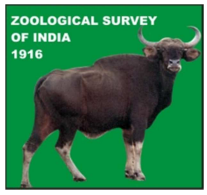
STUDIES ON THE TAXONOMY OF PLATYGASTRINAE AND SCELIOTRACHELINAE (HYMENOPTERA: PLATYGASTRIDAE) OF KERALA STATE

Thesis
Submitted to the University of Calicut
For the Award of the Degree of

DOCTOR OF PHILOSOPHY IN ZOOLOGY

ANJANA GANGADHARAN M



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GOVT. OF INDIA
MIN. OF ENVIRONMENT, FORESTS & CLIMATE CHANGE

Tele: ZOOLSUR-CALICUT
Phone/Fax:0495-2771929& 2771324
Officer-in-Charge: 2771324
E-mail: zoolsurcalicut@dataone.in

ZOOLOGICAL SURVEY OF INDIA
Western Ghat Regional Centre
Kozhikode-673 006, Kerala

Date……..

CERTIFICATE

This is to certify that this thesis entitled, ***"Studies on the Taxonomy of Platygastrinae and Sceliotrachelinae (Hymenoptera: Platygastridae) of Kerala State"*** is an authentic record of the work carried out by **Mrs. ANJANA GANGADHARAN M.,** from March 2013 to July 2016 under my guidance and supervision in partial fulfillment of the requirements of the Degree of Doctor of Philosophy in Zoology, under the Faculty of Zoological Survey of India (Recognized Research Centre of University of Calicut). No part of the thesis has been presented before for any other degree.

It is further certified that the candidate has passed the Ph. D Preliminary Qualifying Examination with Course work conducted by the University of Calicut held on December 2014.

Dr. K. RAJMOHANA

DECLARATION

I do hereby declare that the thesis entitled ***"Studies on the Taxonomy of Platygastrinae and Sceliotrachelinae (Hymenoptera: Platygastridae) of Kerala State"*** submitted to the University of Calicut for the award of Doctor of Philosophy in Zoology (Faculty of Science) is an authentic record of the work carried out by me under the supervision of **Dr. K. Rajmohana,** Scientist D, Western Ghat Regional Centre, Zoological Survey of India. I also declare that, the work has not been submitted to any university or institution for the award of any degree.

Calicut **Anjana Gangadharan M**

2016

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LIST OF ACRONYMS USED

NBAIR	-	National Bureau of Agricultural Insect Resources
WGRS	-	Western Ghat Regional Station
WGRC	-	Western Ghat Regional Centre
ZSI	-	Zoological Survey of India
PTR	-	Periyar Tiger Reserve

LIST OF ABBREVIATIONS USED

A1- A10	-	Antennal segments 1-10
IOS	-	Interorbital space
LOL	-	Lateral Ocellar Line
OD	-	Ocellar Diameter
OOL	-	Ocello Ocullar Line
POL	-	Posterior Ocellar Line
T1- T6	-	Metasomal tergites 1-6

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CHAPTER I
INTRODUCTION

The diversity of life forms, so numerous that we have yet to identify most of them, is the greatest wonder of this planet-

E. O. Wilson

The diversity of life is one of the most striking aspects of our planet; hence knowing how many species inhabit Earth is among the most fundamental questions in science (Mora *et al.* 2011). The diversity of life on earth provides an intellectual and spiritual inspiration that contributes meaning to life. It stimulates scientific inquiry and the pursuit of knowledge. It provides the beauty and the wonder that energizes us to live life to the fullest. And it drives us to seek answers to the most fundamental questions of human existence: Where did we come from and why are we here? (Wilson 2013). Biodiversity is the variety of life on earth and includes variation at all levels of biological organization from genes to species to ecosystems (Gaston & Spicer 2004). It refers to the comprehensive umbrella term for the degree of nature's variety or variation within the natural system, both in number and frequency. In general, it refers to the variety of all forms of life on earth. Every form of life on earth is unique and warrants respect regardless of its worth to human beings. And overall, biodiversity maintains the integrity of the environment (Mutia 2009). In spite of 250 years of species discoveries and taxonomic classification, only 1.2 million species have been catalogued in our central database, some 86% of existing species on Earth and 91% of species in the ocean still await their discovery (Mora *et al.* 2011).

Taxonomy and species conservation are often assumed to be completely interdependent activities. They both go hand-in-hand. We cannot necessarily expect to conserve organisms that we cannot identify, and our attempts to understand the consequences of environmental change and degradation are compromised fatally if we cannot recognize and describe the interacting components of natural ecosystems (Mace 2004). Our efforts to conserve our biodiversity will be much easier if we know the basic units that are species, and their relationships. Taxonomy provides discovery and identification of these basic units and their relationships (Narendran 2006; 2008). Before initiating any kind of studies, it is absolutely essential to know the correct name of the organism on which the studies are initiated (Narendran 2000).

Insects have been around for more than 400 million years and it could be argued that they are the most successful and enduring life form that has ever arisen on this planet (Mc Gavin 2007). Approximately 80% of animal species on earth are insects. We share a large proportion of our genetic material with all life on earth down to the simplest worms. Insects provide natural services that we often take for granted. They are the pollinators, leaf litter sweepers, garbage collectors, soil conditioners and natural fertilizer producers of nature (Saul 1999). Some insects are considered “keystones” because loss of their critical ecological functions could collapse the wider ecosystem (Gullan and Cranston 2004).

Hymenoptera is considered as one of the most species rich insect orders. The order is composed of two suborders, 27 superfamilies, 132 families, 8423 extant genera with an additional 685 extinct genera. Hymenoptera is divided into two suborders- Symphyta and Apocrita. Apocrita is in turn divided into Parasitica and Aculeata. Parasitic hymenoptera represent the most species rich group of hymenoptera and one of the most

speciose of all insect groups (Aguiar *et al.* 2013). Since they are among the most important group of entomophagous insects, they can be used in various bio-control programmes against insect pests. They are very myriad, diverse, ecologically significant and economically important (Narendran 2002) and are common and abundant in all terrestrial ecosystems. It is probable that atleast 75% of parasitic hymenoptera are yet to be described and that many of those that are currently described are not recognizable (La Salle and Gould 1992). Among parasitic hymenoptera, Platygastroidea is the third largest superfamily (Austin *et al.* 2005) comprising of a single family Platygastridae which includes 6008 species under 265 genera. Platygastridae is further subdivided into 5 subfamilies viz. Platygastrinae, Scelioninae, Sceliotrachelinae, Telenominae and Teleasinae. Among these, Scelioninae are the most diverse of all subfamilies (Hymenoptera Online (HOL) [Online] Available from *http://hol.osu.edu.* [accessed 31 March 2016]. Except the members of Platygastrinae which are koinobiont parasitoids on dipteran gall midges, all members of the rest of the subfamilies are exclusively egg parasitoids. This superfamily can be distinguished from other superfamilies of parasitic hymenoptera by the reduced venation, long and slender scape and by examining the antenna which is usually less than 13 segmented and inserted adjoining the dorsal margin of the clypeus or at most slightly away from clypeus by less than the diameter of antennal socket (Narendran 2002).

The present investigation is confined to two subfamilies: Platygastrinae and Sceliotrachelinae (Platygastridae) which are usually very small, ranging from 0.6- 1.5 mm long (2- 4 mm forms are rarely met with), usually black colored with an elbowed antennae. More than thousand specimens under the two subfamilies Platygastrinae and Sceliotrachelinae, collected from various habitats of 14 districts of Kerala were studied. This study will help to explore more platygastrid fauna of Kerala and thus will provide a stable base with

regard to taxonomy of platygastrids. The knowledge thus gained can be effectively utilized in further studies.

Morphological Trends

Platygastroids display a number of morphological trends. The main characteristics are: metasomatic horn and venation reduction. The metasomatic horn is formed from the dorsal expansion of the first metasomatic tergite into a large hump or tubular horn-like structure which importantly, acts as a recess for the internally retracted ovipositor. This character is best developed in some species of *Inostemma* Haliday. This genus shows a great range in form, particularly from species with a short horn to species in which the tubular horn bends over the dorsal mesosoma almost touching the head. The length of the horn is correlated with the length of the ovipositor and presumably represents an adaptation to protect the hypodermic-like ovipositor at rest, but horn length also allows for a more elongate ovipositor that can reach and parasitize protected or hidden hosts (Austin *et al.* 2005). Compared with other hymenoptera, platygastrids have their forewing venation reduced. In members of Platygastrinae, only a short submarginal vein will be present which is knobbed in some genera like *Inostemma, Isostasius,* etc. In Sceliotrachelinae, most of the genera are having a long tubular submarginal vein which is knobbed apically but is absent in genus *Isolia* Förster (Masner and Huggert 1989).

Distribution

Members of Platygastrinae and Sceliotrachelinae often have a very wide geographical distribution. Much diversity of this group was reported from Australia (including New Caledonia and New Guinea) followed by the Nearctic Region which is enriched by the extension of some genera from the New World tropics. Neotropical Region excluding Chile represents the third

Region with high diversity. Oriental Region stands fourth in the diversity of Platygastrinae and Sceliotrachelinae. Lack of enough collection efforts may be one of the reasons for the low diversity documented with regard to this group in the Oriental Region. *Platygaster* Latreille, *Leptacis* Förster, *Synopeas* Förster and *Inostemma* Haliday (Platygastrinae) and *Allotropa* Förster, *Amitus* Haldeman and *Fidiobia* Ashmead (Sceliotrachelinae) are the most diverse genera with Worldwide distribution (Masner and Huggert 1989).

India is a subtropical country rich in insect biodiversity, but the platygastrid fauna of this region is poorly known (Veenakumari *et al.* 2013a). 76 species under 14 genera were included in the Indian checklist of Platygastrinae and Sceliotrachelinae, of which *Platygaster* Latreille, *Leptacis* Förster, *Synopeas* Förster were the widely distributed genera in India and Kerala (Rajmohana and Divya 2011). Subfamily Sceliotrachelinae, poorly known from India are represented by just five genera viz. *Allotropa*, *Amitus*, *Plutomerus*, *Isolia* and *Fidiobia* and by about half a dozen species in India (Veenakumari *et al.* 2012, 2013b).

Biology and behaviour

Members of Platygastrinae are known to be parasitoids on the gall midges (Cecidomyiidae) and members of Sceliotrachelinae are known to be parasitoids of whiteflies and other homopterans (Vlug 1995). Most of these midges are stereotypically specific to their plant hosts, but the parasitoids are apparently not necessarily specific to their host midges (Hawkins & Gagné 1989). While many are larval parasitoids, some attack the pupal stages of their hosts too.

Two Indian species of the genus *Anectadius* Kieffer (1905), viz. *Anectadius bengalensis* and *A. striolatus* have been reported from the gall midges. *Anectadius bengalensis* was reared from the gall midge on *Artemisia*

sp. and *A. striolatus* from *Lasioptera textor*. *Gastrotrypes spatulatus* Brues was reared from *Xylodiplosis praecox* (Winnertz) on fresh stumps of *Quercus robur* L. (Brues 1922). *Inostemma apsyllae* from *Apsylla cistella* (Buckton) (Homoptera) on *Mangifera indica* and *I. oculare* from *Procontarinia matteiana* Kieffer and Cecconi on *Mangifera indica* were described from India (Austin 1984). *Inostemma indicum* is another Indian species reported by Mani (1941) from *Neolasioptera cephalandrae* on *Coccinia indica*. Species of genus *Leptacis* were also reported from the cecidomyiid gall midges (Vlug 1995). The genus *Platygaster* is well known to parasitize larvae of gall midges. An important bio-control agent *P. oryzae* Cameron (1891), was reared from *Pachydiplosis oryzae* Wood- Mason, parasitoid of *Oryza* sp. This species has been reported as a predominant parasitoid against the rice gall midge *Orseolia oryzae* (Wood-Mason) from the studies conducted at Madhya Pradesh (Srivastava *et al.* 1987). Similar results have been observed earlier too by Rao (1964) and Venugopal Rao *et al.* (1981). Indian species *P. salvadorae* Rao was reared from *Thomasiniana salvadorae* on *Salvadora persica* L. (Rao 1950). *Synopeas mangiferae* and *S. procon* were recorded by Austin (1984), the former from *Procontarinia echinogalliperda* (Mani) and the latter from *Procontarinia matteiana* Kieffer and Cecconi on *Mangifera indica*. *Synopeas pisi* was recorded from *Contarinia pisi* (Winnertz) on *Pisum sativum* L. (Förster 1856). *Trichacoides indicus* was reared from *Procontarinia matteiana* Kieffer and Cecconi on *Mangifera indica* (Jackson 1968).

Sceliotrachelinae are found to be specialized mainly on homopterous families like Pseudococcidae and Aleyrodidae (Vlug 1995). Species of *Allotropa* Förster are the major parasitoids of Pseudococcidae (Vlug 1995). Species of *Amitus* Haldeman are well known parasitoids of Aleyrodidae (Homoptera). *Amitus* sp. (Sceliotrachelinae) is known to attack the whitefly larvae which cause great damage to vegetables and other crops. *Amitus*

aleurolobi Mani, species from India was reared from *Aleurolobus barodensis* (Maskell) on *Sacharum officinarum* L. (Mani 1939). The species of *Fidiobia* Ashmead are primary egg parasitoids of coleopterous families like Curculionidae and Chrysomelidae (Vlug 1995). Biology of *Iphitrachelus* is still unknown; except for the data provided by Vlug (1995) that the species of this genus were collected from vegetations of *Vinca minor* L., nothing has been documented still.

Most Platygastrid species attack gall flies (Diptera: Cecidomyiidae), ovipositing either in the egg or early larva of the host and completing their development in the larvae. Platygastrinae as well as Sceliotrachelinae are having ovipositor retracted by antagonistic muscles (*Ceratobaeus*- type system). They can be extended and retracted and when at rest can be withdrawn back inside the abdomen within an elongate membranous tube. This arrangement has been postulated as an adaptation for protecting the delicate hypodermic- like ovipositor when not used to pierce the chorion of host eggs (Austin 1983).

Major Contributors

Main contributors to the taxonomy of Indian fauna of the two subfamilies under investigation are Mani (1975) and Sharma (1982). Mukerjee (1978) too has described some new species of Platygastrinae from India and some species of *Platygaster* from Kerala. Ushakumari had done a preliminary investigation of these groups from Kerala in 2002, but only 21 species under three genera were published. Later on, two more genera were added to the faunal list of Kerala by Rajmohana (2006). Recently Veenakumari (2013b) has reported genus *Allotropa* Förster from Kerala by describing *A. vanajae* and has added a few more species to the Indian fauna of Platygastrids. For the present study, specimens were collected from various localities of Kerala including forests, grasslands, botanical gardens etc.

Detailed systematic analysis was done on the members of the selected subfamilies.

1.2: OBJECTIVES OF THE STUDY

- Surveying of Platygastrid species from all districts of Kerala
- Identifying and describing new taxa and re-describing the little known
- To prepare the dichotomous keys for identification of genera and species
- To map the distribution of genera and species of the study area
- Compiling host-parasitoid list of genera and species of Platygastrinae and Sceliotrachelinae of Kerala and India

1.3: IMPORTANCE AND FURTHER SCOPE OF THE STUDY

In order to understand and conserve biodiversity we need to measure it effectively. In India, only very few studies on the documentation of diversity are going on regarding minute groups like parasitic hymenoptera. Parasitic hymenoptera is such a group ranking high in its diversity as well as in their ecological significance. But the studies of the two subfamilies Platygastrinae and Sceliotrachelinae, especially in Kerala is still in its infancy with only six genera known from this state (Rajmohana 2006; Rajmohana and Divya 2011). Kerala, the mystic land is abundant in its rich variety of Flora and Fauna (Philip 2014) and so, many more areas are to be surveyed and much more species are to be described from this state. This can be done only with the help of taxonomy.

Here, all the species are provided with detailed descriptions along with images. Key to species of all genera and distribution map of all genera and its species in Kerala are also provided. So, it is hoped that the study would contribute more towards identifying these tiny creatures and will help in sealing the gaps with regard to our knowledge on them.

CHAPTER II

REVIEW OF LITERATURE

Latreille and Dalla Torre were the prominent workers on platygastrids and scelionids in the XIXth century. Before this period, references about these groups were made by Linnaeus and Schrank. The early 20th century works on two subfamilies, Platygastrinae and Sceliotrachelinae were mainly by the two great entomologists, Kieffer and Dodd. The late 20th and early 21st centuries, have contributed considerable work in taxonomy on Platygastrids, the major contributors being Kozlov and Masner. During this period, families Platygastridae and Scelionidae together constituted a distinct Superfamily Platygastroidea. The one and only World review and identification keys to genera of subfamilies Platygastrinae and Sceliotrachelinae were prepared by Masner and Huggert (1989). This work aimed to determine the taxonomic status of Inostemmatinae and also a critical determination and description of all described genera were attempted. Buhl, one of the prominent workers in this group has described immense new species to science and has prepared keys to many genera and species of Platygastrinae and Sceliotrachelinae of Oriental as well as Palearctic and Nearctic Regions.

Main contributors to the taxonomy of Indian fauna of Platygastrinae and Sceliotrachelinae are Mani (1975) and Sharma (1982). Mukerjee (1981) too added many new species to Indian faunal list. Ushakumari had conducted a preliminary investigation of Platygastrinae and Sceliotrachelinae from Kerala in 2002 in which 38 species under eight genera were treated but only 21 species under three genera were published. Later on, two more genera were added to faunal list of Kerala by Rajmohana (2006). Recently, Veenakumari and her co-workers started works on these two subfamilies of Platygastridae and has reported genus *Allotropa* Förster from Kerala by

describing *A. vanajae* (2013b). They described a few more new species from India under genera *Fidiobia* Ashmead, *Synopeas* Förster, *Amitus* Haldeman, *Gastrotrypes* Brues, *Isolia* Förster and *Allotropa* Förster (2012, 2013a, 2013b, 2013c, 2014a, 2014b and 2015).

LINNAEUS (1758) made the first mention on Scelionids by describing *Ichneumon ovulorum* which is included in *Telenomus* today. He created a new genus *Platygaster*, the type species being *Platygaster ruficornis*. SCHRANK (1781) for the first time provided a scientific description of a platygastrid species, *Platygaster phragmitis* under the name *Cynips phragmitis*. Eventhough HALIDAY (1833) listed 1066 specific names and 123 generic names in his catalogue on Platygastridae, he recognized only 82 genera and 987 species as valid. HALIDAY (1839) in his *Hymenopterorum Synopsis* (in ASHMEAD 1893) placed all the then known Scelionidae and Platygastridae in the Scelionidae family.

WESTWOOD (1840) in his study- Introduction to the Modern Classification of Insects (in Ashmead 1893) grouped Scelionidae and Platygastridae in the Platygasterides subfamily. Species of Platygastridae of Great Britain and Ireland were published by CURTIS (1837) which consisted of 115 species. In FÖRSTER's work (1856) entitled "Chalcidiae und Proctotrupii", all genera grouped by Walker in Teleadidae were interpolated in a family named Scelionoidae. The studies on Scelionidae and Platygastridae at the beginning of the XXth century were strongly marked by the titanic work performed by the reputed hymenopterologist KIEFFER, 1857-1925 (Popovici and Buhl 2011). KIRCHNER (1867) listed 159 species in Catalogues Hymenopterum Europae. A catalogue of British hymenoptera was published by MARSHALL (1873) in which 111 species were listed.

CAMERON (1891) made notes on some parasitic hymenoptera, in which *Platygaster oryzae* was also included, bred from a midge *Cecidomyia oryzae*, a highly destructive pest of paddy. The species was found effective against species of *Cecidomia*, gall makers.

ASHMEAD (1893) published a monograph of North American Proctotrupoidea in which Platygastrinae was interpreted as a subfamily within the family Proctotrupoidea and also attempted the subdivision of the subfamily into two tribes: Inostemmatini and Platygastrini. DALLA TORRE (1898) published the catalogue of hymenoptera of the World in which 375 species of Platygastridae were listed. By using the presence or absence of submarginal vein in the forewing, the tribes Inostemmatini and Platygastrini were elevated to subfamilies Inostemmatinae and Platygastrinae by ASHMEAD (1903). KIEFFER (1904) described a new genus of Platygastridae, viz. *Proplatygaster*, the type species being *Proplatygaster rufipes* Kieffer. This Neotropical genus is still valid and is monotypic.

BRUES (1908) added the subfamily Sceliotrachelinae under Scelionidae family. He erected this subfamily based on a single genus *Sceliotrachelus* Brues and also provided the diagnostic characters of the subfamily. *Sceliotrachelus braunsi* Brues is the only species treated under this genus.

GAHAN (1919) gave a small report on the collection of Indian parasitic hymenoptera. HILL (1923) reported *Platygaster vernalis* Meyers, a Hessian fly parasitoid. HILL (1926) again reported another Hessian fly parasitoid, *Platygaster hiemalis*. A comprehensive work on Scelionidae of the World was published by KIEFFER (1926) which consisted of 55 genera and 560 species of Platygastrinae. Kieffer divided the family Scelionidae into five subfamilies.

FULLAWAY (1913) prepared a report on the collection of hymenoptera in Guam, Marianne islands. Notes on different families and species were given. *Allotropa thompsoni* (Platygastridae) was described based on a single specimen reared from a mealy bug (*Pseudococcus* sp.) on *Abrus abrus*.

KIEFFER (1926) made the most exhaustive contemporaneous work, the world monograph of Scelionidae, in which 1398 species of Platygastridae and Scelionidae were treated.

One of the prominent earlier workers of Platygastridae, MANI (1941) prepared a catalogue of Indian insects. All the species recorded from British India and also from the neighboring regions like Ceylon, Burma, Malaya, Thailand and Java were included along with the key to families, subfamilies, genera and species. Seven genera were keyed under the subfamily Platygastrinae. Also, key to species of *Anectadius* Kieffer and *Platygaster* Latreille were given.

RAO (1950) described four new platygastrid parasitoids of gall midges from India. *Platygaster salvadorae*, *Proleptacis fici*, *Proleptacis oryzae*, and *Polygnotus ramachandrai* were the described species. Illustrations were also provided. Key to known species of *Platygaster* from India was also included.

MUSEBECK (1954) described three new species of genus *Allotropa* viz. *A. citri*, *A. merilli* and *A. scutellata*, important parasitoids of mealy bugs.

Tribe Iphitrachelini under the subfamily Inostematinae was proposed by MASNER (1957) by considering the tetramerus tarsi, shape of the foretibial spur and shape of the clypeus of genus *Iphitrachelus*. SZABO (1959) recognized the family Platygastridae and it was divided into four tribes, viz. Iphitrachelini, Inostemmatini, Amitini and Platygastrini. The tribe Amitini was erected by considering the absence of venation in the forewing

and also the stout metasoma which was with entirely opened tergites on the ventral side without covering the sternites.

MASNER (1960) made a revision of the African species of genus *Leptacis* Förster. The type species of *Sceliotrachelus* Brues was studied and it was placed in Platygastridae by MASNER (1964). BAITAZAR (1966) prepared a catalogue of Philippine hymenoptera with a bibliography from 1758- 1963. JACKSON (1966a) reported a new species, *M. britannius* of the genus *Metanopedias* from Great Britain, a junior synonym of *M. lasiopterae*. JACKSON (1966b) reported a Nearctic species of *Iphitrachelus* Haliday, viz. *I. foutsi* along with a key to known species.

JACKSON (1968) described a new species of *Trichacoides* Dodd, viz. *T. indicus* from India, parasitic on *Procontarinia* sp. (Cecidomyiidae). The first description of the male of this genus was also given. *Trichacoides scutellaris* Dodd, the type species was re-described and illustrated. JACKSON (1969) discussed the most important characters for the separation of the *Leptacis*- *Synopeas* complex. Notes on the characters of various genera were also included.

KOZLOV (1970) introduced a new concept regarding Platygastridae that, this family was considered to be derived from Diapriidae since order Diptera was the major host in both. He considered the presence and absence of the submarginal vein in the forewing as a major character in Platygastridae. He also recognized three subfamilies within Platygastridae, viz. Inostemmatinae, Platygastrinae and Sceliotrachelinae. Inostemmatinae was further divided into seven tribes: Metacliseini, Inostemmatini, Platystasini, Aphanomerini, Pseudaphanomerini, Allotropini and Iphitrachelini. Sceliotrachelinae was subdivided into two tribes: Fidiobini and Sceliotrachelini. Platygastrinae was also subdivided into two tribes: Platygastrini and Synopeadini.

Allotropa subclavata, a mealy bug parasitoid from Japan was described by MUESEBECK (1970). A new species of *Platygaster* Latreille exhibiting thelytokous parthenogenesis was described by DAY (1971). MACGOWN and OSGOOD (1971) described two parasitoids on balsam gall midge, viz. *P. abicollis* and *P. mainensis*.

HUGGERT (1973) described a new species, *P. lamellicornis* and transferred *Hypocampis compressicornis* and *H. hyalinata* to *Platygaster*. *Platygaster longiventris, P. pini* and *P. laticeps* were renamed as *P. asmeadiana, P. foutsi* and *P. latiforms* respectively. *Misocyclops crevecoeuri* was transferred to *Platygaster*. He also designated lectotypes for *H. compressicornis, H. hyalinata* and *P. longiventris*.

FABRICIUS (1974) first reported Sceliotrachelinae from Romania by reporting *Fidiobia rugosifrons* Crawford. HUGGERT (1974a) studied the taxonomy of *Urocyclops* Maneval and considered *Urocyclops* as a subgenus of *Platygaster*. A revision of the European species of *Anopedias* Förster was made by HUGGERT (1974b).

MACGOWN (1974) described a new species of *Platygaster, P. taylori* which was found to be a parasitoid on cecidomyiid *Lasioptera nodula*, on black berry. A list of Platygastrinae associated with black berry in USA was also listed. MACGOWN and OSGOOD (1974) described *P. kimballi* associated with *Cirsium.* HUGGERT (1975) published a description of Platygastridae from Sweden.

MANI (1975) described eight new species of Platygastrinae from India viz. *Inostemma berijama, Sacespalus indicus, Synopeas indopeninsularis, Synopeas indicum, Trichacis khajjiara, Isocybus indicus, Platygaster panchaganii* and *Platygaster satara*. All descriptions except, *Isocybus indicus* were based on females.

MASNER (1976) made a revision on the Nearctic species of *Iphitrachelus* Haliday. *Iphitrachelus canadensis* was described as new to science. Short diagnosis for the genus along with a key to all known species of the world and images of *I. lar* Haliday were added. Distribution of the genus in the world was also discussed.

CROMWELL (1976) added *Platygaster contorticonis* Ratzeburg (Platygastrinae) and *Iphitrachelus gracilis* Masner (Sceliotrachelinae) to the Bristish faunal list. HUGGERT (1976) described three new species of Platygastridae from Zaire viz. *Iphitrachelus africanus*, *Leptacis mitratus*, *Holocoelia debaucheela* and a key to known species of *Iphitrachelus* was prepared. The genus *Miramblyaspis* Dodd was considered as a junior synonym of *Leptacis* Förster and the type species of *Miramblyaspis* was transferred to *Leptacis*. The Nearctic species of *Iphitrachelus* Walker along with a key to World species was published by MASNER (1976).

RICHARDS (1977) published the second edition of Hymenoptera, Introduction and Key to Families, in which Proctotrupoidea group was divided into three super families: Proctotrupoidea**,** Scelionoidea and Ceraphronoidea. Scelionoidea was differentiated from the other two superfamilies by the shape of the metasoma and by the number of articuli of the antenna. Within Scelionoidea, he distinguished two families: Scelionidae and Platygastridae, based on the forewing venation and the antennal structure.

ANNECKE and PRINSLOO (1977) described a new species of *Allotropa* Förster viz. *A. kamburovi*, parasitoid on citrus mealy bug, *Planococcus citri* (Risso). *Anopedias lacustris* was reported by HUGGERT (1977) from Canada, the first species of this genus recorded outside Europe. SZABO (1977) described four new *Trichacis* species: *T. hungrica*, *T. afurcata*, *T. pannonica* and *T. tatika* extracted from soil samples by the help of Moczarsky- Wrinkler apparatus in Hungary.

KOZLOV (1978) synonymized the genera *Sactogaster* and *Synopeas*, *Sactogaster* as the subgenus of *Synopeas*. FITTON *et al.* **(**1978) published a checklist of British Insects, a work in which 157 species of Platygastridae and 123 species of Scelionidae were presented.

One of the pioneers in the field, MUKERJEE (1978) reported 15 species of Platygastridae from India. Thirteen species among them were new and one was a new record to India. Key to Indian species of *Anopedias* Kieffer and distributional data of some known species were also included. MACGOWN and NEBEKER (1978) prepared a taxonomic review of *Amitus* Haldeman (Sceliotrachelinae) of the western hemisphere.

ALENKSEYEV (1979) described a new species *Isolia longistriata* from middle Asia. YOSHIDA and HIRASHIMA (1979) studied the systematics of Proctrotrupoid and Chalcidoid parasitoids of gall midges injurious to Pinus and Cryptomeria.

RASNITSYN (1980) included Platygastridae and Scelionidae families in a new superfamily, Diaprioidea. He placed Platygastroidea as a sister-group to Chalcidoidea.

HUGGERT (1980) conducted taxonomical studies on some genera and species of Platygastrinae. A new tribe Gastrotrypini was established for the genus *Gastrotrypes* Brues. MASNER (1980) gave a generic diagnosis of *Acerotella* Masner, described six new species and provided a key to Nearctic species. The higher classification, species groups and World distribution of this genus were also discussed. A new species of *Inostemma*, viz. *I. hockpari*, larval parasitoid of the pine gall midge, *Thecodiplosis* sp. was described by KO (1980) from Korea. The new species was an important biocontrol agent against the pine gall midge along with *I. seoulis*, *Platygaster matsutama* and *I. matsutama*.

