to I; distal end dilated; III smallest \((0.65\pm0.07)\) or subequal to IV and 0.33x to II; total labial length \(4.3\pm0.4\), extended upto posterior coxae.

**Pronotum** (Fig. 6c) anteriorly narrow, with anterior margin concave, anterior pronotal angles acute, lateral margins nearly obliquely straight or rounded, delicately reflexed; distance between lateral angles \((7.35\pm0.3)\) 2.1x to the distance between anterior angles \((3.5\pm0.11)\), medial length \((3.33\pm0.14)\) subequal to later one, lateral angles round, posterior margin straight, densely punctured.

**Scutellum** (Fig. 6d) convex, with the base more raised, U-shaped, length \((7.3\pm0.23)\) 1.35x to breadth \((5.4\pm0.37)\) and as long as the abdomen, but not so wide as abdomen, leaving a broad portion of the hemielytra and abdomen uncovered (Fig. 6e); lateral margins almost straight, apex broadly rounded.

**Prosternum** grooved medially and edges raised while meso and metasterna flattened and forming a medially longitudinal groove in which labium lodged at rest.

**Exterior of metathoracic scent gland** (Fig. 6f) with ostiole elongated and transverse crenulated and extended \(\frac{1}{4}\) length of evaporatorium, peritreme transverse with distally terminate in round shape, anterior and posterior margins crenulated, medially grooved to hold the secretion of glands, evaporatorium brown and extended upto mesothoracic region, surface wrinkled.
Legs (Fig. 6g) short and strong; femora flattened; tibiae angulated, the margins raised and set with very short spines or teeth (more prominent in fore tibiae). Hind femur (3.14±0.1) slightly longer than tibia (3.03±0.07), middle and hind femora (2.7±0.12) 1.2x to its corresponding tibiae (2.3±0.13), while fore femur (2.34±0.07) slightly longer than tibia (2.2±0.09).

Abdomen (Fig. 6h) ovate, rather convex beneath; breadth (6.8±0.2) almost equal to length (6.1±0.23); the segments narrow towards centre than at the sides, their posterior margins concave, connexivum horizontal, much rounded and widened posteriorly, and not covered by the hemielytra or scutellum, last segment of female abdomen trapezoid. Spiracles present ventrally on the segment III to VII and also on VIII paratergite and a pair of trichobothria below each spiracle except VIII paratergites.

Male genitalia (Fig. 6i-l) with pygophore (Fig. 6i-j) having breadth and length subequal or breadth slightly more than length; ventro-posterior pygophoral margin sinuated and an oval disc present near ventro lateral pygophoral margin with sparsely arranged thick punctuations; postero- lateral angles obtuse (Fig. 6j). Aedeagus (Fig. 6k) with phallotheca laterally notched near the middle, bearing a phallothecal process, first pair of conjunctival appendages flattened basally, tapering apically, second pair strongly sclerotized and pointed, vesica apically broad, dentate, bearing two small sclerotized vesical process, basally narrow Paramere (Fig. 6l) T-shaped with stem broad near junction to blade, base of blade protruded obtusely towards inner side, apically blade flat, and laterally obtusely produced, inner surface curved slightly and 8-9 setae at base of blade.

Female genitalia (Fig. 6m-n) having ovipositor (Fig. 6m) with VIII paratergite triangular, meet in middle, each with a present, IX paratergite lobe shaped, comparatively small; first pair of gonocoxae subquadrate, lateral margins round, posterior margin straight. Spermatheca (Fig. 6n) simple with bulb almost spherical, pump region absent, spermathecal dilation very small and spherical; proximal spermathecal duct much longer than distal spermathecal duct.

Body size: Female and male 13.13±0.42 and 12.72±0.3 long, respectively.

**Hoteinae**

**Diagnosis:** Tylus extended beyond jugal lobes; light to dark brown and blackish colouration, base of abdomen concealed by anterior margin of prothorax; meso and metasternum without any median groove; abdomen in both sexes provided with stridulatory vittae on abdominal sterna V-VI (Fig. 7f); metathoracic scent gland with well developed ostiole and peritreme; first pair of gonocoxae large and generally triangular; spermatheca with bulb round in shape, spermathecal pump flanges variable, spermathecal duct elongated and thin, generally tortuous and in convoluted form, without dilation; paramere widening apically in an almost triangular crown, texture of preapical region of crown scaled; vesica prolonged as penisfilum and coiled several times.

**Genus Hotea** Amyot and Serville, 1843

Amyot and Serville 1843, 41; Stal 1873, 24; Schouteden, 1903: 63, 64; Kirkaldy, 1909: 276

Type species: *Hotea gambiae* (Westwood, 1837: 11) by subsequent designation (Schouteden, 1903: 66)

**Diagnosis:** Body convex dorsally as well as ventrally; head with tylus remarkably longer than jugal lobes, lateral pronotal angles produced laterally, prothorax rounded anteriorly and covered the base of each antenna; metathoracic scent gland ostiole very narrow, shaped like an elongate chink placed at base of evaporative area; vesica extremely long, slender and flexible, more than 10x longer than the phallotheca, in rest it is kept coiled like a woolball; parameres widen apically in an almost triangular crown. Female with spermatheca has a very long spermathecal duct.
like a tortuous tubule with many convolutions, but without spermathecal dilation, and
a simple terminal globular bulb.

**Key to species**

1. Body ochraceous; apex of tylus subquadrate; lateral margins of head and pronotum not remarkably ochraceous but toothed/serrate; pump with distinct proximal and distal flanges, apical end of spermathecal bulb globular, distal and proximal flanges of spermathecal pump distinct........................................... *Hotea curculionoides*

1'. Body castaneous, apex of tylus tapered; lateral margins of head and pronotum remarkably ochraceous and smooth; apical end of spermathecal bulb pear shaped, proximal flange of spermathecal pump indistinct indistinct.......................................................... *nigrorufa*

**Hotea curculionoides** (Herrich-Schaeffer, 1836)

(Fig. 7; Plate. I, VIII & X))

*Pachycoris curculionoides* Herrich-Schaeffer, 1836: 106  
*Hotea curculionoides* Vollenhoven, 1863: 37; Distant, 1902: 65; Kirkaldy, 1909: 276  
*Pachycoris punctulatus* Germar, 1839: 105; Dallas, 1851: 39; Kirkaldy, 1909: 276  
*Hotea nasuta* Walker, 1867: 58; Kirkaldy, 1909: 276

**Body colouration** ochraceous, light to dark brown, coarsely and thickly punctuate, head and lateral pronotal angles beneath piceous, head beneath, lateral side of jugal lobes and apical part of tylus black, antennae ochraceous, fourth segment (except apices) and the whole of the apical segments piceous.

**Head** (Fig. 7a) with (2.8±0.2) slightly longer than breadth (2.6±0.1), lateral margins crenulate, tylus distinctly longer than jugal lobes, apically round, preocular distance (2.01±0.2) 4.9x to postocular (0.41±0.14), interocular (1.87±0.06) 1.4x to interocellar (1.37±0.6), eyes small enclosed within anterior pronotal angles at rest. **Antennae** five segmented; base of antennae concealed by anterior edges of prosternum, I segment cylindrical and 0.7±0.04 long; II (0.55±0.04) 0.8x to I; III smallest (0.4±0.05) and 0.7x to II; IV (0.8±0.04) 2x to III; V longest among all and 1.4x to IV; total antennal length 3.6±0.2. **Labium** (Fig. 7b) with four segmented; I, 0.78±0.04 long; II longest (1.7±0.11) and 2.1x to I, distally broaden, III broadest and shortest amongst all, 0.4x to II; IV (0.9±0.08) 1.4x to III; total labial length 4.04±0.22 and extended upto posterior coxae.

**Pronotum** (Fig. 7c) with anterior margin almost straight, antero-lateral margins crenulated, lateral angles produced obtusely, distance between lateral angles (6.6±0.7)
2.4x to anterior angles (2.7±0.3) and 2.3x to medial length (2.95±0.25), posterolateral margins straight, posterior margin round, surface thickly punctate.

Scutellum (Fig. 7d) oval, covers whole of the abdomen, medially swollen, lateral margins almost rounded, apex broad and rounded; length (5.5±0.44) and breadth (5.43±0.5) subequal, two oval spots near to anterior margin.

Exterior of metathoracic scent gland (Fig. 7e) with ostiole elongated or slit like and opens into peritreme; latter not in proper plate like elevated structure, evaporatorial surface highly wrinkled and extended upto meso thoracic segment.

Abdomen (Fig. 7f) oval and convexed medially, breadth (5.5±0.5) 1.3x to length (4.25±0.3), a single spiracle located on each lateral side from III-VII abdominal segment and a pair of trichobothria posterior to each spiracle, the intersegmental sutures subquadrate medially; V-VI segment possessed stridulatory patch on ventral surface.

Male genitalia (Fig. 7g-j) having pygophore (Fig. 7g-h) with breadth more than its length, lateral and posterior margin round, ventral side with thick punctures, inner surface invaginated medially, proctiger V-shaped. Aedeagus (Fig. 7i) with phallotheca elongated; vesica is extremely long, slender and flexible; more than 10x longer than the phallotheca. Paramere (Fig. 7j) broad apically, in triangular shape, preapically scales present.

Female genitalia (Fig. 7k-l) with ovipositor (Fig. 7k) having VIII paratergites triangular, posterior margin straight, IX paratergites comparatively bigger, postero-middle margin rounded; first pair of gonocoxae triangular, lateral margins round, posterior margins straight. Spermatheca (Fig. 7l) with bulb oval with apical end globular and tilted towards posterior end of the body, slightly curved and distal and proximal flanges of spermathecal pump narrow and sclerotized; spermathecal duct very long with many convolutions and without spermathecal dilation.

Body size: Female 11.71±0.98 and male 10.64±0.55 long.

Material examined (NPC): 7♀♀ and 2♂♂, INDIA: BIHAR: Chapra, 1♀, coll. Mackenzie, date and host unknown; Pusa, 1♂, 4.xi.1925, coll. Rahman, host

**Hotea nigrorufa** Walker, 1867

(Fig. 8; Plate. I)

*Hotea nigrorufa* Walker 1867, 57; Distant 1902, 66

**Body colouration** dorsally castaneous red, lateral margins of pronotum and abdomen pale yellow or ochraceous, dorsally body impregnated with black punctations. First antennal segment, first and second labial segment red, V and V antennal segment partial red and apically brown; tibiae and tarsal segments reddish brown, base of femora yellow, ventrally head black; body finely punctured.

**Head** (Fig. 8a) elongated, anteriorly pointed, lateral margins almost straight or depressed, tylus much longer than jugal lobes, breadth (2.5±0.12) subequal to length (2.44±0.17), preocular distance (1.8±0.06) 4.4 x to postocular (0.41±0.05), interocular distance 1.5x to interocellar, eyes small and touched anterior margin of pronotum, ocelli placed nearer to eyes than to each other, head possessed thick punctations over the surface but more adjacent to lateral margins. **Antennae** five segmented; attached on ventral side of head, base of each antenna covered with the anterior prosternal margin, I (0.78±0.11) 1.5x to II (0.58±0.08); III smallest (0.44±0.07) and 0.7x to II; IV (0.82±0.06) 1.9x to III; IV (1.15±0.1) longest and 1.4x to IV; I, II and III antennal segment cylindrical with sparse hairs while IV and V comparatively robust and apically bulbous, possessed numerous hairs, total antennal length 3.76±0.41. **Labium** four segmented; I segment 0.85±0.07 long; II longest (1.5±0.12) and 1.8x to I; III smallest (0.52±0.06) while IV slightly longer (0.57±0.05) than III and 0.34x to II; III and IV segment broad and dorso-ventrally flattened; extended upto posterior coxae and total antennal length 3.45±0.25.
**Pronotum** (Fig. 8b) convex towards base, anterior and posterior pronotal margins almost straight, anterior angles normal, antero-lateral margins smooth, lateral angles obtuse and large, projected laterally; distance across lateral angles (5.3±0.13) 1.9x to anterior angles (2.74±0.11), later subequal to medial pronotal length (2.7±0.08).

**Scutellum** (Fig. 8c) round and covers almost whole of the abdomen or except posterior end of abdomen, length (4.82±0.1) slightly more than its width (4.5±0.13).

**Exterior of metathoracic scent gland** (Fig. 8d) ostiole elongated but very small and continued in a small peritreme, evaporatorium extended slightly to the mesothoracic segment.

**Legs** sparsely covered with yellow hairs, hind femora (2.51±0.06) slightly longer than hind tibiae (2.41±0.12), mid femora and tibiae measured 2.18±0.07 and 1.72±0.07 respectively while fore femora (1.72±0.08) shorter than fore tibiae (1.9±0.06).

**Abdomen** (Fig. 8e) broad and convexed ventrally, width (4.7±0.22) more than its length (4.3±0.07), finely punctured; spiracles present on III to VII abdominal segments and also on each VIII paratergite; a pair of trichobothria present just posterior to abdominal spiracles, V-VII intersegmental abdominal sutures subquadrate.

**Male genitalia** (Fig. 8f-i) having **pygophore** (Fig. 8f) ventral border circular, bearing scattered short setae, a semi sclerotized black area present laterally at the junction of dorsal and ventral borders, dorsal border medially narrow, laterally broad, projecting as a lobe, protiger globular, bearing scattered setae. **Aedeagus** (Fig. 8h) with phallotheca longer than broad, proximally narrow, only one pair of membranous conjunctival appendages present, each tapering apically into a sclerotized spine. Vesica thin, narrow and coiled distally, leading to gonopore, basally stout and somewhat flattened. **Paramere** (Fig. 8i) medially flattened over a fairly long stretch, highly sclerotized, pointedly projecting on both sides of the sub truncated apex, a number of setae located on median flattened part of each paramere.

**Female genitalia** (Fig. 8j-k) having **ovipositor** (Fig. 8j) with VIII paratergites small and medially fused, IX paratergite comparatively large and finger shaped; first pair of gonocoxae large and triangular, posterior margin somewhat curved. **Spermatheca** (Fig. 8k) with bulb pear shaped; distal flanges of spermathecal pump sclerotized
while proximal flange not conspicuous, spermathecal duct very long with many coils and without dilation.

**Body size:** Female 9.71±0.2 and male 9.21±0.16 long.


**Odontoscelinae**

**Diagnosis:** Members generally dull coloured, body setose to pilose; pronotum anteriorly broader than the head and posterior apical margin; anterior lateral margins round, metathoracic scent gland possessed distinct ostiole and indistinct peritreme, males with first pair of conjunctival appendages deeply folded; spermathecal duct with very large dilation.

**Genus Irochrotus** Amyot and Serville, 1843

*Irochrotus* Amyot and Serville, 1843: 39.
Type species: *Cimex lanatus* Pallas, 1773: 729.
*Arctocoris* Stal, 1873: 31; Jakovlev, 1884:162; Kirkaldy, 1909: 263

**Diagnosis:** Body setose or pilose, head sub-semiorbicular; pronotum with a deep transverse incision near to lateral pronotal angles; body beneath and legs piceous, body less pilose than above; metathoracic scent gland with distinct ostiole and indistinct peritreme; VIII paratergites of ovipositor with spiracle towards lateral margin; first pair of conjunctival lobe membranous and with many folds.

*Irochrotus incisus* (Stal, 1873)

(Fig. 9; Plate. II & X)

*Arctocoris incisus* Stal, 1873: 31; Kirkaldy, 1909: 263
*Irochrotus incisus* Reuter, 1900: 209; Kirkaldy, 1909: 263
Body colouration brown ochraceous, antennae, labium, eyes, scutellum and legs brownish ochraceous, abdomen beneath black; body covered with thick and long pale or greyish black coloured hairs; punctuation more along margins of head, pronotum, scutellum and abdomen.

**Head** (Fig. 9a) breadth (1.97±0.11) 1.36x to length (1.44±0.09); preocular distance (0.71±0.04) 2.15x to postocular (0.33±0.07); interocular distance (1.55±0.12) 1.72x to interocellar (0.9±0.04). **Antennae** five segmented; II segment cylindrical, V broad and apically tapered, I antennal segment (.52±0.03); II (0.27±0.03) 1.92x to I; III smallest (0.16±0.01) and 0.59x to II; IV (0.26±0.01) 1.62x to III while V longest (0.39±0.02) and 1.5x to IV; total antennal length 1.62±0.11. **Labium** four segmented; I labial segment 0.42±0.03 long; II longest (0.82±0.06) and 1.95x to I; III smallest (0.23±0.03) and 0.28x to II; it is also broadest and almost 2x to II segment; IV (0.29±0.03) 1.26x to III; total labial length 1.77±0.1 and extended upto posterior coxae.

**Pronotum** (Fig. 9b) anteriorly broader than the head; anterio-lateral margins distinctly rounded, lateral margins of the pronotum deeply sinuated near middle, and profoundly transversely impressed across disk, lateral pronotal angles rounded, distance between lateral angles (3.69±0.10) 1.74x to anterior (2.11±0.07) and 1.87x to medial length (1.97±0.1) of pronotum.

**Scutellum** (Fig. 9c) covered almost whole of the abdomen, apically rounded, length (3.72±0.22) 1.05x to breadth (3.53±0.2); scutellar surface covered with long setae, more towards margins, dorsally thickly and densely punctate.

**Exterior of metathoracic scent gland** (Fig. 9d) with ostiole small, peritreme indistinct, evaporatorium also restricted to ostiolar region of metathoracic segment.

**Legs** with length of fore, middle and hind femora recorded as 1.07±0.06, 1.31±0.05 and 1.53±0.06, respectively while lengths of their consecutive tibiae as 0.98±0.07, 1.02±0.04 and 1.5±0.21, respectively.

**Abdomen** (Fig. 9e) ovate, convexed medio- ventrally, breadth (3.6±0.83) 1.12x to length (3.19±0.13); intersegmental sutures convexed anteriorly and lateral margins of
each intersegmental suture round; covered with long and dense hairs, finely and densely punctured.

**Male genitalia** (Fig. 9f-i) having **pygophore** (Fig. 9f-g) with dorso-lateral margins toothed on its posterior end, posterior margin not straight, proctiger ovate. **Aedeagus** (Fig. 9h) tubular with proximal part broader compared to distal, I pair of appendages apically membranous and thickly folded, II and III pair completely sclerotized, elongated and spine like, apically thin, vesica elongated and curved subapically. **Paramere** (Fig. 9i) apically curved, stem delicate with 2-4 setae located on the base of blade.

**Female genitalia** (Fig. 9j-k) having **ovipositor** (Fig. 9j) with its VIII and IX paratergites almost equal, each VIII paratergite with spiracle on its lateral side, First pair of gonocoxae subquadrate with posterior and inner margin straight. **Spermatheca** (Fig. 9i) with bulb very small and oval; proximal and distal flanges as well as pump region indistinct; spermathecal dilation membranous, large and oval in shape.

**Body size:** Female 6.51±0.08 and male 6.21±0.29 long.


### Odontotarsinae

**Diagnosis:** Tylus distinctly surpasses the jugal lobes, metathoracic scent gland with indistinct ostiole and peritreme; I antennal segment somewhat curved, II segment smallest; ovipositor of females generally with IX paratergites equal or larger to VIII, spermatheca with indistinct distal spermathecal dilation.

**Genus Alphocoris** Germar, 1839

*Alphocoris* Germar, 1839: 58; Stal, 1873: 26; Schouteden 1903: 80

**Type species:** *Alphocoris lixoides* Germar 1839: 59
**Diagnosis:** Lateral margins of head and apex of tylus rounded; tylus distinctly surpasses the jugal lobes, apical end of scutellum notched on lateral side; metathoracic scent gland ostiole very small, peritreme indistinct; IX paratergites of ovipositor comparatively larger than VIII not distinct.

*Alphocoris lixoides* Germar, 1839

(Fig. 10; Plate. II & X)

*Alphocoris lixoides* Germar 1839: 59; Distant, 1902: 67; Schouteden, 1903: 81

**Body colouration** pale brown on dorsal surface, lateral margins of jugum, anterior part of tylus, femora and tibiae black; labium, trochanters, tarsomeres, lateral margins of thoracic sterna and abdomen brown while rest of the body beneath black and fine white to cream hairs distributed on ventral surface of body.

**Head** (Fig. 10a) elongated, declivent, tylus extended beyond jugal lobes, apically rounded, breadth 1.2x to length, preocular distance 2.4x to postocular, lateral margins of head straight eyes placed near to basal margin and touched anterior angles of pronotum; interocular distance 1.5x to interocellar. **Antennae** (Fig. 10b) five segmented; located ventrally far from eyes; I antennal segment curved, basal half thin as compared to apical half; II slender and 0.6x to I; III apically broader, 0.7x to II; IV 1.8x to III; V longest and 1.2x to IV and tapered apically; small hairs present all antennal segments except I segment. **Labium** mutilated.

**Pronotum** (Fig. 10c) with anterior margin almost straight or slightly concave; anterior and posterior pronotal angles simple, lateral margins obliquely straight; lateral angles rounded, posterior margin almost straight; distance between lateral angles 1.65x to anterior and 1.7x to medial pronotal length.

**Scutellum** (Fig. 10d) elongated, covered whole of the abdomen; with anterior margin concave; anterior pronotal angles prominent and produced anteriorly; apex subquadrate and toothed at its lateral angles, length 1.55x to breadth; medially swollen throughout the length except apical end; dense punctation but more towards anterior, lateral and submedial length. Thoracic sterna grooved medially to hold the labium in resting condition; anterior margin of prosternum curved.
Abdomen (Fig. 10e) oval, not convexed, intersegmental sutures convexed medio-anteriorly; length 1.3x to breadth, spiracles present laterally from III-VII segments while a pair of trichobothria from III to VII abdominal segment, just posterior to each spiracle, segments medially depressed on its lateral side.

Male genitalia (Fig. 10f-i) with pygophore (Fig. 10f-g) longer than broad, lateral margins straight, dorsally lateral margins rounded on its posterior end, ventrally almost straight (Fig. 10g), inner margin curved, proctiger quadrate, posterior margin and basal half surface on ventral side possessed fine setae. Aedeagus (Fig. 10h) robust and sclerotized, proximally broader, I pair of conjunctival appendage serrate, II semisclerotized; vesica elongated. Paramere (Fig. 10i) with stem broad apically, curved in almost C-shaped, apical end sclerotized and setae present on the curved surface.

Female genitalia (Fig. 10j-k) having ovipositor (Fig. 10j) each with VIII paratergite subquadrate, distinct and with spiracle more towards lateral margin; IX paratergites somewhat rounded and bigger than VIII paratergite; First pair of gonocoxae large and triangular with round apices; thick setae on the surface. Spermatheca (Fig. 10k) very small, with bulb round; distal flange indistinct but proximal flange prominent, spermathecal pump small but distinct; spermathecal dilation indistinct.


Scutellerinae

Diagnosis: Members of this subfamily are generally bright coloured, body ventrally convexed, labium generally extends beyond posterior coxae, abdomen generally sulcated, thorax and scutellum with their bases more or less convexed, pronotum distinctly truncated posteriorly, second antennal segment shortest, metathoracic scent giant with well developed ostiole and peritreme; phallotheca longer than broad, conjunctiva with three pair of appendages, sometimes first and second conjunctival process fused at the base and situated dorso-laterally, parameres C or sickle shaped apically, and bear setae; VIII paratergite generally with spiracle, spermatheca with an
apical bulb and duct with well developed distal and proximal flanges, duct dilated medially, shape of dilation vary species to species.

**Key to the genera** (modified after Distant, 1902)

1. Jugal lobes straight, scutellum with apical end always truncated, wings always projecting beyond the apex of mesoscutellum when at rest; pronotum with lateral angles may or may not produced anteriorly in strong spine. ......................................................... *Cantao*

1'. Jugal lobes not straight; scutellum with apical end not truncated, wings generally not projecting beyond the apex of mesoscutellum when at rest; pronotum with lateral angles not produced anteriorly in strong spine. ................................. 2

2. Body pilose; metathoracic scent gland with peritreme in sickle shaped; abdomen sulcated longitudinally beyond middle on ventral surface......................................................... *Scutellera*

2'. Body not pilose; metathoracic scent gland with peritreme not in sickle shaped; abdomen not sulcated longitudinally beyond middle on ventral surface......................................................... 3

3. Body always broad or ovate; metathoracic scent gland with peritreme transverse and cylindrical in shape; spermathecal bulb always elongated with apex bent at different length and angle, spermathecal dilation always double walled; paramere with apex bifurcated...........

3'. Body ovate to elongated; metathoracic scent gland with peritreme transverse but generally depressed medially or tilted towards posterior end; spermathecal bulb of variable shape, spermathecal dilation devoid of double wall; paramere with apex without any and cylindrical in shape; paramere without bifurcated apex......................................................... 4

4. Pygophore with strigil................................................................. 5

4'. Pygophore without strigil......................................................... 6

5. Body pale yellow orange to brown; tibiae sulcated throughout the length ................. *Encorysses*

5'. Body greenish to blue, sometime with golden tinge; tibiae not sulcated throughout length......................................................... *Chrysocoris*

6. Pronotum constricted before middle, lateral pronotal angles always obtuse; abdomen sulcated medially but only at base............................................................... *Brachyaulax*

6'. Pronotum not constricted before middle, lateral pronotal angles generally obtuse; abdomen not sulcated medially at base............................................................... *Lamprocoris*

Genus *Brachyaulax* Stal, 1871

*Brachyaulax* Stal, 1871: 616; Schouteden, 1904: 23

Type species: *Brachyaulax rufomaculata* Stal, 1871: 616

**Diagnosis:** Body blue to purplish black with variable shapes of spots on dorsal as well as on ventral surface; head short and strongly declivous; lateral margins of pronotum with broad orange to red band and lateral margins also depressed
transversely before its centre, abdomen sulcated at base, odoriferous apertures spherical and small, evaporatorial surface extended upto mesothoracic segment.

*Brachyaylax cyaneovitta* (Walker, 1867)  
(Fig. 11; Plate. II)

*Scutellera cyaneovitta* Walker, 1867: 16; Distant 1899:35  
*Tectocoris oblonga* Westwood, 1837: Distant 1902: 52  
*Scutellera amethystine* Germar, 1839: Ho, 2003: 195

**Body colouration** dorsally greenish or violaceous blue with black spots; antennae, thoracic sternum except lateral margins, femora, tibiae and all tarsal segments black; labium, coxae and trochanters brown; lateral margins of the pronotum and thoracic sterna, a greenish or bluish-black sub quadrate spot present in each segment more towards lateral area; lateral margins of abdominal sternite with 3 small and one basal discal patch to abdomen irregularly ochraceous or reddish ochraceous.

**Head** (Fig. 11a) with length (3.5) and breadth (3.7) subequal; apex broad; lateral margins slightly sinuated; tylus longer than jugal lobes, preocular distance 2.2x than to post ocoular; interocellar distance 2.1x to interocular while distance between eye to each ocellus is 0.8. A black broad longitudinal spot extended from apex of tylus to base of head and a small, elongated spot present in between each eye; eyes protruded laterally. **Antennae** (Fig. 11b) five segmented; located ventrally, near to eyes; I antennal segment (1.0 ) never extended beyond apex of head and subequal to III (1.05); II segment smallest amongst all and also less than 0.5x of I segment; IV 1.2x to III while V longest and almost 3.5x to smallest segment; total antennal length 5.3.  
**Labium** four segmented, extended upto II abdominal segment, I labial segment smallest (0.9); II largest (1.95) and almost 2.2x to I; III and IV measured 1.05 and 1.25, respectively; total antennal length, 5.15.  
**Pronotum** (Fig. 11c) with breadth across anterior angles subequal to the central pronotal length while that of in between lateral angles to 1.53x previous one; anterior pronotal margin straight, anterior angles subquadrate while lateral angles obtuse. Six black spots arranged in two transverse series, posterior spots larger than anterior spots; pronotal dorsal surface depressed before discal area, thick and dense punctures at anterior margin and in depressed area; small hairs near to lateral margins.
Scutellum (Fig. 11d) covered whole of abdomen, length 1.55x to width (at base), ten spots located on surface, three basal, middle one linear and elongated, two before middle, sometimes attached to the lateral margins and sometimes connected, two small and lateral, sometimes connected with the preceding, two spots a little before apex, sometimes connected and one apical, apex round.

Exterior of metathoracic scent gland (Fig. 11e) with ostiole spherical and small, peritreme transverse, slightly curved medially, grooved throughout the length, evaporatorial surface sulcated or wrinkled and extended upto the mesothoracic segment.

Anterior margin of pro sternum concave, sternum medially deeply grooved to hold labium at rest.

Legs with of fore, middle and hind femora 2.1, 2.8 and 3.2 long respectively while that of fore, middle and hind tibiae 2.5, 2.8 and 3.6, respectively, tarsi three segmented, II smallest; I and III subequal and almost 2x to II tarsal segment.

Abdomen (Fig. 11f) U-shaped; with anterior margin almost straight; length 1.25x to breadth; a small central furrow upto III segment to hold the labium when not in use; basally broader than apical end.

Female genitalia (Fig. 11g-h) with ovipositor (Fig. 11g) having VIII paratergite triangular and of moderate sized, postero-lateral angle projected posteriorly, IX small and lobe like, I gonocoxa large, posterior margin medially sinuated, bear small hairs on posterior margin. Spermatheca (Fig. 11h) with bulb elongated and apically round, proximal and distal flanges of pump funnel shaped; pump region short, distal spermathecal duct narrower than proximal duct; spermathecal dilation big and balloon shaped.

Body size: Female measured 20.15 long and 8.05 broad.

**Genus Cantao** Amyot et Serville, 1843

*Cantao* Amyot and Serville, 1843: 29; Dallas, 1851: 3, 17; Stal, 1865: 33; Mayr, 1866: 14; Stal, 1873: 10; Atkinson, 1887: 149; Lethierry and Severin, 1893: 18; Distant, 1902: 42; Schouteden, 1903: 27; 1904: 18; Kirkaldy, 1909: 307

*lostethus* Stal, 1873: 10

Type species by subsequent designation (Kirkaldy, 1909: xxxv): *Calidea parentum*

White, 1839

**Diagnosis:** Body elongated, obovate, brightly coloured, generally of yellow, orange or reddish brown often spotted with black; head elongated, jugal lobes almost straight and tylus slightly extended beyond jugal lobes or both subequal, lateral margin of head slightly sinuated; labium extended beyond posterior coxae, anterior pronotal margin deeply sinuated; anterior pronotal angles prominent, lateral pronotal margins slightly depressed; scutellum extending beyond apex of abdomen and apex subquadrate; abdomen with a small central basal sulcation; genitalic plates possessed dense hairs.

*Cantao ocellatus* (Thunberg, 1784)

(Fig. 12; Plate. II, VIII & X)

*Cimex ocellatus* Thunberg, 1784: 60
*Cimex dispar* Fabricius, 1794: 81; Dallas, 1851: 17; Kirkaldy, 1909: 308
*Callidea dispar* Herrich-Schaeffer, 1836: 99; Westwood, 1837: 16; Kirkaldy, 1909: 308
*Callidea ocellata* Westwood, 1842: 47; Kirkaldy, 1909: 308
*Cantao dispar* Amyot and Serville, 1843: 29; Dallas, 1851: 17
*Cantao rufipes* Dallas, 1851: 17; Walker, 1867: 14; Kirkaldy, 1909: 308
*Cantao inscitus* Walker, 1868: 506; Lethierry and Severin, 1893: 18
*Cantao conscitus* Walker, 1868: 507; Lethierry and Severin, 1893: 18
*Cantao ocellatus* Dallas, 1851: 17; Kirkaldy, 1909: 308

**Body colouration** dorsally orange with brown to black spots on surface, dorsal surface of head, base of head and half way down tylus black with metallic blue green tints, antennae and labium dark brown to black, scutellum orange red, femora orange or bright red while tibiae and tarsomeres black with green or blue tinge, meso and meta pleura with posterior margin outlined in orange, remainder of these segments dark brown with metallic green overlay.

**Head** (Fig. 12a) elongated and anteriorly produced, length (3.9±0.12) and breadth (3.7±0.11) subequal, lateral margins almost straight or slightly sinuated, tylus longer
than jugal lobes, basal area of head and two central fasciae extended from base to before apex black. Preocular distance (2.18±0.15) 2.75x to postocular (0.79±0.06), interocular distance (2.3±0.13) 1.9x to interocellar distance (1.17±0.1). **Antennae** five segmented; I (1.25±0.05) and II (1.2±0.06) antennal segments subequal; III (2.5±0.09) longest and 1.4x to II; IV (2.4±0.09) and V (2.45±0.14) subequal; total antennal length 9.76±0.26. **Labium** four segmented; I labial segment (1.6±0.26) smallest; II longest (2.9±0.16) and 1.75x to I segment; III (2±0.08) and IV (1.9±0.15) labial segment subequal; total labial length 8.4±0.51 and extended beyond posterior coxae.

**Pronotum** (Fig. 12b) with anterior margin sinuated deeply; anterior pronotal angles produced anteriorly, antero-lateral margins reflexed, usually straight or curved; two black spots near anterior pronotal angles; in some specimens lateral pronotal angles produced laterally in black curved pointed spine, or in some it is obsoleted; distance between anterior angles (3.86±0.21) only 0.3x to posterior (12.8±0.54), later 2.7x to medial pronotal length (4.7±0.26); posterior pronotal margin straight with angles produced posteriorly.

**Scutellum** (Fig. 12c) with anterior and lateral margins straight; apex broad and straight; length (14.6±0.5) 1.9x to breadth (7.8±0.4); sometimes two basal spots surrounded by pale to ochraceous margin located at antero-lateral angles or sometimes it has six to eight spots, variable in size, located at lateral and apical area; apical part of wings not covered by it.

**Exterior of metathoracic scent gland** (Fig. 12d) with ostiole elongated, opened in a well developed peritreme which is more or less in sickle shaped and raised from the general evaporatorial surface, gooved through out transverse length; evaporatorial surface slightly wrinkled and usually extended upto metathoracic segment.

**Legs** with tibiae slightly dilated at apical end; femur of each hind leg (7±0.3) generally longer to corresponding tibia (6.4±0.3); in case of middle leg, femur (5±0.2) and tibia (4.8±0.08) subequal or femur slightly bigger than tibia but in case of fore leg, tibia (4.6±0.05) slightly longer than its femur (4.2±0.09); legs possessed creamish white hairs, more dense on tibiae and tarsomeres.
Abdomen (Fig. 12e -f) posteriorly broad; length (11.9±0.63) only 1.2x to the breadth (9.95±0.24), ventrally covered with white or creamish white hairs. Female’s abdomen (Fig. 12e) with a single spiracle present on each lateral side from III to VII segments and also on each VIII paratergite; paired trichobothria located just below each spiracle only on III to VII segment, generally paired black spots near medio-ventral line on III to VI segment and a black on each lateral side from III to VI segment; in case of males the intersegmental sutures are more curved anteriorly and number and arrangement of spots vary (Fig. 12f) while other structural characters similar to females.

Male genitalia (Fig. 12g-k) having pygophore (Fig. 12g) with ventral surface pilose; posterior margin medially produced and emarginated (Fig. 12h), on each side of emargination produced into a triangular flap, ventrally postero-lateral angles rounded (Fig. 12i). Aedeagus (Fig. 12j) with phallotheca funnel shaped, sclerotized, three pairs of conjunctival lobes appendages present, first two having common stem, first distally long, membranous, apically blunt while second heavily sclerotized, stout and hook like and third sclerotized and shortest, apically tapering into a small blunt hook; vesica completely sclerotized, long, apex trilobed, dorsal lobe long, curved, narrowed, apically pointed bearing the gonopore at apex, basally curved to bear a sac like ejaculatory reservoir. Paramere (Fig. 12k) with oval basal plate, stem long and almost straight, blade slightly curved on its inner side and hairy, apical end narrow.

Female genitalia (Fig. 12l-m) having ovipositor (Fig. 12l) with each VIII paratergite large, triangular, having spiracle towards lateral margin, IX paratergite indistinct; First pair of gonocoxae subquadrate, apical margin sinuous. Spermatheca (Fig. 12m) with elongated bulb, curved medially, apically spherical, distal and proximal flanges of pump, broad and well developed and disc shaped distal spermathecal duct narrow compared to proximal duct; spermathecal dilation big and rounded.

Body size: female measured 20.52±1.2 and males 20.45±0.66 long.

Material examined (NPC): 7♀♂ and 5♂♀♀, INDIA: BIHAR: Pusa, 1♀, 13.xi.1905, coll. A.H., sesame; Pusa, 1♂, vii.1911, coll. Dr. R. Keelan, host unknown; DELHI: IARI, 1♂, 3.xi.2008, coll. Shama Parveen, Acacia sp.; JHARKHAND: Hazaribagh, 1♀, 2♂♀♀, 16-25.iii.1928, coll. P.V. Issac, host unknown; TAMIL NADU:

**Genus Chrysocoris** Hahn, 1834

*Chrysocoris* Hahn, 1834: 38; Stal, 1865: 34; Schouteden, 1904: 34

Type species by monotypy: *Chrysocoris stollii* (non Wolff, 1801): Hahn, 1834 (= *Scutella abdominalis* Westwood, 1837)

*Galostha* Amyot and Serville, 1843: 33; Distant, 1902: 54; Kirkaldy, 1909: 292

**Diagnosis:** Body metallic or brassy green (except *C. fascialis*) with black patches, body size varies from 10.00 to 20.00. Head short and declivent, lateral margins deeply sinuated; eyes generally protruded laterally; basal antennal segment never extended beyond apex of head, II segment shortest amongst all; labium always extended beyond posterior coxae and not beyond III abdominal segment, scutellum slightly convexed at base; metathoracic scent gland ostiole as well as peritreme well developed; spermathecal bulb elongated, generally with apical end round; spermathecal dilation present in variable shape shape and size, pygophore always with strigil, conjunctiva with 3 pairs of appendages.

**Key to species**

1. Abdomen with venro-lateral margins with purplish pink band.................................2
   1’. Abdomen with venro-lateral margins without purplish pink ban..............................3

2. Body yellow to brown coloured; scutellum with a black transverse spot, extended between lateral margins; pump region of spermatheca indistinct but flanges not in proper sclerotized plate form..................................................................................*fascialis*
   2’. Body metallic colour to blue, sometime with golden tinge; scutellum possessed seven spots but no one transverse between lateral margins; well developed proximal and distal flanges enclosed the spermathecal pump region.................................................................*stollii*

3. First pair of conjunctival appendages apically curved while second pair of conjunctival appendages with a subapical sclerotized spine........................................................................4
   3’. First pair of conjunctival appendages apically not curved and second pair of conjunctival appendages without any subapical sclerotized spine.........................................................7

4. Lateral margins of head deeply sinuated before eyes......................................................5
   4’. Lateral margins of head not deeply sinuated before eyes.............................................6

5. Spermathecal pump with indistinct distal flange............................................................marginellus
   5’. Spermathecal pump with distinct distal as well as proximal flanges..........................pulchellus
6. Pronotum with lateral angles broadly obtuse; ten round to oval black spots over the dorsal surface; ventro-posterior margin of pygophore deeply sinuated.................*patricius*

7. Second pair of conjunctival appendages balloon shaped, with sclerotized pointed apical tip.............................................................................................................*dilaticollis*

7'. Second pair of conjunctival appendages neither balloon shaped nor with sclerotized pointed apical tip.........................................................................................................................8

8. Pronotum with five spots on dorsal surface; apex of first pair of conjunctival appendages medially cleft or bifurcated; spermathecal dilation smoothly membranous.................*purpureus*

8'. Pronotum with more than five spots on dorsal surface; apex of first pair of conjunctival appendages medially not cleft or bifurcated; spermathecal dilation membranous with longitudinal thread like pattern .........................................................................................................................9

9. Abdomen possessed small, variable shaped of stigmatal spots from III-VI segment on ventral surface, towards lateral margins.........................................................*andamanensis*

9'. Abdomen possessed moderate sized, subquadrate stigmatal spots from III-VI segment on ventral surface, towards lateral margins.........................................................*marginellus*

**Chrysocoris andamanensis** Atkinson, 1887

(Fig. 13; Plate. XI)

*Chrysocoris andamanensis* Atkinson, 1887: 177; Distant, 1902: 60

**Body colouration** metallic green or violaceous blue with black spots over pronotum and scutellum. First antennal segment, I and II labial segment ochraceous, II to IV antennal segment; III and IV labial segments brown to black, coxae, femora and tibiae black with violaceous tinge, tarsal segments black, body with fine and thick punctations except head.

**Head** (Fig. 13a) slightly produced anteriorly, breadth 1.2x to length, lateral margins of head deeply sinuated before eyes, eyes protruded laterally and almost touched anterior pronotal angles, preocular distance 2x to postocular while interocular 2.12x to interocellar distance, ocelli placed more near to eyes than to each other. **Antennae** five segmented; located ventrally on head near to eyes; I antennal segment never extended beyond apex of the head; II smallest; III antennal segment 8.75x to II segment; IV longest and 1.1x to III segment; V subequal to IV segment, small black hairs over III and onward antennal segment. **Labium** four segmented, I labial segment smallest; II 2x to I; III segment 0.8x to II and IV segment 0.8x to III; total labial length 7.55 and extended upto II abdominal segment.
Pronotum (Fig. 13b) convexed at base, anterior margin deeply sinuated, anterior pronotal angles obtuse and slightly produced anteriorly, lateral pronotal margins sinuated deeply just before lateral angles, distance between lateral angles 2.2x to anterior angles; 8 black pronotal spots, 3 variable sized small spots near anterior pronotal margin while 5 variable sized spots located in posterior row, 3 out of these large, elongated on disc towards posterior margin, 1 small spot at each lateral pronotal angles.

Scutellum (Fig. 13c) with base convexed, oval in shape, anterior scutellar margin straight or slightly convexed; covered whole of the abdomen; length 1.5x to breadth, apex rounded, possessed 7 scutellar spots present, 6 in pair situated laterally and 1 elongate spot at middle more towards base.

Legs with fore, middle and hind femora measured 3.9, 4.5 and 6.1, respectively, while fore, middle and hind tibiae measured 4.2, 4.6 and 5.9, respectively, tibiae and tarsal segments possessed small and black hairs and very few on femora.

Exterior of metathoracic scent gland (Fig. 13d) with ostiole moderate sized, oval in shape, peritreme small and black, not grooved medially; evaporatorial surface extended upto mesothoracic segment.

Abdomen (Fig. 13e) ventrally convexed throughout the length, a submarginal series of black spots present on all abdominal sternites except fused I and II segments; punctuations very sparse and located only toward lateral sides; number and position of spiracles and trichobothria same as other species of this genus.

Male genitalia (Fig. 13f-i) with pygophore (Fig. 13f) having posterior margin convex, lateral margins round, strigil present in patch form, inner margin invaginated on to lateral sides, proctiger elongated. Aedeagus (Fig. 13h) with vesica sclerotized and anteriorly sharp, I conjunctival appendages broad at base, medially bent while apically round; completely sclerotized; II pair longest, sclerotized at tip and at basal portion, medially membranous and wrinkled, III pair completed sclerotized, elongated apically spined; vesica hooked or notched apically, duct clear. Paramere (Fig. 13i) with robust stem, basal part broader to apical, not strongly sclerotized, blade curved upwardly and a tufts of hairs at the junction of base and stem.
Female genitalia (Fig. 13j-k) with ovipositor (Fig. 13j) having VIII paratergites fused distally, each eighth paratergite triangular, posterior margin almost straight; IX paratergites comparatively small and elongated, round toward inner side, first pair of gonocoxae with posterior margin straight, inner angle round. Spermatheca (Fig. 13k) with bulb somewhat elongated with apical end round, distal and proximal flanges of pump distinct; distal funnel shaped, broader than proximal; basal part of pump region membranous, distal spermathecal duct almost 0.5x to proximal, median spermathecal duct sclerotized and broad, more than 2x to proximal part, spermathecal dilation membranous, large and spherical in shape.

Body size: Female 20.5 and male 19.5 long

Material examined (NPC): 1♀ and 1♂, INDIA: ANDAMAN ISLAND, 1♂, (without any data); UTTARAKHAND: Masoori, 1♀, ix-x.1920, coll. Mackenzie, host unknown.

*Chrysocoris dilaticollis* (Guerin, 1830)

(Fig. 14; Plate. III & XI)

*Scutellera dilaticollis* Guerin, 1830:160
*Callidea dilaticollis* Dallas, 1851:28
*Chrysocoris stollii* Hahn, 1834:39
*Callidea abdominalis* Westwood, 1837:15
*Galostha stockerus* Amyot and Serville, 1843:34

Body colouration dorsally metallic green, where generally the lateral margins of pronotum and base of scutellum with golden tinge, antennae, labium and tarsal segments black, femora, base of tibiae and abdomen ventrally ochraceous, while rest of tibial portion green.