YAMIGISHI (1980a) described two platygastrid species from Japan, *Sacespalus japonicua* and *Inostemma rufipes*. *Sacespalus* was reported for the first time from Japan. YAMIGISHI (1980b) described a species of *Trichacoides* from Japan, viz. *T. hirsutus*. He gave characters to distinguish this genus from *Platygaster*. An excellent illustration of the species was also provided.

MASNER (1981) made a revision of the Nearctic species of *Metaclisis* Förster. MUKERJEE (1981) described 40 new species from India, among which, *Fidiobia* Ashmead, *Platygastroides* Dodd and *Isostasius* Förster of Platygastridae were reported for the first time. Keys to known species of *Synopeas* and *Leptacis* from India were given along with illustrations.

A review of Proctrotrupoidea from India was prepared by MANI and SHARMA (1982) and summarized all the available information of this group from India. Over 170 species under 69 genera and a series of un-described species of some genera were dealt with. Synoptic keys to families, tribes, genera and species with notes on diagnostic characters and distribution were also included.

MASNER (1983) prepared a revision of the Nearctic species of *Trichacis* Förster which included 15 species. Among them nine species were new to science. Six previously described species were re-described. It also included the generic diagnosis and a key to Nearctic species. The higher classification, bionomics, world distribution and character states of species of *Trichacis* were also discussed.

AUSTIN (1983) investigated the ovipositor system of Platygastroidea, supporting its status as an independent superfamily. Some genera possessed the plesiomorphic *Ceratobaeus*-type ovipositor system (extended and retracted by antagonistic muscles) in common with Platygastridae, whereas

the rest of the genera of the mentioned tribes possessed apomorphic *Scelio*-type ovipositor system operated by changes in hydrostatic pressure, in common with the scelionids.

Five new species of Platygastridae associated with mango were described by AUSTIN (1984). *Synopeas procon*, *S. temporale*, *S. mangiferae* and *Inostemma oculare* were found to parasitize mango leaf midges *Procontarinia* sp. (Cecidomyiidae) while, *Inostemma apsyllae* was seen associated with psyllid, *Apsylla cistellata* (Buckt). He also gave a note on *Trichacoides indicus* Jackson (Platygastrinae) associated with *Procontarinia* and prepared a key to distinguish these parasitoids. Comments on the biology and distribution were also provided.

VLUG (1985) prepared a key to 97 Palearctic species of Platygastrinae, described by Haliday and Walker. Descriptions and illustrations of the type specimens were given based on the lectotypes. Synonymies were proposed for many species of *Platygaster*, *Leptacis*, *Synopeas* and *Amblyaspis*.

One of the most remarkable works in this group was done by MASNER and HUGGERT (1989). They made a World review and generic keys to subfamily Inostemmatinae with reassignment of these taxa to Platygastrinae and Sceliotrachelinae (Hymenoptera: Platygastridae). Out of the 41 genera treated, 15 were classified under subfamily Platygastrinae and 25 under the subfamily Sceliotrachelinae. Twenty new species were described as new to science. They were united as clusters of genera in each subfamily as follows: Platygastrinae: *Proplatygaster* cluster, *Isostasius*-cluster, *Inostemma*-cluster, *Allostemma*-cluster. Sceliotrachelinae: *Fidiobia*-cluster, *Aphanomerus*-cluster, *Isolia*-cluster, *Amitus*-cluster, *Allotropa*-cluster. These generic clusters were all further analysed and described in depth by AUSTIN & FIELD (1997).

VLUG (1991) described two new Palearctic species of Platygastridae, reared from gall midges on wheat. *Inostemma mosellane* sp. nov. was reared from *Sitodiplosis mosellana* (Gehin) and *Piestopleura laurae* sp. nov. from *Contarinia tritici* (Kirby).

MUKERJEE (1992) described three new platygastrid wasps from Garhwal Himalayas, India, viz. *Leptacis agastmuniae*, *Synopeas* (*Sactogaster*) *chamoliana* and *S. tehriensis*. The description of *S. tehriensis* was based on male specimen. Three new species of *Amitus*, whitefly parasitoids from the New-World were described by VIGGIANI and EVANS (1992). *Amitus benneti* and *A. aleuroglanduli* parasitoids of *Bemisia tabaci* (Gennadius) and *Aleuroglandulus malangae* Russell were collected from Puerto Rico. Another new species, *A. sculpturatus*, reared from *Tetraleurodes mori* (Quaintance) was collected from Maryland (USA) and was described.

MASNER (1993) made a publication on the hymenoptera of the World with an identification guide to families and reiterated the systematics of Proctotrupoidea superfamily in which he divided it into three superfamilies: Proctotrupoidea**,** Platygastroidea and Ceraphronoidea. The family Platygastroidea was separated from Proctotrupoidea by considering two major characters, viz. the relatively weakly sclerotised ovipositor which can be retracted inside the metasoma when not in use and also the basiconic sensilla present in the antennal clava of female and he accepted two families under this superfamily, viz. Scelionidae and Platygastridae.

VLUG (1995) made a major contribution by publishing a catalogue of Platygastridae (Platygastroidea) of the World in which in the first part, generic names followed by specific names have been arranged in alphabetical order. In the second part, the hosts of the Platygastridae were presented. The catalogue presents 72 genera of Platygastridae under which 949 species were treated. The catalogue provides information regarding the fauna, type

localities, sex, lectotype designations and also institutions where types were deposited. All genera and species were supported by a reference list of the most important papers.

VIGGIANI (1996) discovered the male of *Amitus fuscipennis* MacGown et Nebeker as a parasitoid of *Trialeurodes vaporariorum* (Westwood). Illustrations were also provided.

The international worker BUHL (1997a) described 35 new species of Platygastrinae, of which 17 species were from Oriental Region. Also, *Platygaster rugosiscutellum* Buhl was transferred to *Trichacoides* Dodd. BUHL (1997b) made a revision of some types of Platygastrinae described by Förster. Six species were re-described and *Synopeas melampus* and *S. rigidicornis* were transferred back to *Synopeas* from *Leptacis*, placed there by Vlug (1973). *Synopeas melampus* Kozlov was renamed as *S. sculpturatus*. *Scatogaster longicauda* and *S. pisi* were new synonyms proposed for *Sactogaster curvicauda*.

BHUIYA *et al.* (1999) recorded four species of parasitic hymenoptera from aleyrodid hosts on citrus in the Chittagong University Botanical Garden. Among them, *Allotropa* sp. and *Amitus* sp. were new records to Bangladesh. Genus *Iphitrachelus* Haliday was reported from Korea for the first time by describing *Iphitrachelus koreensis* along with illustrations by MEGYASZAI (1999). A key to known species of *Iphitrachelus* of the World was also presented along with the diagnosis and distribution of the genus.

CHARERNSOM *et al.* (2000) surveyed the parasitoids of sugarcane whitefly in Thailand. The field effectiveness, biology of important species and population dynamics of the whitefly and parasitoids were carried out. *Amitus* sp. was the most dominant larval pupal parasitoid found.

BUHL (2001) made taxonomic notes on some Platygastrids. Among the 20 species described, *Amblyaspis thoracica*, *Inostemma productum*, *Synopeas bifurcatus*, *S. obesus* and *S. solidus* were from Malaysia. An emendation of the description of *Platygaster danica* Buhl (1999) and comments on *Sacespalus japonicus* along with the illustration of the species were included.

BUHL (2002) described 14 new species of *Leptacis* from Malaysia, viz. *L. adebratti*, *L. laeviusculus*, *L. latispina*, *L. lineatifrons*, *L. longiclava*, *L. mendologensis*, *L. microgaster*, *L. microspina*, *L. microtrichiata*, *L. nigricorpa*, *L. pteridis*, *L. pulla*, *L. synopeana* and *L. tenebrans*, illustrated by 17 text- figures.

BUHL (2003) described three new species of Platygastrinae from Sri Lanka, viz. *Platygaster srilankensis*, *Synopeas srilankensis* and *Leptacis srilankensis*, along with illustrations.

USHAKUMARI (2004) studied the platygastrid fauna of Kerala in detail and described eight species of *Platygaster* from India. A key to known species of *Platygaster* from India were also included in which 19 species were keyed. BUHL (2004) described three new species of Platygastrinae from Malaysia (Borneo, Sabah), viz. *Allostemma brunneum*, *Amblyaspis borneoensis* and *Leptacis acutalata*. The work was illustrated with 10 text-figures.

One of the prominent workers of Platygastridae, RAJMOHANA (2006) made studies on Platygastroidea of Kerala. The study revealed the presence of five genera, viz. *Amblyaspis* Förster, *Inostemma* Haliday, *Isostasius* Förster, *Synopeas* Förster and *Leptacis* Förster. A key to subfamilies of Platygastridae and a key to genera of Platygastrinae in Kerala was also given. BUHL (2006) described three new Afrotropical species of

Platygastrinae, viz. *Amblyaspis elgonensis, Platygaster gambiana and Synopeas pallidicornis* along with the illustrations to species.

USHAKUMARI and NARENDRAN (2007) made a taxonomic revision of *Leptacis* Förster of India. Thirteen species were described as new to science. Notes on the known species of *Leptacis* were also included. Separate keys to male and female of *Leptacis* species from India were given. BUHL (2007) described five new species of Platygastrinae in which, *Synopeas bouceki* and *Platygaster cephalandrae* were from India. He also described the unknown female of *Leptacis propodealis* Buhl and the work was illustrated by 21 text- figures.

MIKO *et al.* (2007) presented a work on the skeletomusculature of the head and mesosoma of Scelionidae. He studied the representatives of 27 scelionid genera together with 13 non-scelionid taxa. Terms employed for other groups of hymenoptera were reviewed and a consensus terminology was proposed. External characters were re-described and their phylogenetic importance was discussed. Two hundred and twety nine skeletal structures were termed and defined from which, 84 of them were newly established or re-defined.

MURPHY *et al.* (2007) performed a phylogenic study of the platygastroid wasps. The subfamilies, Platygastrinae and Sceliotrachelinae were found to be monophyletic. SHARKEY (2007) studied the phylogeny and proposed a revised classification of hymenoptera. Molecular and morphological cladistic and pre-cladistic studies were summarized. He prepared a review of classical hymenopteran classification and phylogeny. He synonymized Scelionidae with Platygastridae, based on the phylogenetic analysis by Murphy *et al.* (2007), leading to which, only family Platygastridae remained valid and all the five subfamilies were assigned under this single family.

BUHL (2008a) described a few little known species of Platygastridae from Indonesia and Malaysia. Forty two new species were described as new to science and *Platygaster intermedius* Ushakumari (2004) was transferred to *Synopeas*. The unknown male of *Gastrotrypes caudatus* Brues was described and Oriental key to species of *Leptacis*, *Platygaster* and *Synopeas* were provided. BUHL (2008b) described 24 new species of Platygastrinae in which, 18 species were from Oriental Region. The male of *Isolia indica* was described from India. Also, comments were given on *Amblyaspis latiscapa* Buhl and *Inostemma rufipes* Kieffer.

BUHL (2009a) described 27 new species of Platygastridae under six genera from the Oriental Region (Vietnam). A key to Oriental species of *Sacespalus* Kieffer and *Amblyaspis* Förster were given. The same author (2009b) made taxonomical studies on Oriental Platygastridae, in which 14 species were described as new to science. New combinations for nine species of *Leptacis* viz. *L. aeros*, *L alus*, *L. asiaticus*, *L. benazeer*, *L. diversus*, *L. manii*, *L. mustus*, *L. nuperus* and *L. scposus*, described by Ushakumari and Narendran (2007) were made and they were transferred to *Synopeas*. New locality records for 20 species were also given.

BUHL (2010) described three new species of Platygastrinae from Malaysia, viz. *Leptacis joenssoni*, *Synopeas viklundi* and *S. westergaardi*. The work was illustrated by 13 text- figures.

RAJMOHANA and DIVYA (2011) prepared a checklist of Platygastrinae and Sceliotrachelinae of India in which, 76 species of Platygastrinae under 14 genera and three species of Sceliotrachelinae under three genera were listed. Available host records were also provided.

BUHL (2011) described 38 new species of subfamily Platygastrinae under four genera and two species of genus *Allotropa* Förster

(Sceliotrachelinae) as new to science. Key to Afrotropical species of *Amblyaspis* Förster, *Inostemma* Haliday, *Leptacis* Förster, *Platygaster* Förster and *Synopeas* Förster were also provided.

Ten new species were described by BUHL (2012) in which *Synopeas himalayanum* and *Amblyaspis hartmanni* were from Oriental Region. Illustrations for the species were also added.

VEENAKUMARI *et al.* (2012) added three new species of Sceliotrachelinae to Indian fauna of Platygastridae. Two species of the genus *Fidiobia* Ashmead, viz. *F. nagarajae* and *F. virakthamati* and one species of *Plutomerus* Masner and Huggert, viz. *P. veereshi* were described. A key to three known species of *Plutomerus* of the World along with the digital images of the species were also provided.

VEENAKUMARI *et al.* (2013a) described two new species of Platygastrinae, viz. *Trichacoides ranganabettensis* and *Platygaster neostriatitergites* along with the first report and description of the unknown female of *Isolia indica* Buhl from South India. VEENAKUMARI *et al.* (2013b) described three new species of *Allotropa* Förster (Sceliotrachelinae), mealybug parasitoids, viz. *A. gundlupetensis*, *A. vanajae* and *A. nigra* from India. The same authors (2013c) described five new species of *Amblyaspis* Förster, viz. *A. fabrei*, *A. panhalensis*, *A. charvakae*, *A. tipusultani* and *A. ashmeadi* from India which also included notes on males of the species except *A. charvakae*.

VEENAKUMARI *et al*. (2014a) reported a few genera from Andaman and Nicobar islands and Indian ocean. Genus *Gastrotrypes* was reported from the Indian mainland for the first time.

BUHL (2014a) described 12 new species of Platygastrinae, viz. *Amblyaspis cederholmi*, *Inostemma srilankense*, *Platygaster bygebjergi*, *P.*

concava, *P. harasbeddensis*, *P. joergenseni*, *P. pilosiscutellata*, *Synopeas anderssonianum*, *S. brincki*, *S. bygebjergi*, *S. sheldrakei* and *S. veenakumarii* from Sri Lanka which was illustrated by 38 text-figures. *Gastrotrypes vindhyensis* (Mukerjee) nov. comb. was transferred from *Metanopedias* and the female of the species was described. BUHL (2014b) described six new species of Platygastridae from Thailand, viz. *Leptacis calabuigae*, *L. unicornis*, *Platygaster lissosoma*, *P. pallidifemur*, *P. subelongata* and *S. khaoyaiense*. *Lepatcis propodealis* Buhl (2001) was recorded from Thailand and emendations to its former descriptions were given.

Six new species of Platygastrinae under three genera from India, viz. *Amblyaspis khasiana*, *A. kurinjii*, *Gastrotrypes longicaudatus*, *G. manii*, *Isolia kalingae*, *Synopeas* (*Sactogaster*) *ribhoiense* were described by VEENAKUMARI *et al*. (2015). *Synopeas halmaheranse* Buhl was recorded from India for the first time and a note on this species was also added.

ANJANA and RAJMOHANA (2015) described three new species of *Amblyaspis* Förster from India, viz. *Amblyaspis hirsuta*, *A. emarginata* and *A. narendrani*. Diagnosis of the genus along with the identification key to Indian species of the genus were also included.

ANJANA and RAJMOHANA (2016a) described a new species of *Gastrotrypes* Brues from India, viz. *Gastrotrypes keralensis*. The female of *G. vindhyensis* (Mukerjee) known only from Sri Lanka was recorded for the first time from India and was re-described. A key to the World species of *Gastrotrypes* was also included.

ANJANA and RAJMOHANA (2016b) reported *Platygaster luteipes* Buhl for the first time from India. Several specimens of both sexes of the species were reared from the globular galls on mature leaves of black pepper. The hitherto un-described male of the species was characterized and

illustrated. The same authors (2015b) again reported a new host association of *Trichacoides indicus* Jackson along with the first report of *Trichacoides rugosiscutellum* Buhl from India which was reported earlier only from Australasian region. *Trichacoides indicus* was reared from the leaf galls of *Mimusops elengi* Linn. A key to species of *Trichacoides* from India was also provided.

ANJANA and RAJMOHANA (2016d) described a new species of *Amitus*, viz. *Amitus vignus* reared from the parasitised puparium of whitefly *Zaphanera* sp. (Hemiptera: Aleyrodidae) on *Vigna trilobata* from India, which formed the first report of a platygastrid parasitoid from *Zaphanera* Corbett, earlier only Encyrtidae and Aphelinidae were known attacking this whitefly genus. A key to species of *Amitus* from India was also provided.

CHAPTER III

MATERIALS AND METHODS

1. SPECIMEN COLLECTION

a. Study Area (Plate 1: Figures A & B)

Specimens for the study were collected from various localities of Kerala state, covering variable habitats, protected areas such as sanctuaries, national parks, natural areas like backyards, grasslands and shola patches. Agro-ecosystems were also surveyed. More than 1000 specimens were collected and studied. Since, most of the taxonomic studies of Platygastrinae and Sceliotrachelinae were based on females, only females were studied. The study was conducted for a period of three years, from March 2013- February 2016.

Kerala lies along the coastline, extreme south west of the Indian peninsula, flanked by the Arabian Sea on the west and the mountains of the Western Ghats on the east. The area stretches north-south along a coastline of 580 kms with a varying width of 35 to 120 kms located between north latitudes $8^0$17'30" and $12^0$47'40" and east longitudes $74^0$52' and $72^0$22'. The geographical area of the state is about 39,863 km^2 and physiographically the state can be divided into four domains from east to west, viz. the Western Ghats, the foothills, the midland and the coastal low- land (Chandrashekara 2015). The Western Ghats form an almost continuous mountain wall, except near Palakkad where there is a natural mountain pass known as Palakkad Gap. The average elevation of the Western Ghats is about 1500 meters above sea level.

There are 44 rivers in Kerala, of which 41 originate from the Western Ghats and flow towards west into the Arabian Sea. Only three tributaries of the river Cauvery originate in Kerala and flow east into the neighboring states. These rivers and streams flowing down from the Western Ghats either empty themselves into the backwaters in the coastal area or directly into the Arabian Sea. Kerala is rich with variety of soils of which laterite and loams form the major soil types of Kerala.

b. Climate

Kerala is located in the humid tropics and the state is well known for the green landscape, water bodies, mountains, valleys and evergreen forests and is often called the land of monsoons. Even though, South west monsoon (June to September) and North east monsoon (October to November) are there in Kerala, South west monsoon is more predominant. About 85% of the annual rainfall is received during the monsoon period between June and November. The occurrence and distribution of rainfall in the state also shows high spatial variations.

c. Collection Gadgets

For collecting insects, mainly two types of traps: passive and active traps are used. The former intercept insects randomly, while the latter use specific attractants (odors, colors etc.) to attract insects more selectively. Examples of passive traps include the Malaise trap and attraction traps include the Moericke trap, where insects are attracted by color.

i) Sweep net (Plate 2: Figure F)

Net-Sweeping, an active method of collection is considered as the most rewarding methods for collecting Platygastridae, since relatively good diversity of species can be collected in a relatively short time. But it is

important to choose an area where the vegetation is as diverse as possible. A grassy land with a good variety of flowering plants, especially yellow flowers surrounded by several kinds of bushes and trees is found to be an excellent location for collection.

Sweep net used in the present study was a modified model of the type designed by Noyes (1982). It consisted of a net bag attached on a triangular frame, which was made of aluminum, which in turn was connected to a cylindrical handle. The size of frame measured 48 x 46 x 48 cms. The triangular frame was found more effective since it remained in contact with the ground while sweeping and with a much larger area covered in each sweep, the collections got were far more than that captured by the round frame net. The handle measured about 106- 122 cms. The long handle allowed the net to be used far away from the body as possible, making sweeping easier underneath low, overhanging bushes, and also extended the area of each individual sweep. The net bag was 600 mm long and was made up of a thin white cotton cloth, which allowed easy passage of air and prevented the escape of minute insects. The top of the bag that was attached on the frame was made of canvas. The bag was attached to the frame by strong wire threaded alternately through the bag and holes drilled at intervals through the frame. The sweeping was done as described by Noyes (1982). The specimens were prevented from escaping, by lapping the bag quickly over the rim. Parasitic hymenoptera collected were immediately sucked into an aspirator.

ii) Aspirator/ Pooter (Plate 2: Figure G)

The aspirator also called pooter is a small and simple piece of apparatus, for collecting small insects. It consisted of a glass or plastic vial fitted with a two-holed cork holding two glass tubes. A rubber tube was attached to one end of the tube for sucking through the mouth which was open

in both ends. The other end of this tube remained in the vial and was covered with a piece of fine muslin cloth to prevent insects from entering the tube. By suction, the vaccum created inside the vial sucked the desired insect into it. Specimens collected were killed by placing a small piece of cotton soaked with a few drops of ethyl acetate in the entry tube. The dead insects were then transferred to 70 percent alcohol with the help of a fine brush.

iii) Malaise trap (Plate 2: Figure E)

Malaise traps are effective insect sampling gadgets, for non-formicid hymenoptera compared to the Moericke pan traps (Leirana-Alcocer & González- Moreno, 2007). This trap finds preference because it is a passive form of collection with minimal maintenance required (Matthews and Matthews 1971). The traps are serviced easily as and when required. Malaise traps are also popular because of the large numbers of insects it collects (Bartholomew and Prowell 2005). Two advantages of the Malaise trap are that it need only be serviced once a week for emptying and it can be managed by a non-entomologist. Another major advantage is that it can be used even during rainy season.

The trap was originally designed by Dr. R. Malaise (1937). Later a suitable model was designed by Townes (1972). The insects collected mostly by this method are parasitic hymenoptera and Diptera. The trap consisted of a tent made up of fine mesh terelene gauze to intercept flying flies. Intercepted insects fly upward and become trapped at the top of the trap in a collecting jar often filled with a killing agent. The trap was about l830 mm wide, 1067 mm high at one end and 1980 mm at the other end. The insects when they fly into the sides of the trap by chance crawled upwards to the roof and entered the collection tube containing 70- 90 per cent alcohol, placed in a collecting jar at the top of the trap. In placing Malaise traps, the flight behavior of the target taxa and factors such as topography of the habitat, density of vegetation, wind

and water conditions need to be taken into consideration (Gressitt and Gressitt 1962). The advantage of this trap is that, it is easy-to-make, low cost sampling tool, which can capture flying arthropods day and night, especially when illuminated at night (Gressitt and Gressitt 1962; Basset 1988; Campos *et al.* 2000). Limitations of Malaise traps are that they are confined to the sampling of flight-active arthropods, having a comparatively low trapping effectiveness which sometimes may cause statistical problems, and the trap equipment becoming easily damaged by wind, especially in long-term studies (Basset 1988).

iv) Yellow pan traps (Plate 2: Figure D)

Pan traps also referred to as Moericke traps or 'water traps', show many similarities to pitfall traps, but are generally operated above the soil surface (Cane *et al.* 2000). This is another passive method employed for the collection of parasitic hymenoptera. Species that are rarely swept or collected using malaise trap can be often collected using this. It is based on the principle that insects get attracted towards yellow color. The trap consisted of a shallow tray of 30 mm square and about 600- 750 mm deep, painted yellow inside and black outside. The tray was filled with water to which few drops of detergent were added to break surface tension. It was then set in a grassy land. Target insects sink into the water when they land on the surface. The trapped insects were washed with fresh water and then filtered through a fine mesh and transferred to 70 per cent alcohol. The advantage of this trap is that, they are cheap and easily transportable. But since they are sensitive to rainfall, they need to be regularly checked.

v) Rearing

Rearing is one of the promising methods of collecting parasitic hymenoptera because the host of the species can be tracked only through this

method (Narendran 2002). Biological information of a species is very well important in the bio-control programs. Taxonomists can associate the male to its female species easily through this method only. But it had a limitation that only a few species could be collected in any given time and also it required more time and effort compared to other collection techniques.

In the present study, Cecidomyiid galls (leaf, stem galls) were collected and were kept in plastic containers plugged with cotton wool or in paper bags to await the emergence of parasitoids. The emerging insects were attracted to the light and collected into a glass tube. Also, the egg mass, larvae and pupae of other suspected hosts like whiteflies and mealybugs were collected and kept for rearing.

2. PRESERVATION OF SPECIMENS

a. Unmounted specimens

The safest method of storing un-mounted platygastrids is to keep them in 70% alchohol.

b. Relaxing

Relaxing often helps to prevent breakage of specimens while card mounted. When using ethyl acetate as the killing agent, the best method of relaxing specimens is to keep them in an atmosphere of acetic acid for atleast 6-8 hours (Noyes 1982).

A clear plastic box with a tight fitting lid was taken and the bottom was covered with a thick cotton wool. Few drops of glacial acetic acid were added, followed by the second layer of cotton wool. Specimens to be relaxed were kept on a tissue in a glass dish and then they were kept in a closed box.

3. STEPS INVOLVED FOR SPECIMEN STUDY

a. Card Mounting

Specimens were mounted based on the procedure described by Noyes (1982), except that cards used were pointed instead of rectangular. Before mounting, the specimens were placed on a slide with a few drops of alchohol. The wings, legs and antennae were then correctly positioned using needle and a brush. A tiny drop of glue was put on the tip of the card using a needle. The specimen was picked up by touching the mesopleural region. It was then positioned on the triangular card, which was tilted at about 45° to the plane of the card in such a way that all the important parts were clearly visible. The specimens thus mounted were held on entomological pins and were stored in insect boxes containing camphor and phenol or naphthalene balls to provide protection against insect attacks. Paradicholobenzene was also used as an anti-fungal agent. The collection boxes were periodically subjected to warming by using lamps with incandescent bulb, inorder to avoid fungal growth.

b. Labeling

Temporary labels which were given in the field at the time of collection were replaced by permanent ones after mounting. GSM ivory cards sliced in rectangular cards were used for labeling specimens. Rotring pen (0. 2mm) was used for hand written labels since it would not fade even after years. The label included:

1. The name of the country (in capital letters), state followed by district and exact area.
2. Date of collection
3. Name of the collector

4. Host data (if available)

After identification, the binomial species name and the Reg . No. were pinned under the host data. *Holotypes* were indicated with red circular cards and *Paratypes* with yellow circular cards respectively.

c. Registering

Specimens were registered after identifying upto species level. *Holotypes* and *Paratypes* were given separate register numbers. While registering the species, following data were provided in the Register:

1) Register number

2) Name of the species with author name

3) Name of the collection locality

4) Date of collection

5) Collectors name

6) Remarks

4. MICROSCOPES AND DIGITAL PHOTOGRAPHY

Labomed CZM6 stereo microscope (Plate 2: Figure A) was used for sorting, mounting and for identification upto generic level. Identification of the specimen upto species and imaging including measurements were carried out employing Leica M 205A stereo microscope (Plate 2: Figure B) with automated multiple image capture at preset focal levels using a Leica DFC 500 camera, and images processed were combined using the Leica Application Suite image processing system.

5. MAPPING AND DISTRIBUTION

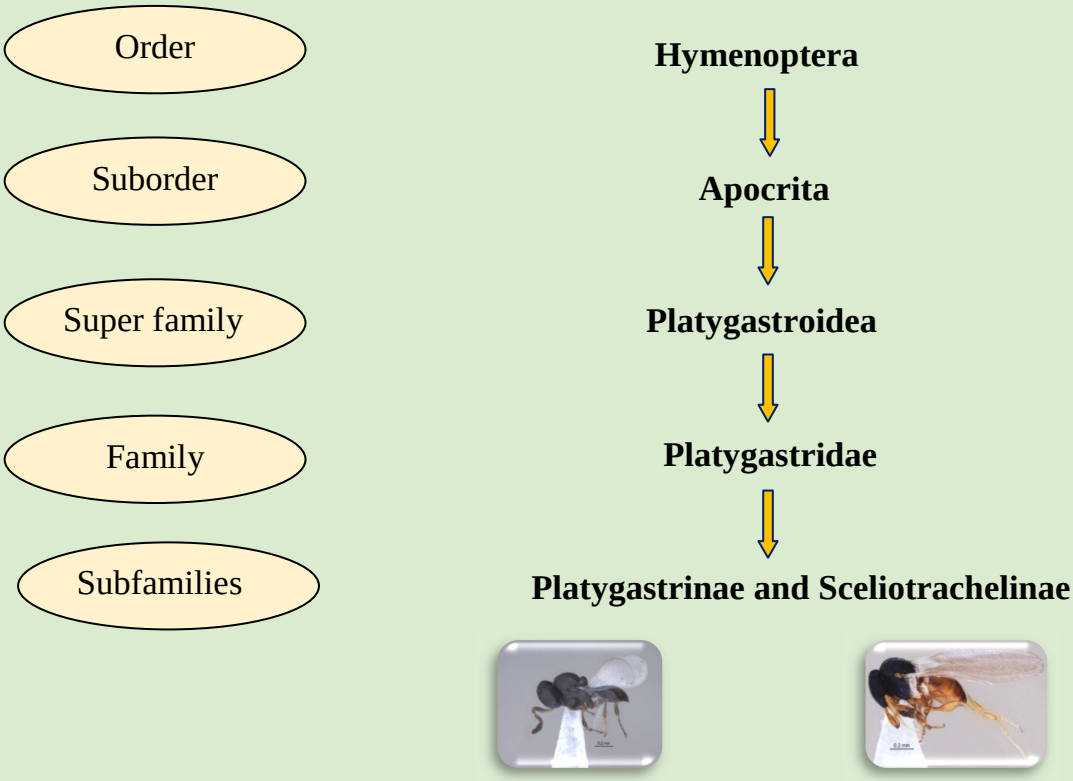
Mapping always gives us necessary data about the collection locality of the specimen studied. Information regarding the latitude and longitude of collection localities of this study were gathered using GPS by GARMIN etrex®H. Distribution maps of species were generated using DIVA- GIS software version 7.1.7. Geographical co-ordinates of the localities surveyed have been provided as a list at the end of this thesis.