Head (Fig. 14a) declivent, lateral margins deeply sinuated before eyes, tylus extended beyond the jugal lobes; breadth 1.5x to length, central fascia present within anterior to posterior end; eyes much protruded laterally, preocular distance 2.2x to postocular, interocular distance 2.2x to interocellar, ocelli located more closer to eyes than to each other. Antennae (Fig. 14b) five segmented; I antennal segment never extended upto apex of head; II segment smallest and only 0.3x to I; III longer than I and 2.4x to I; IV slender and broader amongst all and 1.3x to III segment while V longest
amongst all and 1.4x to III; total antennal length 9.3. **Labium** four segmented; I labial segment smallest; II longest and 1.3x to I; III and IV subequal and extended beyond the posterior coxae.

**Pronotum** (Fig. 14c) with anterior margin straight, anterior angles broad, anterior portion of lateral margins reflexed, lateral angle obtuse, breadth between anterior angles almost equal to medial pronotal length and 0.55x to lateral pronotal angles; ten black spots present on surface, three at anterior margin, one at each lateral angle, two at base, three at disc.

**Scutellum** (Fig. 14d) convexed and covers whole of the abdomen, anterior margin straight, apical end round, length 1.5x to breadth, eight spots, six in pairs, more towards lateral side, one at sub apical, one Y-shaped before middle.

**Exterior of metathoracic scent gland** (Fig. 14e) with ostiole oval, open into transverse peritreme, anterior and posterior margins smooth, without any crenulations, exterior end round, grooved medially beyond half of the length; exterior end slightly curved towards anterior end; evaporatorial surface rugulose and extended to mesothoracic segment.

**Abdomen** (Fig. 14f) convexed on ventral side; abdominal length and breadth subequal; III to VII segment possessed a spiracle and a pair of trichobothria on each lateral side, a black round spot also present on the same segment, intersegmental suture between VI and VII convexed.

**Male genitalia** (Fig. 14g-j) with **pygophore** (Fig. 14g) dorso-lateral margin bulged in middle, dorso-lateral surface concave through inside, having ventro-posterior margin curved (Fig. 14h), whole surface covered with scattered strigil; proctiger oval. **Aedeagus** (Fig. 14i) not heavily sclerotized with tubular phallotheca, conjunctiva represented by three pair of appendages, I pair strongly sclerotized, except basal part, more or less on S-shaped; II pair completely membranous except tip, it is broader and longest, apically pointed, III pair also sclerotized and apically curved. **Paramere** (Fig. 14j) with strong stem, outer margin of stem curved, blade attached with stem by a membranous part, blade deeply curved and possess long and sparse setae at the base.

*Chrysocoris fascialis* White, 1842
(Fig. 15; Plate. III)

*Crysocoris fascialis* White, 1842: 86; Distant, 1902: 60

**Body colouration** yellow to ochraceous with black spots over pronotum and scutellum; base of head metallic green; coxae, trochanters and femora (except apices) yellow/ ochraceous; first labial segment, apices of femora, tibiae and tarsal segments brown to black while rest of the labial segments and antennae brown; abdomen ventrally ochraceous with brown stigmatal spots, laterally purplish pink band throughout the margins; body sparsely punctured.

**Head** (Fig. 15a) small, lateral margins deeply sinuated near eyes before apex, tylus longer than jugal lobes and latter subquadrate; head breadth (2.8) 1.4x to length (2.0); preocular distance 1.2x to postocular, interocellar distance and ocelli located nearer to eyes than to each other. **Antennae** (Fig. 15b) five segmented; I antennal segment never extended beyond apex of the head; II smallest and only 0.4x to I; III 4.7x to II while IV longest and broader among all; 1.2x to III; V subequal to III segment and apically tapered, total antennal length 4.4. **Labium** four segmented; I and IV subequal; II longest and 1.6x to I; III 0.7x to II; total labial length 4.35 and extended upto the II abdominal segment.

**Pronotum** (Fig. 15c) with anterior margin deeply sinuated, lateral margins slightly convexed before lateral angles, anterior pronotal angles anteriorly projected; distance between lateral angles 1.9x to anterior pronotal distance and 2.1x to medial pronotal length; seven spots over surface which covered almost whole pronotal surface, two at anterior angles, connected through a transverse band, two at lateral angles and three at disc, the middle one almost quadrate in shape while adjacent one oblong.

**Scutellum** (Fig. 15d) not convexed at base, covered almost whole of abdomen, scutellar length 1.4x to breadth, anterior pronota margin almost straight while apex
broad and round; four black spots on dorsum, a transverse, thick band like extended between lateral margins, two oval posterior to middle, more towards lateral side and one disc shaped located subapically.

**Legs** with hind pair composed of subequal femora and tibiae, middle femora slightly bigger to corresponding tibiae while in tibiae of fore legs slightly bigger to its corresponding femora.

**Exterior of metathoracic scent gland** (Fig. 15e) with elongated ostiole, peritreme transversely elongated and slightly elevated upward, not grooved medially; evaporatorial surface moderately rugulose.

**Abdomen** (Fig. 15f) U shaped; anterior margin almost straight, a round to disc shaped black spot on each lateral side of abdomen from III-VII, on VI segment one more spot present adjacent to previous; five pairs of spiracles from III to VII segment and a pair of trichobothria posterior to each spiracle.

**Female genitalia** (Fig. 15g-h) having **ovipositor** (Fig. 15g) with VIII paratergites triangular and fused medially, IX paratergites small and bulbous, first pair of gonocoxae subquadrate with posterior posterio middle angle round. **Spermatheca** (Fig. 15h) with bulb elongated, distal end rounded, both flanges present but, not in sclerotized plate like and encloses short pump region; proximal spermathecal duct almost 1.6x to distal duct; spermathecal dilation slender, small and transparent, medial spermathecal duct sclerotized and can be seen easily through spermathecal dilation.

**Body size:** Female 11.2 long and 5.8 broad.


*Chrysocoris marginellus* (Westwood, 1837)  
(Fig. 16; Plate. III & XI)

*Callidea marginella* Westwood, 1837: 15
*Callidea caelestis* Stal, 1855: 181; Kirkaldy, 1909: 293
*Chrysocoris nilgiriensis* Atkinson, 1889: 343; Kirkaldy, 1909: 293
*Chrysocoris marginellus* Stal, 1873: 21; Distant, 1902: 59
Body colouration dorsally metallic green or indigo blue with black spots over dorsum, ventrally thorax metallic green while abdomen ochraceous or reddish ochraceous with lateral margin violaceous or black, submarginal abdominal series of broad, transverse spots, green or bluish green. I segment ochraceous, while rest black. **Head** (Fig. 16a) declivent, lateral margins deeply sinuated, tylus longer than jugal lobes, breadth 1.4x to length; preocular distance, 1.5x to postocular, two median fasciae present between apex to base of head; eyes protruded laterally, touched anterior pronotal angles; interocular distance 2x to interocellar and ocelli placed more closer to eyes than each other. **Antennae** five segmented; I antennal segment never extended beyond apex of head; II segment smallest and only 0.6x to I; III segment 4.3x to II; IV 1.6x to III while V longest amongst all and 1.2x to IV; total antennal length 10.9±0.51. **Labium** four segmented; I labial segment smallest; II longest and 1.9x to I; III and IV subequal and only 0.6x to the II; total labial length 6.1±0.2 and extended upto or beyond posterior coxae. **Pronotum** (Fig. 16b) with anterior margin deeply sinuated and anterior pronotal angles produced anteriorly; lateral pronotal margins obliquely straight, not sinuated with lateral angles obtuse; breadth between anterior pronotal angles subequal to medial pronotal length while distance between lateral pronotal angles 4.2x to anterior; eleven spots on the dorsum, three at anterior margin, one at each lateral angles and remaining spots on disc. **Scutellum** (Fig. 16c) having base convexed with anterior scutellar margin convexed, covered whole of abdomen; scutellar length 1.4x to breadth, basal angle and scutellar apex rounded; seven spots present, six in pairs, more towards lateral sides and one elongated, broad and roughly T-shaped situated medially. **Exterior of metathoracic scent gland** (Fig. 16d) with ostiole round to oval in shape, peritreme transverse with exterior end curved, sickle shaped, medially grooved to hold the secretion through ostiole, evaporatorial surface rugulose and extended upto mesothoracic segment. **Legs** with hind leg having femur 1.1x to corresponding tibia while in case of middle and hind legs, femora and tibiae subequal.
Abdomen (Fig. 16e) with breadth subequal to length or slightly broader; segment III to VII bear subquadrate spots on each lateral side and a black medial spot on the III segment; spiracle on III to VII segments and a pair of trichobothria just below each spiracle; VII intersegmental suture broadly V-shaped.

Male genitalia (Fig. 16f-h) with pygophore (Fig. 16f) having posterior margin sinuated, strigils present in two patches on dorso-posterior region and also scattered on the dorsal surface; lateral margins also sinuated slightly; proctiger ovate, setae on ventral and lateral sides. Aedeagus (Fig. 16g) not highly sclerotized, having tubular phallotheca; three pairs of conjunctival appendages present, I pair sclerotized and apically curved, II pair basally broad and membranous, apically thin and sclerotized and terminated in spine, and bear small spine before apical end, III pair comparatively short and stout with almost uniform thickness, apically tapering; vesica broad having apex notched. Paramere (Fig. 16h) robust, sickle shaped, blade curved, at the junction of stem and blade a tuft of long setae present; stem broad and at middle margin bulged out laterally.

Female genitalia (Fig. 16i-j) having VIII paratergites triangular with posterior margin convex, IX paratergites comparatively small (Fig. 16i), First pair of gonocoxae large and subquadrate with lateral margins convex and posterior margin sinuated slightly. Spermatheca (Fig. 16j) with bulb elongated and distally bulbous with round apex; proximal flange disc shaped while distal flange of pump indistinct; pump conspicuous; spermathecal dilation elongated, membranous and cylindrical.

Body size: Female 19.15 and male 18.8 long.

Material examined (NPC): 2♀ and 2♂; INDIA: KARNATAKA: Bangalore, 1♂, 1903, coll. and host unknown; MAHARASHTRA: Matheran (2500 ft), 1♂, iv.1903, coll. D. N., host unknown. MYANMAR: Myitkyina, 1♀, 30.viii.-1.ix.1914, coll. T. B. Fletcher, host unknown. SRI LANKA: Hambantota, 1♀, 15.ii.1908, coll. T. B. Fletcher, host unknown.

**Chrysocoris patricius** (Fabricius, 1798)

(Fig. 17; Plate. III, VIII & XI)

*Cimex patricius* Fabricius, 1798: 527
*Callidea bengalensis* Westwood, 1837
*Callidea basilica* Germar 1839, 117
*Chrysocoris patricius* Stal 1873, 20; Distant 1902, 57
**Body colouration** dorsally metallic green or blue with golden reflection, central lobe to head and spots over pronotum and scutellum black. Base of I antennal segment, I and base of II labial segment, coxae, femora (except apices) and lateral margins of prosternum orange or reddish, remaining antennal and labial segments and tarsal segments dark brown to black, apices of femora, tibiae, stigmatal plates and sternum metallic green or blue, lateral margins of ventro-lateral abdomen purplish pink.

**Head** (Fig. 17a) declivent, lateral margins sinuated deeply, tylus longer than jugal lobes; head breadth (2.54±.097) 1.4x to length (1.79±0.11); eyes protruded laterally; preocular distance (0.81±0.08) 1.7x to postocular (0.46±0.05); ocelli placed nearer to eyes than to each other; interocular distance (1.03±0.37) 1.3x to interocellar (0.8±0.05) distance and ocelli placed more nearer towards eyes than to each other.

**Antennae** (Fig. 17b and c) five segmented; attached ventrally on head, nearer to eyes. I antennal segment (0.64±0.07) never extended beyond the apex of head; II (0.31±0.09) smallest and only 0.5x to I; III (1.17±0.07) 3.8x to II; IV and V segment flat while IV broadest of all segments, slightly grooved in middle and 1.4x to III; V (1.8±0.1) longest and 1.1x to IV; small hairs on III and onward segment, in males the II segment very small almost half to the females, total antennal length 5.48±0.31.

**Labium** four segmented; I labial segment smallest (0.67±0.07); II longest (1.1±0.15) and 1.6x to I; III (0.76±0.07) and IV (0.78±0.05) subequal and only 0.7x to II segment; total labial length 3.32±0.25 and extended upto posterior coxae.

**Pronotum** (Fig. 17d) convexed, anterior pronotal margin slightly sinuated, lateral margins straight, lateral pronotal angles broad and obtuse; breadth between anterior pronotal angles (2.65±0.16) subequal to medial pronotal length (2.62±0.12) and only 0.5x to the breadth between lateral angles (5.32±0.25); 10 black spots distributed over the surface, 3 at anterior margin, 5 at disc, in which 4 round in pairs and middle one oblong, one at each lateral angles.

**Scutellum** (Fig. 17e) with base convex, covers whole of the abdomen, scutellar length (5.75±0.29) 1.2x to breadth (4.62±0.29), basal margin almost straight or convex and apical margin round, eight black spots over the surface, 6 round and in pairs located more towards lateral side, one spot circular located at base and one
oblimg almost at middle; punctures thick and, dense towards lateral sides while medially it is small and arranged sparsely.

**Legs** with fore, middle and hind femora 1.84±0.12, 2.1±0.11 and 2.59±0.11, respectively while fore, middle and hind tibiae 2.07±0.09, 2.22±0.11 and 2.82±0.17 long, respectively.

**Exterior of metathoracic scent gland** (Fig. 17f) with ostiole large, round to oval in shape, peritreme transverse and grooved medially up to half of the length, anterior margin concave (Fig. 30o); evaporatorial surface black and extended up to mesothoracic segment.

**Abdomen** (Fig. 17g) ventrally subquadrate; breadth 1.04× (4.66±0.31) slightly more than abdominal length (4.49±0.16), ventrally it possessed black spots at base and on each abdominal segment. A spiracle on each lateral side from III to VII abdominal segments and also on VIII paratergites, a pair of trichobothria posterior to each spiracle except VIII paratergites.

**Male genitalia** (Fig. 17h-k) having **pygophore** (Fig. 17g) with ventral margin broad (Fig. 13h), bearing a large strigil of irregular rows of stout setae forming a central arc, dorsal border narrow and bearing two long narrow strigils on each side of a small membranous area composed of irregular rows of stout setae (Fig. 17i). **Aedeagus** (Fig. 17j) with phallotheca cylindrical, basally narrow, three pairs of conjunctival appendages present, first pair flattened proximally, bent distally to sclerotized apices, second pair longest, membranous produced into sclerotized double spines at apices, third pair slender, with distal halves sclerotized and pointed, vesica swollen and basally attained hook shape. **Paramere** (Fig. 17k) stout with a long stem and a long hook pointed at tip, base of hook at its junction with the stem flattened, bearing a number of fairly stout setae.

**Female genitalia** (Fig. 17l-m) having **ovipositor** (Fig. 17l) with VIII paratergite triangular with a spiracle each near to lateral margin and more towards dorsal side, posterior margin straight, medially fused, IX paratergites small and lobe like, first pair of gonocoxae large and subquadrate, moderate setae on genital plate. **Spermatheca** (Fig. 17m) with bulb elongated and apex round; distal and proximal flanges of pump distinct and broad, proximal bulbous while distal flange disc shaped,
proximal spermathecal duct longer and narrower than distal; spermathecal dilation transparent, small and cylindrical.

**Body size:** Female 10.42±0.17 and male 10.13±0.38 long.


**Chrysocoris pulchellus (Dallas, 1851)**

(Fig. 18; Plate IV & XI)

*Callidea pulchella* Dallas, 1851: 25
*Callidea rama* Kirby, 1891: 76; Kirkaldy, 1909: 294
*Chrysocoris pulchellus* Distant, 1902: 59

**Body colouration** bright bluish or brassy green, antennae, rostrum and sternum black, margins of sternum brassy green, base of head beneath and abdomen ochraceous, femora (except apices) reddish ochraceous, their apices, tibiae and all tarsal segments black.
Head (Fig. 18a) with lateral margins deeply sinuated; tylius surpasses the jugal lobes; a central fascia present within anterior to posterior margin, a black oval spot near to eye present; breadth (3.6±0.16) 1.5x to length (2.4±0.23), preocular distance (1.1±0.07) 1.8x to postocular (0.61±0.01), eyes produced laterally, interocular distance (2.2±0.11) 2x to interocellar (1.1±0.07); ocellus placed more closer to eyes than to each other. Antennae five segmented; attached ventrally nearer to eyes; I antennal segment (0.9±0.08) never extended beyond apex of head; II smallest (0.37±0.1); III (2.25±0.22) almost 6x to II while IV (2.76±0.3) and V subequal (2.65±0.36); total antennal length 8.9±0.85. Labium four segmented; I labial segment smallest (1.03±0.06); II (2±1.32) longest and 1.9x to I; III (1.3±0.07) and IV (1.23±0.07) subequal; total labial length 5.56±0.25 and extended upto II-III abdominal segment.

Pronotum (Fig. 18b) with anterior margin depressed slightly, anterior angles produced forward; lateral angles margins convexed before obtused posterior angles; distance between posterior angles (7.97±0.58), 2x to distance between anterior angles (3.86±0.23) while medial pronotal length (4.06±0.27) almost same as that of latter; surface possessed ten black spots of variable size, 3 at anterior margin, one at each posterior angles, 2 at base, 2 on disc and one largest subquadrate placed centrally.

Scutellum (Fig. 18c) oval, having anterior margin slightly convexed, anterior angles notched, apical end round; length (9.75±0.82) 1.4x to breadth (6.86±0.72); possessed eight variable sized black spots, 6 in pairs more towards lateral sides, one round to oval located towards scutellar apex and one Y-shaped or elongated placed medially.

Exterior of metathoracic scent gland (Fig. 18d) having oval or round ostiole which releases its secretion in transverse peritreme, its exterior end raised laterally from evaporatorial surface, grooved medially throughout the length, evaporatorial surface rugulose and extended upto mesothoracic segment.

Legs with fore, middle and hind femora 3.5±0.1, 4.1±0.21 and 4.48±0.44 long, respectively while fore, middle and hind tibiae 3.87±0.08, 4.11±0.13 and 5.01±0.49, respectively.

Abdomen (Fig. 18e) convexed ventrally, length (7.6±0.75) 1.1x to breadth (6.9±0.77), a balck shaded with brassy green stigmata spot on each lateral side from
III to VII segment and one medial on III segment present, arrangement of spiracles and trichobothria same as other species of this genus.

**Male genitalia** (Fig. 18f-i) having pygophore with dorso-posterior margin concave, postero-lateral angles round, dorso-medial surface concave; strigils scattered in irregular plates on whole surface; proctiger elongate, ventro-posterior margin deeply sinuated (Fig. 18g). **Aedeagus** (Fig. 18h) with phallotheca slender; not strongly sclerotized, three pairs of conjunctival appendages present, I pair strongly sclerotized, basally broad while apically tapered and curved before apex; II pair long, basal portion sclerotized, rest membranous excepts apical end which is spinose, it bears a short sclerotized spine before end; III pair sclerotized, apical end spinose and curved; vesica strong, elongate and notched where gonopore exit. **Paramere** (Fig. 18i) with stem comparatively short to blade, basal part broader, stem and blade joined with membranous part, blade curved and a tuft of setae present on inner margin.

**Female genital** (Fig. 18j-k) with ovipositor (Fig. 18j) having VIII paratergites subquadrate with inner margin concave, dorsally fused, IX paratergite comparatively small and thumb shaped; first pair of gonocoxae large and subquadrate with posterior margin almost straight; small setae present on ovipositor. **Spermatheca** (Fig. 18k) with bulb elongated, apical end round, flanges of spermathecal pump present, pump region nearer to distal flange broader than to proximal, distal flange of pump comparatively broader and in disc shape, a sclerotized band present in between two flanges; distal and proximal spermathecal ducts almost same in their length and breadth; spermathecal dilation elongated, medially somewhat broader, membrane transluscent.

**Body size:** Female 15.06±0.47 and male 13±0.8 long.

Chrysocoris purpureus (Westwood, 1837)
(Fig. 19; Plate. IV & XI)

Callidea purpurea Westwood, 1837: 15
Chrysocoris viridis Atkinson, 1887: 175; Kirkaldy, 1909: 294
Chrysocoris purpureus Stal, 1868: 10; Distant, 1902: 58

Body colouration dorsally metallic green with black spots over pronotum and scutellum; head, pronotum, scutellum, and sternum metallic green; first antennal segment, labium, coxae, trochanters, femora (except apices) tibiae and abdomen ochraceous, rest of antennal segments, apices of femora and tibiae metallic green or violaceous blue; small black punctures over pronotum and scutellum

Head (Fig. 19a) declivent, lateral margins deeply sinuated before eyes; tylus surpasses jugal lobes, breadth (4.05±0.13) 1.2x to length (3.31±0.21), preocular distance (1.51±0.07) 2x to postocular (0.74±0.09); eyes protruded laterally, ocelli located near to eyes than to each other; interocular distance (2.53±0.13) 2x to interocellar (1.25±0.1). Antennae five segmented; I antennal segment (1.18±0.91) never extended beyond apex of head; II (0.44±0.05) and only 0.4x to I; III 5.8x to II; IV longest amongst all and 1.4x to III; V (2.86±0.27) 0.9x to IV; total antennal length 10.13±1.27. Labium four segmented; I labial segment smallest (1.09±0.06); II longest (2.26±0.11) and almost 2x to I while III (1.92±0.14) and IV (1.7±0.13) 1.7x and 1.6x, respectively to I segment; total labial length 6.97±0.45 and extended upto II abdominal segment.

Pronotum (Fig. 19b) convexed, more towards base, anterior margin slightly sinuated, lateral margins straight, breadth at lateral angles (9.82±0.33) 2.36x to anterior pronotal angles (4.15±0.24), and length at middle 4.16±0.24, lateral pronotal angles obtuse; five black spots over surface, two at antero-lateral portion, and two at the posterior end while one at middle but more towards the posterior margin.

Scutellum (Fig. 19c) slightly convexed at base, anterior margin convex while apical end truncated, covers whole of the abdomen, length (10.6±0.5) 1.2x to breadth (8.95±0.6), seven black spots, six round located towards lateral side in pair while oblong spot and placed at middle near to base.
Legs with fore, middle and hind femora 3.62 ± 0.24, 4.02±0.31 and 5.53± 0.35, respectively while fore, middle and hind tibiae 3.96± 0.25, 4.01± 0.21 and 5.42± 0.35, respectively; small hairs distributed all over the legs.

**Exterior of metathoracic scent gland** (Fig. 19d) with ostiole small, sunken, peritreme transverse, elevated upward, slightly grooved throughout the length; evaporatorium extended to mesothoracic region, surface is divided into two color zones i.e., black and yellow, black surface sulcated with fine punctuations while yellow surface is smooth.

**Abdomen** (Fig. 19e) ventrally convexed; breadth (8.09 ± 0.9) 1.1x to length slightly (7.34±0.45), a black round spot on each ventro-lateral sides, small punctures towards lateral margins but medially it is smooth, arrangement of spiracles and trichobothria same as other species of this genus.

**Male genitalia** (Fig. 19f-h) having **pygophore** with dorso-posterior angle round, inner margin invaginated on its lateral and posterior side (Fig. 19f), strigils present in patches on dorsal surface. **Aedeagus** (Fig. 19g) with theca distally broad, I pair of conjunctival appendage sclerotized and apically cleft or bifurcated, II pair semisclerotized, anteriorly sclerotized and spinose; 3rd sclerotized and apically tapered, vesica completely sclerotized, apically notched before gonopore. **Paramere** (Fig. 19h) sickle shaped, stem broad, blade curved and strongly sclerotized, small setae at the base of blade.

**Female genitalia** (Fig. 19i-j) having **ovipositor** (Fig. 19i) with VIII paratergites triangular, fused dorsally, IX paratergites small, anterior margin convexed, elongated; first pair of gonocoxa subquadrate, lateral margins round, posterior margins sinuate, postero-interior angles round. **Spermatheca** (Fig. 19j) with bulb apically round, distal and proximal pump flanges in disc shaped, pump region small, distal and proximal spermathecal ducts almost subequal or previous slightly shorter than proximal, spermathecal dilation spherical and big, texture of dilation not transparent.

**Body size:** Female 18.28±0.51 and male 17.84±0.97 long.


**Chrysocoris stockerus (Linnaeus, 1758)**

(Fig. 20; Plate. IV, VIII & XI)

*Cimex stockerus* Linnaeus, 1758: 441  
*Chrysocoris stockerus* Stal, 1873: 20; Distant, 1902: 57  
*Callidea taprobanensis* Westwood, 1837: 15; Kirkaldy, 1909: 294  
*Callidea erichsoni* Germar, 1839: 113

**Body colouration** dorsally metallic green or indigo blue, with black spots over pronotum and scutellum. Head beneath, sternum, apices of femora, tibiae and round spots on ventro-lateral margins of abdomen shining brassy green. Basal margin of head beneath, I antennal segment, base of I labial segment, coxae, trochanters, femora (except apices), posterior margin of meso and metasterna, and abdomen ochraceous; rest of the antennal and labial segments and all tarsal segments brown to black, a large quadrate spot at base, stigmatal spots, inner lateral spots and apex of abdomen black.

**Head** (Fig. 20a) declivent, with breadth (3.39±0.25) more than length (2.65±0.35 mm), lateral margins before eyes deeply sinuated, tylus longer than jugal lobes, preocular distance (1.23±0.06) almost 1.8x to postocular distance (0.67±0.12). Eyes projected laterally, ocelli located below eyes, nearer to eyes than to each other (1.13±0.07), eyes 2.15±0.08 apart. **Antennae** five segmented, attached beneath head, near to eyes; I antennal segment (1±0.11) longer than II (0.74±0.97); later smallest amongst all; III (1.85±0.1) 2.2x to II; IV (2.32±0.28) 1.2x to III and V (2.48±0.24) longest and almost 3.35x to II; the latter two segments flat and slightly grooved.
medially; total antennal length 8.4±0.9 and covered with small bristles. **Labium** four segmented; I labial segment smallest; II longest and 1.7x to I; III slightly longer than IV; total labial length 5.8±0.33 and extends upto II or III abdominal segment.

**Pronotum** (Fig. 20b) convexed at base, anterior margin slightly sinuated, anterior angles acute while lateral obtuse, distance between lateral pronotal angles (8.11±0.9) 2.27x to that of anterior (3.56±0.25), while central pronotal length (3.55±0.36) subequal to the later; eight spots on surface, 3 somewhat transverse spots near anterior margin, 3 large irregular sized discal spots near base and a single on each lateral pronotal angle.

**Scutellum** (Fig. 20c) with anterior margin almost straight, basally convexed, projecting posteriorly, covered almost whole of the abdomen, apically round, length (9±0.78) 1.3x to breadth (6.91±0.52). Seven spots present on dorsal surface; 6 round spot arranged in pairs located more towards lateral scutellar margins and one elongated present centrally.

**Legs** with fore, middle and hind femora 3.31±0.18, 3.42±0.23 and 4.24±0.24, respectively while fore, middle and hind tibiae 3.35±0.17, 3.34±0.22 and 4.2±0.22, respectively.

**Exterior of metathoracic scent gland** (Fig. 20d) with ostiole oval, peritreme transverse and elevated, grooved medially upto exterior end, evaporatorial surface rugulose and surface seemed distinct from sternum.

**Abdomen** (Fig. 20e) with ventral surface convex medially, breadth (7.13±0.4), almost 1.1x to length (6.42±0.46), spiracles located on lateral sides, and below a pair of trichobothria from III to VII abdominal segments, small hairs distributed all over the surface and more at genital plates.

**Male genitalia** (Fig. 20f-i) having **pygophore** (Fig. 20f) with posterior margin possessed small setae, proctiger oval to quadrangular, patches of strigils at anterior and latero-posterior margins, ventrally cup shaped (Fig. 20g), ventro-lateral pygophoral angles round. **Aedeagus** (Fig. 20h) with phallotheca cup shaped and distally broad, 3 pairs of conjunctival appendages present, I pair completely sclerotized, medially broader with distal end round, II pair semisclerotized, apically membranous, III pair sclerotized and distally tapered; vesica completely sclerotized
and curved dorsally and bears the gonopore. **Paramere** (Fig. 20i) consists of a long broad stem and a curved blade at distal end, the proximal inner edge of the blade beset with dense setae.

**Female genitalia** having **ovipositor** (Fig. 20j) with VIII paratergites small, triangular, fused dorsally; IX paratergites small, inner margin round, unlike VIII paratergites not fused; first pair of gonocoxae large and somewhat quadrangular, small setae on plates. **Spermatheca** (Fig. 20k) with bulb elongated but distally round; distal and proximal pump flanges separated by a distinct pump region; spermathecal dilation large and spherical; within dilation present sclerotized rod through which passed spermathecal duct; proximal spermathecal duct small and narrow.

**Body size:** Female 16.4±0.9 and male 14.01±0.6 long.

**Material examined (NPC):** 7♀♀ and 12♂♂; INDIA: MAHARASHTRA: Pune, 1♂, 14.xii.1918, coll. Fletcher, host unknown. SRI LANKA: Arawa (Madulsima), 900ft, 1♀, 9.xii.1908 (1♂, 11.xii.1908; 1♀, 10.xii.1908; 1♀, 13.i.1909),) coll. T.B. Fletcher, host unknown; Hambantota, 1♀, 4♂♂ (1♂, 16.xi.1907; 1♂, 9.i.1909; 3♂♂, 1♀, 6.ii.1909; 1♀, 7.ii.1909; 1♂, 30.xii.1908), coll. T.B. Fletcher, host unknown; Welibama, 1♂, 21.i.1908, coll. T.B. Fletcher, host unknown.

*Chrysocoris stollii* (Wolff, 1801)

(Fig. 21; Plate. IV, IX & XI)

*Cimex stollii* Wolff, 1801: 48
*Scutellera stockerus* Guerin, 1838: 159, 161
*Callidea stockerus* Westwood, 1842: 48
*Callidea porphyricola* Walker, 1867: 29
*Chrysocoris stollii* Stal, 1873: 21; Distant, 1902: 58

**Body colouration** generally metallic green or dark purplish blue, bear black spots over pronotum and scutellum, ventral surface purplish blue or black with green spots on sternum while abdomen brown to ochraceous, lateral margin pink or purple and black stigmata spots; antenna, III and IV labial segments brown; coxae, trochanters, femora (except apices) I and II labial segment ochraceous, apices of femora, tibia and tarsal segments black, ventrally; minute punctures on body except head, dense towards lateral sides of different body parts.
Head (Fig. 21a) declivent, with breadth (3.6±0.2) 1.4x to length (2.65±0.25), lateral margins near eyes deeply sinuated, tylus extended beyond jugal lobes; preocular distance (1.15±0.1) 1.5x to postocular (0.75±0.8); interocular distance (2.21±0.16) almost 2x to inerocellar (1.13±0.1); and ocelli placed closer to eyes than to each other; two fascias from anterior to middle, another from base to middle of the head and one oval spots located near to each eye, lateral surface wrinkled. Antennae five segmented, ventrally located on head, near to eyes; I antennal segment (0.88±0.05) never extended beyond apex of head; II (0.37±0.05) smallest amongst all and only 0.4x to I; III (1.77±0.1) 4.8x to II; IV (2.31±0.11) 1.4x to III; V (2.49±0.1) slightly longer than IV; total antennal length 7.84±0.41; small hairs present (except I and II segment). Labium four segmented; I segment smallest (0.89±0.1); II longest (1.89±0.2) and 2.1x to I; III (1.45±0.08) and IV (1.31±0.09) subequal and almost 0.7x to II labial segment; total labial length 7.83±0.32 and extended upto II abdominal segment.

Pronotum (Fig. 21b) with base convexed, distance within anterior pronotal angles (3.56±0.41) subequal to breadth of head (3.6±0.2), and 0.47x to lateral angles (7.57±0.74), latter obtuse, possessed eight black spots on the surface, 3 small spots near anterior pronotal margin while 3 large, subquadrate or irregular sized spots at disc, extended to posterior pronotal margin and one round shaped at each lateral pronotal angle.

Scutellum (Fig. 21c) slightly convexed at base; covered almost whole of the abdomen, length (8.25±0.78) 1.22x to breadth (6.76±0.33), seven spots present on the surface, 6 in pairs, round to oval shaped, placed more towards lateral margin, one oblong V-shaped at middle, dense punctuation toward lateral sides.

Legs with fore, middle and hind femora 3.08±0.21, 3.27±0.11 and 4.22±0.24, respectively while fore, middle and hind tibiae measured 3.27±0.19, 3.15±0.15 and 4.48±0.26, respectively.

Exterior of metathoracic scent gland (Fig. 21d) with ostiole large oval, peritreme transverse with distal end curved and extended upto lateral margin of evaporatoria, grooved medially through out the length; evaporatoria extended upto half of the mesothoracic segment, surface rugulose with minute and dense punctations.
Abdomen (Fig. 21e) with almost equal in its length (6.71±0.41) and breadth 6.58±0.53, ventrally convexed; round to subquadrate stigmatal plate from II to VI segment at each lateral side; a pair of spiracles present from III to VII segments at each lateral side and just posterior to it a pair of trichobothria present. In case of female abdomen III to VII segment toothed or spined posteriorly on lateral side.

Male genitalia (Fig. 21f-h) having pygophore (Fig. 21f) with dorsal border semicircular; bearing patch of strigil, laterally on each side and another such patch extended along lower side of dorsal border; ventral margin flattened, bearing scattered setae; proctiger ovate with scattered setae. Aedeagus (Fig. 21h) with phallosome not heavily sclerotized, 3 pairs of conjunctival appendages present, first pair flattened and apically spinose, second pair membranous but apices sclerotized, third pair long, proximal half not sclerotized but, distal half strongly sclerotized; vesica curved apically, basally attached to ejaculatory reservoir. Paramere (Fig. 21i) highly sclerotized, dorsally hook shaped and bear a tuft of setae at the base of hook and stem stout.

Female genitalia (Fig. 21j-k) having ovipositor (Fig. 21j) with VIII paratergites triangular, posterior margin almost straight; IX paratergites comparatively small and in lobe shaped; medial end round; first pair of gonocoxae sub quadrate, posterior margin slightly sinuated. Spermatheca (Fig. 21k) with bulb apically round, distal and proximal pump flanges disc shaped, distal comparatively bigger than proximal; pump not sclerotized; distal spermathecal duct smaller than proximal duct; spermathecal dilation oblong and membranous; sclerotized rod distinct.

Body size: Female 15.6±0.32 and male 13.6±0.32 long.


**Genus Eucorysses** Amyot and Serville, 1843

*Eucorysses* Amyot & Serville, 1843: 31  
Type species by monotypy: *Eucorysses pallens* Amyot & Serville, 1843 (= *Cimex grandis* Thunberg, 1783)

**Diagnosis:** Generally pale yellow to brown coloured; large sized, more than 18mm, lateral margin of head moderately sinuated, lateral pronotal margins almost straight; scutellum and abdomen oval shaped; metathoracic scent gland with well developed ostiole and peritreme; tibiae entirely sulcated, strigil present on genital capsule; spermatheca with apical end globular, spermathecal dilation present.

*Eucorysses grandis* (Thunberg, 1783)  
(Fig. 22; Plate. V, IX & XII)

*Cimex grandis* Thunberg, 1783: 43  
*Cimex baro* Fabricius, 1798: 528  
*Calliphara iris* Germar, 1839: 128  
*Eucorysses superbus* Uhler, 1860: 221; Kirkaldy, 1909: 295  
*Callidea distinguenda* Uhler, 1861: 286; Kirkaldy, 1909: 295  
*Chrysocoris grandis* Stal, 1873: 21; Distant, 1902: 54

**Body colouration** yellow to dark orange or brown with very fine punctures over pronotum and scutellum; antennae and labium black while coxae, trochanters, femora, tibiae and all tarsal segments are also black but with violaceous tinge, basal area of head to eyes and medially extended broadly beyond half length of head, then narrowed down before apex and head; punctations fine and sparse but dense on pronotum and scutellum.

**Head** (Fig. 22a) porrect, lateral margins slightly sinuated; tylus surpasses the jugal lobes; breadth (4.68±0.22) 1.15x to length (4.07±0.17), preocular distance (2.01±0.4) 2.6x to postocular; eyes small not protruded laterally, interocular distance (2.74±0.6) 1.65x to interocellar (1.66±0.33) and placed more closer to eyes than towards each
other Antennae five segmented, ventrally located, near to eyes, I antennal segment (1.35±0.15) never extended beyond apex of head; II smallest (0.51±0.11) and 0.38x to I segment; III (3.78±0.23) 7.4x to II while IV (4.46±0.23) and V (4.4±0.15) subequal; total antennal length 14.5±0.65. Labium four segmented, I labial segment smallest (1.68±0.15); II longest (3.74±0.15) and 2.23x to I; III slightly smaller than II while IV 1.7x to I segment; total labial length 11.74±0.53 and extended upto III abdominal segment.

Pronotum (Fig. 22b) convexed at base, anterior margin straight or slightly sinuated, lateral margins straight, breadth within anterior (4.6±0.46), almost 0.37x to posterior breadth (12.32±1.15), and latter 2.2x to medial length (5.66±0.62); a black spot from base of half of the length present but, in some individual it is obsoleted.

Scutellum (Fig. 22c) medially convexed, covered whole of the abdomen, breadth (10.28±1.59) 1.5x to length (15.82±1.47), basal margin convex while apical round, 3 discal spots, 1 oval at centre of the base and one subquadrate spot located before middle, adjacent to lateral margin and extended towards centre; some specimen possessed small spot near antero-lateral angles.

Legs with fore, middle and hind femora 4.84±0.4, 5.5±0.3 and 7.02±0.24, long respectively while respective tibiae 5.18±0.25, 5.2±0.35 and 6.76±0.23 long; small and dense hairs distributed over tibial and tarsal segments.

Exterior of metathoracic scent gland (Fig. 22d) with ostiole oval, peritreme transverse, exterior end of peritreme raised from evaporatorial surface, grooved near to ostiolar region, evaporatorial surface black and rugulose, extended upto mesothoracic segment.

Abdomen (Fig. 22e) elongated, oval shaped and medially convexed; length (12.76±1.31) 1.13x to breadth (11.26±1.47), a spiracle located on each lateral side from III-VII segments and also on VIII paratergites; a pair of trichobothria located posterior to each spiracle except, VIII paratergites; ventral surface of abdomen devoid of any punctations; very small and sparse pale coloured hairs present.

Male genitalia (Fig. 22f-i) with pygophore (Fig. 22f) bearing strigil on dorso-posterior surface, ventral and ventro-lateral margins slightly sinuated, proctiger oval; dorso-lateral margins convexed. Aedeagus (Fig. 22h) with phallotheca highly
sclerotized, first pair of conjunctival appendages slender, sclerotized, second pair long, divided into two parts; first part membranous, flattened, second part sclerotized proximally, pouch-shaped distally, third pair slender, bilobed, heavily sclerotized; vesica broad before gonopore and apically toothed. **Paramere** (Fig. 22i) apically hook-shaped, stem much elongated, cylindrical and stouter than blade, connected with a membranous part; bearing a tuft of setae at the base of hook.

**Female genitalia** (Fig. 22j-i) with **ovipositor** (Fig. 22j) having VIII paratergites triangular, separated medially, each paratergite with a spiracle, located at basal inner angle; IX paratergite small, triangular and narrow; first pair of gonocoxae broad, subquadrate with inner margin slightly curved, apices round. **Spermatheca** (Fig. 22i) with bulb large, apex round constricted near middle; distal flange of pump flattened while proximal notched, distal and proximal spermathecal ducts almost equal; spermathecal dilation elongated or spindle shaped with many longitudinal folds.

**Body size:** Female 27.85±1.2 and male 24.02±0.34 long.


**Genus Lamprocoris** Stal, 1865

*Lamprocoris* Stal, 1865: 34; Schouteden, 1904: 27
Type species by subsequent monotypy (Stal, 1866): *Lamprocoris lateralis* (Guerin-Meneville, 1838: 159)

**Diagnosis:** Body colour variable, with blue green to brown-orange; lateral margins of head sinuated before eyes, the second antennal segment slightly smaller than third, but third segment not double or more than double to II segment, some individual with their lateral pronotal angle produced laterally in spine; metathoracic scent gland with well developed ostiole and peritreme; thoracic sternum and abdomen ventrally

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without any sulcation, scutellum U-shaped; lateral margin of abdomen not completely covered by scutellum, spermathecal dilation present.

**Key to species**

1. Body indigo blue or metallic green, lateral margins of head slightly sinuated; lateral pronotal angles obtuse; lateral margins of each abdominal segment normal; spermathecal bulb elongated with apex quadrate, spermathecal dilation globular with anterior and posterior surface suppressed; phallotheca small and quadrate, paramere with apex end blunt........roylii

1'. Body reddish ochraceous or violaceous, lateral margins of head deeply sinuated; lateral pronotal angles spinose, lateral margins of each abdominal segment medially constricted and appear as bilobed; spermathecal bulb elongated with apex round; spermathecal dilation oval; phallotheca comparatively large and broad; paramere with apex spinose..............spiniger

*Lamprocoris roylii* (Westwood, 1837)

(Fig. 23; Plate. V, IX & XII)

*Callidea roylii* Westwood, 1837: 16
*Callidea histeroides* Walker, 1867: 28
*Callidea scripta* Walker, 1867: 28
*Callidea gibbula* Walker, 1867: 28
*Lamprocoris roylii* Distant, 1902: 63

**Body colouration** metallic green or indigo blue; antennae and labium brown to black; lateral margins of abdomen and pronotum red, abdomen beneath green or bluish black, legs black with metallic green tinge; blue or black spots over pronotum and scutellum, fine and dense punctations on dorsal as well ventral surface; **Head** (Fig. 23a) small, lateral margins sinuated before eyes, tylus generally longer to jugal lobes or sometime equal, breadth (2.5±0.09) 1.3x to length (1.9±0.11), preocular distance (0.9±0.14) 1.6x to postocular (0.5±0.08); interocular distance (1.6±0.1) 1.8x interocellar (0.9±0.06); eyes protruded laterally and touched anterior pronotal angles.

**Antennae** five segmented, ventrally located on head, near to eyes; I antennal segment (0.61±0.06) longer than II; II segment smallest (0.49±0.02) and 0.8x to I; III (0.86±0.07) 1.76x to II; IV (1.2±0.12) 1.4x to III; V segment longest (1.7±0.1) and 1.4x to IV; total antennal length 4.85±0.4; hairs present sparsely on first two segments and densely on III-V segment. **Labium** four segmented; I labial segment smallest (0.68±0.048); II (1.4±0.1) almost 2.13x to I; while III (0.9±0.07) 0.6x to II; IV (1±0.05) 1.1x to III; total labial length (4±0.27) and extended beyond posterior coxae.
**Pronotum** (Fig. 23b) convexed at base, anterior margin slightly sinuated with prominent antero-lateral angles, pronotal lateral margins straight; lateral pronotal angles big and obtuse, distance between lateral angles (6.9±0.3) 2.5x than anterior pronotal angles (2.7±0.09) and almost 2x to medial length (3.5±0.11); seven bluish black spots with different shapes located on dorsum of pronotum, 3 spots of variable sized on each lateral side and one long medial spot extended within base to subapical part of pronotum.

**Scutellum** (Fig. 23c) more or less round shaped, covers almost entire abdomen except lateral sides of abdomen, slightly convexed at base; breadth (6.6±0.31) 1.3x to length (5±0.5); ten spots on the surface, 2 adjacent to anterior margin more towards antero-lateral angle, 1 medial, towards basal part, 1 pair of broad band like transverse located centrally on disc, 1 just below it and adjacent to lateral margins, 2 round spots in pair and 1 oval spot subapically, punctures dense and regular.

**Exterior of metathoracic scent gland** (Fig. 23d) with ostiole elongated and opened into transverse peritreme which is medially grooved through out length, exterior end elevated, surface is black, evaporatorium grayish black, wrinkled and extended to mesothoracic segment.

**Legs** with fore 2.6±0.17 and middle 2.9±0.11 femora longer to its corresponding tibiae (3.3±0.16 and 2.4±0.14, respectively); while in case of hind leg, tibia (3±0.16) longer than femur (2.4±0.11); small hairs present, more densely on tibiae and tarsomeres.

**Abdomen** (Fig. 23e) convexed ventrally, breadth (5±0.52) 1.36x to its length (6.7±0.21), I-IV intersegmental suture of abdomen almost straight while V-VI strongly convexed anteriorly; small and sparse punctures on ventral surface, a spiracle located from III to VII abdominal segment on each lateral sides and a pair of trichobothria located posterior to each spiracle.