3.1: SYSTEMATIC STATUS, DIAGNOSIS OF PLATYGASTRINAE AND SCELIOTRACHELINAE AND KEY TO SUBFAMILIES OF PLATYGASTRIDAE

Platygastroidea was under the superfamily Proctotrupoidea (Ashmead 1893; Mani and Sharma 1982). Masner (1993) separated this superfamily from Proctotrupoidea by considering the relatively weakly sclerotised ovipositor which could be retracted inside the abdomen when not in use and also by considering the antennal club of female provided with basiconic sensillae. Platygastroidea consisted of two families, Scelionidae and Platygastridae (Goulet and Huber 1993). Muesebeck (1979) divided family Platygastridae into three subfamilies, viz. Inostemmatinae, Sceliotrachelinae and Platygastrinae. Masner and Huggert (1989) recognized only two subfamilies, viz. Platygastrinae and Sceliotrachelinae. Sharkey (2007) studied the phylogeny and in his recent classification of hymenoptera, he synonymized Scelionidae with Platygastridae, based on the phylogenetic analysis by Murphy *et al.* (2007).

Platygastroidea is the third largest superfamily (Austin *et al.* 2005) comprising of a single family Platygastridae which includes 6008 species under 265 genera. The family consists of five subfamilies, viz. Scelioninae, Platygastrinae, Sceliotrachelinae, Teleasinae and Telenominae (Hymenoptera Online (HOL) [Online] available from *http://hol.osu.edu. [accessed 31 March 2016]* and The genera of Platygastroidea (Hymenoptera) of the World *http://osuc.biosci.ohio-state.edu/hymDB/eol_scelionidae.home,* maintained by Platygastroidea Planetary Biodiversity Inventory project. Even some recent workers treat Scelionidae as a separate family; we have followed the classification of Platygastroidea with respect to Hymenoptera online (HOL) available from *http://hol.osu.edu.[accessed14June2016]* and so, Platygastridae is the only family considered under this superfamily.

Systematic status of subfamilies Platygastrinae and Sceliotrachelinae



The most important character of this superfamily is the structure of metasoma and the operating mechanism of the ovipositor, which can be retracted inside the soft tissue when not in use (Austin 1983). Another major character of this group is the presence of basiconic sensilla on the clavomeres of the female antenna. Antennae inserted near clypeus, metasoma acutely margined at sides, and reduced wing venations are also the distinguishing characters of this superfamily. Two subfamilies, viz. Platygastrinae and Sceliotrachelinae are considered for the present study.

Platygastrinae, one of the diverse subfamilies of family Platygastridae contains about 1828 species under 40 genera globally. From India, 97 species under 14 genera and from Kerala only 24 species under five genera have been so far reported (Rajmohana and Divya 2011). Sceliotrachelinae consists of 146 species under 28 genera globally (Hymenoptera Online (HOL) [Online] Available from *http://hol.osu.edu. [accessed 31 March 2016]*. From India, only 11 species under five genera have been reported (Rajmohana and Divya 2011; Veenakumari *et al.* 2013a, 2013b, 2015) indicating the rarity of this group and only one species of Sceliotachelinae viz. *Allotropa vanajae* Veenakumari and Buhl has been reported from Kerala (Veenakumari *et al.* 2013b).

3.2: KEY TO SUBFAMILIES OF PLATYGASTRIDAE

(Adapted from Rajmohana 2006)

1. Laterotergites wide, loosely attached to sternites 2

- Laterotergites narrow, tightly attached to sternites 3

2. Antennae in females 10-11 segmented; submarginal vein always present and continued by a mariginal vein .....**Telenominae**

- Antennae in females 8-9 segmented; submarginal vein present, often knobbed apically, marginal vein never present..... **Sceliotrachelinae**

3. Female antennae usually with 14 or 12 segmented, rarely with 8-12 segments 4

- Female antennae 10 or less than 10 segmented ..... **Platygastrinae**

4. Lateral ocelli much closer to front ocellus than to orbits; T3 always largest; marginal vein several times longer than stigma vein; postmarginal vein absent.....**Teleasinae**

- Lateral ocelli usually closer to orbits than to front ocellus, if closer to ocellus, T3 not largest or marginal vein shorter than stigmal vein and post marginal vein long or wing veinless .....**Scelioninae**

Subfamily Platygastrinae

Diagnosis: Body slender to elongate, body length usually 0.6- 1mm (rarely upto 4mm); black, sometimes yellow in color; antenna usually 10 segmented in both males and females, rarely 8 or 9 segmented; clava with 3-5 clavomeres; metasoma usually elongate with six visible tergites (three in *Isostasius*; five in *Gastrotrypes*); laterotergites narrow and tightly appressed; forewings with or without knobbed submarginal vein.

Remarks

Platygastrinae are parasitoids of Cecidomyiid gall midges and are usually koinobiont. They are mostly melanic, but xanthic forms are also present and are cosmopolitan in distribution. Regional affinities are not usually noticed in this subfamily. But genus *Anectadius* Kieffer is endemic to India, with only two species reported Worldwide.

Subfamily Sceliotrachelinae

Diagnosis: Squat to plump species, less than 2mm; body dorsoventrally flattened; antennae 8-9 segmented with 3 distinct clavomeres or fused to a single clavomere; laterotergites wide, metasoma often short and plump; forewing usually with knobbed submarginal vein.

Remarks

Sceliotrachelinae are parasitoids of homopterous families like Pseudococcidae and Aleyrodidae. Only less number of genera are reported Worldwide as well as in India and Kerala compared to Platygastrinae.

3.2: MORPHOLOGY AND MEASUREMENTS (Plate 4-7)

Standard morphological terminology and abbreviations are after Masner & Huggert (1989) and Miko *et al*. (2007).

- Admedian lines (al) – Two abbreviated parallel lines in anteromedian part of mesoscutum, often reduced to mere pits.
- Antennal formula – Total number of apparent segments in female antenna (first number) and male antenna (second number), excluding radicle (ra); e.g. antennal formula 8-10 in *Iphitrachelus*.
- Antennal segments/ Antennomeres (A1, A2, A3….) – all segments of the antenna excluding radicle (ra); numbered from (A1) to distal segment.
- Anterior ocellus (ao) – middle ocellus in ocellar triangle.
- Clava – Several distal flagellar segments, usually incrassate, shaped and sized differently from preceeding segments.
- Clavomeres/ claval segments – each segment of the clava.
- Diameter of ocellus – maximal diameter of any ocellus.
- Epomium (ep) – anteriovertical keel on side of pronotum (pn).
- Foamy structures – whitish or yellowish structures usually on propodeum (pr), rarely on T1, S1 or S2.
- Frons– region of head between inner orbits of eyes (io), lower margin of toruli (tr) and anterior ocellus (ao).
- Hyperoccipital carina (hc) – transverse carina on top of head behind posterior ocelli (po).

- Interorbital space (IOS) – shortest distance of frons (fr) between inner orbits of eyes (io).
- Knob– apex of submarginal vein (sv), usually swollen, rounded.
- Lamella – transparent sharp edge on apex of scape (A1) partly housing the base of pedicel (A2) from both sides.
- Lateral ocellar line (LOL) – shortest distance on vertex (vx) between inner margins of anterior ocellus (ao) and posterior ocelli (po).
- Laterotergites– lateral part of tergite.
- Marginal cilia – fringe of hairs around periphery of forewings and hindwings.
- Median keel (s) of propodeum – usually two, rarely three longitudinal keels on the propodeum (pr), in some platygastrids, keels may be covered with foamy structures.
- Mesonotum (msn) – dorsal sclerite of mesothorax comprising mesoscutum (msc) and scutellum (sc).
- Mesopleural depression– declivity on mesopleuron (mpl).
- Mesopleuron (mpl) – lateral region of mesothorax.
- Mesoscutum (msc) – anterior region of mesonotum (msn) between pronotum (pn) and scutellum (sc), often divided into middle and lateral lobes by notauli (nt).
- Mesosoma – Thorax and propodeum (pr) combined.
- Metanotum – dorsal sclerite of metathorax.
- Metapleuron (mp2) – lateral region of metathorax.

- Metasoma – abdomen posterior to propodeum (pr).
- Microtrichia – hairs on the surface of fore (fw) and hind (hw) wings.
- Notauli (nt) – longitudinal furrows on mesoscutum (msc).
- Occipital carina (oc) – transverse ridge on posterior part of head dividing vertex (vx) from occiput (ot).
- Occiput (ot) – region of head posterior to occipital carina (oc).
- Ocular ocellar line (OOL) – shortest distance on vertex (vx) between outer margin of posterior ocellus (op) and inner orbit of eye (io).
- Posterior ocellar line (POL) – shortest distance on vertex (vx) between inner margins of posterior ocelli (po).
- Posterior ocellus (po) – paired outer ocelli of the ocellar triangle.
- Pronotum (pn) – dorsal sclerite of prothorax.
- Propodeum (pr) – first abdominal tergite fused with thorax.
- Scape – first antennal segment.
- Scutellar suture – suture between the scutellum and axilla (ax).
- Scutellum (ds) – posterior region of mesonotum (msn) between mesoscutum (msc) and metanotum (mtn).
- Sternite – ventral sclerite of metasoma.
- Submarginal vein (sm) – first apparent tubular vein on the forewing of some Platygastridae, sometimes knobbed, as in *Inostemma*.
- Tarsomere – any tarsal segment of all three pairs of legs.

- Tegula – sclerite covering base of forewing.
- Temple– region of head posterior to eye in dorsal view.
- Tergites (T1- T6) – dorsal sclerite of metasoma.
- Vertex (vx) – dorsal region of head between anterior ocellus (ao) and occipital carina (oc).

CHAPTER IV
OBSERVATIONS AND RESULTS

Taxonomic investigations on two subfamilies of Platygastridae, viz. Platygastrinae and Sceliotrachelinae were conducted based on samples collected from various habitats in different localities of Kerala state (Plate 2: Figure C; Plate 3: Figures A- D). More than thousand samples collected from fourteen districts were studied. Identifications were done based on literatures available till March 31st 2016. All the available *Holotypes* at NBAIR and WGRC, Kozhikode were examined in detail as a part of this study.

A dichotomous key to Indian species of all genera under Platygastrinae and Sceliotrachelinae were prepared, with the exception of the immensely diverse *Platygaster and Leptacis*, for which the keys are to species from Kerala only. Keys of *Amblyaspis*, *Gastrotrypes* and *Trichacoides* were modified from the published keyes by Anjana and Rajmohana. Rest of the key to species were newly prepared. Detailed descriptions of all studied specimens are included inorder to maintain a uniformity through out the thesis.

A revised checklist and a host/ host-plant parasitoid list of genera and species of Platygastrinae and Sceliotrachelinae from India are also provided. All species descriptions are supplemented by digital images and distribution maps. All the studied specimens are deposited at Zoological Survey of India, Kozhikode.

There was a considerable hike in the number of species of Platygastrinae and Sceliotrachelinae after this study (Table 4.1; Figure 5. 2; Figure 5. 3).

Table 4. 1 Status of Platygastrinae and Sceliotrachelinae in India and Kerala (Before and after the study)

	Region	No of Genera		No of species	
		Platygastrinae	Sceliotrachelinae	Platygastrinae	Sceliotrachelinae
Before study	India	14	5	97	11
	Kerala	5	1	24	1
After study	India	14	5	116	14
	Kerala	9	3	52	6

In subfamily Platygastrinae, a total of 52 species under nine genera (Table 4. 2; Figure 5.1) have been treated in which, 19 species are new to science (15 unpublished and 4 published). Number of species treated in each genus is also represented (Table 4.2; Figure 5.1). For four species not represented in the collection, diagnosis has been provided.

Females of three species have been recorded for the first time from the World. Eight species are first reports from India. Four genera and 20 species are recorded from Kerala for the first time. Nine species (seven species of *Platygaster* Latreille and two species of *Leptacis* Förster) have been re-described by studying the *Holotypes* at ZSI, Kozhikode.

Under the subfamily Sceliotrachelinae, a total of three genera and five species were described in which, three species are new to science. Diagnosis of one species, viz. *Allotropa vanajae* Veenakumari and Buhl, reported earlier from Kerala, but not represented in the present collection is also provided. Two genera and two species are recorded from Kerala for the first time.

Table 4. 2. Number of species studied in each genus

Genera	Total No. of species treated	No. of new species
Allotropa Förster	3	2
Amblyaspis Förster	6	4
Anectadius Kieffer	1	0
Fidiobia Ashmead	1	0
Gastrotrypes Brues	2	1
Inostemma Haliday	5	1
Iphitrachelus Haliday	2	2
Isolia Förster	2	1
Leptacis Förster	12	5
Platygaster Latreille	17	5
Synopeas Förster	4	0
Trichacoides Dodd	3	1
Total	**58**	**22**

SUBFAMILY PLATYGASTRINAE

4.1.1: Diagnostic characters

Body length usually 0.6- 1mm (rarely upto 4 mm). Black, sometimes yellow in color; elongate; antennae inserted close to clypeus, usually ten segmented (8 segmented in *Iphitrachelus*), clava usually 4 segmented, rarely 3 or 5 segmented; forewings usually veinless, some are with small submarginal vein, knobbed in some genera like *Inostemma*, *Isostasius* etc; scutellum usually unarmed except in a few genera like *Leptacis*, *Synopeas* etc; tarsi usually five segmented (4 segmented in *Iphitrachelus*); metasoma with six visible tergites; in genus *Inostemma*, most of the species are with metasomal horn for housing the ovipositor.

4.1.2: A KEY TO INDIAN GENERA OF PLATYGASTRINAE

1. Forewing with a long submarginal vein, knobbed apically (Plate 20: Figure D) 2

- Forewing with short submarginal vein, never knobbed at apex…… ..…3

2. Antennae 8 segmented, clavomeres fused into a single segment (Plate 24: Figure G)….. ..... ***Iphitrachelus*** **Haliday**

- Antennae 10 segmented, clava with 3-5 distinct clavomeres, clavomeres never fused 4

3. T5 elongate, never transverse (Plate 16: Figure C); notauli absent…….. .....***Gastrotrypes*** **Brues**

- T5 never elongate, always transverse; notauli present or absent……..….. 5

4. Metasomal horn usually present (absent in some); OOL clearly shorter than LOL; T3-T5 never fused, metasoma with 6 visible tergites……..…..*****Inostemma*** **Haliday**

- Metasomal horn never present; OOL subequal or longer than LOL; T3-T5 fused, metasoma with 3 visible tergites…… ……..… ***Isostasius*** **Förster**

5. A9–A10 almost fused (Plate 8: Figure F); scutellum never transverse, not separate from mesoscutum by a groove (Plate 11: Figure: E)……..... ***Amblyaspis*** **Förster**

- A9–A10 clearly separated; scutellum may be transverse or elongate, scutellum often separated from mesoscutum by a groove (Plate 40. Figure C)……..……...…….....5

6. Scutellum strongly convex, covered by sharp spines (Plate 57: Figure E)……..... ***Trichacoides*** **Dodd**

- Scutellum convex without any spines 7

7. Abdomen sessile or subsessile, T1–T2 with dense silvery hairs, (Plate 52: Figure H)…… ..... ***Synopeas*** **Förster**

- Abdomen petiolate, T1–T2 without or with few silvery hairs laterally... …8

8. Scutellum behind with a short stout tuft of hairs in middle, of which there is a minute process… .....***Trichacis*** **Förster**

- Scutellum without tuft of hairs in the middle 9

9. Scutellum modified into a spine apically……. 10

- Scutellum unarmed……..... .11

10. Scutellar spine sharp, elongate (Plate 27: Figure A) narrowly pointed, forewings usually with long marginal cilia .....***Lepatacis*** **Förster**

- Scutellum posteriorly with short prolongation..... ***Ceratacis*** **Thomson**

11. Antennal clava 6 segmented…… .....***Isocybus*** **Förster**

- Antennal clava 4 or 5 segmented…… 12

12. Clava distinct, 4 segmented; scutellum not evenly convex……... .... ***Anectadius*** **Kieffer**

- Clava distinct or indistinct; 4 or 5 segmented; scutellum usually evenly convex… 13

13. Notauli absent; clava 4 segmented; posterior ocelli closer to eye orbits than to median ocellus…..... ***Proleptacis*** **Kieffer**

- Notauli present or absent; clava 4 or 5 segmented; posterior ocelli closer to median ocelli than to eye orbits…… .....***Platygaster*** **Latreille**

4.1.3: TAXONOMIC DESCRIPTIONS

1. Genus *AMBLYASPIS* Förster

Amblyaspis Förster, 1856: 107, 112. Original description. Type: *Platygaster tritici* Walker, designated by Kieffer (1926). Keyed.

Diagnostic characters

Head transverse, Antenna 10 segmented; A9-A10 almost fused, separated only by a fine suture; scutellum flattened in dorsal view with dense hairs apically, somewhat pointed, hardly transverse, not separated from mesoscutum by a groove; tarsi 5 segmented; metasoma six segmented; forewing with short submarginal vein, not knobbed apically.

Distribution: Worldwide

Host: Parasitoids of Cecidomyiidae (Vlug 1995)

Discussion

This genus closely resembles *Platygaster* except for two characters. A9-A10 is almost fused in *Amblyaspis* whereas it is distinctly separate in *Platygaster*. Also, *Amblyaspis* is having dense hairs on the scutellum forming a cone like structure in the dorsal view, while it is not so in the latter.

Remarks

This genus is represented by 84 species from the World, 16 species from Oriental Region, eight species from India and only one species from Kerala. Recently, Anjana and Rajmohana (2015) described three more new species from Kerala. The present work reports six species, out of which, one species is described as new to science and another species is reported for the first time from Kerala. Diagnosis of one species reported earlier from Kerala is also included. A key to species of India and a distribution map of this genus and its species in Kerala are provided (Plate 13).

KEY TO INDIAN SPECIES OF *AMBLYASPIS* FÖRSTER

(Modified from Anjana and Rajmohana, 2015a; based on females)

1. Notauli present 2

- Notauli absent..... 3

2. Scape 7 X as long as wide; T1 elongate with entirely extending costae… .....*A.kurinjii* **Veenakumari and Buhl**

- Scape less than 6 X as long as wide; T1 transverse with a tuft of long dense hairs ..... ***A. dalhousianus*** **Mukerjee**

3. Wings emarginate medially (Plate 9: Figure G)..... .....***A. emarginata*** **Anjana and Rajmohana**

- Wings rounded medially…… 4

4. Mesoscutum smooth…….***A. charvakae*** **Veenakumari and Buhl**

- Mesoscutum finely reticulate…… 5

5. Occiput with six prominent longitudinal striae laterally .... ***A. ashmeadi*** **Veenakumari and Buhl**

- Occiput with faint striae or without striae (Plate 8: Figure C)…..... 6

6. OOL equal to LOL…… 7

- OOL greater than LOL…… 8

7. Frons smooth; scape 4 X as long as wide; A10 1.25 X as long as wide ....***A. shivanki*** **sp. nov**

- Frons reticulate; scape 5.3 X as long as wide; A10 elongate, 1.67 X as long as wide……..... ***A. narendrani*** **Anjana and Rajmohana**

8. OOL less than 1.5 X LOL 9

- OOL greater than 1.5 X LOL *10*

9. A10 1.7 X as long as wide … ..... ***A. hirsutus*** **Anjana and Rajmohana**

- A10 1.08 X as long as wide…… ..... ***A. khasiana*** **Veenakumari and Buhl**

10. ...Occiput reticulate with sparse longitudinal striae in lower half; scape less than 5 X as long as wide 10

- Occiput reticulate without any longitudinal striae; scape more than 5.5 X as long as wide… ..... ***A. panhalensis*** **Veenakumari and Buhl**

11. Head 1.7 X higher than long; A10 1.76 X as long as wide .... ***A. fabrei*** **Veenakumari and Buhl**

- Head 1.48 X higher than long; A10 1.43 X as long as wide ..... ***A. tipusultani*** **Veenakumari and Buhl**

1. *Amblyaspis ashmeadi* Veenakumari and Buhl (Plate 8)

Amblyaspis ashmeadi Veenakumari, Buhl, Prashanth & Khan, 2013: 231. Original description, diagnosis.

Diagnosis

Body length 1.13 mm. Occiput stongly reticulate; hyperoccipital carina present; A3 equal to A4; notauli absent; scape 5.8 X as long as wide; mesoscutum finely reticulate.

Re-description

Female: Body length 1.97 mm (Plate 8: A); antenna dark brown; tegula dark brown; microtrichia brown; legs except coxae yellowish brown; coxae black.

Head: 2.16 X as wide as long in dorsal view (Plate 8: C); head in front view 1.11 X as wide as high (Plate 8: E); eyes large; occiput strongly reticulate with six prominent striae; frons finely reticulate; lower frons above toruli with several transverse striae laterally; IOS 1.38 X eye height; OOL 1.95 X OD; OOL 1.33 X LOL; POL 2.68 X LOL; POL 2.19 X OOL; eye height 3.26 X as long as temples; hyperoccipital carina sharp; scape 5.3 X as long as wide, 1.32 X as long as A7-A10 combined; length to breadth ratio of antennal segments A1-A10 being: 0.46: 0.09; 0.11: 0.04; 0.08: 0.05; 0.07: 0.05; 0.07: 0.05; 0.07: 0.05; 0.09: 0.08; 0.09: 0.08; 0.08: 0.07;0.09: 0.05 respectively (Plate 8: F).

Mesosoma: 1.42 X as long as wide (Plate 8: B); pronotum non angular, clearly visible from above; anterior lateral pronotal area sparsely setose with fine reticulations; mesoscutum as long as wide, finely reticulate with an imaginary notaular line; notauli absent (Plate 8: B); epomial carina distinct; posterior margin of mesoscutum with median lobe projecting above mesoscutellum; scutellum conical, 1.12 X as long as wide; fully covered with white setae, posterior margin of mesoscutum not straight, convex, densely setose towards the posterior region; mesopleuron smooth; metapleuron with white setae towards posterior end (Plate 8: D). Forewings hyaline, 2.69 X as long as wide (Plate 8: G), with fine and dense microtrichia.

Metasoma: 2 X as long as wide (Plate 8: H); T1 with two parallel carina medially, dense white setae present laterally and also on sides of the median carinae; T2 with white setae at basal region, rest smooth; T3-T6 with punctures at apex; T5-T6 with a transverse row of white setae; length to width ratio of metasomal tergites T1-T6 being: 0.15: 0.21; 0.57: 0.45; 0.05: 0.4; 0.04: 0.35; 0.05: 0.26; 0.06: 0.12 respectively.

Host: Unknown

Specimens examined

4 f. INDIA: Kerala, Gajamugam, Nilambur, 30. xii. 2011; Coll. Rajmohana; on card; Reg. No. ZSI/WGRS/IR.INV.4640; f. INDIA: Kerala, Pattiyar, Silent valley, 24. ii. 2013; Coll. P. M. Sureshan; on card; Reg. No. ZSI/WGRS/IR.INV.4641.

Discussion

This species is similar to *A. roboris* (Walker) but the frons is finely granulate, POL 2.8 X OOL and forewings are infuscate in *A. roboris* whereas in *A. ashmeadi*, frons is finely reticulate, POL 2.19 X OOL and forewings are hyaline.

Remarks

This is the first report of *A. ashmeadi* from Kerala.

2. ***Amblyaspis dalhousianus*** (Mukerjee)

Anopedias dalhousianus Mukerjee, 1978: 73, 78. Original description, keyed. *Amblyaspis dalhousianus***:** Masner, *in* Vlug, 1995: 13. Generic transfer.

Diagnosis

Female. Length 1.8 mm. Body brownish black, eyes naked; OOL 1.45 X OD; scape 5.5 X as long as wide; clava longer than A3-A6 combined; mesososma finely reticulate, densely clothed with long setae; notauli present; scutellum flat; metasoma smooth and shiny; T1 with tuft of long dense hairs; T3 onwards with fine punctures.

Type locality: Munnar- Kodaikanal road

Discussion

Mukerjee (1978) reported that some specimens were collected from Munnar-Kodaikanal road. The diagnosis is based on the original description. But variations were noted in the antennal measurements of the image of the *Holotype* available at Specimage which are included in the diagnosis.

http://specimage.osu.edu/getImageInfo.html?image_id=92011

Remarks

The species is not represented in the present collection.

3. *Amblyaspis emarginata* Anjana and Rajmohana

(Plate 9)

Amblyaspis emarginata Anjana Gangadharan M. & Rajmohana K., 2015: 113, 115. Original description, keyed.

Diagnosis

Body length 0.93 mm (Plate 9: A); head 1.86 X as wide as long; scape 5.2 X as long as wide; forewings emarginate medially; metapleuron setose only at the posterior corners.

Description

Female. Body length 0.93 mm. Scape yellowish brown; A2-A10 brown; legs including coxae yellow; tegula light brown; microtrichia dark brown; last segment of tarsi slightly darkened.

Head: 1.86 X as wide as long in dorsal view (Plate 9: F), 1.18 X as wide as mesosoma; occiput finely reticulate with granulations and without any striae; head in front view 1.14 X as wide as high; frons reticulate (Plate 9: E), lower frons above toruli with several transverse striae; IOS 2.25 X eye height; eyes

bare; OOL 3.45 X OD; OOL 1.4 X LOL; POL 1.96 X LOL; eye height 3.5 X temples; hyperoccipital carina present extending between orbits; antennae covered with white setae (Plate 9: D); scape 5.2 X as long as wide, 1.24 X as long as claval segments combined; length to breadth ratio of antennal segments A1-A10 being: 0.26: 0.05; 0.07: 0.04; 0.05: 0.04; 0.03: 0.03; 0.04: 0.03; 0.04: 0.04; 0.05: 0.05; 0.05: 0.06; 0.04: 0.05; 0.07: 0.04 respectively (Plate 9: D).

Mesosoma: 1.45 X as long as wide (Plate 9: C); mesoscutum 1.09 X as long as wide, finely reticulate with sparse setae; notauli absent; pronotum non angular, clearly visible from above, lateral sides of pronotum with fine reticulations; mesopleuron smooth; metapleuron with sparse setae at the anterior margin and thick setae at posterior margin (Plate 9: B). Forewings emarginate medially, 2.18 X as long as wide with fine and dense microtrichia; marginal fringe 0.15 of forewing width (Plate 9: G).

Metasoma: 1.5 X as long as wide (Plate 9: H); T1 with white setae laterally; white setae on the base of T2, rest smooth; T3-T6 with a transverse row of setae; length to width ratio of metasomal tergites T1-T6 being: 0.05: 0.13; 0.26: 0.27; 0.03: 0.23; 0.02: 0.19; 0.02: 0.12; 0.03: 0.07 respectively.

Host: Unknown

Specimen examined

f. INDIA: Kerala, Anjuruli, Idukki; 09. iv. 2013; Coll. Rajmohana; on card; Reg. No. ZSI/WGRS/IR.INV.4638.

Discussion

Amblyaspis emarginata runs to *A. cariniceps* Buhl (1997) in Buhl's key to Oriental species of *Amblyaspis* (2009). The former differs from *A. cariniceps*

in having medially emarginate wing. This character makes this species unique from all other known species of *Amblyaspis*.

Remarks

Amblyaspis emarginata was described by Anjana and Rajmohana (2015).

4. *Amblyaspis hirsuta* Anjana and Rajmohana

(Plate 10)

Amblyaspis hirsuta Anjana Gangadharan M. & Rajmohana K., 2015: 114. Original description, keyed.

Diagnosis

Body length 1.13 mm; occiput strongly reticulate; hyperoccipital carina present; A3 sub equal to A4, scape 5.8 X as long as wide; notauli absent; mesoscutum finely reticulate.

Description

Female. Body length 1.13 mm (Plate 10: A); A1-A2 and legs yellowish brown; A3-A9 dark brown; tegula dark brown; microtrichia dark brown; last segment of tarsi slightly darkened.

Head: 2.18 X as wide as long in dorsal view (Plate 10: G), 1.09 X as wide as mesosoma; head in front view 1.17 X as wide as high (Plate 10: B); occiput strongly reticulate without any striae; frons finely reticulate, lower frons above toruli with several transverse striae; IOS 2.29 X eye height; eyes bare; OOL 2.8 X OD; OOL 1.89 X LOL; POL 2.4 X LOL; eye height 3.2 X as long as temples; hyperoccipital carina present, extending between orbits; scape 5.8 X as long as wide; A3 equal to A4; scape 1.36 X as long as A7-A10 combined; A10 1.7 X as long as wide; length to breadth ratio of antennal segments A1-A10 being: 0.29: 0.05; 0.07: 0.03; 0.05: 0.03; 0.05: 0.03; 0.04:

0.03; 0.04: 0.04; 0.06: 0.05; 0.05: 0.06; 0.05: 0.06; 0.06: 0.04 respectively (Plate 10: D).

Mesosoma: 1.39 X as long as wide (Plate 10: E); pronotum non angular, clearly visible from above; lateral sides of pronotum sparsely setose with fine reticulations; epomial carina present; mesoscutum 1.07 X as long as wide, finely reticulate with sparse setae; notauli absent (Plate 10: E); posterior margin of mesoscutum with median lobe projecting above mesoscutellum; scutellum 1.07 X as long as wide, fully covered with white setae; posterior margin of mesoscutum not straight, slightly convex; mesopleuron smooth; metapleuron fully covered with white setae (Plate 10: C). Forewing 2.56 X as long as wide (Plate 10: H), with fine and dense microtrichia, marginal cilia on posterior margin of forewing 0.12 of wing width.

Metasoma: 1.96 X as long as wide (Plate 10: F); T1 with dense white setae laterally; T2 with white setae at the basal region, rest smooth; T3-T6 with punctures at the apex; T5-T6 with a transverse row of white setae; length to width ratio of metasomal tergites T1-T6 being: 0.09: 0.10; 0.36: 0.29; 0.03: 0.24; 0.03: 0.19; 0.03: 0.11; 0.03: 0.06 respectively.