**Male genitalia** (Fig. 23f-i) having **pygophore** somewhat rectangular in outline, dorso-posterior pygophoral margin (Fig. 23f) slightly concave, latero-posterior margins toothed, inner surface possess setae, ventral margin (Fig. 23g) semicircular, setae present on margins as well as surface; proctiger oval and bilobed. **Aedeagus** (Fig. 23h) with phallotheca cup shaped, distally more flattened and somewhat pointed.
on dorsal side, a pair of strongly sclerotized process present which is produced laterally, I and II pair of conjunctival appendages fused basally, basally membranous and broad, apically tapered into strongly sclerotized curved or hooked shape spine, and dorso-posterior end sclerotized, one pair of conjunctival lobes, apically sclerotized and produced in spine; its margins toothed; II pair sclerotized and rod like, III pair of conjunctival appendages absent; vesica curved and pointed distally. **Paramere** (Fig. 23i) semisclerotized, stem elongated, cylindrical, not strongly sclerotized, blade curved on inner side, apically blunt and strongly sclerotized, setae present at the base of blade, stem elongated and cylindrical.

**Female genitalia** (Fig. 23j-k) having **ovipositor** (Fig. 23j) with VIII paratergites triangular, posterior margin straight widely separated towards centre; IX paratergites thumb like, end towards middle round; first pair of gonocoxae large and triangular with lateral margins round, posterior margin almost straight, surface depressed medially; small setae distributed on the plates. **Spermatheca** (Fig. 23k) with bulb elongated, apically round; distal pump flange small and disc shaped, proximal flange indistinct; distal spermathecal duct globular at base of pump region; distal and proximal spermathecal duct subequal, proximal almost 2 twice broader than distal, spermathecal dilation spherical but depressed at both surfaces; sclerotized rod absent.

**Body size:** Female 12.36± 0.67 and male 11.30±0.19 long.

**Lamprocoris spiniger** Dallas, 1849
(Fig. 24; Plate. V & XII)

*Callidea spiniger* Dallas, 1849: 186
*Lamprocoris spiniger* Distant, 1902: 64

**Body colouration** ochraceous or reddish ochraceous, head dorsal and ventral, lateral pronotal margins of pronotum, ventral surface of pronotum, base of scutellum and sometime apices of femora as well as tibiae brassy green with, I and II antennal segment brown with reflection of green while rest of the antennal segment and labium brown; lateral abdominal margins reddish, body regularly punctated.

**Head** (Fig. 24a) with breadth (3.57±0.13) 1.25x to length (2.9±0.18), lateral margins deeply sinuated before eyes; tylus extended beyond jugal lobes, latter apically subquadrate; preocular distance (1.37±0.09) 1.6x than postocular (0.85±0.06); interocular distance (2.37±0.12) 1.7x to interocellar (1.4±0.08) and closely situated to eyes than to each other. **Antennae** (Fig. 21b) five segmented, located ventrally on head, near to eyes; I antennal segment (0.95±0.05) never extended beyond apex of head, II smallest (0.8±0.81) and only 0.8x to I, III (1.53±0.3), 1.9x to II, IV (2.3±0.27), 1.5x to III, and V (2.45±0.13) generally longest or subequal to IV segment, total antennal length 8.02±0.6; small hairs distributed on all antennomeres.

**Labium** four segmented; I labial segment smallest (1.2±0.08); II longest (1.97±0.09) and 1.6x to I; III (1.55±0.06) and IV (1.47±0.09) long; total labial length 6.2±0.2 and extended beyond posterior coxae.

**Pronotum** (Fig. 24c) convexed, anterior pronotal margin deeply sinuated, angles pointed anteriorly; antero-lateral margins reflexed, straight or slightly curved, anterior part possessed prominent green or violaceous callus marking; lateral pronotal angles spined and produced transversely, distance between lateral angles (11.2±0.43) almost 3x to the anterior angle (3.95±0.13), and 2x to medial pronotal length (5.42±0.17); thick punctation on the surface except anterior region.

**Scutellum** (Fig. 24d) convexed, oval in shape, lateral margins round, with apex round and broad, basal angles in fold, scutellar length (10.47±0.22) slightly more than its breadth (9.22±0.17), covered whole of the abdomen except lateral sides.
Legs normal, length of tibiae more than their corresponding femora except in case of fore legs; length of fore, middle and hind femora 3.95±0.13, 4.37±0.09 and 5.3±0.08, respectively while fore, middle and hind tibiae measured 4.12±0.15, 4.07±0.09 and 5.05±0.06, respectively.

Exterior of metathoracic scent gland (Fig. 24c) with ostiole elongated and narrow, peritreme transverse and curved towards exterior end, grooved through out the length, evaporatorium black, extended to the basal region of mesopleuron, surface wrinkled.

Abdomen (Fig. 24f) ventrally convexed; breadth (8.87±0.33) subequal or slightly more than length (8.2±0.32); each segment slightly or deeply convexed and every sternum sinuated or depressed on lateral side; a single spiracle located laterally on III to VII segments and a pair of trichobothria just below each spiracle.

Male genitalia (Fig. 24g-j) with pygophore (Fig. 24g) having dorso-posterior margin notched medially, lateral pygophoral margins almost straight, ventro-posterior margin arcuate medially (Fig. 24h); proctiger globular; dorsal as well as ventral pygophoral surfaces covered with small hairs. Aedeagus (Fig. 24i) long, phallotheca bowl shaped, distally more broad, strongly sclerotized; I and II pairs of conjunctival appendages form a single structure, basally membranous and broad and apically tapered and completely sclerotized, III pair distinct, basally broad and medially toothed, apically sclerotized and pointed; vesica distally much broader, tapering into gonopore. Parameres (Fig. 24j) with almost straight, strong and cylindrical stem, blade curved on its inner side, setae present at base of blade.

Female genitalia (Fig. 24k-l) having ovipositor (Fig. 24k) with VIII paratergites triangular and comparatively larger than IX paratergites, posterior margin straight; IX paratergites medially separated; first pair of gonocoxae large, lateral margins narrow, posterior margin clefted towards inner side; small and sparse setae present on plates. Spermatheca (Fig. 24l) with bulb elongated, apically round, subapically somewhat constricted; distal and proximal pump flanges disc shaped, pump sclerotized except basally, distal and proximal spermathecal duct almost of same length but latter more broader, approximately 1.5x to distal, spermathecal dilation big and ovate, membrane with light and dark bands in zigzag pattern.

Body size: Female 19.3 and male 18.1 long.

Genus Poecilocoris Dallas, 1848

Poecilocoris Dallas, 1848: 100; Stal, 1864: 33; Mayr, 1866: 17; Schouteden, 1904: 20
Poecilochroma White, 1842: 84
loglena Stal, 1873: 12; Kirkaldy, 1909: 305

Type species by monotypy Cimex drurai Linnaeus, 1771: 534

Diagnosis: Body pale yellow to orange-red to brown with black spots, dorsally round to ovate with strongly convexed pronotum and scutellum; lateral margins of head generally sinuated, tylus longer than jugal lobes; antennae always five segmented, I segment never extended beyond apex of head, labium of variable length and always extended beyond posterior coxae; anterior pronotal margins deeply sinuated, scutellum round to ovate covered whole of abdomen, connexiva slightly exposed at repose; metathoracic scent gland ostiole with well developed ostiole and transverse peritreme; evaporatorium extended up to mesothoracic segment; ventrally abdomen furrowed slightly up to middle of length; females with eighth paratergites always with spiracle, spermatheca bulb elongated and bent at different length and angle, proximal and distal flanges always developed, spermathecal dilation double walled; in case of males, ventro-posterior margin of pygophore always with slight to deep sinuation, phallotheca in tubular shape, parameres apically bifurcated.

Key to species

1. Body bluish black with red strips on pronotum, scutellum and ventral surface of abdomen; body moderately convexed; labium extended up to posterior coxae; dorso-ventral margin of pygophore broadly sinuated ................................................................. interruptus

1'. Body pale yellow to orange brown; body strongly convexed; labium extended beyond posterior coxae; dorso-ventral margin of pygophore moderately sinuated ........................................2

2. Phallotheca strongly sclerotized, with basal part narrow while apically broadened, assuming cup shape; 2nd pair of conjunctival appendages apically hammer shaped .................................................. hardwickii

2'. Phallotheca not strongly sclerotized; elongated and tubular shaped of the same thickness or broadened medially; 2nd pair of conjunctival appendages not hammer shaped ........................................3
3. Pronotum always with four spots, 2 at anterior pronotal and 2 adjacent to posterior margin; distal part of abdomen without any remarkable spot; apical part of distal spermathecal duct broader, almost 4x to basal part........................................latus

3'. Pronotum not with four spots; ventral surface of abdomen always with remarkable spots; apical part of distal spermathecal duct almost of the uniform thickness throughout the entire length..................................................................................................................4

4. Pronotum with a transverse black band, extended between anterior pronotal angles; spermathecal bulb elongated .................................................................druraei

4'. Pronotum with a transverse black band, extended between lateral pronotal angles through anterior margin spermathecal bulb bent apically..................................................5

5. Lateral margins of head almost straight .......................................................rufigenis

5'. Lateral margins of head deeply sinuated.....................................................6

6. Lateral pronotal angles broadly obtuse; scutellum with 11 spots; 1 spot at middle of the base in roughly w-shaped; spermathecal bulb remarkably bent almost at middle and at an angle of 90°................................................................................................................ornatus

6'. Lateral pronotal angles not broadly obtuse; scutellum with 9 spots; spermathecal dilation oval and bulb slightly curved at middle....................lewisi

**Poecilocoris druraei** (Linnaeus, 1771)

(Fig. 25; Plate. V & XII)

*Cimex druraei* Linnaeus, 1771: 534

*Poecilocoris druraei* Dallas, 1848: 103; Distant, 1902: 45

*Poecilocoris obsoletus* Dallas, 1848: 104

*Poecilocoris drurayi* Lethierry & Severin, 1893: 20

*Poecilochroma drurayi* Stal, 1873: 12

*Poecilocoris heissi* Ahmad and Kamaluddin, 1982: 271

**Body colouration** orangish red dorsally with black spots, head (dorsal and ventral), antennae, labium, sternum (except lateral margins of pro sternum), legs and abdomen (except middle part) black, rest of parts red; eyes and ocelli pale brown; body possessed small pale hairs.

**Head** (Fig. 25a) tapered anteriorly, with breadth (3.9±0.16)1.2x to the length (3.3±0.17), lateral margins slightly sinuated and reflexed, tyulus withapex pointed, longer than jugal lobes, preocular distance (1.7±0.8) 2.1x to postocular (0.8±0.05); interocular (2.5±0.11) 2.1x to interocellar (1.2±0.05), surface punctuate but densely towards lateral margins and near to eyes. **Antennae** five segmented, ventrally located on head near to eyes; I antennal segment (1±0.06) extended beyond apex of head; II smallest (0.72±0.08) and 0.7x to I; III (2.1±0.2) 3x to II; IV (2.4±0.25) and V (2.5±0.12) subequal; total antennal length 8.8±0.72, small pale hairs distributed on
antennomeres. **Labium** four segmented, I labial segment smallest (1.3±0.14); II longest (2.85±0.16) and 2.2x to I; III (2.5±0.11) 0.9x to II; IV (2.2±0.08) 1.1x to III; total labial length 8.9±0.34 and extended upto IV abdominal segment.

**Pronotum** (Fig. 25b) convexed at base, anterior pronotal margin deeply sinuated, anterior angles toothed; antero-lateral pronotal margins obliquely straight and reflexed; distance within lateral angles (10.4±0.66) 2.5x to anterior (4.1±0.16) and medial length (4.2±0.23); a continuous black band within anterior lateral angles through anterior margin and two big subquadrate spot present, more towards posterior margin.

**Scutellum** (Fig. 25c) convexed basally, not covering whole of the abdomen. connexivia exposed; length (11.2±0.6) 1.2x to breadth (9.5±0.7) lateral scutellar margins round; apex narrow and round; 11 spots, one broad spot of irregular shape at anterior margin, one at each antero-lateral angles, one at middle on each lateral sides. 6 in pairs on either side of mid-dorsal scutellar line.

**Exterior of metathoracic scent gland** (Fig. 25d) with ostiole round and sunken open in black transverse peritreme grooved through entire length; evaporatorium grayish black and extended upto mesothorax.

**Legs** with fore, middle and hind femora 3.8±0.06, 4.3±0.26 and 5.25±0.35, respectively and tibiae 4±0.07, 4±0.17 and 5±0.31 long, respectively.

**Abdomen** (Fig. 25e) flattened ventrily, breadth (10.25±0.5) 1.2x to length (8.6±0.12); medially anterior margin sulcated; abdomen sulcated medio-longitudinally upto IV or V sterna; inter segmental sutures curved; a spiracle on eah lateral side from III to VII segment and also on VIII paratergite, and a pair of trichobothria below each spiracle except VIII paratergite.

**Male genitalia** (Fig. 25f-i) with **pygophore** as long broad (Fig. 25f), dorso-median surface inpushed, dorso lateral lobes (Fig. 25g) with sub acute apices at inner margins, proctiger oblong and apically rounded. **Aedeagus** (Fig. 25h) with a pair of semi sclerotized conjunctival lobes, apically round, a pair of rod like thecal appendage present; vesica funnel shaped and possessed small lateral projections. **Paramere** (Fig. 25i) robust and strongly sclerotized stem broad medially and grooved on inner side, a tuft of setae at the base of blade, apex of blade bifurcated distinctly.
Female genitalia (Fig. 25f-g) having ovipositor (Fig. 25f) with VIII paratergites triangular, not meeting centrally posterior margin straight, a spiracle present on inner basal angle; IX paratergites comparatively small and triangular, medially distinct; first pair of gonocoxae subquadrate, inner margin convexed; small setae present on plates but more on posterior margins. Spermatheca (Fig. 25g) with bulb long and simple, apex round; distal pump flange larger than proximal, latter disc shaped; pump region with base bulbous, distal spermathecal duct narrow at base but widened distally; spermathecal dilation round, proximal spermathecal duct uniformly thick and only 0.75 x as long as distal one.

Body size: Female 19.6±1.07 and 18.2±0.15 long.

Material examined (NPC): 5♀ and 2♂ INDIA: MEGHALAYA: Khasi hills (5000 ft), 1♀, vii.1929, coll. D. P. Singh, host unknown; Shillong (5000 ft), 2♀♂, 1♂. vi.vii.1918, coll. Fletcher, host unknown; Shillong (4900 ft), 1♀, 31.v.1918, coll. Y.R. Rao, host unknown; Shillong, 1♂, 10.vi.1920, coll. Fletcher, host unknown. NEPAL: Kathmandu; 1♂, 1967; coll. M.M.S; host unknown.

**Poecilocoris hardwickii** (Westwood, 1837)

(Fig. 26; Plate. VI, IX & XII)

*Tectocoris hardwickii* Westwood, 1837: 13; Dallas, 1851: 13; Distant, 1902: 45

*Pachycoris nepalensis* Herrich and Schaeffer, 1839: 339; Dallas, 1851: 13

*Scutellera hardwickii* Germar, 1839: 135; Dallas, 1851: 13; Distant, 1902: 45

*Poecilocoris hardwickii* Dallas, 1848: 107; Dallas, 1851: 13

*Poecilocoris anisopilus* Walker, 1867: 9; Distant, 1902: 45

Body colouration above yellowish-orange or red; head above and beneath shiny black or violaceous blue; antennae, labium and legs dark brown to black, ocelli brown or red, sternum except lateral margins and I to III and medial part of VII abdominal segment black while lateral margins of sternum and rest of abdominal segments red.

Body rather thickly and finely punctured.

Head (Fig. 26a) anteriorly produced; breadth (4±0.08) 1.1x to length (3.5±0.19), lateral margins sinuate near eyes; tylus extended beyond jugal lobes, preocular distance (1.9±0.12) 1.9x to postocular (1±0.17); ocelli placed more closer to eyes than to each other; interocular distance (2.6±0.09) 2.3x to intercellar distance
Antennae five segmented, I antennal segment 1.33±0.16 long; II smallest (1±0.05) and 0.8x to I; III (3.2±0.17) and 3.2x to II; IV (3.4±0.14) slightly longer than III while V longest (4±0.17) and 1.2x to IV; total antennal length 12.5±0.45. Labium four segmented; I labial segment smallest (1.5±0.14); II longest (2.9±0.09) and 1.5x to I; III (2.32±0.17) and IV (2.33±0.1) subequal and 0.8x to II, extended upto IV abdominal segment.

Pronotum (Fig. 26b) with anterior margin deeply sinuated, anterior angles distinctly toothed, antero-lateral margins reflexed; postero-lateral margins smooth; lateral angles obtused; distance within lateral pronotal angles (12.7±0.5) 2.35x to anterior and 2.2x to medial pronotal length (5.4±0.3); two large, oval black spots on disc and one transverse broad black marking along anterior pronotal margin and also anterior angle narrow band extended along lateral margins.

Scutellum (Fig. 26c) convexed through out the length but more towards base, covered whole of abdomen, apex round and broad, length (14.8±0.64) 1.1x to breadth (13.8±0.5), majority of specimens possessed eleven irregular shaped black spots. three spots of different shape and size located at the base, of which the central one largest, elongated-triangular, a small round one on each side of the apex of this, a transverse row of four across the disc, behind the middle, two intermediate spots largest, and two smaller towards apex, but in some specimens these spots very small sized and two spots obliterated, these spots generally either more or less confluent.

Exterior of metathoracic scent gland (Fig. 26d) with ostiole round and small, peritreme transverse, almost straight, exterior end elevated upward, grooved throughout entire length; evaporatorial surface black and wrinkled, extended upto basal part of mesothorax.

Legs possessed dense hairs, more on tibiae and tarsomeres, length of fore, middle and hind femora 4.9±0.14, 5.72±0.2 and 7.45±0.21, while that of fore, middle and hind tibia 5.57±0.21, 5.7±0.37 and 7.87±0.35, respectively.

Abomen (Fig. 26e) strongly convexed; breadth (12.2±0.93) 1.1x to length (11±0.93), spiracles located near to the lateral margins from III to VII and on VIII paratergites, and a pair of trichobothria below each spiracle except VIII paratergites,
intersegmental sutures in curved but in case of females VI segment in subquadrate shape while in males V-shaped.

**Male genitalia** (Fig. 26f-i) with **pygophore** (Fig. 26f) having posterior margin sinuate, postero-lateral angles round (Fig. 26g), lateral and posterior margins possessed numerous setae, dorso-lateral area also covered with dense setae; proctiger oval. **Aedeagus** (Fig. 26h) strongly sclerotized; phallotheca cup shaped with basal part narrow and apicaly broadened; conjunctival lobes strongly sclerotized except apical part of the II pair of conjunctival appendages; II pair of conjunctival appendages apically hammer shaped; vesica completely sclerotized and apically notched, assuming a hook shape. **Paramere** (Fig. 26i) robust and elongateed, apically stem curved and hooked with apex highly sclerotized and pointed.

**Female genitalia** (Fig. 26j-k) with **ovipositor** (Fig. 26j) with VIII paratergites triangular and sulcated medially; spiracle present at inner basal angle of VIII paratergites; IX paratergites comparatively small and lobe like, first pair of gonocoxae subquadrate, lateral margins somewhat round, inner and posterior margins straight. **Spermatheca** (Fig. 26k) with bulb elongated and slightly depressed at subapical region, apex round; distal pump flange shorter than proximal flange; distal spermathecal duct narrow at base compared to apical end; spermathecal dilation round, proximal duct long and of uniform thickness.

**Body size:** Female 24.35±0.35 and male 23.±25 long.

**Material examined** (NPC): 12♀ and 3♂; INDIA: MEGHALAYA: Khasi Hills (5000 ft.), 2♀♀, v. 1929, coll. D.P. Singh, host unknown; Shillong (5000 ft.), 6♀♂, ix.1917, coll. Fletcher, host unknown; Shillong, Khasi Hills, 2♂♂,vii-x.1919, coll. Fletcher, host unknown; Shillong (5000 ft.), 2♀♀,1♂, 27.viii.1928, coll. Dutt, host unknown.

*Poecilocoris interruptus* (Westwood, 1837)

(Fig. 27; Plate. VI, IX & XII)

*Tectocoris interrupta* Westwood, 1837: 14; Dallas, 1851: 12
*Scutellera interrupta* Herrich-Schäffer, 1839: 73; Dallas, 1851: 12; Kirkaldy, 1909: 306
*Poecilochroma interrupta* Stal, 1873: 13; Kirkaldy, 1909: 306
*Poecilocoris interruptus* Dallas, 1848: 102; Distant, 1902: 48; Kirkaldy, 1909: 306
**Body colouration** dorsally black with greenish tinge and red patches or spots; ocelli red, legs brown (except all tarsal segments) while antennae, labium, peritreme and tarsal segments brown to black; red marking or strips on pronotum, scutellum and abdomen (ventral); punctures on dorsal and ventral surface.

**Head** (Fig. 27a) with breadth (2.6±0.16) 1.2x to length (2.6±0.22), lateral margins sinuated slightly, tylus projected beyond jugal lobes, later subquadrate apically; preocular distance (1.27±0.09) 1.8x than postocular (0.7±0.1); antero-lateral surface wrinkled; interocular space (2.1±0.11) 2x than interocellar (1±0.08); ocelli placed closer to eyes than to each other. **Antennae** five segmented; I antennal segment (1.05±0.1) never extended beyond apex of head, II (0.62±0.07) smallest and 0.6x to I; III (2.1±0.13) and IV (2±0.08) subequal and 3.3x to II while V (2.5±0.12) longest and 1.25x to IV; total antennal length 8.3±0.5. **Labium** four segmented; I labial segment (1.07±0.06) smallest; II longest (1.9±0.07) and 1.8x to I; III (1.4±0.1) and IV (1.3±0.1) subequal and almost 1.25x to I; total labial length 5.7±0.33 and extended upto posterior coxae.