Host: Unknown

Specimens examined

2 f. INDIA: Kerala, Anjuruli, Idukki; 09. iv. 2013; Coll. Rajmohana; on card; Reg. No. ZSI/WGRS/IR.INV.4636.

Discussion

Amblyaspis hirsuta runs to *A. vietnamensis* in Buhl's key (2009) to Oriental species of *Amblyaspis*. But differs from it in the following characters- OOL 1.89 X LOL in *Amblyaspis hirsuta* whereas only 1.25 X in *A. vietnamensis*. Mesoscutum is with sparsely arranged short hairs in *A. hirsuta* whereas, two broad stripes of short hairs along imaginary notauli are present in *A. vietnamensis*. Metapleuron is fully pilose in *A. hirsuta* whereas sparsely pilose in *A. vietnamensis*.

A. hirsuta is very similar to *A. khasiana* Veenakumari & Buhl, described from India but differs in the following. A10 in 1.7 X as long as wide in *A. hirsuta* but only 1.08 X as long as wide in *A. khasiana*. Scape is 5.8 X as long as wide in *A. hirsuta* whereas 5.3 X as long as wide in *A. khasiana*.

Remarks

Amblyaspis hirsuta was described by Anjana and Rajmohana (2015).

5. *Amblyaspis narendrani* Anjana and Rajmohana

(Plate 11)

Amblyaspis narendrani Anjana Gangadharan M. & Rajmohana K., 2015: 118. Original description.

Diagnosis

Body length 1.72 mm; head 2 X as wide as long; scape 5.3 X as long as wide; occiput with longitudinal striae on lateral ends; marginal fringe almost absent.

Description

Female. Body length 1.72 mm (Plate 11: A); scape yellowish brown at base and more darker towards apex; A2-A10 brown; legs yellow; tegula black; microtrichia dark brown; last segment of tarsi slightly darkened.

Head: 2 X as wide as long in dorsal view (Plate 11: D); occiput reticulate with longitudinal striae on lateral ends; head in front view 1.04 X as wide as high (Plate 11: C); frons finely reticulate, lower frons above toruli with several transverse striae; IOS 1.36 X eye height; eyes bare; OOL 2.3 X OD; OOL equal to LOL; POL 2.4 X LOL; eye height 2.3 X as long as temples; hyperoccipital carina present extending between orbits; antennae fully covered with white setae; scape 5.3 X as long as wide, 1.25 X as long as A7-A10 combined; length to breadth ratio of antennal segments A1-A10 being: 0.41: 0.08; 0.1: 0.03; 0.08: 0.04; 0.06: 0.04; 0.06: 0.04; 0.06: 0.05; 0.09: 0.08; 0.08: 0.08; 0.06: 0.07; 0.10: 0.06 respectively (Plate 11: F).

Mesosoma: 1.5 X as long as wide (Plate 11: E); mesoscutum 1.08 X as long as wide, finely reticulate; five setae present towards lateral end of mesoscutum; notauli absent, imaginary notaular line present; pronotum non angular, clearly visible from above; lateral sides of pronotum with fine reticulations with scattered white setae; scutellum fully covered with white setae, 1.2 X as long as wide; mesopleuron smooth; metapleuron with sparse setae at anterior margin and thick setae at posterior margin (Plate 11: G). Forewings 2.4 X as long as wide, with fine and dense microtrichia (Plate 11: H).

Metasoma: 1.5 X as long as wide (Plate 11: B); T1 with parallel median carinae with a depression in between; dense lateral setae present on T1; white setae on base of T2, rest smooth; T3-T6 with a transverse row of setae; length to width ratio of metasomal tergites T1-T6 being: 0.14: 0.18; 0.53: 0.4; 0.04: 0.35; 0.05: 0.3; 0.05: 0.24; 0.07: 0.13 respectively.

Host: Unknown

Specimen examined

f. INDIA: Kerala, Manalar, Idukki, 07. iv. 2013; Coll. Abhilash Peter; on card, Reg. No. ZSI/WGRS/IR.INV.4639.

Discussion

This species runs to *A. cariniceps* Buhl (1997) in key to Oriental species of *Amblyaspis* (Buhl 2009). *A. cariniceps* is much smaller compared to *A. narendrani*. Occiput is without longitudinal striae in *A. cariniceps.* Also, OOL is equal to LOL in *A. narendrani* whereas, LOL is 1.2 X OOL in *A. cariniceps.*

Remarks

Amblyaspis narendrani was described by Anjana and Rajmohana (2015).

6. *Amblyaspis shivanki* sp. nov.

(Plate 12)

Diagnosis

Body length 1.01 mm (Plate 12: A); head 1.96 X as wide as long; OOL equal to LOL; scape 4 X as long as wide; occiput with longitudinal striae on lateral ends; hyperoccipital carina present; notauli absent.

Description

Holotype. Female. Body length 1.01 mm (Plate 12: A). Body black, A1-A6 brown, A7-A10 dark brown; legs including coxae dark brown; tegula black; forewings with a brownish tinge, microtrichia dark brown; last segment of tarsi slightly darkened.

Head: 2 X as wide as long in dorsal view (Plate 12: E); occiput reticulate with longitudinal striae on lateral ends; head in front view 1.09 X as wide as high (Plate 12: H); frons entirely smooth; IOS 1.33 X eye height; eyes bare; OOL 2.33 X OD; OOL equal to LOL; POL 2.57 X LOL; eye height 2.28 X as long as temples; hyperoccipital carina present extending between orbits; scape 4 X as long as wide; A6 and A8 as long as wide; A10 1.25 X as long as wide; length to breadth ratio of antennal segments A1-A10 being: 0.48: 0.12; 0.13: 0.05; 0.09: 0.05; 0.09: 0.05; 0.07: 0.05; 0.06: 0.06; 0.1: 0.09; 0.09: 0.09; 0.07: 0.08; 0.1: 0.08 respectively (Plate 12: F).

Mesosoma: 1.41 X as long as wide (Plate 12: D); mesoscutum as long as wide, finely reticulate; notauli absent, setae arranged as two lines vertically on mesoscutum marking an imaginary notaular line; pronotum non angular, clearly visible from above; anterior and lateral pronotum with fine reticulations and with scattered white setae; scutellum fully covered with white setae, 1.22 X as long as wide; mesopleuron smooth; metapleuron with sparse setae at anterior margin and thick setae at posterior margin (Plate 12: C). Forewings 2.42 X as long as wide, with dense microtrichia (Plate 12: G).

Metasoma: 2.02 X as long as wide (Plate 12: B); T1 with parallel median carinae with a depression in between and fine setae laterally; short white setae on base of T2, rest smooth; T3-T6 with a transverse row of setae; length to width ratio of metasomal tergites T1-T6 being: 0.13: 0.21; 0.58: 0.47; 0.06: 0.42; 0.06: 0.35; 0.05: 0.27; 0.08: 0.17 respectively.

Host: Unknown

Specimen examined

Holotype. f. INDIA: Kerala, Pandimotta: Kollam; 17. xii. 2015; Coll. Rajmohana and Party; on card; Reg. No. ZSI/WGRS/IR.INV.6194.

Etymology

The species is named '*shivanki*' after 'Shivank' the nephew of the author of this species.

Discussion

Amblyaspis shivanki sp. nov. runs to *A. narendrani* in the Key to Indian species by Anjana and Rajmohana (2015) and it runs to *A. cariniceps* Buhl (1997) in the key to Oriental species of *Amblyaspis* (Buhl 2009). Occiput is without longitudinal striae in *A. cariniceps*, which is present in the new species. Also, OOL is equal to LOL in the new species whereas, LOL is 1.2 X OOL in *A. cariniceps.* The new species differs from *A. narendrani* in having a smooth frons, which is reticulated in *A. narendrani.* Scape is 5.3 X as long as wide in *A. narendrani* whereas it is only 4 X as long as wide *in A. shivanki* sp. nov. A10 is elongate, 1.67 X as long as wide in *A. narendrani*, but only 1.25 X as long as wide in *A. shivanki* sp. nov.

2. Genus *ANECTADIUS* Kieffer

Anectadius Kieffer, 1905: 187. Original description. Type: *Anectadius striolatus* Kieffer, designated by Kieffer (1926).

Diagnostic characters

Head transverse in dorsal view and rounded in front view; eyes large, bare; vertex arched; antennae 10 segmented; notauli complete; ad-median lines present in the anterior half of mesoscutum; scutellum rounded without spine, separated from mesonotum by a deep groove; forewings without vein; abdomen longer than rest of the body.

Distribution: India

Host: *Lasioptera textor* Kieffer (Vlug 1995) and Gall midge on *Artemesia* sp.

Discussion

Anectadius is having close similarity to *Platygaster* Latreille. But the distinct four segmented clava of this genus can be used to separate it from *Platygaster* in which clava is indistinct.

Remarks

This genus is endemic to India, represented by only two species. One species is re-described here along with a new host association. A key to species of India and a distribution map of the genus and species of Kerala are provided (Plate 15).

KEY TO INDIAN SPECIES OF *ANECTADIUS* KIEFFER

(Based on females)

1. Frons and vertex smooth and shiny ……..***A. bengalensis* Kieffer**

- Frons and vertex transversely striate…….***A. striolatus* Kieffer**

1. *Anectadius striolatus* Kieffer

(Plate 14)

Anectadius Kieffer, 1905: 187. Original description. Type: *Anectadius striolatus* Kieffer, designated by Kieffer (1926).

Diagnosis

Body length 1.05 mm (Plate 14: A), black, smooth and shiny body; head 2 X as wide as long in dorsal view; occiput, vertex and gena transversely striat; forewings hyaline with very short microtrichia.

Re-description

Female. Body length 1.05 mm (Plate 14: A). Black, legs including coxae brown, tegula brown, antennal clava dark brown.

Head: 1.7 X as wide as long in dorsal view (Plate 14: F), 1.34 X as wide as high in front view (Plate 14: B); eyes bare; occiput and vertex with striations; forehead and gena striate; IOS 1.4 X eyeheight; eyeheight 5 X as long as temples; POL 2.1 X OOL; LOL 1.09 X OOL; OOL 2.6 X OD; scape slightly thickened in distal half; scape 7.3 X as long as wide, 1.16 X as long as claval segments combined; A3- A6 as long as wide; length to breadth ratio of antennal segments A1-A10 being: 0.22: 0.03, 0.06: 0.03, 0.02: 0.02, 0.04: 0.04, 0.04: 0.04, 0.04: 0.04, 0.03: 0.06, 0.04: 0.06, 0.04: 0.05, 0.08: 0.05 respectively (Plate 14: D).

Mesosoma: 1.13 X as long wide (Plate 14: C); pronotum visible from above; striations distinct in lateral part of pronotum; notauli deep; scutellum finely hairy, 1.54 X as wide as long; mesopleuron smooth; metapleuron finely hairy (Plate 14: E). Forewings hyaline with less scattered microtrichia at apex, 2.18 X as long as wide with short marginal cilia (Plate 14: G).

Metasoma: 1.5 X as long as wide (Plate 14: H); T1 with deep longitudinal striations; T2 with striations extending up to half its length; length to width ratio of metasomal tergites T1-T6 being: 0.08: 0.12, 0.28: 0.29, 0.02: 0.024, 0.02: 0.19, 0.02: 0.01, 0.03: 0.05 respectively.

Host: *Lasioptera textor* Kieffer (Vlug 1995); Leaf gall of *Barringtonia acutangula* (Linn.) Garten.

Specimens examined

3 f. INDIA: Kerala, Chemmad, Malappuram; 14. iii. 2012; Coll. K. M. Shameem; on card; Reg. No. ZSI/WGRC/IR.INV.3604.

Discussion

Only two species are reported from the World, both being from India. The two species can be easily differentiated since, the frons and vertex in *Anectadius striolatus* is transversely striate, but is smooth in the other.

Remarks

This is the first report of the genus as well as the species from Kerala. A new host plant association of this species is also provided.

3. Genus *GASTROTRYPES* Brues

Gastrotrypes Brues, 1922: 270. Original description. Type: *Gastrotrypes spatulatus* Brues, by original designation.

Diagnostic characters

Head transverse, wider than thorax; ocelli arranged in a broad triangle; antennae ten segmented in both sexes; females with four segmented clava; notauli absent; scutellum highly convex without apical spine, pubescent at sides apically, not deeply separated from the mesonotum; female metasoma usually with five visible tergites (except in *G. malaysianus* Buhl), T5 never transverse in females and male metasoma with six visible tergites.

Distribution: Neotropical, Palearctic and Oriental

Host: Parasitoids of Cecidomyiidae living in fresh cut stumps of trees (Vlug 1995)

Discussion

This genus is unique since the metasoma of female is with five visible tergites (except in *G. malaysianus* Buhl) and also T5 in female is never transverse. This character itself will distinguish this genus from all other genera.

Remarks

Gastrotrypes Brues is represented by seven species from the World, four species from the Oriental Region and three species from India. This genus was reported for the first time from Kerala by Anjana and Rajmohana by describing *G. keralensis* (2016a). The female of *G. vindhyensis* Mukerjee were also reported for the first time from India by the same workers. The re-description of these two species is given along with key to species of India. A species distribution map of the genus and species in Kerala is also provided (Plate 18).

There existed always a slight discrepancy in flagellomere count of the genus *Gastrotrypes.* Huggert (1980) figured apparently ten segments in his drawings of *Gastrotrypes* antennae even though Brues (1922) did not consider the minute hyaline connection between the pedicel and the first flagellar joint. However Veenakumari *et al*. (2015) mentions the antennal segments as ten. In this work also, the small connection between the pedicel and A4 is considered as a separate segment.

KEY TO INDIAN SPECIES OF *GASTROTRYPES* BRUES

(Modified from Anjana *et al*., 2016a; based on females)

1. Vertex and face smooth (Plate 16: Figure G) 2

- Vertex and face weakly and transversely reticulate coriaceous (Plate 17: Figure B)… ..... ***G. vindhyensis*** **Mukerjee**

2. A8- A9 as long as wide; hyperoccipital carina present.…..... ....***G. manii*** **Veenakumari and Buhl**

- A8- A9 twice as long as wide; hyperoccipital carina absent .... ***G. keralensis*** **Anjana and Rajmohana**

1. *Gastrotrypes keralensis* Anjana and Rajmohana

(Plate 16)

Gastrotrypes keralensis Anjana, Rajmohana & Shweta, 2016: 11, 22. Original description, keyed.

Diagnosis

Body length 1.25 mm; frons smooth; OOL 1.2 X OD; female metasoma 5 segmented; T4 with a row of white setae; T5 almost as long as

Description

Female. Body length 1.25 mm (Plate 16: A). Shiny black; A1-A2 and legs except coxae yellowish brown; coxae dark brown; A3-A9 brown; last segment of tarsi slightly darkened.

Head: 1.5 X as wide as long in dorsal view (Plate 16: F), 1.2 X as wide as mesosoma; rounded, without hyperoccipital carina; occiput in posterior half with concentric curved striations; frons not sculptured, smooth entirely (Plate 16: G); eyes bare; OOL 1.2 X OD; LOL 4.6 X OOL; POL 1.9 X LOL; IOS 1.16 X eye height; eye height 2.7 X as long as temples; head in front view 1.06 X wider than high; scape equal to last three antennal segments combined; A3 subequal to A9; A6 2.7 X as long as wide; A7 2.4 X as long as wide; A8 2.1 X as long as wide; length of A9 2.5 X its width; length to breadth ratio of antennal segments A1-A10 being: 0.24:0.04; 0.05: 0.03; 0.02: 0.02; 0.05: 0.03; 0.04: 0.03; 0.04: 0.02; 0.09: 0.03; 0.09: 0.04; 0.08: 0.04; 0.09: 0.04 respectively (Plate 16: E).

Mesosoma: 1.7 X as long as wide; lateral sides of pronotum with a few white scattered setae; mesoscutum 1.63 X as long as wide, hind margin medially with a prolongation extending 0.3 of scutellum (Plate 16: B); mesopleuron and metapleuron smooth, with pilosity only along lower and hind margins (Plate 16: D). Forewings 2.9 X as long as wide, with fine and dense microtrichia; marginal cilia of forewing very short, 0.06 of wing width (Plate 16: H).

Metasoma: 2.3 X as long as wide, 1.04 X of head and mesosoma combined, 1.14 X as wide as head; T1 with deep fovea covered with white setae; T2 with short striations at base reaching almost one third of T2, rest smooth; T4 medially with transverse row of white setae; T5 0.29 of length of T2, almost as long as wide with single setae on either side; longitudinal striations at basal

part of T5 extending upto one third of T5; length to width ratio of metasomal tergites T1-T5 being: 0.07: 0.15; 0.35: 0.28; 0.05: 0.22; 0.06: 0.15; 0.09: 0.09, respectively (Plate 16: C).

Host: Unknown

Specimens examined

f. INDIA: Kerala, Manalar, Periyar Tiger Reserve; 07. iv. 2013; Coll. Abhilash Peter; on card; Reg. No. ZSI/WGRS/IR.INV.4408; f. INDIA: Kerala, Manalar, Periyar Tiger Reserve; 07. iv. 2013; Coll. Abhilash Peter; on card; Reg. No. ZSI/WGRS/IR.INV.4452; 2 f. INDIA: Chelavoor, Kozhikode; 24. viii. 2015; Coll. Anjana; on card; Reg. No. ZSI/WGRS/IR.INV.5158; f. INDIA: Kerala, Ponkuzhi range, Wayanad; 07. iv. 2014; Coll. Anjana; on card; Reg. No. ZSI/WGRS/IR.INV.5347; f. INDIA: Kerala, Kakkayam, Kozhikode; 29. xii. 2015; Coll. Ranjith; on card; Reg. No. ZSI/WGRS/IR.INV.5196; f. INDIA: Kerala, Pandimotta, Kollam; 17. xii. 2015; Coll. Rajmohana; on card; Reg. No. ZSI/WGRS/IR.INV.5201.

Discussion

G. keralensis is similar to *G. vindhyensis* (Mukerjee) as given in the key to species, but differs in the following characters. The entire frons in *G. keralensis* is smooth (slightly obliquely reticulate-coriaceous in *G. vindhyensis*). Length of A9 in female 2.5 X its width (only twice as long as wide in *G. vindhyensis*). OOL greater than OD (1.2 X) in *G. keralensis* (OOL less than OD in *G. vindhyensis*).

Remarks

G. keralensis was described by Anjana and Rajmohana (2016a) as a part of this work.

2. *Gastrotrypes vindhyensis* (Mukerjee) (Plate 17)

Trichacis vindhyensis Mukerjee, 1978: 94. Original description.

Metanopedias vindhyensis: Masner, in Vlug, 1995: 42. Generic transfer.

Gastrotrypes vindhyensis: Buhl 2014: 151. Description of female, diagnosis, new distribution record for Sri Lanka.

Diagnosis

Body length 1.45 mm; vertex and entire frons with reticulations transverse striations in occiput; hyperoccipital carina absent; forewings 3.2 X as long as wide.

Re-description

Female. Body length 1.45 mm (Plate 17: A). Black; A1-A2 and legs except coxae yellowish brown; coxae brown; A3-A9 brown; last segment of tarsi slightly darkened.

Head: 1.6 X as wide as long in dorsal view Plate (17: F), 1.2 X as wide as mesosoma, rounded without a hyperoccipital carina; transverse striations in occiput; eyes bare; vertex and entire frons with reticulations (Plate 17: B); OOL 0.7 of OD; LOL 2.3 X POL; IOS 1.02 X eye height; eye height 3.3 X as long as temples; scape subequal to last 3 antennal segments combined; A9 1.1 X as long as A8; length to breadth ratio of antennal segments A1-A10 being: A1–A10 being 0.27:0.05; 0.06:0.03; 0.03:0.03; 0.06:0.04; 0.06:0.03; 0.03:0.02; 0.09:0.04; 0.10:0.05; 0.09:0.05; 0.10:0.05 (Plate 17: G).

Mesosoma: 1.4 X as long as wide (Plate 17: E); lateral sides of pronotum with few white scattered setae; mesoscutum 1.6 X as long as wide with few scattered setae, hind margin medially with a long prolongation extending to scutellum; mesopleuron and metapleuron smooth, pubescent near hind coxa.

Forewings 3.2 X as long as wide, with fine and dense microtrichia, marginal cilia very short (Plate 17: C).

Metasoma: 1.9 X as long as wide (Plate 17: H) and 1.05 X as long as head and mesosoma combined; foveae distinct on either sides of T1; T2 at base with short striations, almost reaching one third of T2, rest smooth; T3 and T4 with a transverse row of white setae; T2 3.2 X as long as T5, T5 1.10 X as long as wide; short longitudinal striae in basal part of T5; length to width ratio of metasomal tergites T1-T5 being: 0.09: 0.17; 0.37: 0.38; 0.05: 0.33; 0.06: 0.23; 0.12: 0.11 respectively.

Host: Unknown

Specimens examined

f. INDIA: Kerala, Chelavoor, Kozhikode; 5-11. xii. 2014; Coll. Shweta; Malaise trap; on card; Reg. No. ZSI/WGRC/IR.INV.4406; f. INDIA: Kerala, Periyar Tiger Reserve, Anjuruli, Idukki; 09. iv. 2013; Coll. K. Rajmohana; on card; Reg. No. ZSI/WGRC/IR.INV.4407.

Discussion

The reticulations in the frons differentiate this species from all other known species of this genus from India.

Remarks

Gastrotrypes vindhyensis was reported for the first time from Kerala by Anjana and Rajmohana (2016a) as a part of this study.

4. Genus *INOSTEMMA* Haliday

Inostemma Haliday, 1833: 270. Original description. Type: *Psilus boscii* Jurine, by monotypy. Keyed. Proposed as a subgenus of *Platygaster* Latreille.

Acerota Förster, 1856: 107, 110. Original description. Type: *Acerota caryae* Ashmead, designated by Muesebeck & Walkley (1951). Keyed. Synonymized by Masner (1964).

Ceratopsilus Kieffer, 1913: 462, 493. Original description. Type: *Ceratopsilus rufipes* Kieffer, by original designation. Synonymized by Yamigishi (1982).

Brachinostemma Kieffer, 1916a: 551. Original description. Type: *Brachinostemma mediterranea* Kieffer, by monotypy and original designation. Synonymized by Masner (1964).

Diagnostic characters

Moderately elongate to very slender, almost spindle like, melanic; OOL clearly shorter than LOL; eyes glabrous; antenna ten segmented in both sexes; clava of female usually four segmented, rarely three or five segmented; epomia not developed; pronotal shoulders rounded; notauli well developed; lateral keel of scutellum raised, meeting scutellar rim at almost right angles, scutellar disc subquadratic to subrectangular; forewings with tubular submarginal vein, knobbed apically, T1 in females usually with a horn or hump for housing of ovipositor.

Distribution: Worldwide

Biology: Members are parasitoids of gall midges (Cecidomyiidae)

Discussion

Inostemma Haliday appears related to genus *Sacespalus* Kieffer. But they can be separated based on the eye orbit which is raised and crenulate in *Sacespalus* and also by the distinctly developed epomia which are not known to exist among the species of *Inostemma*.

Remarks

Out of the 109 species reported Worldwide, 16 species are reported from Oriental and nine species from India. Only one species was described from Kerala. Here four species are included of which, three species are reported for the first time from Kerala and one species is described as new to science. Along with this, the diagnosis of known species and a key to species of India along with a distribution map of this genus and its species in Kerala is also provided (Plate 23).

KEY TO INDIAN SPECIES OF *INOSTEMMA* HALIDAY

(Based on females)

1. Sharp horizontal ledge on upper part of eye present (Plate 19: Fig. B)…..... 2

- Sharp horizontal ledge on upper part of eye absent.. 3

2. OOL about twice OD; A3 as long as pedicel; body length 1.7mm ……..... ***I. apsyllae* Austin**

- OOL only slightly more than OD; A3 shorter than pedicel; body length 1.2mm……..... ***I.oculare* Austin**

3. Metasomal horn absent… ..... ***I. shencottahensis* Mukerjee**

- Metasomal horn present 4

4. Metasomal horn hardly reaching upto middle of scutellum……..... ..... ***I. parvocornus* sp. nov.**

- Metasoma horn reaching upto mesosoma or extending beyond mesosoma…….....5

5. Metasomal horn equal to metasoma, not extending beyond mesosoma ..... …..... ***I. indica*** **Mukerjee**

- Metasomal horn not equal to metasoma, extending beyond mesosoma…….....….6

6. Metasomal horn towering over dorsal head (Plate 20: Figure G); OOL less than OD; scape 5 X as long as wide.……..... ***I. berijamum*** **Mani**

- Metasomal horn extending little beyond median ocellus; OOL equal to OD; scape 4.14 X as long as wide..…… ..... ***I. coorgensis*** **Mukerjee**

1. *Inostemma apsyllae* Austin

(Plate 19)

Inostemma apsyllae Austin, 1984: 554, 556. Original description, keyed.

Diagnosis

Body length 2.1 mm; robust; metasomal horn absent; upper surface of eye with prominent ledge; OOL about twice OD; metasoma as long as head and mesosoma combined.

Re-description

Female. Body length 2.1 mm (Plate 19: A). Black, scape and last three claval segments brown; A2-A4 light brown; A5-A7 yellow; eyes brown; legs except coxae brown, coxae black, tegula black; submarginal vein brown.

Head: 1.77 X as wide as long in dorsal view (Plate 19: C), 1.2 X as wide as high in front view (Plate 19: B); lower frons and vertex with uniformly scattered white setae and vertex with coriaceous sculpturing; upper surface of eye with prominent ledge (Plate 19: B); IOS 1.76 X eye height; lower head with coriaceous sculpturing; OOL 1.5 X OD; LOL 2.5 X OOL; POL 2 X

LOL; eye height 2.7 X as long as temples; scape 5 X as long as wide, 1.46 X as long as A7-A10 combined; length to breadth ratio of antennal segments A1-A10 being: 0.35: 0.07; 0.07: 0.04; 0.07: 0.04; 0.06: 0.04; 0.02: 0.03; 0.03: 0.04; 0.04: 0.05; 0.06: 0.07; 0.05: 0.06; 0.09: 0.05 respectively (Plate 19: D).

Mesosoma: 1.09 X as long as wide (Plate 19: G); pronotum with broadly rounded shoulders; mesoscutum 1.17 X as wide as long; notauli broad; scutellum oval, 1.53 X as wide as long; mesopleuron with 4-5 longitudinal striae below tegula; metapleuron with dense pilosity (Plate 19: E). Forewings 2.23 X as long as wide (Plate 19: H), almost hyaline, marginal fringe almost absent.

Metasoma: 1.7 X as long as wide (Plate 19: F), T1 with three prominent striae medially; T2 striate laterally; T3-T6 finely granulate anteriorly, smooth posteriorly with a transverse row of white setae in middle; length to width ratio of metasomal tergites T1-T6 being: 0.20: 0.3; 0.55: 0.63; 0.13: 0.54; 0.08: 0.4; 0.06: 0.25; 0.05: 0.1 respectively.

Host: *Apsylla cistella* (Buckton) (Homoptera) on *Mangifera indica* (mango) (Vlug 1995).

Specimen examined

f. INDIA: Kerala, University of Calicut, Malappuram; 25. v. 1998; Coll. T. C. Narendran and party; on card; Reg. No. ZSI/WGRS/IR.INV.4580; deposited by Ushakumari.

Discussion

The genus was misidentified as *Isostasius* by Ushakumari in her doctoral thesis (2002). Detailed examination of the specimen under high magnification (160 x) was conducted and the generic identity was corrected to *Inostemma*. The species was confirmed as *apsyllae*. The unusual ledge at upper part of the

eye makes it closer to *I. oculare* Austin. However, the latter species is more robust, dull and the eye ledges are more pronounced.

Remarks

This is the first record of *Inostemma apsyllae* from Kerala.

2. *Inostemma berijamum* Mani

(Plate 20)

Inostemma berijama Mani, 1975: 74. Original description.

*Inostemma berijamum***:** Masner & Huggert, 1989: 75. Emendation, description.

Diagnosis

Body length 2.1 mm; OD 1.5 X OOL; scape 4.7 X as long as wide; metasomal horn towering over dorsal head.

Re-description

Female. Body length 2.1 mm (Plate 20: A); Black, antenna dark brown; submarginal vein dark brown; legs except coxae dark brown; coxae black.

Head: 1.92 X as wide as long in dorsal view (Plate 20: E), 1.37 X as wide as high in front view (Plate 20: B); lower frons and vertex with scattered white setae and with coriaceous sculpturing; IOS 1.76 X eye height; OD 1.5 X OOL; LOL 6.5 X OOL; POL 1.85 X LOL; eye height 1.75 X as long as temples; antennae covered with white setae; scape 4.7 X as long as wide; A3 3 X as long as wide; scape 1.43 X as long as A7-A10 combined; length to breadth ratio of antennal segments A1-A10 being: 0.33: 0.07; 0.08: 0.04; 0.09: 0.03; 0.04: 0.03; 0.03: 0.02; 0.03: 0.03; 0.04: 0.05; 0.05: 0.06; 0.05: 0.07: 0.09: 0.06 respectively (Plate 20: C).

Mesosoma: 1.1 X as long as wide (Plate 20: F); pronotum with broadly rounded shoulders, lateral pronotum with sparse setae; notauli broad; scutellum oval, 1.58 X as wide as long; mesopleuron smooth with a depression in middle; metapleuron with dense pilosity (Plate 20: G). Forewing 2.49 X as long as wide (Plate 20: D), submarginal vein reaching upto 0.27 of forewing.

Metasoma: 3.4 X as long as wide (Plate 20: H), metasomal horn towering over dorsal head; T2 finely striate laterally; T3-T6 finely granulate anteriorly, smooth posteriorly with a transverse row of white setae in middle; length to width ratio of metasomal tergites T1-T6 being: 0.14: 0.18; 0.48: 0.34; 0.10: 0.27; 0.09: 0.21; 0.08: 0.14; 0.25: 0.1 respectively.

Host: Unknown

Specimen examined

f. INDIA: Kerala, Mettap, Idukki; 07. iv. 2012; Coll. Rajmohana; on card; Reg. No. ZSI/WGRS/IR.INV.4656.

Discussion

I. berijamum comes close to *I. opacum* Thomson. The reticulations on the head differentiate *I. berijamum* from *I. opacum*. Also, the metasomal horn reaches upto posterior ocellus and A3 is 2 X as long as wide in *I. opacum* whereas in *I. berijamum,* A3 is 3 X as long as wide and the metasomal horn is almost reaching in front of head.

Remarks

This study brings out the first report of *I. berijamum* from Kerala.

3. *Inostemma indicum* Mani

(Plate 21)

Inostemma indica Mani, 1941: 32. Original description.

Inostemma indicum: Masner & Huggert, 1989: 76. Emendation.

Diagnosis

Body length 1.85 mm; metasomal horn equal to metasoma; T2 wider than long, almost equal to remaining tergites combined.

Re-description

Female. Body length 1.85 mm (Plate 21: A). Black, submarginal vein yellow; trochanter, femur and tarsus except last tarsi yellow; coxae and femur black; antennal segments except scape and pedicel brown.

Head: 1.8 X as wide as long in dorsal view (Plate 21: E); occiput and vertex reticulate with sparse white setae; frons fully reticulate (Plate 21: F); eyes large; IOS 1.36 X eye height; OOL 0.8 of OD; LOL 3.6 X OOL; POL 2 X LOL; eye height 5.52 X as long as temples; scape 4.05 X as long as wide with an apical lamella, 1.01 X as long as A7-A10 combined; length to breadth ratio of antennal segments A1-A10 being: 1.66:0.41; 0.65:0.30; 0.35: 0.26; 0.41: 0.32; 0.13:0.17; 0.16: 0.22; 0.33: 0.37: 0.44; 0.38: 0.44; 0.56: 0.36 respectively (Plate 21: C).

Mesosoma: 1.2 X as long as wide (Plate 21: B); pronotum with broadly rounded shoulders; mesoscutum 1.08 X as wide as long; notauli broad; scutellum oval, 2.55 X as long as wide; mesopleuron smooth with a median depression; metapleuron pilose (Plate 21: H); lateral propodeum sparsely pilose. Forewing 2.55 X as long as wide (Plate 21: G), with very short marginal fringe, submarginal vein of forewing reaching upto 0.28 of wing width.

Metasoma: 2.6 X as long as wide (Plate 21: D); length of metasomal horn almost equal to metasoma; T1 longitudinally striate; T2 with fine striae laterally; T3-T6 with transverse row of white setae; length to width ratio of metasomal tergites T1-T6 being: 0.11: 0.22; 0.47: 0.37; 0.09: 0.33; 0.08: 0.25; 0.07: 0.17; 0.16: 0.1 respectively.

Host: Larvae of *Neolasioptera cephalandrae* Mani (Cecidomyiidae: Diptera), producing galls on stem of *Coccinia indica* (Vlug 1995); stem galls of *Cephalandra indica.*

Specimen examined

f. INDIA: Kerala, Kottakkal, Malappuram; 12. iv. 2012; Coll. U. K. A. Saleem; on card; Reg. No. ZSI/WGRS/IR.INV.3605.

Discussion

Inostemma indicum comes near *I. coorgensis*. But the metasomal horn is equal to metasoma in *I. indicum* whereas, metasoma is 1.4 X as long as the metasomal horn in *I. coorgensis.*

Remarks

I. indicum is reported from Kerala for the first time through this study. A new host plant association is also provided.

4. ***Inostemma parvocornus* sp. nov.**

(Plate 22)

Diagnosis

Body length 1.68 mm; OOL 2 X OD; scape 6 X as long as wide, A2 0.17 of A1, A5 subequal to A6, A7 as long as wide, A8 subequal to A9; metasomal horn hardly reaching up to middle of scutellum.

Description

Holotype. Female. Body length 1.68 mm (Plate 22: A); Black; antenna dark brownish black; submarginal vein dark brown; legs dark brown.

Head: 1.74 X as wide as long in dorsal view (Plate 22: C), 1.23 X as wide as high in front view (Plate 22: F); frons coriaceously sculptured, frons and vertex with scattered white setae; vertex and occiput with strong reticulations; IOS 1.3 X eye height; OOL 2 X OD; LOL 2 X OOL; POL 2 X LOL; eye height 6.3 X as long as temples; antennae covered with white setae; scape 6 X as long as wide, pedicel 0.17 of A1, A5 subequal to A6; A7 as long as wide; A8 subequal to A9; A10 1.6 X as long as wide; length to breadth ratio of antennal segments A1-A10 being: 0.3: 0.05; 0.05: 0.03; 0.05: 0.03; 0.05: 0.04; 0.02: 0.03; 0.02: 0.03; 0.04: 0.04; 0.05: 0.06; 0.05: 0.06; 0.08: 0.05 respectively (Plate 22: H).

Mesosoma: 1.07 X as long as wide (Plate 22: B), finely reticulate; pronotum with broadly rounded shoulders; lateral pronotum reticulate with sparse setae; mesoscutum 1.14 X as long as wide; notauli broad; scutellum oval, 1.8 X as wide as long; scutoscutellar groove wide; mesopleuron with reticulations posteriorly and with a medial depression; metapleuron with dense pilosity (Plate 22: E). Forewings 2.23 X as long as wide (Plate 22: G), submarginal vein reaching upto 0.32 of forewing; marginal fringe short, 0.07 of wing width.

Metasoma: 2.58 X as long as wide, metasomal horn hardly reaching middle of scutellum; T2 hardly striate laterally; T3-T6 finely granulate anteriorly, smooth posteriorly with a transverse row of white setae in middle; length to width ratio of metasomal tergites T1-T6 being: 0.41: 0.21; 0.48: 0.37; 0.09: 0.32; 0.07: 0.26; 0.06: 0.19; 0.13: 0.10 respectively (Plate 22: D).

Host: Unknown

Specimen examined

f. INDIA: Kerala, Kattangal, Kozhikode; 05. xii. 2013; Coll. Shweta; on card; Reg. No. ZSI/WGRS/IR.INV.6195.

Etymology

The species is named **'***parvocornus***'** since its having a short metasomal horn; 'parvus' in latin meaning small and 'cornus' meaning horn.

Discussion

Similar to *I. matsutuma* Yoshida & Hirashima from Japan, but differ in the antennal measurements and in OOL, POL, LOL ratios. LOL is 2.67 X OOL in *I. matsutuma* whereas only 2 X in the new species. Scape is only 5.2 X as long as wide and A10 is 1.75 X as long as wide in *I. matsutuma* whereas scape is 6 X as long as wide and A10 is 1.6 X as long as wide in *I. parvocornus.*

5. ***Inostemma shencottahensis*** Mukerjee

Inostemma shencottahensis Mukerjee, 1981: 56, 58. Original description, keyed.

Diagnosis

Female. Body length 1.54 mm. Body black, scape brown, rest of the segments brownish black; legs brown, except for very dark brown coxae; forewings hyaline. Head finely reticulate, 1.25 X as wide as high; eyes bare; OOL 0.75 X OD; POL 3.5 X OD; scape 5 X as long as wide, pedicel 1.88 X as long as wide, 0.24 of scape, A3 subequal to pedicel, clava subequal to preceeding four antennal segments combined; notauli complete; T1 with longitudinal striae.

Type locality: Shencottah Gap.

Discussion

The females of this species are not having metasomal horn. Metasomal horn is also absent in *I. apsyllae* and *I. oculare*, two species described from India by Austin (1984) but they are characterized by an unusual ledge on the eye surface which differentiate *Inostemma shencottahensis* from them.

Remarks

The species is not represented in the present collection.

5. Genus *IPHITRACHELUS* Haliday

Iphitrachelus Haliday, *in* Walker, 1836: 273. Original description. Type: *Iphitrachelus lar* Haliday, by monotypy.

Diagnostic characters

Minute (under 1mm); usually brown to dark brown in color; head transverse with distinct sculptures; occipital pit well developed; antennae eight segmented in female; A8 to A10 fused into a single segment and with sensillar formula 1-1-0; antennae ten segmented in male; foretibia with pectinate spur; notauli well distinct; scutellum convex, distinctly separated from mesoscutum by a deep groove; tarsi four segmented; forewing with a submarginal vein knobbed at apex; laterotergites wide; in female, metasoma usually with six tergites in female and with eight tergites in male.

Distribution: Worldwide

Biology: Host and habits are unknown

Discussion

The presence of occipital pit, the large clypeal depression and the structure of S2 with no felt fields bring this genus close to *Acerotella* Masner but *Iphitrachelus* can be easily differentiated from *Acerotella* since its having four segmented tarsi which is five segmented in *Acerotella* (Masner and Huggert).

Remarks

Eight species of this genus are described from the World, three species from Oriental Region and one species from India. No species has been described from Kerala. Two new species are described here. A key to species of India and a distribution map of this genus and its species in Kerala are provided (Plate 26).

KEY TO INDIAN SPECIES OF *IPHITRACHELUS* HALIDAY

(Based on females)

1. Lateral ocelli almost as far from inner orbits as from median ocellus; T1 without foamy scales..... ***I. lar* Haliday**

- Lateral ocelli closer to eye margin than to median ocellus; T1 with foamy scales 2

2. Female clava broad, only 1.8 X as long as wide; propodeum and T1 with thick foamy structures, foamy scales on T1 almost completely confluent (Plate 24: Figure F)…… ..... ***I. neogracilis* sp. nov.**

- Female clava elongate, 4.1 X as long as wide; propodeum with foamy structures at hind corners, foamy scales on T1 not confluent (Plate 25. Figure H)…….…… ....***I. shajii* sp. nov.**

1. *Iphitrachelus neogracilis* sp. nov.

(Plate 24)

Diagnosis

Body length 0.72 mm; scape 3.75 X as long as wide; propodeum with remarkable foamy structures, foamy structure on T1 confluent.

Description

Holotype. Female. Body length 0.72 mm (Plate 24: A); body dark brown; A3-A9 brown, A1, A2, legs including coxae, first metasomal tergite yellow; tegula light brown; submarginal vein brown; forewings slightly infuscate.

Head: 1.75 X as wide as long in dorsal view, transverse (Plate 24: D), as wide as mesosoma; surface of head with strong reticulate punctures; eyes bare; IOS 1.55 X eye height (Plate 24: E); eye height 4 X as long as temples; POL 2.2 X LOL; OD 2 X OOL; LOL 10 X OOL; scape 3.75 X as long as wide with thin, complete ventral lamella; length to breadth ratio of antennal segments A1-A10 being: 0.15: 0.04; 0.04: 0.03; 0.03: 0.03; 0.03: 0.03; 0.02: 0.01; 0.02: 0.02; 0.01: 0.02; 0.09: 0.05 respectively (Plate 24: G).

Mesosoma: 1.1 X as long as wide (Plate 24: B); mesonotum with fine microsculpture; notauli complete, deeply impressed; scutellum convex, separated from mesoscutum by a very broad, deep, smooth groove; upper part of lateral pronotum with fine reticulation; mesopleuron smooth; metapleuron pubescent; foamy structures developed only at posterolateral corners of propodeum. Forewings 2.32 X as long as wide (Plate 24: H), slightly infuscate, with submarginal vein knobbed at apex (Plate 24: H), microtrichia absent at base of wing, marginal fringe absent.

Metasoma: 1.88 X as long as wide, T1 with foamy structures extending to base of T2; T2 smooth; length to width ratio of metasomal tergites T1-T6 being: 0.06: 0.08; 0.20:0.16; 0.01: 0.06; 0.01: 0.06; 0.01: 0.04; 0.01: 0.03; 0.01: 0.02 respectively (Plate 24: F).

Host: Unknown

Specimen examined

Holotype. f. INDIA: Kerala, Mayanad, Kozhikode; 26. xii. 2014- 01. i. 2015; Malaise trap; Coll. Shweta; on card; Reg. No. ZSI/WGRS/IR.INV.6196.

Etymology

The species is named ‘*neogracilis*’ since it comes close to *I. gracilis*.

Discussion

This species runs to *I. gracilis* Masner in key to World species of *Iphitrachelus* Haliday by Megyaszai (1999). Even though the new species is having similarities with *I. gracilis*, some typical differences are noted. The foamy structures in the new species are more prominent than in *I. gracilis.* Propodeum and T1 is almost completely covered with foamy structures which is extending to base of T2 in the new species whereas, T1 is having foamy structures only medially and is not extending to T2 in *I. gracilis*. The clava of *I. gracilis* is 2.2 X as long as wide whereas, clava in the new species is only 1.8 X as long as wide.

2. ***Iphitrachelus shajii* sp. nov.**

(Plate 25)

Diagnosis

Body length 0.95 mm; LOL 1.25 X OOL; scape 4 X as long as wide; propodeum with foamy structures at hind corners, foamy structure on T1 not confluent.

Description

Holotype. Female. Body length 0.95 mm (Plate 25: A); body dark brown; antennal segments except scape brown; scape, legs including coxae, first metasomal tergite and tegula yellow; submarginal vein brown; forewings slightly infuscate.

Head: 1.8 X as wide as long, transverse (Plate 25: D); 1.1 X as wide as mesosoma; temples short; surface of head with strong reticulate punctures; eyes bare; IOS 1.77 X eye height (Plate 25: B); eye height 9.3 X as long as temples; POL 2.2 X LOL; OOL 2.2 X OD; LOL 1.25 X OOL; antenna 8

segmented; scape with large and complete ventral lamella covering flagellomeres (Plate 25: B); scape 4 X as long as wide; A6 as long as wide, length to breadth ratio of antennal segments A1-A10 being: 0.20: 0.05; 0.06: 0.03; 0.07: 0.03: 0.07: 0.03; 0.02: 0.02; 0.02: 0.02; 0.02: 0.03; 0.15: 0.04 respectively (Plate 25: F).

Mesosoma: 1.08 X as long as wide (Plate 25: E); mesonotum with coarsely reticulate sculpture; notauli complete, deeply impressed and wide; scutellum convex, separated from mesoscutum by a very broad, deep, smooth groove; upper part of lateral pronotum distinctly reticulate; mesopleuron smooth; metapleuron pubescent; foamy structures developed only at posterolateral corners of propodeum. Forewings slightly infuscate (Plate 25: G), 2.4 X as long as wide, with a submarginal vein knobbed at apex, 0.23 of forewing length, microtrichia absent at base of wing, marginal fringe absent.

Metasoma: With six visible tergites (Plate 25: H); 1.2 X shorter than head and mesosoma combined; T1 transverse with foamy structures at apex of two keels; T2 largest; smooth; basal foveae sharply separated from median area; length to width ratio of metasomal tergites T1-T6 being: 0.05: 0.12; 0.28: 0.2; 0.03: 0.13; 0.03: 0.11; 0.03: 0.08; 0.03: 0.04 respectively.

Host: Unknown

Specimens examined

Holotype. f. INDIA: Kerala, Eravikulam, Idukki; 12. iv. 2012; Sweep net; Coll. Bijoy C; on card; Reg. No. ZSI/WGRS/IR.INV.4523; *Paratypes*. f. INDIA: Kerala; University of Calicut; Malappuram; 04. xii. 2015; Sweep net; Coll. Ranjith; on card; Reg. No. ZSI/WGRS/IR.INV.5338; f. INDIA: Kerala, Idaykkadu, Kasargod; 10. xi. 2015; Malaise trap; Coll. Sinu; on card; Reg. No. ZSI/WGRS/IR.INV.6197.

Etymology

The species epithet *'shajii'* is after the author's husband's name 'Shaji', for his support and encouragement towards this work.

Discussion

The species runs to *I. foutsi* Jackson in both Masner's (1976) and Megyazai's (1999) key to species of *Iphitrachelus* of the World. But antennal clava is 4 X as long as wide in *I. shajii* whereas it is 2 X as long as wide in *I. foutsi.* Also, the presence of upper lamella in *I. shajii* differentiates it from *I. foutsi*.

6. Genus *LEPTACIS* Förster

Leptacis Förster, 1856: 107, 112. Original description. Type: *Ichneumon tipulae* Kirby, designated by Ashmead (1893). Keyed.

Xestonotus Förster, 1856: 107, 112. Original description. Type: *Xestonotus andriciphilus* Ashmead, first included species. Keyed. Preoccupied by *Xestonotus LeConte* (1853) (Coleoptera). Synonymized by Masner (1964).

Miramblyaspis Dodd, 1914a: 91. Original description. Type: *Miramblyaspis mirabilis* Dodd, by monotypy. Synonymized by Huggert (1976).

Axestonotus: Kieffer, 1926: 561, 625. Type: *Xestonotus andriciphilus* Ashmead, by substitution of *Axestonotus* for *Xestonotus*. Replacement name unnecessarily proposed, keyed, key to species. Synonymized by Masner (1964).

Prosamblyaspis Kieffer, 1926: 561, 610. Original description. Type: *Amblyaspis flavosignatus* Kieffer, by monotypy. Keyed. Synonymized by Masner (1965).

Prosamblyaspis Kieffer, 1926: 561, 610. Original description. Type: *Amblyaspis* flavosignatus Kieffer, by monotypy. Keyed. Synonymized by Masner (1965).

Anacoryphe Debauche, 1947: 274. Original description. Type: *Anacorypha orchymonti* Debauche, by monotypy and original designation. Synonymized by Masner (1960) as a subgenus of *Leptacis* Förster.

Xestonotidea: Gahan, 1919: 524. Type: Xestonotus andriciphilus Ashmead, by substitution of Xestonotidea (X. foersteri Gahan incorrectly designated as type). Replacement name. Synonymized by Masner (1964).

Mandraka Risbec, 1953: 343. Original description. Type: *Mandraka pauliani* Risbec, by monotypy. Synonymized by Masner (1960) as a subgenus of *Leptacis* Förster.

Diagnostic characters

Body smooth and shiny; antennae ten segmented in both sexes; notauli present or absent; hyper occipital carina usually present, sometimes absent; apical region of scutellum modified into a tooth or long sharp spine; metasoma six segmented; forewings usually with long marginal cilia.

Distribution: Worldwide

Biology: Parasitoids of Cecidomyiidae

Discussion

Leptacis shows similarities with *Ceratacis* Thomson and *Synopeas* Förster in having an apical scutellar spine but can be separated easily from these two genera. Firstly *Leptacis* is having relatively long T1 and also, T1 and T2 are distinctly separated. In *Synopeas*, T1 and T2 are almost fused with dense hairs at the junction of T1-T2. Many species of *Leptacis* have very small spine as in *Synopeas*, but it is still usually more finely pointed, whereas more blunt in *Synopeas*. Eventhough mesosoma is slightly higher than wide in *Ceratacis* as in *Leptacis*, *Ceratacis* is having a short bluntly prolonged spine.

Remarks

Leptacis is represented by 273 described species all over the World and 68 species from Oriental Region. From India, 16 species and from Kerala only four species were so far reported. The present work reports 12 species, out of which three are new reports from India, five are new reports from Kerala and five are new to science. Female of two species are reported for the first time from the World. The *Holotypes* of Ushakumari were studied and re-described. A key to species of Kerala and a distribution map of this genus and its species in Kerala are provided (Plate 38).

KEY TO SPECIES OF *LEPTACIS* FÖRSTER FROM KERALA

(Based on females)

1. Propodeum with distinct foamy structure (Plate 35: Figure A)…..... 2

- Propodeum without foamy structure, only two simple propodeal carina present…….. .....… 3

2. Marginal cilia 0.9 X of forewing width; forewing 2.8 X as long as wide; …….....***L. transoceanica*** **Buhl**

- Marginal cilia 0.18 X of forewing width; forewing 2.4 X as long as wide; ……..…..***L. tenuispinae*** **sp. nov**.

3. Scutellum with a sharp and distinct spine …….....4

- Scutellum with only a blunt tooth like process at apex (Plate 31: Figure H)……..... ***L. pilosa*** **sp. nov.**

4. Hyperoccipital carina absent…….....5

- Hyperoccipital carina present.....6

5. OOL half OD.....7

- OOL equal to or greater than OD.....8

6. LOL less than 5 X OOL 9

- LOL 9 X OOL…..... ***L. maldarensis*** **Mukerjee**

7. Frons smooth and shiny; OOL 2 X OD…..... ..... .***L. malabarensis*** **Ushakumari and Narendran**

- Frons weakly reticulate; OOL 0.5 of OD ..... ***L. pulla*** **Buhl**

8. Vertex frons and occiput reticulate; OOL equal to OD; LOL 3.5 X OOL; POL 8 X LOL…….....***L. tegulata*** **Buhl**

- Vertex, frons and occiput punctate; OOL half OD; LOL 6 X OOL; POL 2 X LOL…… .....***L. keralensis*** **Ushakumari and Narendran**

9. Scutellar spine elongate, thick and prominent (Plate 33. Figure B)..... 10

- Scutellar spine short, fragile (Plate 30: Figure B)…..... 11

10. Scutellar spine with a bent on middle, about twice as long as scutellum in lateral view (Plate 33: Figure B); LOL more than 3.5 X OOL……..….....***Leptacis robusta*** **sp. nov.**

- Scutellar spine straight, about as long as scutellum in lateral view (Plate 27: Figure D); LOL less than 3.5 X OOL…***Leptacis atturensis*** **Mukerjee**

11. A8 sub equal to A9; scutellum 1.7 X as long as wide …….***L. lata*** **sp. nov.**

- A8 as long as wide, not equal to A9; scutellum 1.27 X as long as wide…….....…….***L. manii*** **sp. nov.**

1. *Leptacis atturensis* Mukerjee

(Plate 27)

Leptacis atturensis Mukerjee, 1981: 60, 72. Original description. Keyed.

Diagnosis

Body length 1.6 mm; notauli absent; complete hyperoccipital carina present; vertex reticulate; OOL equal to OD; scape 6.2 X as long as wide, almost as long as A7-A10 combined.

Re-description

Female. Body length 1.6 mm (Plate 27: A). Body black; antennal scape yellowish brown; A2- A10 dark brown; legs except last tarsal segment yellowish brown; last tarsal segment dark brown; tegula black.

Head: 1.83 X as wide as long in dorsal view, finely reticulate (Plate 27: F), as wide as mesosoma; rounded, low but complete hyperoccipital carina present; vertex reticulate with sparsely white setae; frons weakly striate (Plate 27: C); OOL equal OD; LOL 2.67 X OOL; POL 2 X LOL; IOS 1.24 X eye height; eye height 1.44 X as long as temples; head in front view 1.11 X as wide as high; scape 6.2 X as long as wide, almost as long as A7-A10 combined; length to width ratio of antennal segments A1-A10 being: 0.31: 0.05; 0.08: 0.04; 0.06: 0.03; 0.10: 0.03; 0.04: 0.03; 0.04: 0.03; 0.09: 0.05; 0.08: 0.06; 0.07: 0.06; 0.1: 0.05 respectively (Plate 27: H).

Mesosoma: 1.92 X as long as wide (Plate 27: G), smooth and shiny covered fully with white setae; anterior part of pronotum flat, lateral areas smooth; mesoscutum finely reticulate, 1.45 X as wide as long; notauli absent; mesopleuron and metapleuron smooth, latter with white setae posteriorly (Plate 27: D); scutellar spine thick and straight, about as long as scutellum in lateral view; propodeum with dense setae laterally. Forewings with fine and dense microtrichia, 2.67 X as long as wide (Plate 27: B).

Metasoma: 1.5 X as long as wide; lateral sides of T1 and base of T2 with white setae; length to width ratio of metasomal tergites T1-T6 being: 0.15: 0.17; 0.52: 0.39; 0.03: 0.27; 0.03: 0.19; 0.02: 0.11; 0.01: 0.04 respectively (Plate 27: E).

Host: Unknown

Specimens examined

f. INDIA: Kerala, Pambadum shola, Idukki; 08. iv. 2012; Coll. Rajmohana; on card; Reg. No. ZSI/WGRS/IR.INV. 4902; f. INDIA: Kerala, Kakkayam, Kozhikode; 29. xii. 2015; Coll. Ranjith; on card; Reg. No. ZSI/WGRS/IR.INV.5197; f. INDIA: Kerala, Mavoor, Kozhikode; 07. xii. 2015; Coll. Shweta; on card; Reg. No. ZSI/WGRS/IR.INV.5333.

Discussion

The species comes close to *L. indicus* Mukerjee in having a long scutellar spine and also in length to width ratio of the forewing. But *L. atturensis* can be distinguished by the longer marginal fringe of forewing which is almost absent in *L. indicus*. Also, notauli which are present in *L. indicus* is absent in *L. atturensis*.

Most of the characters shown by female match the description of male. But in female, setae on the propodeum is not that much dense as in male.

Remarks

The *Holotype* and *Paratype* of *L. atturensis*, described by Mukerjee (1981) were male. The female is reported for the first time from the World through this study and it also forms the first report of this species from Kerala.

2. *Leptacis keralensis* Ushakumari & Narendran

(Plate 37: Figure A)

Leptacis keralensis Ushakumari & Narendran, 2007: 8, 17. Original description, keyed.

Diagnosis

Body length 1.38 mm. OOL half OD; hyperoccipital carina absent; A9 as wide as long; notauli absent; T2 smooth.

Re-description

Female. Body length 1.38 mm. Body black; antennae black except brown basal one fourth of scape; eyes black; ocelli glassy; tegula dark brown.

Head: 1.78 X as wide as long in dorsal view, finely reticulate, rounded without hyperoccipital carina; vertex, frons and occiput punctate; OOL half OD; LOL 6 X OOL; POL 2 X LOL; eye height 2.75 X as long as temples; head in front view 1.25 X as wide as high; scape 5.25 X as long as wide, pedicel twice as long as wide, A9 as wide as long; length to breadth ratio of antennal segments A1-A10 being: 0.21: 0.04; 0.06: 0.03; 0.04: 0.02; 0.05: 0.02; 0.03: 0.02; 0.03: 0.02; 0.05: 0.04; 0.05: 0.04; 0.05: 0.05; 0.08: 0.05 respectively.

Mesosoma: Finely reticulate, shiny with sparse hairs; twice as long as wide, mesoscutum 1.35 X as long as wide; notauli absent; mesopleuron shiny with transverse striae; metapleuron smooth and shiny with white setae; scutellum flat, 1.4 X as long as wide, scutellar spine slender, long, propodeum with white setae laterally. Forewing 3.1 X as long as wide, with fine and dense microtrichia.

Metasoma: 1.8 X as long as wide; T1 as long as wide, T2 smooth with basal pits on lateral sides of T2, white setae present basally; length to width ratio of metasomal tergites T1-T6 being: 0.07: 0.07; 0.25: 0.21; 0.02: 0.16; 0.01: 0.11; 0.01: 0.08; 0.02: 0.04 respectively.

Host: Unknown

Specimen examined

Holotype. INDIA: Kerala, University of Calicut, Malappuram; 18. vi. 2000; Coll. T. C. Narendran and party; on card; Reg. No. ZSI/WGRS/IR.INV.4573.

Discussion

The species runs to *L. yercaudensis* Mukerjee in the key to Indian species by Mukerjee (1978). Notauli which is present in *L. yercaudensis* is a major character to distinguish it from *L. keralensis*, which lacks notauli. Basal pits are present on lateral sides of T2 of *L. keralensis* which is absent in *L. yercaudensis*.

Remarks

No fresh specimens of this species were collected. The species is re-described here, based on the *Holotype*.

3. *Leptacis lata* sp. nov. (Given on Cover page)

(Plate 28)

Diagnosis

Body length 1.07 mm, notauli absent; strong hyperoccipital carina present; scape 5.75 X as long as wide; A8 subequal to A9; notauli absent; LOL 4 X OD.

Description

Holotype. Female. Body length 1.07 mm (Plate 28: A). Body black; eyes black; A1- A6 yellowish brown, A7-A10 brown; legs including coxae yellowish brown; wings with a brownish tinge, clear towards basal region; tegula yellow; T1 orangish brown.

Head: 2.15 X as wide as long in dorsal view (Plate 28: F); complete hyperoccipital carina present; vertex reticulate with white setae; occiput reticulate; ocelli glazy; frons elongately reticulate with sparse setae anteriorly

and a row of white setae laterally, towards the eye margin (Plate 28: D); OOL almost absent; LOL 4 X OD; POL 2.12 X LOL; IOS 1.13 X eye height; eye height 2 X as long as temples; head in front view 1.08 X as wide as high; scape 5.75 X as long as wide; A3 as long as wide, A9 1.2 X as long as wide, length to breadth ratio of antennal segments A1-A10 being: 0.23: 0.04; 0.07: 0.03; 0.02: 0.02; 0.04: 0.02; 0.03: 0.02; 0.03: 0.02; 0.04: 0.03; 0.06; 0.05; 0.06: 0.05; 0.08: 0.05 respectively (Plate 28: C).

Mesosoma: 1.7 X as long as wide, densely clothed with white setae; anterior part of pronotum flat; anterior region of lateral pronotum smooth and shiny, posterior region with long white setae; mesoscutum 1.3 X as long as wide; notauli absent; scutellum 1.7 X as long as wide with a short spine; mesopleuron and metapleuron smooth, mesopleuron with two white setae below tegula; posterior end of metapleura with long white setae (Plate 28: E). Forewings clear towards basal region, rest with dense and closely packed microtrichia, 2.85 X as long as wide, marginal fringe of forewings 0.18 of wing width (Plate 28: G).

Metasoma: 1.57 X as long as wide, smooth and shiny, 0.96 times shorter than mesosoma; T1 as long as wide with long white setae laterally; T2 with short white setae basally; length to width ratio of metasomal tergites T1-T6 being: 0.09: 0.09; 0.31: 0.28; 0.01: 0.19; 0.01: 0.14; 0.01: 0.08; 0.01: 0.05 respectively (Plate 28: B).

Host: Unknown

Specimen examined

Holotype. f. INDIA: Kerala, Achankovil, Kottavasal, Kollam; 15. i. 2014; Coll. Bijoy; on card; Reg. No. ZSI/WGRS/IR.INV.6198.