**Pronotum** (Fig. 27b) with anterior margin sinuated deeply; anterio-lateral angles prominent; antero-lateral margins slightly sinuated and recurved, lateral angles obtuse, postero-lateral margins straight distance within posterior pronotal angles (8.5±0.6) 2.6x to anterior angles (3.3±0.15) and 1.7x to medial length (3.5±0.3); C-shaped red mark on lateral sides of pronotum more towards base and a small pointed mark at middle of the base available. **Scutellum** (Fig. 27c) convexed throughout entire length, more towards apex, anterior margin convex, antero-lateral angles produced anteriorly; lateral pronotal margins straight or slightly round towards apex, widely round and broad at apex; covered almost whole of abdomen except sides of corium slightly exposed; length (8.8±0.4) 1.2x to breadth (7.2±0.3); a central transverse red mark interrupted in the middle and one mark on the apical margin. **Legs** length of fore, middle and hind leg 5.08±0.21, 3.91±0.15 and 3.43±0.25, respectively while fore, middle and hind tarsi 5.46±0.24, 4.1±0.1 and 3.92±0.25, respectively.
Exterior of metathoracic scent gland (Fig. 27d) with ostiole round and deeply situated, exteriorly open in transverse peritreme, grooved throughout the length, lateral end directed upward; evaporatorial surface smooth and extended upto mesothoracic segment.

Abdomen (Fig. 27e) ventrally convexed; breadth (8.9±0.6) 1.2x to length (7.25±0.5); sanguineous or reddish to ochraceous transverse mark on the bases of III to VI abdominal segments and marginal abdominal spots at the apices of the incisures; a spiracle present on each lateral side from 3rd to VII and VIII paratergite and a pair of trichobothria caudal to spiracles except VIII paratergites, abdomen sulcated ventrally at base, in females intersegmental suture between VI and VII sterna convex anteriorly and lateral margins subacute.

Male genitalia (Fig. 27f-i) having pygophore (Fig. 27f) with dorsal surface medially concave, dorso-lateral lobes projecting inward with rounded apices, proctiger ovate,, ventro-posterior margin medially concave. Aedeagus (Fig. 27h) with phallotheca tubular, sclerotozed, without dorsal thecal appendages; one pair of semisclerotized dorsal conjunctival appendages, apically membranous; one pair of sclerotized spine-like ventral thecal appendages available; vesica elongated, but apically narrow and curved. Paramere (Fig. 27i) with short blade having apex acute, curved in hook or sickle shape, stem cylindrical and grooved on inner side, a tuft of setae at the base of blade.

Female genitalia (Fig. 27j-k) with ovipositor having VIII paratergites triangular and possessed spiracle at antero-basal angle, IX paratergites comparatively short and lobe like (Fig. 27j), first pair of gonocoxae triangular, posterior margin straight, postero-medial angles round. Spermatheca (Fig. 27k) with bulb elongated, apically bulbous and medially curved; proximal and distal pump flanges well developed and enclosed an elongated pump region, distal spermathecal duct narrower and longer than proximal duct; spermathecal dilation large and almost round or globular.

Body size: Female 15.5±0.9 and male 14.4±0.64 long.


*Poecilocoris latus* Dallas, 1848

(Fig. 28; Plate. VI, IX & XII)

*Poecilocoris latus* Dallas, 1848: 101

*Poecilocroma lata* Sharp, 1890: 412; Kirkaldy, 1909: 305

*Poecilocoris latus* Distant, 1902: 44

**Body colouration** yellow to orange red with dark green or black spots over pronotum and scutellum; head black, ventrally metallic green or blue, antennae, labium, legs (except basal half of femora) and lateral part of black with bluish hue while rest of the body pale to orange red.

**Head** (Fig. 28a) declivent, tyulus extended to jugal lobes, apically head quadrate, lateral margins slightly sinuated, breadth (4.5±0.12) 1.2x to length (3.8±0.15), preocular distance (2±0.11) 2.35x to postocular (0.85±0.1); ocellus red and placed more closer to eyes than to each other, interocular (2.9±0.2) 2.1x to interocellar (1.4±0.14). **Antennae** five segmented; I anternal segment 1.2±0.04 long; II smallest (1.5±0.15) and 0.95x to I; III (2.7±0.08) 2.3x to II, IV (3.45±0.18) 1.3x to III while V longest (3.8±0.26) and 1.1x to IV segment; total antennal length 12.3±0.48. **Labium** four segmented; I labial segment smallest (1.9±0.22); II longest (3.3±0.08) and 1.7x to I; III (3±0.13) 0.9x to II while IV (2.5±0.17) 0.8x to III; total labial length 10.6±0.3 and extended upto III or IV abdominal segment.

**Pronotum** (Fig. 28b) with anterior margin sinuated deeply; anterior pronotal angles prominently toothed, antero-lateral margins straight, lateral pronotal angles distinctly large and obtuse; distance within lateral pronotal angles (13.6±0.7) 2.8x to the anterior angles (4.8±0.26) and 2.6x to the medial pronotal length (5.3±0.37); posterior pronotal margin not straight, slightly sinuated at both lateral angles; four green or black irregular shaped spots on the surface, anterior two spots comparatively and located at anterior pronotal angles while two large extended from posterior margin to mid of pronotum.
Scutellum (Fig. 28c) ovate, convexed through out the length; anterior scutellar margin convexed with angles small and round, lateral margins curved with apex broad and U-shaped; covered whole of the abdomen, length (14.4±0.54) and breadth (13.9±1.2) subequal; seven spots of irregular shape and size present, two spots small at antero-lateral angles, one smallest at each lateral sides, two spots before apex and one large bilobed at anterior margin.

Legs with fore, middle and hind femora 6.75±0.23, 5.6±0.25 and 4.9±0.15 long, respectively while corresponding tibiae 6.9±0.3, 5.1±0.38 and 5.2±0.1 long.

Exterior of metathoracic scent gland (Fig. 28d) with ostiole, round and small, opened in transverse tube like peritreme, grooved throughout the length; evaporatorial surface wrinkled, minute punctations over surface and extended up to the half of mesothorax.

Abdomen (Fig. 28e) flattened, medio-ventrally sulcated up to VI segment; breadth (13.6±1.3) 1.3x to length (10.5±0.86); a spiracle located on each lateral side from III to VII segment and also VIII paratergites and a pair of trichobothria present, caudal to each spiracle except VIII paratergites.

Male genitalia (Fig. 28f-i) having pygophore (Fig. 28f-g) slightly longer than broad, dorso-median surface concave, lateral margins round, postero-lateral angles round, proctiger quadrangular, setae present on the margins and posterior surface. Aedeagus (Fig. 28h) tubular, a pair of broad, semisclerotized dorsal conjunctival appendages present, membranous at base and apically sclerotized, a pair of thin spine like sclerotized ventral appendages present, vesica short. Paramere (Fig. 28i) with stem broad, blade curved and apically bifurcated, inner surface grooved, tuft of setae present at base.

Female genitalia (Fig. 28j-k) with ovipositor (Fig. 28j) having VIII paratergites triangular shaped, widely separated and with single spiracle on inner corner and more towards lateral margin; IX paratergites comparatively small; first pair of gonocoxae subquadrate, posterior margin slightly convexed. Spermatheca (Fig. 28k) with bulb curved at sub medially, distal pump flange larger as compared to proximal flange, distal spermathecal duct not of uniform thickness, at base narrow but very thick distally, almost 4x, duct constricted before proximal pump flange; spermathecal
dilation oval shaped, membrane striated; proximal spermathecal duct long and narrow with uniform thickness.

**Body size:** Female 24.26±0.74 and male 22.63 long.


*Poecilochroma lewisi* (Distant, 1883)

(Fig. 29; Plate. IX)

*Poecilocoris lewisi* Yang, 1934: 266

*Poecilocoris separabilis* Yang, 1934: 260

**General colouration** dorsally ochraceous or brown, with black spots on dorsum, black spots possess metallic green coloured small spots, ocelli red, I antennal segment, labium except apical end of IV segment and peritreme yellow or orange while rest of the antennal and labial segments brown; ventrally body metallic green with lateral margins yellow, coxae and trochanter yellow, femora yellow with green reflection; tibiae green with black tarsal segments, ventrally abdomen yellow with green stigmatal plates on lateral sides.

**Head** (Fig. 29a) with breadth (4.±0.16) 3.1x to length (3.5±0.19); lateral margins sinuated before eyes; tylus extended beyond jugal lobes, preocular distance (1.7±0.08) more than 1.5x to postocular (1.01±0.14), interocular distance (2.5±0.17) 2.1x to interocellar (1.2±0.08), surface with thick and dense punctations and more towards lateral margins. **Antennae** five segmented; I antennal segment (1.±0.07) never extended beyond apex of head; II smallest (0.8±0.05) and 0.8x to I; III (2.2±0.1) 2.75x to II; IV (2.5±0.08) 1.1x to III while V longest (2.9±0.1) and 1.2x to IV; total antennal length 9.37±0.3. **Labium** four segmented; I labial segment smallest (1.44±0.1); II longest (2.9±0.22) and 1.4x to I; III (2.4±0.11) 0.7x to II while IV (2.1±0.08) 0.9x to III; total labial length 8.9±0.32 and extended upto IV abdominal segment.
Pronotum (Fig. 29b) with anterior margin sinuated; anterior pronotal angles pointed anteriorly, antero-lateral and postero-lateral margins somewhat straight; lateral pronotal angles round, posterior margin also slightly depressed; distance between posterior pronotal angles (10.5±0.6) 2.5x to anterior angles and 2.6x to medial length (4.04±0.25); a continuous brown or black band within lateral angles through anterior margin and two big subquadrate spots present, more towards posterior margin and occupied more than middle area of pronotum anteriorly.

Scutellum (Fig. 29c) dorsally not convexed as in other members of the genus, covered whole of abdomen, anterior pronotal margin convexed, apically subquadrate, length (10.7±0.48) slightly more than breadth (9.75±0.68); nine spots of different shapes and size present on surface, one oblong at each basal angle, one M-shaped confluent medially, adjacent to anterior margin, one oval medially, near to each lateral side, one large and subquadrate adjacent to lateral, sometime they are medially fused and two at apical portion.

Exterior of metathoracic scent gland (Fig. 29d) with ostiole small and oval, peritreme transverse with exterior end upwardly curved; medially grooved, evaporatorium rugulose and extended upto mesothoracic segment.

Legs with hind (5.35±0.3) and middle femora (4.44±0.17) longer to their corresponding tibiae (5.25±0.21 and 4.1±0.25), respectively, while in case of fore leg femur (3.6±0.1) shorter than tibia (3.9±0.22).

Abdomen (Fig. 29e) flattened, with breadth (9.9±0.35) 1.2x to length (8.3±0.26), spiracles present on III-VII abdominal venter and also on VIII paratergites and a pair of trichobothria caudal to each spiracle except VIII paratergites, intersegmental suture between segment VI and VII curved in U-shape; a black subquadrate spot present on III-VI segments, VII segment almost completely black.

Female genitalia having (Fig. 29f-g) ovipositor (Fig. 29f) with VIII paratergites triangular, posterior margin straight, latero-posterior angle pointed, IX paratergites comparatively small and lobe-like; first pair of gonocoxae triangular and large, posterior margin depressed twice. Spermatheca (Fig. 29g) with bulb comma shaped; distal and proximal pump flanges well developed but latter larger than former, distal
spermathecal duct of uniform diameter, spermathecal dilation round; proximal spermathecal duct also possessed almost same length and thickness as distal duct.

**Body size:** Female 18.2±0.91 long.

**Material examined (NPC):** 6♀; INDIA: UTTARAKHAND: Jyolicot, 5♀, 6-7.vi.1915, coll. H.H.P, apricot; Ranikhet (8000 ft), 1♀, 20.vi.1939, coll. H.S. Pruthi, host unknown.

**Poecilocoris ornatus** Dallas, 1851
(Fig. 30; Plate. VI)

*Poecilocoris ornatus* Dallas, 1851: 15; Distant, 1902: 48

**Body colouration:** dorsally orange- yellow to ochraceous, head black; ocelli brown to red, sternum and head beneath golden except lateral margins of prosternum and evaporatorium of metathoracic scent gland; I antennal segment yellow to orange while rest of the segments, labium and all tarsal segment brown; coxa and trochanters ochraceous to brown red, femora and tibia brown with green reflection; abdomen ventrally ochraceous with a large subquadrate golden green spot on lateral sides of each segment.

**Head** (Fig. 30a) with breadth (4.17±0.15) 1.2x to length (3.6±0.2), lateral margins slightly sinuated, tylus distinctly longer than jugal lobes, preocular distance (1.6±0.7) 1.6x to postocular (1.05±0.7), interocular distance (2.5±0.11) 2x to interocellar distance (1.27±0.06); ocelli placed more closer to lateral margin than to eyes. **Antennae** five segmented; I antennal segment (1.07±0.06) never extended beyond apex of head, II smallest (0.85±0.13) and 0.85x to I; III (2.2±0.15) 2.6x to II; IV (2.7±0.1) 1.4x to III while V longest (2.9±0.15) and 1.1x to IV; total antennal length 9.72±0.5. **Labium** four segmented, I labial segment smallest (1.6±0.21); II longest (2.8±0.06) and 1.75x to I; III (2.5±0.1) 0.9x to II while IV (2.2±0.15) also 0.9x to III; total labial length 9.07±0.21 and extended upto V abdominal segment; apical tip of segment possessed conspicuous fine setae.

**Pronotum** (Fig. 30b) with anterior margin sinuated deeply, anterior pronotal angles prominent; antero-lateral margins obliquely straight; posterior pronotal angles obtuse.
posterior margin slightly curved; distance within posterior pronotal angles (11±0.7) 2.5x to anterior (4.4±0.06) and 2.4x to medial length, brown or black confluent patch within lateral margins through anterior margin, two large sub quadrate black spots located on disc more towards base.

Scutellum (Fig. 30c) oval, convexed towards base and covered almost whole of abdomen, basal margin convexed; anterio-lateral angles round, apically ovate and broad, length (11.7±0.3) 1.2x to breadth (9.8±0.2); 11 spots of irregular shape present dorsally, one irregular W-shaped at base, one at each antero-lateral angle, 6 in pairs of variable shapes and size, placed on disc, more towards middle and one small round in middle but near to each lateral margins.

Legs with length of fore, middle and hind femora 3.97±0.05, 4.5±0.1 and 5.87±0.32, respectively while length of fore, middle and hind tibiae 4.17±0.05, 4.3±0.11 and 5.73±0.3, respectively.

Exterior of metathoracic scent gland (Fig. 30d) with ostiole oval, sunken open in black, transverse peritreme, grooved through out the length, evaporatorial surface orange and red coloured, surface wrinkled, extended upto mesothoracic segment.

Abdomen (Fig. 30e) flattened ventrally, breadth (11.03±0.25) 1.36x to length (8.06±0.25); a green sub quadrate spot present spot present from III to VI segments on each lateral side and also on VII, spot on VII segment extended through out segment and medially attained knob shaped; spiracle located on each latera side from III to VII and also on VIII paratergites and caudal to it a pair of trichobothria except VIII paratergites.

Female genitalia (Fig. 30f-g) with ovipositor (Fig. 30f) having VIII paratergites triangular and medially distinctly separated, spiracle present at inner corner, towards lateral margin, posterior margin with small setae, IX paratergites comparatively small and lobe shape (Fig. 30f); first pair of gonocoxae large subquadrate, lateral margins round, posterior margin distinctly sinuated. Spermatheca (Fig. 30g) with bulb curved sub medially, but apically narrowed slightly; proximal pump flange larger as compared to distal pump; distal spermathecal duct not uniformly thick throughout length; spermathecal dilation round and double walled; proximal duct almost of same length as distal but with uniform thickness.
Body size: Female 16.7 and male 15.9 long.

Material examined (NPC): 1♀ and 2♂; INDIA: MEGHALAYA: Shillong (5000 ft), 1♂, vi-vii.1918, coll. Fletcher, host unknown; Shillong (5000 ft), 1♀, 24.v.1924, coll. Bose, host unknown; Shillong, Khasi Hills (5000 ft), 1♂, v.1929, coll. D.P. Singh, host unknown.

Poecilocoris rufigenis Dallas, 1851
(Fig. 31; Plate. VII)

Poecilocoris rufigenis Dallas 1851, 14; Distant 1902, 49
Poecilocoris capitatus Yang, 1934:264

Body colouration dorsally ochraceous or red with green and purple spots on pronotum and scutellum; head brown to black, base and central lobe of head, basal margin of scutellum, antennal segments except I segment, labium, transverse segmental spots to sternum and abdomen, and legs, black or bluish black.

Head (Fig. 31a) with lateral margins slightly sinuated or almost straight, apex round, tyulus longer and projecting beyond jugal lobes, breadth 1.25x to length; preocular distance 2.3x to postocular interocular distance 2x to interocellar; ocelli placed near to eyes than to each other, thickly punctate near to ocelli and lateral margins.

Antennae five segmented; I segment never extended beyond apex of head, II smallest; III almost 3.5x to II segment; IV and V segment mutilated. Labium four segmented; I labial segment smallest; II longest and extended upto VI abdominal segment.

Pronotum (Fig. 31b) with anterior margin deeply sinuated, anterior angles pointed, lateral pronotal margins straight, lateral pronotal angles obtuse or round; distance between posterior angles 2.4x to anterior and 2.3x to the medial length, posterior pronotal margin almost straight; anterior and lateral margins black, two large black subquadrate spots on disc, more towards base.

Scutellum (Fig. 31c) with anterior margin convexed; medially convexed through out length; apex broad and round; length 1.3x to breadth, seven spots present on dorsal surface, one at base, 3 large confluent spots on each lateral side and extended upto middle.
Exterior of metathoracic scent gland (Fig. 31d) with ostiole small and round, peritreme transverse, exterior end slightly elevated, evaporatorial surface extended upto mesothoracic segment, surface wrinkled and with fine punctations.

Abdomen (Fig. 31e) grooved medio-ventrally upto V abdominal segment; breadth 1.2x to length, subquadrate spot on III to VII segment on each lateral side, a spiracle on each lateral side from III-VII and VIII paratergites and a pair of trichobothria posterior to spiracle, except VIII paratergites.

Female genitalia having ovipositor (Fig. 31f) with sparsely distributed setae, VIII paratergites large and triangular with spiracle near each inner corner; medially widely separated and latero-posterior angle pointed, IX paratergites lobe like and comparatively small; first pair of gonocoxae large and subquadrate, posterior margin sinuated.

Material examined (FRI): 1♀; INDIA: UTTARAKHAND: Musoorie: 1♀, vi.1921, coll. F.Z., host unknown.

Genus Scutellera Lamarck, 1801

Scutellera Lamarck, 1801: 293; Dallas, 1851: 4; Stal, 1864: 33; Schouteden, 1904: 22

Type species: Cimex nobilis (non Linnaeus, 1763): Fabricius, 1775 (= Tectocoris perplexa Westwood, 1837: 4

Diagnosis: body oblong and pilose; colouration vary from metallic green to blue with black spots on dorsal and ventral surface. Head triangular and porrect; lateral margins sinuate. First antennal segment never goes beyond apex of head; second smallest, labium extends upto 3rd or 4th abdominal segment. Anterior pronotal margin depressed slightly; anterior angles obtuse; posterior margin produced posteriorly at both sides. Scutellum long and finely punctured; apex truncate. Mesosternum distinctly sulcated, peritreme sickle shaped. Ventrally abdomen furrowed beyond half of the abdomen.

Key to species

1. Scutellum possessed 9 black spots; posterior margin of VIII paratergites almost straight; first pair of gonocoxae subquadrate............................................................fasciata

1'. Scutellum possessed 11 spots; posterior margin of VIII paratergites convexed posteriorly; first pair of gonocoxae triangular shaped .........................................................perplexa
Scutellera fasciata (Panzer, 1797)

(Fig. 32; Plate. VIII)

Cimex fasciata Panzer, 1797: 108; Dallas, 1851: 19
Tectocoris nepalensis Westwood, 1837: 19
Callidea lanius Stal, 1854: 231
Scutellera amethystina Vollenhoven, 1863: 12

Body colouration dorsally metallic bluish- green or purplish, central fascia to head, and spots on pronotum and scutellum black; I antennal, I and II labial segment, coxae, trochanters and femora yellow or ochraceous, rest of the antennal and labial segments, tibia and tarsal segments brown, lateral margins of pronotum bright orange, brown spots on each ventral abdominal segment which extended upto middle; sterna green or blue with lateral margins ochraceous.

Head (Fig. 32a) porrect, lateral margins sinuated before eyes; tylus longer and projected beyond jugal lobe; breadth 1.1x to length; dorsally sulcated; preocular distance 1.7x to postocular; interocular distance 2.1x to interocellar. Antennae (Fig. 32b) five segmented; II antennal segment smallest; I and III subequal while IV longest; small and dense hairs distributed over III to V segment, II possessed sparse hairs while I completely devoid of hairs. Labium four segmented; I labial segment smallest; II longest; extended upto III abdominal segment.

Pronotum (Fig. 32c) with anterior margin sinuated, anterior pronotal angles pointed anteriorly; antero-lateral margins straight but constricted medially; lateral angles obtuse; distance between lateral angles 1.75x to anterior angles and 1.8x to medial length; 5 black spots, one central elongated, from anterior to posterior margin, one round near to each lateral angle and one quadrate from posterior margin to middle; two transverse series of thick and dense punctations, one near to anterior margin and another before middle.

Scutellum (Fig. 32d) elongated, anterior margin almost straight, covered almost whole of abdomen, apical margin of wings exposed; generally 12 irregular shaped and sized spots present, one elongated, medial, extended from base to half of scutellar length, one oval near to base but more towards lateral angles, two round adjacent to each lateral sides, one comparatively larger extended beyond middle, adjacent to
lateral margins and one apical. In some individuals these spots confluent and counted only 10 in number.

**Exterior of metathoracic scent gland** (Fig. 32e) with ostiole small and slit like, opened into sickle shaped peritreme, grooved almost entire length, evaporatorial area small and restricted only to metathoracic region, surface smooth.

**Legs** same as in *Scutellera perplexa*.

**Abdomen** (Fig. 32f) elongated, centrally grooved from base to beyond middle of the abdomen; spiracles present from III to VII segments on each lateral sides and a pair of trichobothria below each spiracles, a greenish black spot on each lateral side and extends to the middle from III to VII segment.

**Female genitalia** with **ovipositor** (Fig. 32g) having dense setae, more on posterior margin; VIII paratergites subquadrate and large and widely separated; latero-posterior angle round; IX paratergites comparatively small, first pair of gonocoxa large and subquadrate; lateral margins somewhat round, inner and posterior margins straight.