Etymology

The species is named '*lata*' since its having a wide T2, '*lata*' in latin means wide.

Discussion

The species runs to *L. vertexialis* Buhl in key to Oriental species of *Leptacis* by Buhl (2008b). Marginal cilia of forewing are 0.3 of wing width in *L. vertexialis* whereas it is only 0.18 of wing width in the new species. A9 as long as wide and metasoma is as long as mesosoma in *L. vertexialis* whereas, A9 1.2 X as long as wide and metasoma is 0.96 times shorter than mesosoma in new species.

4. *Leptacis malabarensis* Ushakumari & Narendran

(Plate 37: Figure B)

Leptacis malabarensis Ushakumari & Narendran, 2007: 8, 18. Original description, keyed. Type deposited at ZSI, WGRC, Kozhikode.

Diagnosis

Body length 0.96 mm; head finely reticulate; vertex weakly reticulate without pubescence; frons smooth and shiny; occipital carina distinct; OOL 2 X OD.

Re-description

Female. Body length 0.96 mm. Body black; A1- A6 yellow; legs including coxae yellowish brown; tegula brown; microtrichia brown.

Head: 2.4 X as wide as long in dorsal view, finely reticulate; vertex weakly reticulate without pubescence; frons smooth and shiny; occipital carina distinct; hyperoccipital carina absent; OOL 2 X OD; LOL 3.5 X OOL; POL 2 X LOL; IOS equal to eye height; eye height 1.33 X as long as temples; scape

5.25 X as long as wide, A5 subequal to A6, length to breadth ratio of antennal segments A1-A10 being: 0.21: 0.04; 0.06: 0.03; 0.03: 0.02; 0.05: 0.02; 0.03: 0.02; 0.03: 0.02; 0.05: 0.04; 0.05: 0.05; 0.05: 0.05; 0.05: 0.05 respectively.

Mesosoma: Finely reticulate, shiny, 1.69 X as long as wide, covered fully with white setae; anterior pronotum flat and finely reticulate, lateral areas smooth; mesoscutum 1.16 X as long as wide; notauli absent; propodeum with dense white setae laterally; mesopleuron with few punctures, shiny; metapleuron smooth, with white setae at posterior ends; scutellum 1.4 X as long as wide, scutellar spine sharp; propodeum with white setae laterally. Forewing 2.87 X as long as wide.

Metasoma: 1.79 X as long as wide; T1 transverse with longitudinal carina; T2 with two basal pits; length to width ratio of metasomal tergites T1-T6 being: 0.07: 0.1; 0.25: 0.21; 0.04: 0.18: 0.02: 0.13; 0.03: 0.1; 0.02: 0.06 respectively.

Host: Unknown

Specimen examined

Holotype. INDIA: Kerala, Muthanga, Wayanad; 06. v. 2000; Coll. R. Ushakumari; on card; Reg. No. ZSI/WGRS/IR.INV.4574.

Discussion

The species reaches *L. yercaudensis* Mukerjee in the key to Indian species of *Leptacis* by Mukerjee (1978). However *L. malabarensis* differs from the latter by the presence of a notauli and also A5 and A6 are subequal in *L. malabarensis* which are unequal in *L. yercaudensis.*

Remarks

No fresh specimens of this species were collected. The species is re-described here, based on the *Holotype*.

5. *Leptacis maldarensis* (Mukerjee)

(Plate 29)

Leptacis maldarensis Mukerjee, 1981: 67, 72. Original description. Keyed.

Diagnosis

Body length 1.14 mm, hyperoccipital carina present; head finely reticulate; OOL 0.5 of OD; pedicel 0.24 of scape; A5 and A6 as long as wide; forewings with long marginal fringes.

Description

Female. Body length 1.14 mm (Plate 29: A). Body black; A1-A6 yellowish brown; scutellar spine yellow, legs including coxae yellowish brown.

Head: 1.12 X as wide as long in dorsal view (Plate 29: F); 1.23 X as wide as mesosoma; head finely reticulate, rounded; hyperoccipital carina present; OOL 0.5 of OD; LOL 9 X OOL; POL 19 X LOL; IOS 1.15 X eye height; eye height 1.86 X as long as temples; head in front view 1.12 X as wide as high (Plate 29: B); scape 5.8 X as long as wide; pedicel 0.24 of scape; A5 and A6 as long as wide; ratio length to breadth ratio of antennal segments A1-A10 being: 0.29: 0.05; 0.07: 0.03; 0.03: 0.02; 0.08: 0.03; 0.03: 0.03; 0.03: 0.03; 0.06: 0.05; 0.06: 0.05; 0.06: 0.05; 0.09: 0.04 respectively (Plate 29: G).

Mesosoma: 1.97 X as long as wide, clothed with white setae; mesoscutum 1.21 X as long as wide, uniformly reticulate, notauli absent (Plate 29: C); scutellum 1.67 X as long as wide with reticulations, round with a sharp

median spine; metapleuron smooth and bare anteriorly, pilose posteriorly; Forewing 2.97 X long as wide, with fine and dense microtrichia (Plate 29: H), marginal fringe of forewing well developed; 0.58 of wing width.

Metasoma: 1.64 X as long as wide, smooth and shiny; T1 transverse, laterally with white setae; length to width ratio of metasomal tergites T1-T6 being: 0.08: 0.13; 0.34: 0.28; 0.01: 0.22; 0.01: 0.16; 0.01: 0.1; 0.01: 0.05 (Plate 29: D) respectively.

Host: Unknown

Specimen examined

f. INDIA: Kerala, Kakkayam, Kozhikode; 29. xii. 2015; Coll. Ranjith; on card; Reg. No. ZSI/WGRS/IR.INV.5200.

Discussion

This species shows similarities to *L. indicus* Mukerjee in having a long scutellar spine and smooth and shiny metasoma. This species differs from *L. indicus* in having finely reticulate head and mesosoma and long marginal fringes on forewings.

Remarks

The first report of *L. maldarensis* from Kerala and first report of female from the World are provided through this study.

6. *Leptacis manii* sp. nov.

(Plate 30)

Diagnosis

Length 0.96 mm; scape 4.75 X as long as wide; A10 1.2 X as long as wide; A5 and A6 subequal; A7 and A8 as long as wide; hyperoccipital carina present.

Description

Holotype. Female. Body length 0.96 mm (Plate 30: A). Body yellowish brown, eyes, ocelli and clava dark brown; A1-A7 yellow, forewings with a brownish tinge, T1 yellowish brown, metasoma dark brown.

Head: 1.83 X as wide as long in dorsal view, with faint reticulations (Plate 30: F), vertex very finely reticulate with sparse setae, hyperoccipital carina present, complete and raised; frons almost smooth (Plate 30: C); OOL almost absent, LOL 3.5 X OD; POL 2 X LOL; IOS 1.36 X eye height; eye height as long as 2.33 X temples; head in front view as wide as high; scape 4.75 X as long as wide, A5 and A6 subequal, A7 and A8 as long as wide, A10 1.2 X as long as wide, length to breadth ratio of antennal segments A1-A10 being: 0.19: 0.04; 0.06: 0.03; 0.03: 0.02; 0.03: 0.02; 0.02: 0.02; 0.02: 0.02; 0.03: 0.03; 0.05: 0.05; 0.04: 0.06; 0.06: 0.05 respectively (Plate 30: D).

Mesosoma: Finely reticulate, 1.64 X as long as wide (Plate 30: E), clothed with white setae; lateral pronotal areas smooth; mesoscutum 1.19 X as long as wide; notauli absent; mesopleuron and metapleuron smooth, latter with white setae at posterior and hind corners (Plate 30: B); scutellum covered with white setae, 1.27 X as long as wide, with small and fragile scutellar spine. Forewings elongate, with dense microtrichia, 2.9 X as long as wide, marginal fringe of forewing 0.36 of wing width (Plate 30: G).

Metasoma: 2.04 X as long as wide; T2 smooth, 1.18 X as long as wide; length to width ratio of metasomal tergites T1-T6 being: 0.06: 0.07; 0.26: 0.22; 0.01: 0.19; 0.01: 0.16; 0.02: 0.13; 0.08: 0.09 respectively (Plate 30: H).

Host: Unknown

Specimens examined

Holotype. f. INDIA: Kerala, Amboori, Trivandrum; 11. xii. 2016- 20. xii. 2016; Coll. Rajmohana and party; Malaise trap; on card; Reg. No. ZSI/WGRS/IR.INV.6199; *Paratype*. f. INDIA: Kerala, Amboori, Trivandrum; 11. xii. 2016- 20. xii. 2016; Coll. Rajmohana and party; Malaise trap; on card; Reg. No. ZSI/WGRS/IR.INV.6200.

Etymology

The species is named '*manii*' after the collector of this species.

Discussion

Runs to *L. acutalata* Buhl (2004) in key to Oriental species of *Leptacis* by Buhl (2008). *L. acutalata* is having a low hyperoccipital carina whereas the hyperoccipital carina is not low in the new species. Marginal cilia of forewing is 0.2 of wing width in *L. acutalata* whereas its 0.36 of wing width in the new species.

7. ***Leptacis pilosa* sp. nov.**

(Plate 31)

Diagnosis

Body length 1.27 mm; notauli absent; hyperoccipital carina present; scape 7.3 X as long as wide; A8-A9 transverse; A3 and A5 as long as wide; notauli absent.

Description

Holotype. Female. Body length 1.27 mm (Plate 31: A). Body black; A1- A7 yellow, A8- A10 dark brown; T1 yellowish brown

Head: 2 X as wide as long in dorsal view, finely reticulate (Plate 31: D); complete hyperoccipital carina present; vertex reticulate with dense white setae; ocelli glazy; frons elongately reticulate (Plate 31: C); OOL half OD; LOL 8 X OOL; POL 2.1 X LOL; IOS 1.19 X eye height; eye height 2.5 X as long as temples; head in front view 1.1 X as wide as high; scape 7.3 X as long as wide, A3 and A5 as long as wide; A8-A9 transverse; length to breadth ratio of antennal segments A1-A10 being: 0.22: 0.03; 0.05: 0.02; 0.02: 0.02; 0.04: 0.02; 0.02: 0.02; 0.03: 0.02; 0.04: 0.03; 0.05: 0.06; 0.04: 0.06; 0.08: 0.06 respectively (Plate 31: G).

Mesosoma: 1.6 X as long as wide, densely clothed with white setae (Plate 31: B); anterior part of pronotum flat, lateral areas smooth, posteriorly with white setae, anterior region bare; mesoscutum finely reticulate, 1.22 X as long as wide; notauli absent; mesopleuron and metapleuron smooth, mesopleuron with parallel white setae below tegula, metapleura with irregular white setae, denser towards posterior region (Plate 31: E). Forewings 2.79 X as long as wide with fine and dense microtrichia, marginal cilia of forewing 0.28 of wing width (Plate 31: H).

Metasoma: 2.79 X as long as wide, smooth and shiny; T3-T5 strongly transverse, T6 elongate; length to width ratio of metasomal tergites T1-T6 being: 0.08: 0.09; 0.35: 0.24; 0.02: 0.2; 0.02: 0.18; 0.02: 0.16; 0.18: 0.13 respectively (Plate 31: F).

Host: Unknown

Specimens examined

Holotype. f. INDIA: Kerala, Munnar, Idukki; 20. ix. 2014; Coll. Emiliyamma; on card; Reg. No. ZSI/WGRS/IR.INV.6201; *paratype*. f. INDIA: Kerala, Munnar, Idukki; 20. ix. 2014; Coll. Emiliyamma; on card; Reg. No. ZSI/WGRS/IR.INV.6202.

Etymology

The species is named '*pilosa'* since the vertex of this species is covered with hairs/pilosity.

Discussion

Runs to *L. vertexialis* in key to Oriental species of *Leptacis* by Buhl (2008). Metapleura with irregular long white setae and A9 as long as wide in *L. vertexialis* whereas metapleuron is bare with pilosity only at hind corners and A9 is transverse in new species.

8. *Leptacis pulla* Buhl

(Plate 32)

Leptacis pulla Buhl, 2002: 21. Original description.

Diagnosis

Body length 0.96 mm; occiput strongly transversely reticulate; notauli absent; hyperoccipital carina absent; marginal fringe of forewing 0.4 of wing width.

Re-description

Female. Body length 0.96 mm (Plate 32: A). Body black; antenna, legs and scutellar spine yellowish; A7- A10 brown.

Head: 1.65 X as wide as long in dorsal view, rounded, finely reticulate (Plate 32: C), as wide as mesosoma; occiput strongly transversely reticulate;

hyperoccipital carina absent; vertex strongly reticulate with scattered white setae; frons weakly reticulate (Plate 32: F); OOL 0.5 of OD; LOL 6 X OOL; POL 2.16 X LOL; IOS equal to eye height; eye height 3 X as long as temples; head in front view 1.04 X as wide as high; A6 as long as wide; length to breadth ratio of antennal segments A1-A10 being: 0.22: 0.04; 0.06: 0.03; 0.03: 0.02; 0.07: 0.02; 0.03: 0.02; 0.02: 0.02; 0.06: 0.04; 0.05: 0.04; 0.06: 0.05; 0.08: 0.04 respectively (Plate 32: D).

Mesosoma: 1.92 X as long as wide, smooth and shiny with white setae (Plate 32: E); anterior part of pronotum broad, lateral areas reticulate anteriorly; mesoscutum finely reticulate, 1.39 X as wide as long; notauli absent; mesopleuron with about four longitudinal furrows below tegulae; metapleuron smooth, with white setae posteriorly (Plate 32: B); scutellum hairy. Forewing 3.1 X as long as wide, with fine and dense microtrichia, marginal fringe of forewing 0.4 of wing width (Plate 32: G).

Metasoma: 1.6 X as long as wide; lateral sides of T1 and base of T2 with white setae; length to width ratio of metasomal tergites T1-T6 being: 0.07: 0.11; 0.24: 0.23; 0.02: 0.20; 0.02: 0.16; 0.01: 0.12; 0.02: 0.04 respectively (Plate 32: H).

Host: Unknown

Specimens examined

f. INDIA: Kerala, Janakikaadu, Kozhikode; 02. iv. 2015; Coll. Ranjith; on card; Reg. No. ZSI/WGRS/IR.INV.4899; f. INDIA: Kerala, University of Calicut, Botanical garden, Malappuram; 14. xii. 2015; Coll. Ranjith; on card; Reg. No. ZSI/WGRS/IR.INV.5156.

Discussion

This species runs to *L. yercaudensis* Mukerjee in key to Indian species by Mukerjee (1981). But *L. yercaudensis* has notauli, which is absent in *L. pulla*. OOL 0.75 of OD in *L. yercaudensis* also differentiate the two species since OOL is 0.5 of OD in *L. pulla.*

Remarks

L. pulla was reported from Malaysia by Buhl (2002). The species is reported from India for the first time through this study.

9. ***Leptacis robusta*** **sp. nov.**

(Plate 33)

Diagnosis

Body length 1.57 mm, scape 7.6 X as long as wide, A10 1.8 X as long as wide, A6 and A9 as long as wide; hyperoccipital carina present; IOS equal to eye height; OOL half OD; scutellar spine sharp with a bent or curve medially, about twice as long as scutellum in lateral view.

Description

Holotype. Female. Body length 1.57 mm (Plate 33: A). Body black; A1- A6 yellow; A7-A10 dark brown; scutellar spine yellow; base of T1 with yellowish tinge; legs yellowish brown; tegula black.

Head: 1.7 X as wide as long in dorsal view, finely reticulate (Plate 33: G), rounded with complete hyperoccipital carina; vertex reticulate with sparsely white setae; frons weakly reticulate with sparse white setae (Plate 33: D); OOL half OD; LOL 4.6 X OOL; POL 2.35 X LOL; IOS equal to eye height; eye height 2.6 X as long as temples; head in front view 1.1 X as wide as high;

scape 7.6 X as long as wide; A10 1.8 X as long as wide; A6 and A9 as long as wide; length to breadth ratio of antennal segments A1-A10 being: 0.38: 0.05; 0.09: 0.04; 0.07: 0.03; 0.13: 0.03; 0.04: 0.03; 0.03: 0.03; 0.10: 0.05; 0.08: 0.06; 0.06: 0.06; 0.11: 0.06 respectively (Plate 33: F).

Mesosoma: 1.95 X as long as wide (including scutellar spine), covered fully with white setae (Plate 33: C); anterior pronotum flat and finely reticulate, lateral areas smooth; mesoscutum 1.25 X as long as wide; notauli absent; mesopleuron and metapleuron smooth, latter with white setae at posterior and hind corners (Plate 33: B); scutellum 1.3 X as long as wide, scutellar spine sharp with a bent on middle, about twice as long as scutellum in lateral view, but not reaching posterior third of T1; propodeum with white setae laterally. Forewing 2.8 X as long as wide, with fine and dense microtrichia, marginal cilia of forewing 0.24 of wing width (Plate 33: H).

Metasoma: 1.79 X as long as wide; lateral sides of T1 and base of T2 with white setae; T11.2 X as long as wide with two parallel keels and a small median carina; length to width ratio of metasomal tergites T1-T6 being: 0.15: 0.18; 0.46: 0.38; 0.02: 0.29; 0.02: 0.22; 0.02: 0.13; 0.01: 0.04 respectively (Plate 33: E).

Host: Unknown

Specimens examined

Holotype. f. INDIA: Kerala, Thoppimudi, Thattekkad, Ernakulam; 26. xi. 2014; Coll. Kumar; on card; Reg. No. ZSI/WGRS/IR.INV.6203.

Etymology

The species name ‘*robusta’* because of the robust scutellar spine.

Discussion

Runs to *L. mendolongensis* Buhl (2002) in key to Oriental species of *Leptacis* by Buhl (2008). Eventhough it shows some similarities with this species, they can be separated easily based on the following characters. Fine longitudinal striation is present in upper 0.3 of mesopleura in *L. mendolongensis* whereas the mesopleura of new species is smooth. Also, the scutellar spine of *L. mendolongensis* reaches posterior third of T1 and is with a semitransparent lamella below, whereas the spine of the new species is having a bent in the middle and is not reaching the posterior third of T1. Also, T1 is as long as wide in *L. mendolongensis* whereas it is 1.2 X as long as wide in *L. robusta.*

10. *Leptacis tegulata* Buhl

(Plate 34)

Leptacis tegulata Buhl, 2008: 525, 544. Original description, keyed.

Diagnosis

Body length 1.59 mm; notauli and hyperoccipital carina absent; mesopleuron with longitudinal sculptures in upper half; A4 4.3 X as long as wide; A7 2.4 X as long as wide; OOL equal to OD.

Re-description

Female. Body length 1.59 mm (Plate 34: A). Body black; antennae and legs yellowish brown; A7- A10 dark brown; spine brown at base and rest yellow; T1 dark brown.

Head: 1.68 X as wide as long in dorsal view (Plate 34: F), 1.13 X as wide as mesosoma; head rounded without hyperoccipital carina; vertex and frons finely reticulate (Plate 34: D); occiput strongly reticulate; OOL equal to OD; LOL 3.5 X OOL; POL 8 X LOL; IOS 1.32 X eye height; eye height 3.4 X as

long as temples; head in front view 1.11 X as wide as high; scape 5.66 X as long as wide; A4 elongate; A7 2.4 X as long as wide; length to breadth ratio of antennal segments A1-A10 being: 0.34: 0.06; 0.07: 0.04; 0.05: 0.03; 0.13: 0.03; 0.04: 0.03; 0.04: 0.03; 0.12: 0.05; 0.07: 0.06; 0.07: 0.06; 0.08: 0.05 respectively (Plate 34: B).

Mesosoma: 2.08 X as long as wide; sides of pronotum with faint longitudinal striae; mesoscutum 1.44 X as long as wide, uniformly reticulate, notauli absent (Plate 34: E); scutellum 2.2 X as long as wide; scutoscutellar grooves with dense setae; mesopleuron with weak longitudinal microsculpture in upper portion, rest smooth; metapleuron smooth and bare anteriorly, pilose posteriorly (Plate 34: F). Forewing 2.84 X long as wide, with fine and dense microtrichia (Plate 34: H).

Metasoma: 1.56 X as long as wide; T1 with strong longitudinal keels, laterally with short white setae extending to base of T2, rest smooth; length to width ratio of metasomal tergites T1-T6 being: 0.06: 0.16; 0.39: 0.34; 0.01: 0.26; 0.02: 0.21; 0.02: 0.13; 0.02: 0.08 respectively (Plate 34: C).

Host: Unknown

Specimens examined

f. INDIA: Kerala, Mayanad, Kozhikode; 11. iii. 2014; Coll. Shweta; on card; Reg. No. ZSI/WGRS/IR.INV.4900; f. INDIA: Kerala, Chethalayam, Wayanad; 01. iv. 2014; Coll. Anjana; on card; Reg. No. ZSI/WGRS/IR.INV.5006; f. INDIA: Kerala, University of Calicut, Botanical garden, Malappuram; 14. xii. 2015; Coll. Ranjith; on card; Reg. No. ZSI/WGRS/IR.INV.5157.

Discussion

This is a characteristic species on account of the sculpture of mesopleuron which is striate in upper half and also relatively long A4 is another character of this species which distinguishes it from other species.

Remarks

L. tegulata was first described from Indonesia by Buhl (2008a). The species is reported for the first time from India through this study.

11. *Leptacis tenuispinae* sp. nov.

(Plate 35)

Diagnosis

Body length 0.76 mm; scape 4 X as long as wide; hyperoccipital carina prominent; forewings with dense microtrichia; complete notauli present; slender long spine present; propodeum and T1 with foamy structures.

Description

Holotype. Female. Body length 0.76 mm (Plate 35: A). Body black; scape yellow, A2-A6 brown, A7- A10 dark brown, ocelli black, scutellar spine yellow, T1 brown.

Head: 1.6 X as wide as long in dorsal view, with granulations (Plate 35: E), complete and prominent hyperoccipital carina; vertex and frons also with same texture as head (Plate 35: F); OOL 1.5 X OD; LOL 1.67 X OOL; POL 2.2 X LOL; IOS 1.2 X eye height; eye height as long as 2.4 X temples; head in front view 1.26 X as wide as high; scape 4 X as long as wide, A4 5 X as long as wide, A6 as long as wide, A10 twice as long as wide, length to

breadth ratio of antennal segments A1-A10 being: 0.16: 0.04; 0.06: 0.03; 0.03: 0.02; 0.04: 0.02; 0.06: 0.03; 0.02: 0.02; 0.05: 0.03; 0.04: 0.03; 0.04: 0.03; 0.06: 0.03 respectively (Plate 35: B).

Mesosoma: 1.73 X as long as wide, with sparse short white setae (Plate 35: H); anterior pronotum flat with reticulations, anterior region of lateral protonum reticulate, posterior region smooth; mesoscutum 1.3 X as long as wide; complete notauli present; mesopleuron and metapleuron smooth, latter with long white setae (Plate 35: C); scutellum 1.54 X as long as wide, scutellar spine sharp and slender; propodeum with dense foamy structures. Forewings 2.42 X as long as wide, with fine and dense microtrichia, marginal cilia of forewing 0.18 of wing width (Plate 35: G).

Metasoma: 1.46 X as long as wide; T1 with white setae extending to base of T2, foamy structures present on lateral sides of T1; T2 as long as wide, T2 – T6 smooth, length to width ratio of metasomal tergites T1-T6 being: 0.07: 0.09; 0.24: 0.24; 0.01:0.17; 0.01: 0.05; 0.01: 0.1; 0.01: 0.06 respectively (Plate 35: D).

Host: Unknown

Specimens examined

Holotype. f. INDIA: Kerala, University of Calicut, Malappuram; 04. xii. 2015; Coll. Ranjith; on card; Reg. No. ZSI/WGRS/IR.INV.6204; *paratype*. f. INDIA: Kerala, University of Calicut, Malappuram; 04. xii. 2015; Coll. Ranjith; on card; Reg. No. ZSI/WGRS/IR.INV.6205.

Etymology

The species is named '*tenuispinae*' because of the slender spine on its mesoscutum.

Discussion

Only two species of this genus having foamy structure in the propodeum are described from Oriental Region. This species runs to *L. pteridis* Buhl (2002) in key to Oriental species of *Leptacis* by Buhl (2008b). The new species shows difference in color (*L. pteridis* is light brown) and many other characters. OOL equal to OD in *L. pteridis* whereas, OOL 1.5 X OD in new species. Vertex and frons faintly reticulate in *L. pteridis* whereas, vertex and frons are with granulations in new species.

12. *Leptacis transoceanica* Buhl

(Plate 36)

Leptacis transoceanica Buhl, 2008: 523, 547. Original description, keyed.

Diagnosis

Body length 1.57 mm; hyperoccipital carina strong; head 1.89 X as wide as long; OOL 1.5 X OD; propodeum with foamy, semitransparent structure.

Re-description

Female. Body length 1.57 mm (Plate 36: A). Body black; scape yellowish brown; A2- A7 brown; A8-A10 dark brown; legs and scutellar spine yellowish.

Head: 1.89 X as wide as long in dorsal view, finely reticulate (Plate 36: D); vertex and occiput reticulate; hyperoccipital carina strong; frons weakly reticulate (Plate 36: F), discontinuous striae towards toruli; OOL 1.5 X OD;

LOL 3.3 X OOL; POL 2 X LOL; IOS 1.41 X eye height; head in front view 1.3 X as wide as high; scape 6.4 X as long as wide, A8 as long as A9, length to breadth ratio of antennal segments A1-A10 being: 0.32: 0.05; 0.08: 0.04; 0.05: 0.03; 0.11: 0.02; 0.06: 0.03; 0.04: 0.03; 0.07: 0.04; 0.08: 0.06; 0.08: 0.07; 0.12: 0.06 respectively (Plate 36: B).

Mesosoma: 1.78 X as long as wide with a parallel row of white setae; anterior part of pronotum broad, lateral areas striate anteriorly; mesoscutum finely reticulate (Plate 36: E), 1.5 X as wide as long; mesopleuron and metapleuron smooth, latter with white setae at hind posterior corners (Plate 36: G); scutellum 1.8 X as long as wide with lateral white setae; propodeum with distinct foamy semitransparent structures. Forewing 2.66 X as long as wide, with fine and dense microtrichia (Plate 36: H).

Metasoma: 2.47 X as long as wide; base of T2 with short white setae; length to width ratio of metasomal tergites T1-T6 being: 0.09: 0.10; 0.49: 0.32; 0.03: 0.28; 0.04: 0.24; 0.05: 0.19; 0.09: 0.13 respectively (Plate 36: C).

Host: Unknown

Specimen examined

f. INDIA: Kerala, Thoppimudi, Tattekkad, Ernakulam; Coll. Rajmohana and Party; 02.iv.2013; on card; Reg. No. ZSI/WGRS/IR.INV.4901; f. INDIA: Kerala, Thoppimudi, Tattekkad, Ernakulam; Coll. Rajmohana and Party; 02.iv.2013; on card; Reg. No. ZSI/WGRS/IR.INV. 5004.

Discussion

A remarkable species in having propodeum with foamy, semitransparent structure and is similar to *L. athos* Masner (1960) in having foamy structures on the propodeum and in having an elevated hyperoccipital carina. But the head of female of *L. transoceanica* is 1.1 X as wide as high whereas in *L.*

athos, it is slightly higher than wide and OOL longer, 1.5 X as long as OD in new species but OOL is not longer than OD in *L. athos*.

Remarks

L. transoceanica is reported for the first time from India through this study.

7. Genus *PLATYGASTER Latreille*

Platygaster Latreille, 1809: 31. Original description. Type: *Scelio ruficornis* Latreille, by monotypy.

Epimeces Westwood, 1833: 421. Original description. Type: *Epimeces ensifer* Westwood, by elimination. Preoccupied by Epimeces Bilberg (1820) (Coleoptera). Synonymized by Walker (1836).

Isorhombus Förster, 1856: 107, 113. Original description. Type: *Isorhombus hyalinipennis* Ashmead, first included species. Keyed. Synonymized by Muesesbeck & Walkley (1951). Fouts (1924) also recognized that *Isorhombus hyalinipennis* Ashmead is a species of *Platygaster*.

Polygnotus Förster, 1856: 108, 115. Original description. Type: *Platygaster striolatus* Nees von Esenbeck, by original designation. Keyed. Synonymized by Fouts (1920).

Hypocampsis Förster, 1856: 108, 115. Original description. Type: *Hypocampsis hyalinata* Thomson, designated by Ashmead (1903). Keyed. Synonymized by Fouts (1924).

Coelopelta Ashmead, 1893: 263, 264, 289. Original description. Type: *Coelopelta mirabilis* Ashmead, by monotypy and original designation. Keyed. Synonymized by Fouts (1920).

Aneuron Brues, 1910: 49. Original description. Type: *Aneuron anormis* Brues, by monotypy and original designation. Synonymized by Fouts (1924).

Triplatygaster Kieffer, 1913: 178. Original description. Type: *Platygaster contorticornis* Ratzeburg, by monotypy. Proposed as a subgenus of *Platygaster* Latreille. Synonymized with *Hypocampsis* by Szelényi (1938).

Misocyclops Kieffer, 1914: 362. Original description. Type: *Platygaster ornatus* Kieffer, by monotypy. Keyed. Synonymized by Masner (1965).

Urocyclops: Maneval, 1936: 142. Type: *Paracyclops bettyae* Maneval, by substitution of *Urocyclops* by *Paracyclops*. Replacement name. Synonymized, change to subgeneric status by Huggert (1974).

Parepimeces Kieffer, 1926: 563, 760. Original description. Type: Epimeces ensifer Westwood, by substitution of Parepimeces for Epimeces. Description, keyed. Synonymized by Masner (1965).

Pyrgaspis Kozlov, 1967: 715. Original description. Type: *Pyrgaspis haloxylonomyiae* Kozlov, by monotypy and original designation, Synonymised by Talamas & Buffington, 2014: 107.