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**Scutellera perplexa (Westwood, 1837)**

(Fig. 33; Plate. VIII, IX & XII)

*Cimex nobilis* (non Linnaeus, 1763): Fabricius, 1775: 697
*Tectocoris perplexa* Westwood, 1837: 4
*Scutellera nobilis* Distant, 1902: 51
*Scutellera brevirostris* Breddin, 1909: 258. Synonymized by Distant, 1918: 116

**Body colouration** metallic green or violaceous blue, head, pronotum (except lateral margins), pronotum, head beneath and sternum (except extremity) metallic green or blue, lateral margins of pronotum, peritreme, ventral abdomen (except stigmatal spots) and ocelli red; first antennal segment, coxae, trochanters and femora (except apices) dark orange or red while rest of the antennal segments, apices of femora, tibiae and tarsal segments black with metallic green tinge; labium brown to black.

**Head** (Fig. 33a) porrect, tylus round distally, projected beyond jugal lobes; lateral margins sinuates near eyes; length (3.74±0.31) 0.95x to breadth (3.93±0.16), preocular distance (1.91±0.08) 1.9x to postocular (1±0.06), interocular distance
(2.69±0.11) 1.9x to interocellar (1.4±0.06), two black elongated spot from anterior to posterior end of head; eyes touches the anterior pronotal angles; ocelli red and located near to eyes than to each other. **Antennae** five segmented; I antennal segment (0.99±0.05) never extended beyond apex of head; II smallest (0.73±0.04) and 0.73x to I; III (1.84±0.18) 2.5x to II; IV (2.44±0.22) longest and 1.32x to III while V (2.3±0.11) 0.94x to IV; total antennal length measured 8.3±0.48. **Labium** four segmented, I labial segment smallest (1.68±0.22); II longest (3.13±0.13) and 1.68x to I; III (2.56±0.16) 0.81x to II while IV (2.3±0.14) 0.89x to III; total labial length 9.67±0.53 and extended upto IV or V abdominal segment.

**Pronotum** (Fig. 33b) with anterior margin sinuated, anterior angles acute; antero­lateral margins slightly sinuated; red coloured, lateral pronotal angles big and obtuse, posterior angles produced, distance between lateral angles (8.7±0.65) 2.09x to anterior angles (4.15±0.23) and 1.84x to medial length (4.72±0.33); a row of punctations observed in between anterior pronotal angles and second similar row of punctations observed posteriorly, four black spots in pairs located posterior to second row, of these, former on disc while latter on posterior angles, one elongated median spot extends from anterior to posterior pronotal margin.

**Scutellum** (Fig. 33c) slightly convexed dorsally, anterior margin almost straight, anterior angles simple rounded; lateral pronotal margins almost straight, apex broad, subquadrate; length (11.9±1.04) 1.65x to breadth (7.18±0.61), covered almost whole of abdomen except lateral and posterior part of abdomen; 9 black spots present on scutellum; one long extended from base to almost middle of scutellum and 8 roughly round spots located much before apex, 6 spots arranged in 3 pairs on either side of central elongated spot.

**Legs** with length of fore, middle and hind femora 3.36±0.21, 3.95±0.24 and 5.03±0.36 while fore, middle and hind tibiae 3.92±0.16, 4.23±0.16 and 5.52±0.35 long, respectively.

**Exterior of metathoracic scent gland** (Fig. 33d) with ostiole narrow and slit like, peritreme long and sickle shaped, grooved at least half of length; evaporatorium restricted only to metathoracic region, surface moderately wrinkled.
Abdomen (Fig. 33e) elongated, convexed medially; length (10.3±0.68) 1.25x to breadth (8.2±0.76); distinctly furrowed longitudinally and mid-ventrally extended upto fifth segment, where labium retained when not in use; a pair of trichobothria distinct posterior to each spiracle from III to VII segments, a series of green to bluish transverse spots observed on the ventro-lateral aspects.

Male genitalia (Fig. 33f-i) having pygophore (Fig. 33f-g) with posterior margin possessed two sclerotized spines, ventro-lateral margin straight; dorsal margin semicircular, proctiger elongated with a tuft of setae, thick and dense setae on dorsal as well as ventral surfaces. Aedeagus (Fig. 33h) with phallotheca basally narrow, distally broad, bearing a small spinose process, laterally with sclerotized areas; first and second pair of conjunctival appendages fused into a flat structure, divided into two parts, basal part representing first pair of appendages, membranous, pointed into a blunt sclerotized apex, second portion representing the second pair of appendages, which is also membranous, apically tapering to a sclerotized spine, third pair of conjunctival appendages slender and highly sclerotized; vesica narrow, curved distally, tapered to gonopore. Paramere (Fig. 33i) with stem long, cylindrical uniformly stout, inner margin more sclerotized, hooked at apex, latter pointed and a tuft of setae at apex of stem.

Female genitalia (Fig. 33j-k) having ovipositor (Fig. 33j) with VIII paratergites triangular, narrow, widely separated posteriorly; posterior margin straight, first pair of gonocoxae large, hairy posterior margin somewhat convex, dense setae present on all plates. Spermatheca (Fig. 33k) with bulb apically round and constricted, both the pump flanges distinct, pump narrow; spermathecal duct narrow and spermathecal diation globular.

Body size: Female and male 21.4±1.65 and 19.3±0.88 long, respectively.

Material examined (NPC): 87♀ and 74♂; INDIA: ASSAM, 1♀, v.1913, coll. N.C.D., host unknown; BIHAR: Pusa, 2♂♂, 24.vii.1906, coll. T.R.C., weeds; Pusa, 1♂, 29.iii.1910, coll. H.M.L., host unknown; Pusa, 1♂, 2.viii.1916, coll. H. Singh, weeds; Pusa, 1♀, 16.iv.1913, coll. D.P.S. (1♂, 1♀, 13.vii.1927); Pusa, 1♀, 22.ix.1913, coll. C.B.S., host unknown; Pusa, 1♀, 16.iv.1913, coll. D.P.S. (1♂, 1♀, 13.vii.1927), host unknown; Pusa, 1♀, 22.ix.1913, coll. C.B.S., host unknown; Pusa,

SRI LANKA: Madulsima, 1♂, 23.xii.1908, coll. T.B. Fletcher, host unknown; Uva: Taldana (1000 ft), 1♀, 10. viii.1908, coll. T.B. Fletcher; host unknown; Arawa: Madulsima (900 ft), 1♂, 1♀, 1909, (1♂, 1♀, 26.v.1908), coll. T.B. Fletcher, host unknown.
4.4 Biology of *Scutellera perplexa*

*Scutellera perplexa* was observed as a serious sucking pest of *Jatropha curcas* Linnaeus from Delhi and adjoining areas. This species causes severe damage to foliage and developing fruits. To study the biology, they were observed almost for two consecutive years *i.e.*, between April 2007 and 2009 under laboratory and field conditions. It remained active throughout the year and was observed between July and March. Population density was highest between September and November. The life cycle takes about 63.3±3.07 days; egg period lasted for 6.67±0.87 days with 98.87±2.24 per cent hatchability and nymphal durations of I, II, III, IV and V instar were 5.33±0.82, 7.95±0.68, 6.15±0.91, 7.54±0.76 and 9.69±1.18 days, respectively. A key to the identification of different instars is given. It was observed at Delhi and adjoining areas. Because little was known of its ecology, studies on seasonal activity in the field and bionomics (under field and laboratory conditions) were done between April 2007 and 2009. Results are presented herein.

**Seasonal occurrence:** Adults appeared starting the last week of June or first week of July, and remained active until the following March with reduced activity during extremely hot and cold months. Egg batches and adults were abundant between September and October, with nymphal instars abundant between second week of July and fourth week of August. The bugs migrated to adjacent plants or weeds as and when the leaves dry and fall.

**Mating behaviour** (Plate XIIIb): Copulation started within 14.9±0.77 days (n=11) after emergence of adults and pairs remained in copulation in end to end position (Plate XIIIa) for 2.05±0.49 hours (n=10). Copulation was repeated intermittently for 1.70±0.45 days (n=10).

**Oviposition:** females oviposited 5.95±0.86 days (n=18) after mating and eggs were laid in batches of two rows and these are light yellow (Plate XIIIc); number of eggs per batch was 36.47±6.70 (n=15) with a total fecundity of 68.17±12.51 (n=6). Eggs were laid either on the leaves or muslin cloth (in the laboratory) and under field conditions, egg batches were observed on leaf surfaces (77.5%), petioles (17.5%) and
stems (5.0%). When leaves fall (i.e. December to January), females oviposit in leaf litter (Plate XIIIId) from which neonates emerge (Plate XIIIe-f).

**Duration and description of juveniles and adults**

**Egg** (Fig. 34a-c): eggs were firmly glued by a sticky secretion, and these change from light yellow to orange and bright red just before hatching. Eggs were oblong and measured $1.57\pm0.09 \, \text{mm} \times 1.19\pm0.07 \, \text{mm}$ (n=10). A well chitinized, triangular or T-shaped egg burster with 22-26 chorionic processes was present near the top of each egg shell, and arranged adjacent to the micropylar boundary (Fig. 34a-b). At hatching, the chorion opened distally (Fig. 34c) allowing a cap to separate out, which either remained attached or was completely detached. A few hours $(7.93\pm1.56 \, \text{hrs})$ (n=10) before hatching, eyes of the first instar were observable through the chorion. The incubation stage lasted $6.67\pm0.87 \, \text{days}$ (n=31) with $98.87\pm2.24$ per cent hatchability.

**First instar** (Fig. 34d): these aggregated without any feeding over or near empty chorion for about $1.65\pm0.36 \, \text{days}$ (n=10). Nymphs were rounded, and darkened to light brown before molting (Fig. 34d). They measured $2.21\pm0.22 \, \text{mm} \times 1.73\pm0.05 \, \text{mm}$ (n=10). The head was more or less triangular, transverse, with eyes projecting laterally, ocelli not developed, antennae four segmented and covered with small brown hairs, first antennal segment orange, while remaining segments, coxae and femora brown. Labium four segmented (Fig. 34m), $1.18\pm0.08 \, \text{mm}$ long and reaching posterior end of abdomen. Thoracic segments distinct, with prothorax broadest. Legs with tarsi two segmented, legs and lateral margins of the body covered with small, soft hairs. Abdominal tergites and sternites without any characteristic spots. This instar lasted for $5.33\pm0.82 \, \text{days}$ (n=52).

**Second instar** (Fig. 34e): these were uniformly colored, dorsally head, thorax (except lateral margins) and lateral margins of abdomen black and rest of the body orange to red, measuring $2.98\pm0.25 \, \text{mm} \times 2.21\pm0.19 \, \text{mm}$ (n=10). Eyes reached anterior pronotal angles, ocelli not developed, antennae and labium four segmented, hairy and latter reaching beyond the posterior end of abdomen (Fig. 34e). Anterior margin of pronotum almost straight or slightly depressed medially (Fig. 34n). Legs brown with two tarsal segments black. Two black spots present on abdomen in the middle (Fig.}
34e), anterior rectangular and larger while posterior oblong. Segmentally arranged dorsal and ventral, small, bluish black small spots were observed laterally on abdomen. This instar lasted 7.95±0.68 days (n=44).

**Third instar** (Fig. 34f): body ovate, measuring 4.82±0.47 × 3.48±0.32 mm (n=10). Head (dorsally), thorax (except lateral margins), lateral margins and middle portions of abdomen shiny black, the remainder orange. Two fasciae observed extending to the midpoint from the anterior. Ocelli not developed (Fig. 34f). Antennae and labium four segmented, latter extending considerably beyond the abdomen (Fig. 34o). Legs brown with tarsi two segmented. Middle portion of abdomen with three black spots dorsally, the anteriormost larger, rectangular and notched laterally while intermediate ones were ovate and posterior narrow, band-like and slightly concave. Laterally abdomen with segmentally arranged bluish black spots; ventrally, four brown spots seen on middle abdomen from fourth to sixth segments. A pair of trichobothria were observed just posterior to spiracles from the second to sixth segments (Fig. 34j). This instar lasted 6.15±0.91 days (n=37).

**Fourth instar** (Fig. 34g): pilose, elongate, measuring 7.68±0.76 mm × 5.32±0.52 mm (n=10). Two color morphs occurred, one a combination of black and red, and the other light yellow and brown. In the first morph, head (dorsal), thorax (except lateral margins), middle and lateral portion of abdomen bluish black, the remainder bright red. In the second morph, head (dorsal), thorax (except lateral margins), middle and lateral portion of abdomen brown, the remainder light yellow. A pair of fascia on the head extended from the anterior to nearly the posterior of the head. Eyes protruded laterally, ocelli not developed (Fig. 34g). Antennae and labium four segmented, and the latter extending to the fourth or fifth abdominal segment (Fig. 34p). Pronotum slightly depressed medially. Small wing pads observed extending to the first abdominal segment. Evaporatoria of metathoracic scent glands appeared in this stage. Legs were brown with two- segmented tarsi. Three medial spots were distinct dorsally with a pair of brown ventral spots medially the fourth to sixth segments (Fig. 34k). In addition, segmentally arranged dorsal and ventral bluish-black spots were present laterally. Position and number of trichobothria were similar to those of the
third instar. External genitalia were evident in both sexes. This instar lasted 7.54±0.76 days (n=24).

**Fifth instar** (Fig. 34h): elongate, measuring 12.60±0.56 mm × 8.80±0.44 mm (n=10). Two color morphs were observed similar to the fourth instar and the body coloration for both morphs was similar to that of the fourth instar. A pair of fasciae extended from the anterior to posterior of the head. Eyes more protruding, ocelli not developed, antennae and labium four segmented the latter extending to the third or fourth abdominal segment. Thoracic segments distinct and well developed, anteriorly pronotum more or less straight, wing pads extending beyond the first abdominal segment (Fig. 34h). Evaporatoria of metathoracic scent glands were evident. Legs were brown with two segmented tarsi. Three median spots distinct on the abdomen as in the fourth instar, but slightly larger. Ventrally anterior and intermediate spots much closer, posterior ones fused and ovate (Fig. 34i). Spiracles and trichobothria were the same as in third and fourth instars. External genitalic structure more developed than in the fourth instar. This nymphal stage lasted 9.69±1.18 days (n=38).

**Key to nymphal instars**

1. **Body rounded, uniformly colored; labium extending to posterior end of abdomen; abdominal segmentation indistinct** ................................................................. I instar
2. **Labium extending well beyond the abdomen; wing pads and external genitalia indistinct** ............... 3
2’. **Labium short never extending beyond the fifth abdominal segment, wing pads and external genitalia distinct** ........................................................................................................ 4
3. **Trichobothria indistinct** .......................................................................................................... II instar
3’. **Trichobothria distinct** ......................................................................................................... III instar
4. **Wing pads small, extending only to first abdominal segment, labium extending to fourth or fifth abdominal segment** ................................................................. IV instar
4’. **Wing pads large, extending well beyond first abdominal segment, labium extending to third or fourth abdominal segment** ..................................................................... V instar

**Adult** (Fig. 34i): body oblong, obscurely pilose, metallic bluish green females (19.54±1.09×9.12±0.60, n=10) generally larger than males (18.06±1.10×8.28±0.41, n=10). Head triangular, convex dorsally and declivent. Tylus longer than jugal lobes.
Ocelli present, placed nearer to eyes than to each other. Antennae five segmented, second segment shortest while fourth longest (1: 3.44). Labium four-segmented, extending to third or fourth abdominal segment. Pronotum metallic green or blue, except lateral margins red. A row of punctations between pronotal angles anteriorly and second similar row of punctations posteriorly, four black spots in pairs located posterior to second row, of these, former on disc while latter on the posterior angles, one elongate median spot extends from anterior to posterior (Fig. 7i). Scutellum slightly convexed dorsally, 12.42±1.17 mm (♀) and 11.36±0.61 mm (♂) long, covering abdomen completely, six rounded discal black spots and one median spot present; median spot elongate, extending from base to middle, discal spots in pairs on either side. Ostiole of metathoracic scent glands elongate, near to posterior coxa, evaporatorium red with black outer margin. Coxae, trochanters and femora (except apices) red, apices of femora and tibiae metallic green. Tarsi black and three segmented. Abdomen distinctly furrowed longitudinally on the ventral aspect in middle extending to the fifth segment, where labium rests when not in use, a pair of trichobothria located posterior to each spiracle from the second to sixth segments, a series of green to bluish transverse spots on the ventrolateral aspect. Females and males survived 31.36±4.63 (n=13) and 27.60±7.23 days (n=11), respectively.
DISCUSSION

The present study on the family of Scutelleridae of Pentatomoidea (Hemiptera: Heteroptera) includes 12 genera and 29 species, and a total of 475 specimens of 6 subfamilies have been included. A critical review of the literature on its current taxonomic position and systematic history undertaken. These have led to salient details and these are discussed below accounting for how the Scutelleridae has emerged distinctly as a family, how the fauna studied distributed under the six subfamilies, how the distribution between these subfamilies are valid enough, the generic concepts delineating the 12 genera under which the species fall, and the species diversity how gets characterised in terms of distinguishing characters as revealed from the detailed studies and the redescriptions accomplished now.

5.1 SCUTELLERIDAE AS A FAMILY

Scutelleridae got its family status early as 1860's with the work of Fieber (1861) and Stal (1867). In attempting suprageneric classification of Pentatomoidea there had been always controversies especially in the concepts given by Distant (1902, 1904) and Kirkaldy (1909) when compared to the views of Reuter (1912) and Van Duzee (1917). Thus this family had been variously considered at the suprageneric classification given by Pentatomidae specialists like Pendergrast (1957), Scudder (1959), Kumar (1965) and McDonald (1966). Despite these controversies, the contribution of Gross (1975), Ahmad and Mushtaq (1977), Afzal et al. (1982) and Schuh and Slater (1995) considered as a distinct family.

In deciding and validating Scutelleridae as a family the concepts that have been followed is varying. These variations are mainly on account of considerations with regard to chromosome number, origin of eclosion, variation in shape of egg and micropylar ring. Also, there had been consistent morphological variations which had been attributed to differentiating members of this group and considering them in the form of a distinct family. In doing so it has been observed that presence or absence of ancestral characters has also been regarded (Ahmad and Abbasi, 1974) Scutelleridae was considered a distinct family after the work of McDonald (1966). In fact, the
Zoological Records which is formally looked upon for decisions in this regard started considering Scutelleridae as a distinct family from 1967. Pendergrast (1957), Scudder (1959), Kumar (1965), McDonald (1966), Gross (1975), Ahmad and Mushtaq (1977), Afzal et al. (1982), Schuh and Slater (1995) approved this and this was followed thereafter by many heteropterists. The present study taking into consideration the observations recorded on 29 species under 12 genera in 6 subfamilies corroborates these views. Thus the taxonomic characters of phylogenetic significance substantiate considering Scutelleridae as a distinct family of Pentatomoidea. The detailed observations on the metathoracic scent glands and on the salient features of the male and female genitalia observed in the present study reveal that there are reasons to believe the concepts given by Leston (1958b) and Cobben (1968), and establish further that the Scutelleridae is a stable group at family level.

5.2 SCUTELLERIDAE AND ITS SUBFAMILIES

Twenty nine species studied herein falling under 6 subfamilies namely Elvisurinae, Eurygastrinae, Hoteinae, Odontoscelinae, Odontotarsinae and Scutellerinae reveal significant taxonomic variations. These subfamilies are separated from each other mainly by the external as well as internal characteristics which are consistent in these species. The critical taxonomic characters which are valuable in the distinction of these subfamilies include development of tylus and jugal lobes, ostiole and peritreme of metathoracic scent glands, extension of evaporatorial surface, shape and size of pronotum and scutellum, sulcation on the sterna and variations in the structure of genitalia especially pygophore, aedeagus, paramere, shape of phallotheca and ejaculatory reservoir. In case of female genitalia, the salient distinctions are on the presence or absence of spiracle on VIII paratergites, shape and size of gonocoxae, shape of spermathecal bulb, development of spermathecal pump flanges, length and breadth of spermathecal duct.

The exploration of metathoracic scent glands in the members of four subfamilies of Scutelleridae under SEM reveal that the variations in the structure of metathoracic scent gland ostiole and their peritremes could be used as a sole character for distinguishing these subfamilies. It has also been concluded that there are
relationships that are exhibited through genitalic characters especially pygophore, aedeagus, spermathecal bulb, spermathecal pump flanges and spermathecal duct related with these gland variations. The emphasis that could be given on these characteristics will definitely pave the way for establishing a stable subfamily level classification in this group. The distinct characteristics that emerged as stable variations among the 6 subfamilies are given below:

5.2.1 Elvisurinae

Elvisurinae is represented from India by one genus with one species i.e., Solenosthedium rubropunctatum (Guerin). The members of this subfamily possess meso and metasterna with a deep and broad groove and its margins raised prominently; ventrally abdomen with a broad sulcation extended beyond middle. Metathoracic scent gland ostiole with well developed ostiole but peritreme reduced. Aedeagus with phallotheca short; I and II conjunctival appendages fused basally; distally divided into two branches; vesica long tubular shape. Female genitalia with I pair of gonocoxae narrow and small; spermatheca with bulb elongated, distal and proximal pump flanges well developed; median spermathecal duct visible externally.

5.2.2 Eurygastrinae

Eurygastrinae in India is represented by one genus i.e., Eurygaster Laporte with two species viz., E. integriceps Puton and E. maura (Linnaeus). The members of this subfamily are identified with the following characters:

Body almost flat or slightly convexed, head broad with equally developed tylus and jugal lobes; II antennal segment curved; scutellum not covering the whole abdomen, connexivum exposed. Metathoracic scent gland ostiole transverse slit like, open in transverse peritreme whose anterior and posterior margins crenulated. Aedeagus of male genitalia with sclerotized dorso-lateral conjunctival appendages, vesica membranous with wide opening, Paramere T-shaped. Spermatheca of females with elongated and sclerotized dilation which makes it peculiar to other group of family Scutelleridae.
5.2.3 Hoteinae

Hoteinae is the recent established subfamily which erected to accommodate the species which possess stridulatory organ on their ventral abdominal surface. This subfamily is represented with one genus and two species from India viz., *Hotea curculionoides* (Herrich-Schaeffer) and *Hotea nigrorufa* Walker. Members generally with obovate body, strongly convexed; head elongate, preocular distance more than 4x to postocular distance, apparently looks like weevil; base of antenna concealed by the anterior margin of prosternum; V-VI ventral abdominal surface possess stridulatory patch. Metathoracic scent gland ostiole with well developed ostiole and peritreme, although peritreme not in proper sclerotized form. Male only with one pair of membranous conjunctival appendages, vesica uniformly thin and very long, remain in coiled form; females with spermatheca long, tortuous of uniform thickness, without any dilation. These characters justify keeping them in a separate group of the Scutelleridae.