Anirama Kozlov, 1970: 224. Original description. Type: *Platygaster marikovskii* Kozlov, by monotypy and original designation. Synonymised by Talamas & Buffington, 2014: 105.

Criomica Kozlov, 1975a: 965. Original description. Type: *Criomica viktorovi* Kozlov, by monotypy and original designation, Synonymised by Talamas & Buffington, 2014: 106.

Cylindrogaster Huggert, 1980: 102. Original description. Type: *Platygaster tubulosa* Brues, by monotypy and original designation. Described as a subgenus of *Platygaster* Latreille.

Diagnostic characters

Body length ranges from 0.8- 4mm; usually black, rarely xanthic; antennae ten segmented; lateral ocelli closer to median ocelli than to eye margin; hyperoccipital carina present or absent; notauli present or absent; scutellum convex and unarmed; forewing without knobbed submarginal vein; metasoma with six visible tergites, sometimes very elongate.

Distribution: Worldwide

Host: Parasitoids of Cecidomyiidae

Discussion

Platygaster shows similarities to *Amblyaspis*. But scutellum of *Amblyaspis* is with hairs forming a cone like structure and also the antennal segments A9 and A10 are fused in *Amblyaspis* whereas, scutellum is usually rounded and A9 and A10 are distinctly separated in *Platygaster*.

Remarks

Platygaster is the most diverse genus of subfamily Platygastrinae and is represented by 642 species from the World and 54 species from Oriental Region. From India, 21 species and from Kerala, only eight species were reported (Rajmohana and Divya 2011). The present work reports 17 species which includes five new species, two new reports from India and three new reports from Kerala. Diagnosis of two species reported earlier from Kerala is also included. A key to species of Kerala, distribution map of the genus and its species in Kerala (Plate 51) are provided along with new host plant associations of four species.

KEY TO SPECIES OF *PLATYGASTER* LATREILLE FROM KERALA

(Based on females)

1. Notauli present, complete or at least faintly indicated…..... 2

- Notauli completely absent…….....…3

2. Metasoma elongate, more than 3.5 X as long as wide…….....…4

- Metasoma short, not more than 2 X as long as wide…… 5

3. Body black; scape 4.18 X as long as wide…… …***P. malabarica*** **Mukerjee**

- Body yellowish brown; scape 5.2 X as long as wide…..... 6

4. Occiput with prominent transverse striae (Plate 42: Figure G)……..... ..... ***P. kesaavrita*** **sp. nov.**

- Occiput reticulate 7

5. T2 with basal striation (Plate 43: Figure E)… 8

- T2 smooth (Plate 39: Figure F)… 9

6. A8 transverse; A4 as long as wide..... .***P. galbus*** **Ushakumari**

- A8 twice as long as wide; A4 1.67 X as long as wide…..... ...…..***P. neogalbus*** **sp. nov.**

7. T2 striate basally, rest of tergites smooth…..….....***P. caudatus*** **sp. nov.**

- T2 striate to almost tip of T2, T3- T5 with several longitudinal striae (Plate 46. Figure G)… ..... ***P. neostriatitergites*** **Veenakumari and Buhl**

8. Occiput transversely striate (Plate 49: Figure C)..….....
....…***P. sasii*** **Ushakumari**

- Occiput reticulate… 10

9. Scape 6.5 X as long as wide…… ..... .***P. acterbergiana*** **Buhl**

- Scape less than 5.5 X as long as wide…… 14

10. Coxae dark brown or black……..…..11

- Coxae pale…… ..... ……12

11. Hyperoccipital carina present…… ..... …***P. narendrani*** **Ushakumari**

- Hyperoccipital carina absent…… ..... .13

12. Head and occiput finely reticulate; marginal fringe of forewing only 0.15 of wing width; A9 1.25 X as long as wide…….. …***P. rusticus*** **sp. nov.**

- Occiput densely transversely coriaceous, marginal cilia of forewing 0.4 of wing width; A9 hardly longer than wide…… .....***P.luteipes*** **Buhl**

13. Frons smooth…… .....***P. keralicus*** **Ushakumari**

- Frons strongly reticulate…… .....…***P. reticulatus*** **sp. nov.**

14. Frons reticulate…… .....…..***P. nigrocoxatus*** **Ushakumari**

- Frons smooth…… ..... …….....15

15. OOL 0.67 of OD…… .....***P.tanus*** **Ushakumari**

- OOL greater than OD…… 16

16. Vertex reticulate…… ..... …..***P. zantanus*** **Ushakumari**

- Vertex smooth and shiny……..... …***P. minima*** **(Mukerjee)**

1. *Platygaster achterbergiana* Buhl

(Plate 39)

Platygaster achterbergiana Buhl, 2009: 892. Original description.

Diagnosis

Body length 1.09 mm; hyperoccipital carina absent; occiput reticulate anteriorly; frons smooth; notauli almost complete; T2 without striation.

Re-description

Female. Body length 1.09 mm (Plate 39: A). Body black, legs including coxae yellowish brown, A1 brown, A2- A10 dark brown.

Head: 1.74 X as wide as long in dorsal view (Plate 39: G), 1.14 X as wide as mesosoma, 1.07 X as high as wide in frontal view (Plate 39: E); eyes bare; IOS 1.47 X eye height; frons smooth; occiput reticulate anteriorly, smooth posteriorly; vertex smooth except for weak reticulation between ocelli; POL 4.33 X OOL; LOL 2 X OOL; OOL 1.5 X OD; eye height 2.17 X as long as temples; antennal segments broad; scape 6.5 X as long as wide; pedicel 0.27 of scape; A8 subequal to A9; length to breadth ratio of antennal segments A1-A10 being: 0.26: 0.04; 0.07: 0.03; 0.02: 0.02; 0.06: 0.03; 0.03: 0.03; 0.03: 0.04; 0.04: 0.04; 0.05: 0.05; 0.05: 0.05; 0.07: 0.05 respectively (Plate 39: D).

Mesosoma: 1.38 X as long as wide (Plate 39: B); pronotum smooth laterally; mesoscutum smooth, 1.08 X as long as wide; notauli almost complete; scutellum at level of mesoscutum, 1.2 X as wide as long and evenly covered with white setae; mesopleuron smooth; metapleuron fully covered with white setae (Plate 39: C). Forewing clear with moderately long microtrichia, 2.7 X as long as wide (Plate 39: H).

Metasoma: 2.03 X as long as wide; T1 with two longitudinal carinae, T2 smooth with two basal fovea laterally; length to width ratio of metasomal

tergites T1-T6 being: 0.09: 0.14; 0.36: 0.29; 0.04: 0.25; 0.04: 0.25; 0.04: 0.19; 0.03: 0.15; 0.04: 0.08 respectively (Plate 39: F).

Host: Unknown

Specimen examined:

f. INDIA: Kerala, Ambukuthi, Muthanga, Wayanad; 05. iv. 2014; Coll. Anjana; on card; Reg. No.ZSI/WGRS/IR.INV.5345.

Discussion

This species runs to *P. achterbergi* Buhl in key to Oriental species of *Platygaster* by Buhl (2008). But the species differs from *P. achterbergi* in having coarsely reticulate occiput and weakly margined head. Also, *P. achterbergiana* is having broader antennal segments compared to *P. achterbergi.*

Remarks

This species is reported for the first time from India.

2. *Platygaster caudata* sp. nov.
(Plate 40)

Diagnosis

Body length 1.94 mm; elongate; A3 as long as wide; pedicel 0.29 of scape; hyperoccipital carina absent; OOL twice OD; notauli present.

Description

Holotype. Female. Body length 1.94 mm (Plate 40: A). Dark brown, legs including coxae yellowish brown; A1-A3 yellowish brown; A4-A10 dark brown; metasoma brown; tegula yellow.

Head: 1.9 X as wide as long in dorsal view, weakly reticulate (Plate 40: F); 1.3 X as wide as mesosoma; hyperoccipital carina absent; eyes bare; eye height 2.33 X as long as temples; POL 3.5 X OOL; LOL 1.5 X OOL; OOL twice OD; frons and occiput weakly reticulate; head in front view 1.22 X as wide as high (Plate 40: G); IOS 1.44 X eye height; scape 4.8 X as long as wide, length to breadth ratio of antennal segments A1-A10 being: 0.24: 0.05; 0.07: 0.04; 0.02: 0.02; 0.04: 0.03; 0.04: 0.03; 0.06: 0.04; 0.06: 0.05; 0.05: 0.05; 0.06: 0.05; 0.09: 0.05 respectively (Plate 40: B).

Mesosoma: 1.4 X as long as wide (Plate 40: C); mesoscutum 1.15 X as long as wide; anterior region of lateral pronotum reticulate; notauli present, almost complete; scutellum 1.56 X as wide as long; sparse setae present on mesosoma; scutoscutellar grooves wide, in between 3-4 white setae present; mesopleuron smooth; metapleuron with white setae, prominent towards hind corners (Plate 40: D). Forewings hyaline, 2.58 X as long as wide (Plate 40: H).

Metasoma: Elongate, 5.6 X as long as wide; T1 transverse with several longitudinal striae; T2 striate to one third of tergite; T4 and T5 subequal; length to width ratio of metasomal tergites T1-T6 being: 0.1: 0.13; 0.31: 0.21; 0.18: 0.20; 0.2: 0.16; 0.21: 0.13; 0.18: 0.11 respectively (Plate 40: E).

Host: Unknown

Specimen examined

Holotype. f. INDIA: Kerala, Pandimotta, Kollam; 21. ii. 2015; Coll. Kumar; on card; Reg. No.ZSI/WGRS/IR.INV.6206; *Paratypes.* 2 f. INDIA: Kerala, Pandimotta, Kollam; 21. ii. 2015; Coll. Kumar; on card; Reg. No.ZSI/WGRS/IR.INV.6207; f. INDIA: Kerala, Vellimala, Idukki; 08. iv. 2013; Coll. Rajmohana; on card; Reg. No.ZSI/WGRS/IR.INV.6208; f.

INDIA: Kerala, Rajamalai shola, Idukki; 09. iv. 2012; Coll. Rajmohana; on card; Reg. No.ZSI/WGRS/IR.INV.6209.

Etymology

The species is named '*caudata*' after its tail like long metasoma.

Discussion

The species runs to *P. narendrani* Ushakumari in key to Oriental species of *Platygaster* by Buhl (2008). But the new species is very elongate than *P. narendrani*. Metasoma is only 2.29 X as long as wide and hyperoccipital carina is present in *P. narendrani* whereas, metasoma is 5.6 X as long as wide and hyperoccipital carina is absent in *P. caudata*.

3. *Platygaster galbus* Ushakumari

(Plate 41: Figure A)

Platygaster galbus Ushakumari, 2004: 576, 589. Original description, keyed.

Diagnosis

Body length 1.08 mm; OOL 1.25 X OD; occipital carina distinct; frons reticulate; pedicel twice as long as wide; T1 transverse with two longitudinal ridges; T2 almost as long as wide.

Re-description

Female. Body length 1.08 mm. Body and legs including coxae yellow; A6-A10 brown; eyes black; apical region of metasoma dark brown.

Head: 3.5 X as wide as long in dorsal view; eyes bare, eye height 1.83 X as long as temples; OOL 1.25 X POL; OOL 1.67 X LOL; OOL 1.25 X OD; occipital carina distinct; frons reticulate; head in front view 1.24 X as wide as high; IOS 1.75 X eye height; scape 4.5 X as long as wide, pedicel twice as

long as wide; length to breadth ratio of antennal segments A1-A10 being: 0.18: 0.04; 0.08: 0.04; 0.04: 0.02; 0.04: 0.03; 0.05: 0.04; 0.05: 0.06; 0.07: 0.05; 0.06: 0.07; 0.07: 0.05; 0.10: 0.05 respectively.

Mesosoma: Smooth, 1.12 X as long as wide with sparse hairs; mesoscutum as long as wide; notauli absent; scutellum 1.5 X as wide as long; mesopleuron smooth and shiny; metapleuron with white setae. Forewing hyaline, 2.7 X as long as wide.

Metasoma: 1.67 X as long as wide; T1 transverse with two longitudinal ridges; T2 almost as long as wide; length to width ratio of metasomal tergites T1-T6 being: 0.06: 0.11; 0.26: 0.27; 0.05: 0.25; 0.04: 0.22; 0.04: 0.14; 0.03: 0.07 respectively.

Host: Unknown

Specimen examined

Holotype. f. INDIA: Kerala, University of Calicut; 10. xi. 1998; Coll. T. C. Narendran and Party; on card; Reg. No.ZSI/WGRS/IR.INV.4558.

Discussion

P. galbus shows similarities to *P. minimus* Mukerjee in the measurement of antennal scape and in having 5 segmented antennal clava. But differs from *P. minimus* in the absence of notauli (present in *P. minimus*), in body colour-head and mesosoma pale yellowish brown and metasoma brown with a black tint which is dark brown to black in *P. minimus* whereas body fully yellowish in *P.galbus*.

4. *Platygaster keralicus* Ushakumari

(Plate 41: Figure B)

Platygaster keralicus Ushakumari, 2004: 580, 590. Original description, keyed.

Diagnosis

Body length 1.03 mm, frons smooth; vertex finely reticulate; mesoscutum as long as wide; notauli present and distinct.

Re-description

Female. Body length 1.03 mm. Black, antenna dark brown; eyes black; ocelli black; tegula dark brown; legs including coxae dark brown.

Head: 1.93 X as wide as long in dorsal view, 1.03 X as wide as mesosoma; eyes bare; eye height 2.75 X as long as temples; POL 3.67 X OOL; LOL 2 X OOL; OOL 1.5 X OD; frons smooth; vertex finely reticulate, shiny; occipital carina distinct; head in front view, 1.1 X as wide as high; IOS 1.25 X eye height; scape 4.2 X as long as wide, pedicel 0.41 of scape, length to breadth ratio of antennal segments A1-A10 being: 0.17: 0.04; 0.07: 0.03; 0.01: 0.02; 0.03: 0.03; 0.03: 0.03; 0.03: 0.03; 0.03: 0.04; 0.04: 0.04; 0.05: 0.04; 0.07: 0.04 respectively.

Mesosoma: Finely reticulate, shiny, 1.28 X as long as wide; mesoscutum as long as wide; notauli present and distinct; scutellum slightly convex, as wide as long; propodeum with lateral carina on either side; mesopleuron smooth and shiny; metapleuron sculptured with white setae. Forewing hyaline, 2.53 X as long as wide.

Metasoma: 1.9 X as long as wide, tergites smooth; T1 transverse; T2 with striation extending upto 0.4 its length; length to width ratio of metasomal tergites T1-T6 being: 0.06: 0.11; 0.23: 0.23; 0.04: 0.21; 0.04: 0.18; 0.04: 0.14; 0.03: 0.08 respectively (Plate 41: C).

Host: Unknown

Specimen examined

Holotype. f. INDIA: Kerala, Vellanikkara, Thrissur; 23. ix. 1998; Coll. Ushakumari; on card; Reg. No. ZSI/WGRS/IR.INV.4561.

Discussion

Eventhough, *P. keralicus* resembles *P. indicus* Mukerjee in four segmented clava, presence of notauli and slightly bulging scutellum, it can be differentiated from the latter mainly in the measurement of the antennal segments. Scape is 4.2 X as long as wide in *P. keralicus* whereas it is 5.2 X as long as wide in *P. indicus*. Pedicel is only 0.29 of scape in *P. indicus* whereas, 0.41 of scape in *P. keralicus*. Also, T2 is smooth in *P. indicus* whereas T2 is with striation extending upto 0.4 of its length in *P. keralicus*.

Remarks

The author in the original description of the species described all tergites smooth. But on detailed examination of the *Holotype* under high magnification, it was clear that striations were present on T2 which is clear in Plate 41: C.

5. *Platygaster kesaavrita* sp. nov.

(Plate 42)

Diagnosis

Body length 1.37 mm; black; vertex striate; OOL equal to LOL; A2 0.29 of A1; notauli complete; A5 subequal to A6.

Description

Female: Body length 1.37 mm (Plate 42: A). Body black; ocelli glassy; legs except coxae dark brown, coxae black; antenna brownish black.

Head: 2.44 X as wide as long in dorsal view (Plate 42: G); 1.16 X as wide as mesosoma; eyes bare; eye height 2.6 X as long as temples; vertex striate; occiput with scattered white setae; POL 2.17 X OOL; LOL equal to OOL; OOL 2 X OD; frons smooth (Plate 42: E); head in front view 1.29 X as wide as high; IOS 1.4 X eye height; scape 5.17 X as long as wide; pedicel 0.29 of scape; A5 subequal to A6; length to breadth ratio of antennal segments A1-A10 being: 0.31: 0.06; 0.09: 0.04; 0.03: 0.02; 0.06: 0.04; 0.06: 0.03; 0.06: 0.03; 0.07: 0.04; 0.08: 0.05; 0.08: 0.04; 0.1: 0.04 respectively (Plate 42: D).

Mesosoma: 1.37 X as long as wide (Plate 42: F); mesoscutum 1.18 X as long as wide; white setae present on notaular lines and towards lateral areas of the mesosoma and also on anterior region of lateral pronotum; notauli complete, scutellum 1.7 X as wide as long, almost fully covered with white setae; mesopleuron smooth; metapleuron fully covered with white setae (Plate 42: B). Forewings hyaline, 2.57 X as long as wide (Plate 42: H).

Metasoma: Elongate, 3.77 X as long as wide; white setae present on T1 laterally; T2 1.2 X as long as wide with striations to less than basal third; T3 transverse; length to width ratio of metasomal tergites T1-T6 being: 0.08: 0.17; 0.36: 0.3; 0.11: 0.25; 0.23: 0.18; 0.24: 0.13; 0.12: 0.10 respectively (Plate 42: C).

Host: Unknown

Specimens examined

Holotype. f. INDIA: Kerala, Rajamalai shola, Idukki; 09. iv. 2012; Coll. Rajmohana; on card; Reg. No.ZSI/WGRS/IR.INV.6210; *paratype*. f. INDIA:

Kerala, Rajmalai shola, Idukki; 09. iv. 2012; Coll. Rajmohana; on card; Reg. No. ZSI/WGRS/IR.INV.6211.

Etymology

The species is named 'kesaavrita', since it is having unusual covering of hair on mesosoma and occiput, (in Sanskrit means covered with hair)

Discussion

This species runs to *P. sasii* Ushakumari in Buhl's key (2008). POL is 2.17 X OOL and metasoma is elongate, 3.77 X as long as wide in new species whereas POL is 2.8 X OOL and metasoma is only 1.5 X as long as wide in *P. sasii*. *P. pahangensis* Buhl (2008) is a similar species to *P. sasii* and so is compared with the new species. A8 is 1.6 X as long as wide and A9 twice as long as wide in new species whereas, A8 and A9 are as long as wide in *P. pahangensis*.

6. *Platygaster luteipes* Buhl

(Plate 43)

Platygaster luteipes Buhl, 2008: 551, 555. Original description, keyed.

Diagnosis

Body length 1.4 mm; head evenly rounded, transversely coriaceous; occiput reticulate; antennae 10 segmented; notauli faintly indicated; mesosoma reticulate; legs pale yellow; forewings with dense microtrichia; T2 striate basally, hardly up to half its length.

Re-description

Female. Body length 1.4 mm (Plate 43: A). Black, A1-A3 and legs including coxae pale yellow; A4-A6 yellowish brown; A7-A10 brown; tegula dark brown.

Head: 1.88 X as wide as long in dorsal view (Plate 43: C); 1.19 X as wide as mesosoma; occiput densely transversely coriaceous; vertex with reticulations; OOL equal to LOL; OOL 2.3 X OD; POL 2.3 X LOL; IOS 1.4 X eye height; eyes bare; eye height 3.4 X as long as temples; head in front view 1.32 X as wide as high (Plate 43: F); A1 5.2 X as long as wide, A2 1.75 X as long as wide, 0.27 of A1; A4 1.67 X as long as wide; A10 2.5 X as long as wide, length to width ratio of antennal segments A1-A10 being 0.26: 0.05; 0.07: 0.04; 0.03: 0.02; 0.05: 0.03; 0.05: 0.03; 0.06: 0.04; 0.06: 0.05; 0.06: 0.05; 0.05: 0.05; 0.1: 0.04 respectively (Plate 43: G).

Mesosoma: 1.19 X as long as wide (Plate 43: B), sides of pronotum reticulate coriaceous; mesoscutum slightly convex, uniformly reticulate; laterally with sparse setae; notauli faintly indicated; midlobe slightly prolonged to base of scutellum; scutellum 1.5 X as wide as long; smooth and bare medially and coriaceous laterally with fine numerous setae; mesopleuron smooth; metapleuron completely pilose (Plate 43: D). Forewings 2.38 X as long as wide, with a very short marginal fringe and dense microtrichia (Plate 43: H).

Metasoma: 1.59 X as long as wide; T1 evenly crenulate; T2 striate to hardly half its length; rest of tergites smooth; length to width ratio of metasomal tergites T1-T6 being: 0.08: 0.18; 0.38: 0.38; 0.04: 0.32; 0.04: 0.25; 0.03: 0.18; 0.05: 0.11 respectively (Plate 43: E).

Host: Globular and robust Cecidomyiid galls of mature leaves on black pepper and Cecidomyiid leaf galls of *Strobilanthus* sp.

Specimens examined:

f. INDIA: Kerala, Ayiroor, Trivandrum; 10. xii. 2011; Coll. Prathapan & Shameem; on card; Reg. No. ZSI/WGRS/IR.INV.4512; f. same data except date 21. vi. 2012; on card; Reg. No. ZSI/WGRS/IR.INV.4517; f. INDIA: Kerala, Braemore Estate, Trivandrum; 29. iii. 2012; Coll. Prathapan & Shameem; on card; Reg. No. ZSI/WGRS/IR.INV.4513; 15 f (in alchohol); f. (on card); same data except date 17. iv. 2012; Reg. No. ZSI/WGRS/ IR.INV.4514; f. same data; on card; Reg. No. ZSI/WGRS/IR.INV.4518; 2 f. INDIA: Kerala, Vellayani, Trivandrum; 23. ix. 2011; Coll. Shameem; on card; Reg. No. ZSI/WGRS/IR.INV.4515; f. same data except date; 11. x. 2011; on card, Reg. No. ZSI/WGRS/IR.INV.4519; f. same data except date, 12. x. 2011, on card, Reg. No. ZSI/WGRS/IR.INV. 4520; f. INDIA: Kerala, Venganoor, Trivandrum; 11. xii. 2011; Coll. Shameem; on card; Reg. No. ZSI/WGRS/IR.INV.4516; f. INDIA: Kerala, Palakkal, Malappuram; 15. vii. 2012; Coll. Shameem; on card; Reg. No. ZSI/WGRS/IR.INV.4521; 11 f. INDIA: Kerala, Dhasanaghatta, Wayanad; 10. x. 2013; Coll. Anjana; on card, Reg. No. ZSI/WGRS/IR.INV.5339; f. INDIA: Kerala, Janakikkadu, Kozhikode; 14. xi. 2012; Coll. UKA Saleem; on card; Reg. No. ZSI/WGRS/IR.INV.6212.

Discussion

Similar to *P. baliensis* Buhl and *P. sparsipilosa* Buhl in having smoothly rounded occiput without a hyperoccipital carina but can be differentiated from them by certain characters. *Platygaster baliensis* is having darker forewings and A4 is hardly as long as wide whereas in *P. luteipes*, forewings are hyaline and A4 is 1.67 X as long as wide and in *P. sparsipilosa* only sparse microtrichia is present on the forewings compared to *P. luteipes* in which dense microtrichia is present.

Remarks

Platygaster luteipes was reported for the first time from India by Anjana and Rajmohana (2016b) and the male of this species was also reported from the world for the first time by the same authors (2016b).

7. *Platygaster malabarica* Mukerjee

Trichacis malabaricus Mukerjee, 1978: 93. Original description.

Platygaster malabaricus: Masner, *in* Vlug, 1995: 58. Generic transfer.

Diagnosis

Female. Body length 1.10 mm. Body brownish black to black; head finely reticulate; vertex convex; OOL 1.6 X OD; POL 3.1 X OD; LOL 1.25 X OD; A1 4.18 X as long as wide; A2 0.32 of A1, 1.76 X as long as wide; clava sub equal to preceeding 3 segments combined; mesosoma finely reticulate; notauli absent; forewing 2.78 X as long as wide; metasoma smooth, 0.45 of body; 1.47 X as long as wide.

Distribution: Pathanamthitta (Kerala)

Remarks

The species was not represented in the present collection.

8. *Platygaster minima* (Mukerjee)

Anopedias minimus Mukerjee, 1978: 76, 78. Original description. Keyed.

Platygaster minimus: Vlug, 1995: 58. Cataloged, type information, generic transfer.

Diagnosis

Female. Body length 1.00 mm. Body dark brown to black; vertex, frons and occiput smooth and shiny; OOL 2 X OD; POL 4 X OD; LOL 1.5 X OD;

scape 4 X as long as wide; pedicel 0.33 of scape; terminal segment of clava oval, clava subequal to preceding three segments combined; mesosoma smooth and shiny; notauli present; forewings 2.7 X as long as wide; submarginal vein short, not touching the wing margin; marginal fringe moderately long; metasoma smooth and shiny.

Distribution

Moozhiyar- Thekkady road: Idukki (Kerala)

Remarks

The species is not represented in the present collection.

9. *Platygaster narendrani* Ushakumari

(Plate 44)

Platygaster narendrani Ushakumari, 2004: 574, 590. Original description, keyed.

Diagnosis

Body length 1.32 mm; black; notauli present; frons and vertex finely reticulate; pedicel twice as long as wide.

Re-description

Female: Body length 1.32 mm (Plate 44: A). Body black; ocelli glassy white; A1- A3 yellow; A4- A10 dark brown; tegula dark brown; legs except coxae yellowish brown, coxae dark brown.

Head: 2.09 X as wide as long in dorsal view (Plate 44: C); 1.26 X as wide as mesosoma; eyes bare, eye height 2.8 X as long as temples; frons and vertex finely reticulate; POL 3 X OOL; LOL 1.2 X OOL; OOL 1.67 X OD; head in front view, 1.3 X as wide as high (Plate 44: D); IOS 1.53 X eye height; scape 4.8 X as long as wide; A10 1.5 X as long as wide, length to breadth ratio of

antennal segments A1-A10 being: 0.24: 0.05; 0.08: 0.04; 0.02: 0.03; 0.05: 0.05; 0.04: 0.04; 0.05: 0.04; 0.07: 0.08; 0.07: 0.08; 0.07: 0.08; 0.09: 0.06 respectively (Plate 44: E).

Mesosoma: Finely reticulate and sparsely hairy; 1.23 X as long as wide (Plate 44: F); mesoscutum as long as wide; notauli present, lateral pronotum finely reticulate; scutellum semicircular, 1.55 X as wide as long; mesopleuron smooth; metapleuron with white setae (Plate 44: B). Forewings hyaline, 2.65 X as long as wide; marginal fringe of forewing 0.12 of wing width (Plate 44: H).

Metasoma: 2.03 X as long as wide; T1 transverse with strong longitudinal ridges; T2 striate laterally in less than basal half, 1.67 X as long as wide; length to width ratio of metasomal tergites T1-T6 being: 0.08: 0.14; 0.35: 0.30; 0.04: 0.27; 0.04: 0.22; 0.04: 0.17; 0.05: 0.1 respectively (Plate 44: G).

Host: Cecidomyiid stem galls of *Lufa cylindrica* (L.) Roem

Specimens examined

2 f. INDIA: Kerala, Mathikettan shola, Idukki; 19. ix. 2014; Coll. Emiliyamma; on card; Reg. No.ZSI/WGRS/IR.INV.5340; 2 f. INDIA: Kerala, Churulipetti, Chinnar, Idukki; 04. iv. 2012; Coll. Rajmohana; on card; Reg. No.ZSI/WGRS/IR.INV.5341; f. INDIA: Kerala, Chimmony Dam, Thrissur; 05. i. 2012; Coll. Rajmohana; on card, Reg. No.ZSI/WGRS/IR.INV.5343; f. INDIA: Kerala, University of Calicut, Malappuram; 14. xii. 2012; Coll. Rajmohana; on card, Reg. No.ZSI/WGRS/IR.INV.5344; f. INDIA: Kerala, Vettichira, Malappuram; 14. x. 2012; Coll. UKA Saleem; on card, Reg. No.ZSI/WGRS/IR.INV.6213.

Discussion

Eventhough *P. narendrani* is similar to *P. srilankensis* Buhl, the former can be differentiated from the latter based on the ratio of the measurement of the marginal cilia of the forewing to its wing width. The marginal cilia are much shorter in *P. narendrani* (less than 0.15 of forewing width) whereas, 0.2 of forewing width in *P. srilankensis.* This species is similar to *P. tubulosa* Brues in having notauli and highly convex scutellum. However, the wing lamella is densely hairy in *P. tubulosa* whereas only finely hairy in *P. narendrani.*

10. *Platygaster neogalbus* sp. nov.
(Plate 45)

Diagnosis

Body length 1.1 mm; yellowish brown; head finely reticulate between ocelli and striated posteriorly, 1.86 X as wide as long; an incomplete hyperoccipital carina present; notauli absent.

Description

Holotype. Female. Body length 1.1 mm (Plate 45: A). Body pale brown; legs including coxae pale brown; A1- A5 pale brown; A6- A10 brown; eyes black with a white border; tegula pale yellow.

Head: Finely reticulate between ocelli and striate posteriorly, 1.86 X as wide as long in dorsal view (Plate 45: C); 1.33 X as wide as mesosoma; eyes bare; eyeheight 3.5 X as long as temples; an incomplete hyperoccipital carina present; POL 2.4 X OOL; LOL 1.2 X OOL; OOL 2.5 X OD; frons smooth (Plate 45: F); head in front view 1.26 X as wide as high; IOS 1.59 X eye height; scape 5.2 X as long as wide; A4 1.67 X as long as wide; A6 subequals A7; A8 twice as long as wide, subequal to A9; A2 0.3 of A1; length to

breadth ratio of antennal segments A1-A10 being: 0.26: 0.05; 0.08: 0.04; 0.03: 0.02; 0.05: 0.03; 0.05:0.03; 0.07: 0.04; 0.07: 0.04; 0.08: 0.04; 0.08: 0.04; 0.11: 0.04 respectively (Plate 45: D).