5.2.4 Odontoscelinae

This subfamily is represented by one genus with only one species, *viz.*, *Irochrotus incisus* (Stal). Member with dull colour and pilose; head sub semi-orbicular; pronotum anteriorly broader than head; antero-lateral margin distinctly round. Metathoracic scent gland with well distinct ostiole and indistinct peritreme. Male with I pair of conjunctival appendages membranous and thickly folded; spermatheca with bulb short; dilation large and pump flanges indistinct.

5.2.5 Odontotarsinae

This family is represented by four genera and six species from India and among these only one genus with one species was available to study in this subfamily *viz.*, *Alphocoris lixoides* (Germar). Members of this subfamily are represented with elongated body, apex of tylus round and distinctly extended beyond jugal lobes; metathoracic scent gland with indistinct ostiole and peritreme; spermatheca with indistinct distal pump flange and dilation.
5.2.6 Scutellerinae

This subfamily is the largest subfamily of Scutelleridae, which are represented by 10 genera along with 47 described species from India; among these 7 genera with 23 species are studied here viz., Brachyaulax cyaneovittata, Cantao ocellatus, Chrysocoris andamanensis, C. dilaticollis, C. fascialis, C. marginellus, C. patricius, C. pulchellus, C. purpureus, C. stockerus, C. stollii, Eucorysses grandis, Lamprocoris roylii, L. spiniger, Poecilocoris druraei, P. hardwickii, P. interruptus, P. latus, P. lewisi, P. ornatus, P. rufigenis, Scutellera fasciata and Scutellera perplexa. The members of this subfamily show rather stable and somewhat advanced characters through which they can be identified with the following characters: adults generally bright coloured, head generally broad, II antennal segment smallest, metathoracic scent gland with well-developed ostiole with variable shapes and size and peritreme which generally extends transversally. Aedeagus generally with 3 pairs of conjunctival appendages, paramere well developed with erect stem and a curved and lunate blade with tuft of setae on the inner basal side of blade; spermathecal bulb round to elongate, proximal and distal spermathecal pump flanges generally developed, spermathecal dilation round to oval.

5.3 MORPHOMETRICS

The distribution and faunistics of the 29 species studied reveal that the subfamily Scutellerinae is more complex. Of the 29 species studied, 23 fall under Scutellerinae and under 7 genera. The taxonomic diversity of this subfamily as occurring in India and adjacent countries is complex. The other subfamilies namely Elvisurinae, Eurygastrinae, Hoteinae, Odontoscelinae and Odontotarsinae, all had only one genus.

The morphometrics on the 29 characters of each of the species reveal that the components of head length, preocular and postocular distance, length of antennal segments, distance between lateral pronotal angles, scutellar and breadth exhibit diversity and it has been concluded that their morphometrics are complex and these are valid enough for establishing a valid generic level classification.
It has been observed through an analysis of the species falling under different genera that two genera namely *Chrysocoris* and *Poecilocoris* are faunistically more diverse with significant species diversity. It has also been observed that the characters differentiating these genera namely *Brachyaulax*, *Cantao*, *Chrysocoris*, *Eucorysses*, *Lamprocoris*, *Poecilocoris* and *Scutellera* are more valuable in characterizing the fauna of Scutelleridae at generic level and attributing the species diversity towards lower level classification. The morphometric studies undertaken on 29 characters which has been singled out as of significance in characterizing the species establish that the variations in the ratio of head length to head breadth, preocular to postocular distance, antennal length segments, pronotal length to distance between lateral pronotal angles, abdominal length to breadth are valuable and should be relied upon for an authentic identifications at species level and further higher level classification.

5.4 BIOLOGY OF *SCUTELLERA PERPLEXA*

The present study also dealt with the biology of an economically important bug *Scutellera perplexa* (Westwood). The species has been reported as a pest of biodiesel plant *Jatropha curcas* from Delhi and adjoining areas and also some other parts of the country like Jhansi (Shankar and Dhayani, 2006); Coimbatore (Ambika et al., 2007); and Andhra Pradesh (Prabhakar et al., 2008). This species is studied time to time by different workers on different aspects: Distant (1902) described about adult in brief; Ahmad and Mushtaq (1977) described the metathoracic scent gland ostiole and male and female genitalia while Agarwal and Baijal (1984) studied the male genitalia. Here we add some more additional characteristics of adults and immature stages. Ambika et al. (2007) recorded the incubation period, total nymphal period and adult longevity at Coimbatore as 5.92, 26.92 and 38.83 to 43.50 days, respectively. These corroborate present observations except the total nymphal duration (36.65±2.27 days), and adult longevity ($\delta$=27.60±7.23 days and $\varphi$=31.36±4.63 days) which may be due to variation in environmental conditions. Here the first detailed descriptions of egg, nymphal stages, and adults are presented and a key to the nymphal instars of this important pest provided.
Scutelleridae comes under superfamily Pentatomoidea (Hemiptera: Heteroptera). Members of this family are generally large and brightly coloured, body colouration varies from brown, orange, red, green to indigo blue. They get attention due to their large size, bright colour, and well-developed metathoracic scent glands. Species are abundant everywhere in terrestrial habitats. Only few species of this family are economically important viz., Eurygaster spp., Scutellera spp., Poecilocoris spp. etc.

The available information on this important group is limited and especially from taxonomic studies on Indian species, it is very much scanty. Hence, the present study was undertaken with objectives of survey and collection of specimens of scutellerid species from different agroecosystems, study of their important diagnostic morphological characters as well as genitalic characters and to consolidate the earlier findings, in addition to description and redescription of species, and formulation of keys for easy identification of different taxa.

Simultaneously the bionomics of economically important bug, Scutellera perplexa (Westwood) has been done alongwith an identification key to the nymphal instars.

The present study was based on freshly collected specimens as well as preserved specimens available at the NPC, New Delhi, DZAMU, Aligarh and FRI, Dehradun. Collections were also made through extensive surveys in different states of India viz., Arunachal Pradesh, Delhi, Himachal Pradesh, Meghalaya, Uttarakhand, Uttar Pradesh, and West Bengal. Approximately 475 specimens were studied under 6 subfamilies, including 12 genera consisting 29 species. All these species have been redescribed with a specific focus on their morphometry, genitalia and many additional morphological characters. All biological parameters of S. perplexa have been studied under the laboratory and field conditions, along with the morphometry of adult as well as their immature stages; seasonal occurrence, fecundity, egg laying pattern (ovipositional behaviour) and per cent hatchability have also been studied. Keys to
subfamilies, genera as well as species have been formulated afresh or modified from existing ones by augmenting with more valid characters using up to date terminology. A critical review of literature of the current taxonomic position and systematic history of Scutelleridae has been presented in the second chapter where the work done by earlier workers has been arranged chronologically.

The source material, which formed the basis of the investigations, procedure adopted for collection, mounting and preparation of material for illustrations, morphometry and other microscopic studies, and protocols of scanning electron microscopy comprises the 3rd chapter.

The fourth chapter deals with the results obtained during the studies which have been summarized as below:

1. General morphology of Scutelleridae has been updated with recent terminology and strengthened with self explanatory illustrations.

2. A checklist of 61 species under 18 genera within 6 subfamilies of Scutelleridae occurring in India and adjoining countries provided.

3. Redescription of 29 species under 12 genera belonging to 6 subfamilies accomplished.

4. The description of all the species have been were supplemented with morphometric ratios based on actual measurements of the following characters viz., body length, head length, head breath, preocular distance, postocular distance, interocellar distance, interocular distance, length of all antennal segments, length of all labial segments, medial length of pronotum, distance between anterior pronotal angles, distance between lateral pronotal angles, scutellar length, scutellar breath at base, length of femora and tibiae of fore, middle and hind legs, and length and breadth of abdomen. Total body length of male and female specimens of each species under study.

5. A total of 325 line diagrams depicting various important diagnostic characters of the species have been included.
6. Fourteen images have been illustrated with SEM to show the detailed structure of external morphology *i.e.*, exterior of metathoracic scent gland.

7. Coloured photographs/ images of male genitalia (*i.e.*, aedeagus and paramere) of the 22 species have been incorporated. Coloured photographs of adults for 23 species have been included.

8. Morphometric data of 29 characters of each species has been recorded and explained.

9. Biology of an economically important scutellerid bug, *Scutellera perplexa* (Westwood) was undertaken with special attention to their nymphal durations and survival of all life stages *i.e.*, eggs, 5 nymphal instars and male and female adult bugs. For the first time, attempt has been made to provide illustrations of all nymphal instars and their diagnostic characters.

10. Key has been constructed for the identification of nymphal instars under laboratory and field conditions.
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Fig. 1. General morphology of Scutelleridae; a. Morphological characters: b. Morphometrics.

Abbreviations: Abd: abdomen; Ans: antennal segments; Apa: anterior pronotal angle; Cal: Callus; Cl: claw; Ey: eye; Fm: femur; Frl: fore leg; Hi: hind leg; Jul: jugal lobe; Lpa: lateral pronotal angle; Ml: middle leg; Oc: ocellus; Plv: pulvillus; Prn: pronotum; Scu: scutellum; Tb: tibia; Trs: tarsal segments; Ty: tylus and Wg: wing; i: head length; ii: head breadth; iii: pronotal length; iv: length between anterior pronotal angles; v: length between lateral pronotal angles; vi: scutellar length and vii: scutellar breadth at base.
Fig. 2. a. antenna; b. labium; c. leg; d. forewing and e. hind wing. Abbreviations: Anv: anal vein; Bc: buccula; Clf: claval fracture; Clv: Clavus; Co: corium; Cu: cubitus; Cx: coxa; Emb: embolium; Iv: intervenal vein; Ju: juga; Lbs: labial segments; M: medial vein; Mem: membrane; R+M: radiomedial vein; Trc: trochanter and Vn: veins.
Fig. 3. a. Exterior of metathoracic scent gland and b. abdomen, ventral. Abbreviations: Abs: abdominal segments; Ev: evaporatorium; Mst: mesothorax; Mt: metathorax; Ost: ostiole; Prt: periteme; Ps: peritremal surface; Ptg: paratergite; Spr: spiracle and Tr: trichobothria.
Fig. 4. a. pygophore, dorso-posterior; b. aedeagus; lateral; c. paramere, lateral; d. ovispositor and e. spermatheca. Abbreviations: Abs: abdominal segments; Bl: blade; Cja: conjunctival appendages; Df: distal flange; Dsd: distal spermathecal duct; Gnx: gonocoxae; Gp: gonopore; P: pump; Pct: proctiger; Pf: proximal flange; pr: paramere; Psd: proximal spermathecal duct; Ptg: paratergites; Sb: spermathecal bulb; Sd: spermathecal dilation; Se: setae; Spr: spiracle; St: stem; Str: strigil; Th: Theca; Trb: trichobothria and Ve: vesica.
Fig. 5. (a-l) *Solenosthedium rubropunctatum* (Guerin): a. head (dorsal), b. pronotum, c. scutellum (female), d. scutellum (male), e. metathoracic scent gland, f. abdomen (ventral), g. pygophore (dorsal), h. pygophore (ventral), i. aedeagus, j. paramere, k. ovipositor and l. spermatheca.
Fig. 6. (a-m) *Eurygaster maura* (Linnaeus): a. head (dorsal), b. antenna, c. pronotum, d. scutellum, e. scutellum with exposed connexivum, f. exterior of metathoracic scent gland, g. hind leg, h. abdomen (ventral), i. pygophore (dorsal), j. pygophore (ventral), k. aedeagus, l. paramere, m. ovipositor and n. spermatheca.
Fig. 7. (a-l) *Hotea curculionoides* (Herrich-Schaeffer): a. head (dorsal), b. labium, c. pronotum, d. scutellum, e. metathoracic scent gland, f. abdomen (ventral), g. pygophore (ventral), h. pygophore (dorsal), i. aedeagus, j. paramere, k. ovipositor and l. spermatheca; Vt: vittae.
Fig. 8. (a-k) *Hotea nigroruia* Walker: a. head (dorsal), b. pronotum, c. scutellum, d. exterior of metathoracic scent gland, e. abdomen (ventral), f. pygophore (dorsal), g. pygophore (ventral), h. aedeagus, i. paramere, j. ovipositor and k. spermatheca.
Fig. 9. (a-j) *Irochrotus incisus* (Stal): a. head (dorsal), b. pronotum, c. scutellum, d. metathoracic scent gland, e. abdomen (ventral), f. pygophore (dorsal), g. pygophore (ventral), h. aedeagus, i. paramere, j. ovipositor and k. spermatheca.
Fig. 10. (a-k) *Alphocoris lixoides* (Germar): a. head (dorsal), b. antenna, c. pronotum, d. scutellum, e. abdomen (ventral), f. pygophore (dorsal), g. pygophore (ventral), h. aedeagus, i. paramere, j. ovipositor and k. spermatheca.
Fig. 11. (a-h) *Brachyaulax cyaneovitta* (Walker): a. head (dorsal), b. antenna, c. pronotum, d. scutellum, e. exterior of metathoracic scent gland, f. abdomen (ventral), g. ovipositor and h. spermatheca.
Fig. 12. (a-k) Cantao ocellatus (Thunberg): a. head (dorsal), b. pronotum, c. scutellum, d. exterior of metathoracic scent gland, e. abdomen (female), f. abdomen (male), g. pygophore intact with abdomen, h. pygophore (dorsal), i. pygophore (ventral), j. aedeagus, k. paramere, l. ovipositor and m. spermatheca.
Fig. 13. (a-k) *Chrysocoris andamanensis* Atkinson: a. head (dorsal), b. pronotum, c. scutellum, d. metathoracic scent gland, e. abdomen (ventral), f. pygophore intact with abdominal segment g. pygophore (dorso-posterior), h. aedeagus, i. paramere, j. ovipositor and k. spermatheca.
Fig. 14. (a-j) *Chrysocoris dilaticollis* (Guerin): a. head (dorsal), b. antenna, c. pronotum, d. scutellum, e. exterior of metathoracic scent gland, f. abdomen (ventral), g. pygophore (dorsal), h. pygophore (ventral), i. aedeagus and j. paramere.
Fig. 15. (a-h) *Chrysocoris fascialis* White: a. head (dorsal), b. antenna (male), c. pronotum, d. scutellum, e. exterior of metathoracic scent gland, f. abdomen (ventral), g. ovipositor and h. spermatheca.
Fig. 16. (a-j) *Chrysocoris marginellus* (Westwood): a. head (dorsal), b. pronotum, c. scutellum, d. exterior of metathoracic scent gland, e. abdomen (ventral), f. pygophore (dorso-posterior), g. aedeagus, h. paramere, i. ovipositor, and j. spermatheca.
Fig. 17. (a-j) *Chrysocoris patricius* (Fabricius): a. head (dorsal), b. antenna (male), c. antenna (female), d. pronotum, e. scutellum, f. exterior of metathoracic scent gland, g. abdomen, h. pygophore (ventral), i. pygophore (dorso-posterior), j. aedeagus, k. paramere, l. ovipositor and m. spermatheca.
Fig. 18. (a-k) Chrysocoris pulchellus (Dallas): a. head (dorsal), b. pronotum, c. scutellum, d. exterior of metathoracic scent gland, e. abdomen (ventral), f. pygophore (dorso-posterior), g. pygophore (ventral), h. aedeagus, i. paramere, j. ovipositor and k. spermatheca.
Fig. 19. (a-j) *Chrysocoris purpureus* (Westwood): a. head (dorsal), b. pronotum, c. scutellum, d. abdomen (ventral), e. exterior of metathoracic scent gland, f. pygophore (dorso-posterior), g. aedeagus, h. paramere, i. ovipositor and j. spermatheca.
Fig. 20. (a-k) Chrysocoris stockerus (Linnaeus): a. head (dorsal), b. pronotum, c. scutellum, d. exterior of metathoracic scent gland, e. abdomen (ventral), f. pygophore (dorso-posterior), g. pygophore (ventral), h. aedeagus, i. paramere, j. ovipositor and k. spermatheca.
Fig. 21. (a-j) *Chrysocoris stollii* (Wolff): a. head (dorsal), b. pronotum, c. scutellum, d. exterior of metathoracic scent gland, e. abdomen (ventral), f. pygophore (dorso-posterior), g. aedeagus, h. paramere, i. ovipositor and j. spermatheca.
Fig. 22. (a-j) *Eucorysses grandis* (Thunberg): a. head (dorsal), b. pronotum, c. scutellum, d. abdomen (ventral), e. exterior of metathoracic scent gland, f. pygophore (dorso-posterior), g. pygophore (ventral), h. aedeagus, i. paramere, j. ovipositor and k. spermatheca.
Fig. 23. (a-k) Lamprocoris roylii (Westwood): a. head (dorsal), b. pronotum, c. scutellum, d. exterior of metathoracic scent gland, e. abdomen (ventral), f. pygophore (dorsal), g. pygophore (ventral), h. aedeagus, i. paramere, j. ovipositor and k. spermatheca.
Fig. 24. (a-l) *Lamprocoris spiniger* (Dallas): a. head (dorsal), b. antenna, c. pronotum, d. scutellum, e. exterior of metathoracic scent gland, f. abdomen (ventral), g. pygophore (dorsal), h. pygophore (ventral), i. aedeagus, j. paramere, k. ovipositor and l. spermatheca.
Fig. 25. (a-h) *Poecilocoris drurai* (Linnaeus): a. head (dorsal), b. pronotum, c. scutellum, d. exterior of metathoracic scent gland, e. abdomen, f. pygophore (dorsal), g. pygophore (ventral), h. aedeagus, i. paramere, j. ovipositor and k. spermatheca.
Fig. 26. (a-j) *Poecilocoris hardwickii* (Westwood): a. head (dorsal), b. pronotum, c. scutellum, d. exterior of metathoracic scent gland, e. abdomen (ventral), f. pygophore (dorsal), g. pygophore (ventral), h. aedeagus, i. paramere, j. ovipositor and k. spermatheca.
Fig. 27. (a-j) Poecilocoris interruptus (Westwood): a. head (dorsal), b. pronotum, c. scutellum, d. abdomen (ventral), e. exterior of metathoracic scent gland, f. pygophore (dorsal), g. pygophore (ventral), h. aedeagus, i. paramere and j. spermatheca.
Fig. 28. (a-k) *Poecilocoris latus* Dallas: a. head (dorsal), b. pronotum, c. scutellum, d. metathoracic scent gland, e. abdomen (ventral), f. pygophore (dorsal), g. pygophore (ventral), h. aedeagus, i. paramere, j. ovipositor and k. spermatheca.
Fig. 29. (a-g) *Poecilocoris lewisi* (Distant): a. head (dorsal), b. pronotum, c. scutellum, d. exterior of metathoracic scent gland, e. abdomen (ventral), f. ovipositor and g. spermatheca.
Fig. 30. (a-h) *Poecilocoris ornatus* Dallas: a. head (dorsal), b. pronotum, c. scutellum, d. exterior of metathoracic scent gland, e. abdomen (ventral), f. ovipositor and g. spermatheca.
Fig. 31. (a-h) *Poecilocoris rufigenis* Dallas: a. head (dorsal), b. pronotum, c. scutellum, exterior of metathoracic scent gland, e. abdomen (ventral), and f. ovipositor.
Fig. 32. (a-g) Scutellera fasciata (Panzer): a. head (dorsal), b. antenna, c. pronotum, d. scutellum, e. exterior of metathoracic scent gland, f. abdomen (ventral), and g. ovipositor.
Fig. 33. (a-k) Scutellera perplexa (Westwood): a. head (dorsal), b. pronotum, c. scutellum. d. exterior of metasthoracic scent gland, e. abdomen (ventral), f. pygophore (dorsal). g. pygophore (ventral), h. aedeagus, i. paramere, j. ovipositor and k. spermatheca.
Fig. 34. (a-r) Different life stages of *Scutellera perplexa* (Westwood): a. egg (dorsal), b. egg (lateral), c. egg (batch), d. I instar, e. II instar, f. III instar, g. IV instar, h. V instar, i. adult, j-l. development of sternal plates at different life stages and m-r. extension of labium in different instars.
Solenostedium rubropunctatum (Guerin)  
Eurygaster maura (Linnaeus)  
Hotea curculionoides (Herrich-Schaeffer)  
Hotea nigrorufa Walker
Irochrotus incisus (Stal)  
Alphocoris lixoides Germar  
Brachyaulax cyaneovitta (Walker)  
Cantao ocellatus (Thunberg)
PLATE-III

**Chrysocoris dilaticollis** (Guerin)  
**Chrysocoris fascialis** White

**Chrysocoris marginellus** (Westwood)  
**Chrysocoris patricius** (Fabricius)
Chrysocoris pulchellus (Dallas)

Chrysocoris purpureus (Westwood)

Chrysocoris stockerus (Linnaeus)

Chrysocoris stollii (Wolff)
Eucorysses grandis Amyot & Serville

Lamprocoris roylii (Westwood)

Lamprocoris spiniger (Dallas)

Poecilocoris druraei (Linnaeus)
Poecilocoris rufigenis Dallas

Scutellera fasciata (Panzer)

Scutellera perplexa (Westwood)
Solenosthemium rubropunctatum (Guerin)

Eurygaster maura (Linnaeus)

Hotea curculionoides (Herrich-Schaeffer)

Cantao ocellatus (Thunberg)

Chrysocoris patricius (Fabricius)

Chrysocoris stockerus (Linnaeus)
PLATE-X

*Solenostedium rubropunctatum* (Guerian)  
*Eurygaster maura* (Linnaeus)

*Hotea curculionodes* (Herrich-Schaeffer)  
*Irochrotus incisus* (Stal)

*Alphocoris lixoides* Germar  
*Cantao ocellatus* (Thunberg)
PLATE XI

Chrysocoris andamanensis Atkinson

Chrysocoris dilaticollis Guerin

Chrysocoris marginellus (Westwood)

Chrysocoris patricius (Fabricius)

Chrysocoris pulchellus (Dallas)

Chrysocoris purpureus (Westwood)

Chrysocoris stockerus (Linnaeus)

Chrysocoris stollii (Wolff)
**PLATE-XII**

- **Eucorysses grandis** (Thunberg)
- **Lamprocoris roylii** (Westwood)
- **Lamprocoris spiniger** (Dallas)
- **Poecilocoris druraei** (Linnaeus)
- **Poecilocoris hardwickii** (Westwood)
- **Poecilocoris interruptus** (Westwood)
- **Poecilocoris latus** Dallas
- **Scutellera perplexa** (Westwood)
Different life stages of *Scutellera perplexa* (Westwood)