Mesosoma: Smooth, 1.32 X as long as wide (Plate 45: B); mesoscutum as long as wide; notauli absent, scutellum smooth with white setae, 1.6 X as wide as long; mesopleuron smooth; metapleuron with white setae (Plate 45: E). Forewings hyaline, 2.76 X as long as wide, marginal fringe of forewing 0.15 of wing width (Plate 45: G).

Metasoma: 1.77 X as long as wide; T1 transverse; T2 smooth, almost as long as wide; length to width ratio of metasomal tergites T1-T6 being: 0.08: 0.13; 0.27: 0.3; 0.04: 0.29; 0.05: 0.26; 0.04: 0.20; 0.05: 0.11 respectively (Plate 45: H).

Specimen examined:

Holotype. f. INDIA: Kerala, Gavi, Pathanamthitta; 10. iv. 2013; Coll. Bijoy; on card; Reg. No.ZSI/WGRS/IR.INV.6214.

Host: Unknown

Etymology

The species is named '*neogalbus*' since the species comes near *P. galbus*.

Discussion

Runs to *P. galbus* Ushakumari in key to species of *Platygaster* of Oriental Region by Buhl (2008). But the new species can be differentiated from *P. galbus* mainly in the antennal measurements. A6 and A8 are transverse in *P. galbus* whereas, A6 is 1.75 X as long as wide and A8 is twice as long as wide in the new species. A10 is also more elongate in the new species compared to *P. galbus.* A4 is as long as wide in *P. galbus* whereas its 1.67 X as long as wide in *P. neogalbus*.

11. *Platygaster neostriatitergitis* Veenakumari and Buhl

(Plate 46)

Platygaster neostriatitergitis Veenakumari, Buhl, & Mohanraj, 2013: 896. Original description, diagnosis.

Diagnosis

Body length 1.05 mm; black; vertex beneath posterior ocelli reticulate; strong curved ridges above toruli; frons reticulate; scutellum globose with short blunt protrusions.

Re-description

Female. Body length 1.05 mm (Plate 46: A); Black, coxae brownish black; legs brown, hind femur dark brown, A1 yellowish, A2 and A3 brown, tegula brown, antennal clava dark brown.

Head: 1.49 X as wide as long in dorsal view (Plate 46: F); 1.7 X as wide as mesosoma; eyes bare; vertex beneath posterior ocelli reticulate; IOS 1.08 X eye height; eye height 2.64 X as long as temples; frons reticulate (Plate 46: B); strong curved ridges above toruli, POL 1.48 X OOL; LOL 1.04 X OOL; OOL 1.87 X OD; scape 7.04 X as long as wide; length to width ratio of antennal segments being: 0.34: 0.05, 0.09: 0.03, 0.05: 0.03, 0.08: 0.04, 0.08: 0.04, 0.09: 0.04, 0.09: 0.05, 0.08: 0.05, 0.08: 0.05, 0.12: 0.05 respectively (Plate 46: D).

Mesosoma: 1.77 X as long as wide (Plate 46: E); mesoscutum convex, 1.7 X as long as wide; epomial carina well developed, notauli reaching anterior lateral margin of mesoscutum, lateral notaular area reticulate, scutellum globose with short blunt protrusions, 1.24 X as wide as long; mesopleuron smooth; metapleuron with white setae (Plate 46: C). Forewings hyaline with scattered microtrichia at apex, 3 X as long as wide, with short marginal cilia (Plate 46: H).

Metasoma: Spindle shaped, 4.93 X as long as wide; T1 with lateral setae, T2 striate laterally, smooth medially, T3- T6 longitudinally striate; length to width ratio of metasomal tergites T1-T6 being: 0.19: 0.28; 0.89: 0.44; 0.21: 0.37; 0.34: 0.25; 0.37: 0.19; 0.18: 0.12 respectively (Plate 46: H).

Host: Unknown

Specimens examined:

f. INDIA: Kerala, Ponmudi, Trivandrum; 12. xii. 2015; Coll. Anjana; on card; Reg No. ZSI/WGRC/IR.INV.5154; 2 f. INDIA: Kerala, Mullaperiyar, Idukki; 16. iv. 2013; Coll. Rajmohana; on card; Reg. No. ZSI/WGRC/IR.INV.5334; f. INDIA: Kerala, Mullaperiyar, Idukki; 16. iv. 2013; Coll. Abhilash; on card; Reg. No. ZSI/WGRC/IR.INV.4146; f. INDIA: Kerala, Anjuruli, Idukki; 09. iv. 2013; Coll. Rajmohana; on card; Reg. No. ZSI/WGRC/IR.INV.4556; f. INDIA: Kerala, Kakkayam, Kozhikode; 29. iv. 2012; Coll. Rajmohana; on card; Reg. No. ZSI/WGRC/IR.INV.4557; f. INDIA: Kerala, Pandipath, Trivandrum; 15. xii. 2015; Coll. Rajmohana; on card; Reg. No. ZSI/WGRC/IR.INV.5198; f. INDIA: Kerala, Pandimotta, Kollam; 17. xii. 2015; Coll. Rajmohana; on card; Reg. No. ZSI/WGRC/IR.INV.5199; f. INDIA: Kerala, Parepally, Changanassery, Kottayam; 13. iii. 2015; Coll. Anjana; on card; Reg. No. ZSI/WGRC/IR.INV.5714; f. INDIA: Kerala, Pekkavu, Pathanamthitta; 23. i. 2014; Coll. Bijoy; on card; Reg. No. ZSI/WGRC/IR.INV.4555.

Discussion

Platygaster neostriatitergitis closely resembles *P. striatitergitis* Buhl in having characteristic striations on T2-T5. But *P. neostriatitergitis* differs from the latter in the following characters. Head 1.32- 1.4 X as wide as mesosoma and occiput and vertex are elongately reticulate in *P. neostriatitergitis* while it is smooth in *P. striatitergitis.* Frons is uniformly reticulate and no line is

found from anterior ocellus to clypeus in *P. neostriatitergitis* while frons is faintly punctured with a trace of a longitudinal line from anterior ocellus towards clypeus in *P. striatitergites*.

Remarks

The female of *P. neostriatitergitis* Veenakumari and Buhl is reported here for the first time from the World and it also forms the first report of this species from Kerala.

12. *Platygaster nigrocoxatus* Ushakumari

(Plate 50: Figure A)

Platygaster nigrocoxatus Ushakumari, 2004: 581, 590. Original description, keyed.

Diagnosis

Body length 1.18 mm; head 1.84 X as wide as long; OOL 1.5 X OD; scape 4.8 X as long as wide, pedicel 2.67 X as long as wide and 0.33 of scape; frons shiny and finely reticulate; T2 smooth.

Re-description

Female. Body length 1.18 mm. Black, A1 and A3 yellowish brown; pedicel brown, A4-A10 brown; legs yellow with a brown tinge; coxae dark brown; last tarsal segment dark brown; forewings hyaline.

Head: 1.84 X as wide as long in dorsal view, 1.25 X as wide as mesosoma; eyes bare; frons shiny and finely reticulate; vertex shiny with sparse hairs; eye height 3 X as long as temples; POL 4.33 X OOL; LOL 2 X OOL; OOL 1.5 X OD; head in front view, 1.17 X as wide as high; IOS 1.38 X eye height; scape 4.8 X as long as wide, pedicel 2.67 X as long as wide and 0.33 of scape, length to breadth ratio of antennal segments A1-A10 being: 0.24: 0.05; 0.08: 0.03; 0.04: 0.02; 0.04: 0.03; 0.04: 0.03; 0.05: 0.03; 0.05: 0.04; 0.07: 0.05; 0.07: 0.05; 0.09: 0.04 respectively.

Mesosoma: Shiny, 1.53 X as long as wide; mesoscutum 1.21 X as long as wide, finely reticulate; notauli distinct; scutellum 1.17 X as wide as long; propodeum with lateral carina on either side; mesopleuron smooth; metapleuron with few white setae at hind corners. Forewings hyaline, 2.54 X as long as wide.

Metasoma: 1.96 X as long as wide, T2 smooth, posterior tergites with a few punctures; length to width ratio of metasomal tergites T1-T6 being: 0.1: 0.13; 0.34: 0.27; 0.03: 0.22; 0.02: 0.18; 0.02: 0.13; 0.03: 0.06 respectively.

Host: Unknown

Specimen examined

Holotype. f. INDIA: Kerala, Kollakadavu, Alappuzha; 26. vii. 1999; Coll. Ushakumari; on card; Reg. No.ZSI/WGRS/IR.INV.4562.

Discussion

This species comes near Indian species *P. indicus* Mukerjee in having four segmented clava and in presence of notauli, but differs from the latter in having a distinct hyperoccipital carina. Also, LOL is slightly less than OD and pedicel is 2 X as long as wide in *P. indicus*, whereas LOL is 3 X OD and pedicel is 2.67 X as long as wide in *P. nigrocoxatus* Ushakumari.

13. *Platygaster reticulatus* sp. nov.

(Plate 47)

Diagnosis

Body length 0.94 mm; head coriaceously reticulate; vertex and occiput coriaceous; LOL equal to OOL; scape 3.5 X as long as wide.

Description

Holotype. Female. Body length 0.94 mm (Plate 47: A). Brownish, all antennal segments and legs including coxae yellowish brown; tegula yellow.

Head: Coriaceously reticulate, 2.07 X as wide as long in dorsal view (Plate 47: F), as wide as mesosoma; eyes bare, eye height 3.3 X as long as temples; POL 2.25 X OOL; LOL equal to OOL; OOL 2 X OD; vertex and occiput coriaceous; head in front view 1.32 X as wide as high; frons fully reticulate (Plate 47: E); IOS 1.54 X eye height; scape 3.5 X as long as wide, pedicel 1.67 X as long as wide; length to breadth ratio of antennal segments A1-A10 being: 0.14: 0.04; 0.05: 0.03; 0.02: 0.02; 0.02: 0.03; 0.03: 0.03; 0.03: 0.04; 0.03: 0.04; 0.03: 0.05; 0.03: 0.04; 0.06: 0.03 respectively (Plate 47: D).

Mesosoma: 1.3 X as long as wide (Plate 47: C); about $3/4^{th}$ of lateral pronotum elongately reticulate; mesoscutum 1.5 X as long as wide; notauli clearly visible in posterior half; scutellum bulging, 1.37 X as wide as long; mesopleuron smooth and shiny; metapleuron with a few white setae (Plate 47: B). Forewings with sparse microtrichia, 2.16 X as long as wide, marginal cilia on forewing almost absent (Plate 47: G).

Metasoma: Pointed posteriorly, 2.14 X as long as wide (excluding ovipositor), T2 with few striae in basal pits, medially with a single

longitudinal striae; ovipositor exserted; length to width ratio of metasomal tergites T1-T6 being: 0.05: 0.10; 0.23: 0.22; 0.03: 0.18; 0.04: 0.15; 0.04: 0.11; 0.08: 0.09 respectively (Plate 47: H).

Host: Cecidomyiid stem galls of *Coccinia indica* Wight & Arn.

Specimen examined

Holotype. f. INDIA: Kerala, Vettichira, Malappuram; 14. x. 2012; Coll. U. K. A Saleem; on card; Reg. No.ZSI/WGRS/IR.INV.6215.

Etymology

This species is named '*reticulatus*' because of its reticulate occiput.

Discussion

The species runs to *P. sparsipilosa* Buhl in the key to Oriental species of *Platygaster* by Buhl (2008). But the occiput and frons of *P. sparsipilosa* is smooth and head is distinctly margined in front whereas the head is not margined and occiput and frons are coriaceously reticulate in the new species. Also, marginal cilia of forewing in *P. sparsipilosa* is 0.3 of wing width whereas marginal cilia is almost absent in the new species.

14. ***Platygaster rusticus*** **sp. nov.**

(Plate 48)

Diagnosis

Body length 0.9 mm; POL 2.75 X OOL; scape 5.25 X as long as wide; scutellum smooth, slightly bulging; marginal fringe of forewing 0.15 of wing width.

Description

Holotype. Female. Body length 0.94 mm (Plate 48: A). Brownish, all antennal segments yellowish brown; tegula yellow; legs including coxae pale; T1 yellow.

Head: Finely reticulate, 2.13 X as wide as long (Plate 48: F), as wide as mesosoma; eyes bare, eye height 1.5 X temples; POL 2.75 X OOL; LOL 1.25 X OOL; OOL 2 X OD; head in front view 1.29 X as wide as high; frons with fine reticulations and several transverse striae above toruli (Plate 48: E); IOS 1.61 X eye height; scape 5.25 X as long as wide, pedicel twice as long as wide, length to breadth ratio of antennal segments A1-A10 being: 0.21: 0.04; 0.06: 0.03; 0.02: 0.02; 0.03; 0.03; 0.03: 0.03; 0.04: 0.03; 0.04: 0.04; 0.05: 0.04; 0.05: 0.04; 0.08: 0.04 respectively (Plate 48: B).

Mesosoma: 1.1 X as long as wide (Plate 48: D); mesoscutum smooth, 1.09 X as long as wide; notauli visible in posterior half; scutellum smooth, slightly bulging, 1.6 X as wide as long; propodeum with few white setae; mesopleuron smooth and shiny; metapleuron with a few regularly arranged white setae. Forewings 2.7 X as long as wide, marginal fringe of forewing 0.15 of wing width (Plate 48: G).

Metasoma: 1.86 X as long as wide; T1 transverse; T2 striate basally; length to width ratio of metasomal tergites T1-T6 being: 0.06: 0.11; 0.25: 0.22; 0.04: 0.21; 0.03: 0.18; 0.02: 0.14; 0.03: 0.06 respectively (Plate 48: H).

Host: Stem gall of *Oryza sativa* L.

Specimen examined

Holotype. f. INDIA: Kerala, Pattambi, Palakkad; 18. i. 2013; Coll. U. K. A. Saleem, on card; Reg. No.ZSI/WGRS/IR.INV.6216.

Etymology

This species is named '*rusticus'* after its rusty coloration.

Discussion

Runs to *P. luteipes* in key to Oriental species of *Platygaster* by Buhl (2008). But the head and occiput are finely reticulate, marginal fringe of forewing is only 0.15 of wing width and A9 is 1.25 X as long as wide in *P.rusticus* sp. nov. whereas, occiput is densely transversely coriaceous, marginal cilia of forewing is 0.4 of wing width and A9 is hardly longer than wide in *P. luteipes*. *P.convexissima* Buhl is another species showing similarity with *P. luteipes* Buhl (2009) in having striation on T2 upto half its length and in forewings with dense microtrichia. So the new species is compared with *P. convexissima*. But the dense, distinct striae on the occiput and bulged scutellum make it different from the new species.

15. *Platygaster sasii* Ushakumari

(Plate 49)

Platygaster sasii Ushakumari, 2004: 583, 589. Original description, keyed.

Diagnosis

Body length 1.63 mm; OOL twice OD; frons smooth; pedicel 2.5 X as long as wide; occiput with distinct transverse striations; hyperoccipital carina present; notauli distinct.

Re-description

Female. Body length 1.63 mm (Plate 49: A). Black, A1 and legs except coxae yellow; A2-A6 yellowish brown; A7- A10 dark brown; coxae black.

Head: 2.04 X as wide as long in dorsal view (Plate 49: C); 1.12 X as wide as mesosoma; occiput with distinct transverse striations and scattered white setae; hyperoccipital carina well defined; IOS 1.23 X eyeheight; eyeheight 2.14 X temples; frons smooth (Plate 49: D); POL 4.25 X OOL; LOL 1.75 X OOL; OOL twice OD; scape 5.8 X as long as wide, A10 twice as long as wide, length to width ratio of antennal segments A1- A10 being: 0.28: 0.05; 0.1: 0.04; 0.04: 0.02; 0.06: 0.03; 0.06: 0.03; 0.05: 0.03; 0.06: 0.05; 0.07: 0.05; 0.07: 0.05; 0.12: 0.06 respectively (Plate 49: E).

Mesosoma: 1.45 X as long as wide (Plate 49: F); pronotum with white setae anteriorly; mesoscutum 1.15 X as long as wide with sparse white setae; notauli distinct and complete, scutellum smooth with sparsely arranged white setae, 1.4 X as wide as long; mesopleuron smooth; metapleuron with white setae (Plate 49: B). Forewings hyaline with dense microtrichia, 2.5 X as long as wide (Plate 49: H).

Metasoma: 2.05 X as long as wide; T1 with distinct longitudinal carina on each side of median groove and dense white setae laterally, T2 with fovea laterally and short striations in them, length to width ratio of metasomal tergites T1- T6 being: 0.14: 0.15; 0.52: 0.39; 0.05: 0.31; 0.03: 0.25; 0.02: 0.18; 0.03: 0.09 respectively (Plate 49: G).

Host: Unknown

Specimens examined

f. INDIA: Kerala, Parambikulam, Palakkad; 09. ix. 2013; Coll. P. M. Sureshan; on card; Reg. No. ZSI/WGRC/IR.INV.5701; 2 f. INDIA: Kerala, Kakkavayal, Kozhikode; 24. x. 2010; Coll. Bijoy; on card; Reg. No. ZSI/WGRC/IR.INV.5704; f. INDIA: Kerala, Aralam, Kannur; 12. x. 2014; Coll. Abhilash; on card; Reg. No. ZSI/WGRC/IR.INV.5707; f. INDIA: Kerala, Mullaperiyar, Idukki; 06. iv. 2013; Rajmohana; on card; Reg. No.

ZSI/WGRC/IR.INV.5702; f. INDIA: Kerala, Marayoor, Idukki; 04. ix. 2013; Coll. Rajmohana; on card; Reg. No. ZSI/WGRC/IR.INV.5710; f. INDIA: Kerala, S. B. College, Kottayam; 13. iii. 2015; Anjana; on card; Reg. No. ZSI/WGRC/IR.INV.5711; 2 f. INDIA: Kerala, Gavi, Pathanamthitta; 10. iv. 2013; Coll. Bijoy; on card; Reg. No. ZSI/WGRC/IR.INV.5712; f. INDIA: Kerala, Ranipuram, Kasargod; 05. xi. 2013; P. M. Sureshan; on card; Reg. No. ZSI/WGRC/IR.INV.5705; f. INDIA: Kerala, Ranipuram, Kasargod; 08. iv. 2013; Coll. P. M. Sureshan; on card; Reg. No. ZSI/WGRC/IR.INV.5708; f. INDIA: Kerala, Parambikulam, Palakkad; 10. ix. 2013; Coll. P. M. Sureshan; on card, Reg. No. ZSI/WGRC/IR.INV.5706; f. INDIA: Kerala, Kakkayam, Kozhikode; 29. xii. 2015; Coll. P. M. Sureshan; on card; Reg. No. ZSI/WGRC/IR.INV.5195; f. INDIA: Kerala, Mathikettan shola, Idukki; 19. ix. 2014; Coll. Emiliyamma; on card; Reg. No. ZSI/WGRC/IR.INV.5709.

Discussion

This species resembles *P. foersteri* (Gahan) in having transversely striate occiput. But T2 in *P. foersteri* is only with a distinct longitudinal fovea on each side and a shallow median one without striations whereas T2 is striate in less than basal third in *P. sasii*. *P. sasii* resembles *P. indicus* Mukerjee in having scape 5 X as long as wide, presence of notauli and slightly bulging scutellum but differs in having a distinct hyperoccipital carina which is absent in *P. indicus.*

Remarks

Holotype was examined as a part of this study.

16. *Platygaster tanus* Ushakumari

(Plate 50: Figure C)

Platygaster tanus Ushakumari, 2004: 585, 589. Original description, keyed.

Diagnosis

Body length 1.12 mm; vertex reticulate, shiny; occipital carina distinct; frons smooth; scape 4 X as long as wide; pedicel as long as wide; distinct notauli present; scutellum flat, T2 smooth.

Re-description

Female. Body length 1.12 mm. Black, scape and pedicel yellow, rest of antennal segments brown; eyes and ocelli black; tegula brown; legs pale.

Head: 1.64 X as wide as long in dorsal view, 1.09 X as wide as mesosoma; eyes bare; eyeheight 3.25 X as long as temples; POL 5 X OOL; LOL 3 X OOL; OOL 0.67 of OD; vertex reticulate, shiny; occipital carina distinct; head in front view 1.12 X as wide as high; frons smooth; IOS 1.33 X eye height; scape 4 X as long as wide, pedicel as long as wide, length to breadth ratio of antennal segments A1- A10 being: 0.24: 0.06; 0.07: 0.07; 0.04: 0.07; 0.05: 0.06; 0.04: 0.05; 0.05: 0.06: 0.05: 0.06; 0.05: 0.06; 0.09: 0.05 respectively.

Mesosoma: Finely reticulate, 1.3 X as long as wide; mesoscutum 1.03 X as long as wide, sparse setae present on mesoscutum; distinct notauli present; scutellum flat, 1.27 X as wide as long; propodeum with lateral carina on either side; mesopleuron smooth and shiny; metapleuron with white setae. Forewings hyaline, 2.4 X as long as wide.

Metasoma: 1.54 X as long as wide, T2 smooth; length and width of matasomal tergites being: 0.08: 0.15; 0.33: 0.35; 0.04: 0.29; 0.04: 0.23; 0.03: 0.14; 0.03: 0.06 respectively.

Host: Unknown

Specimen examined

Holotype. f. INDIA: Kerala, University of Calicut, Malappuram; 23. vi. 2000; Coll. Ushakumari; on card; Reg. No.ZSI/WGRS/IR.INV.4564.

Discussion

This species comes nearest to *P. indicus* but differ mainly in the shape of scutellum. Scutellum is flat and hairy in *P. tanus* whereas it is highly convex in *P. indicus*. OOL is 1.8 X OD in *P. indicus* whereas OOL is only 0.67 of OD in *P. tanus.*

Remarks

No fresh specimens of this species were collected. The species is re-described here, based on the *Holotype*.

17. *Platygaster zantanus* Ushakumari

(Plate 50: Figure B)

Platygaster zantanus Ushakumari, 2004: 587. Original description.

Diagnosis

Body length 0.98 mm; POL 4 X OOL; OOL 1.5 X OD; vertex finely reticulate, shiny; occipital carina distinct; scape 4.5 X as long as wide; pedicel 1.67 X as long as wide; A6, A7 and A9 as long as wide; A10 twice as long as wide; notauli distinct.

Re-description

Female. Body length 0.98 mm. Scape yellowish brown, A2-A10 brown, legs including coxae yellowish brown; eyes black.

Head: 1.78 X as wide as long in dorsal view, 1.32 X as wide as mesosoma; eyes bare; eye height 1.4 X as long as temples; POL 4 X OOL; LOL 2 X

OOL; OOL 1.5 X OD; vertex finely reticulate, shiny; occipital carina distinct; head in front view, 1.27 X as wide as high; frons smooth; IOS 1.4 X eye height; scape 4.5 X as long as wide; pedicel 1.67 X as long as wide; A6, A7 and A9 as long as wide; A10 twice as long as wide; length to breadth ratio of antennal segments A1- A10 being: 0.18: 0.04; 0.05: 0.03; 0.02: 0.03; 0.03: 0.04; 0.03: 0.04; 0.03: 0.03; 0.04: 0.04; 0.04: 0.05; 0.05: 0.05; 0.08: 0.04 respectively.

Mesosoma: Finely reticulate, shiny, 1.4 X as long as wide; mesoscutum as long as wide; notauli distinct; scutellum not bulging, 1.37 X as wide as long; propodeum with lateral carina on either side; mesopleuron smooth and shiny; metapleuron with white setae. Forewings hyaline, 2.2 X as long as wide.

Metasoma: 1.83 X as long as wide, T2 smooth, length to width ratio of matasomal tergites T1- T6 being: 0.06: 0.1; 0.27: 0.24; 0.03: 0.18; 0.02: 0.14; 0.02: 0.11; 0.04: 0.06 respectively.

Host: Unknown

Specimen examined

Holotype. f. INDIA: Kerala, University of Calicut, Malappuram; 23. ix. 1998; Coll. Ushakumari; on card; Reg. No.ZSI/WGRS/IR.INV.4564.

Discussion

Even though *P. zantanus* comes near *P. indicus*, it differs mainly in the shape of scutellum. Scutellum is flat in *P. zantanus* whereas it is convex in *P. indicus*. POL is 2.8 X OD in *P. indicus* whereas it is 6 X in *P. zantanus*. Also, *P. zantanus* is much smaller when compared to *P. indicus*.

Remarks

No fresh specimens of this species were collected. The species is re-described here, based on the *Holotype*.

8. Genus *SYNOPEAS* Förster

Synopeas Förster, 1856: 108, 114. Original description. Type: *Synopeas inermis* Thomson, designated by Muesebeck & Walkley (1951). Keyed.

Ectadius Förster, 1856: 108, 113, 114. Original description. Type: *Platygaster craterus* Walker, by monotypy. Keyed. Synonymized by Fouts (1924).

Polymecus: Förster, 1856: 144. Type: *Platygaster craterus* Walker, by substitution of *Polymecus* for *Ectadius* Förster. Unnecessarily proposed replacement name for *Ectadius* Förster.

Sactogaster Förster, 1856: 108, 113. Original description. Type: *Epimeces ventralis* Westwood; designated by Ashmead (1893). Keyed, key to species. Synonymized by Masner, in Krombein & Burks (1967).

Dolichotrypes Crawford & Bradley, 1911: 124. Original description. Type: *Dolichotrypes hopkinsi* Crawford & Bradley, by monotypy and original designation. Synonymized by Fouts (1924).

Stosta Kozlov, 1975b: 310, 311. Original description. Type: *Stosta tosticola* Kozlov, by monotypy and original designation. Keyed, Synonymised by Talamas & Buffington, 2014: 112.

Haustagaster Szabó, 1979: 178. Original description. Type: *Haustagaster dentiscutellaris* Szabó, by monotypy. Synonymised by Buhl, 2000: 415

Diagnostic characters

Antennae ten segmented; hyperoccipital carina present or absent; pronotal collar with a ventral pit or depression; scutellum usually terminating in a short spine, or tooth; marginal fringe very short or completely absent; dense white setae usually present in the lateral sides of T1; metasoma with six visible tergites; T1 and T2 fused in both sexes.

Divided into three subgenera based on the shape and length of metasoma. In subgenus *Dolichotrypes*, long and narrow metasoma is present whereas in *Sactogaster*, T2 is swollen and T3-T6 is tapering forming a comma shaped structure. In subgenus *Synopeas*, metasoma is normal shaped (Macgown and Evans 2003).

Kozlov (1971) considered the subgeneric status of *Sactogaster* Förster valid and this has been followed in the recent publications. Here, in this study also, *Sactogaster* is treated as a valid subgenus of *Synopeas.*

Distribution: Worldwide

Host: Parasitoids of Cecidomyiidae

Discussion

This genus was misidentified by some workers as genus *Leptacis* since both genera were having a tooth or a spine at the apical end of the scutellum. But *Synopeas* can be easily identified since T1 and T2 in this genus are fused together. Also the very short marginal fringe of *Synopeas* differentiates it easily from *Leptacis*.

Remarks

Synopeas is a very speciose genus with 375 species all over the world. Since, there are three subgenera for this genus and the study of all subgenera would be unwieldy in the present study, hence only one subgenus, viz. *Sactogaster* is considered for the present study.

The present work reports four species of this subgenus, out of which two are first reports from India and two species are new reports from Kerala. A key to species of India and a distribution map of this subgenus and its species in Kerala are provided (Plate 56).

KEY TO INDIAN SPECIES OF *SYNOPEAS* (*SACTOGASTER*) FÖRSTER (Based on females)

1. Hyperoccipital carina at least slightly present… 2

- Hyperoccipital carina completely absent… 3

2. T2 smooth……..... ***S. ribhoiense*** **Veenakumari and Buhl**

- T2 reticulate, at least in posterior 0.2……..…***S. westwoodi*** **Buhl**

3. OOL equal to OD… .....…***S. nepalensis*** **Mukerjee**

- OOL greater than OD 4

4. OOL 1.5 X OD… ..... ***S. chamoliana*** **Mukerjee**

- OOL at least twice OD or more than 2 X OD.....5

5. Head more than 1.75 X as wide as long…..... ***S. ventricosum*** **Buhl**

- Head less than 1.2 X as wide as long.....***S. indicum*** **Mani**

1. *Synopeas (Sactogaster) chamoliana* Mukerjee

(Plate 52)

Synopeas chamoliana Mukerjee, 1992: 177. Original description.

Diagnosis

Body length 1.47 mm; OOL 1.5 X OD; scape 4 X as long as wide; A4 elongate, 0.21 of scape.

Re-description

Female. Body length 1.47 mm (Plate 52: A); Black, scape and pedicel yellowish brown; rest segments brown; scutellar spine dark brown; tegula black; legs except coxa brown.

Head: 1.8 X as wide as long in dorsal view (Plate 52: F), reticulate, in front view 1.15 X as wide as high (Plate 52: E); eyes large; frons reticulate; IOS 1.2 X eye height; frons flat; vertex sloping behind, finely reticulate; OOL 1.5 X OD; LOL 1.66 X LOL; POL 2.4 X LOL; eye height 3 X as long as temples; scape 4 X as long as wide, A4 elongate, 0.21 of scape, length to breadth ratio of antennal segments A1-A10 being: 0.24: 0.06; 0.07: 0.03; 0.03: 0.02; 0.05: 0.02; 0.02: 0.02; 0.03: 0.02; 0.04: 0.05; 0.04: 0.07; 0.04: 0.07; 0.08: 0.06 respectively (Plate 52: D).

Mesosoma: Finely reticulate, 1.58 X as long as wide (Plate 52: B); pronotum hardly visible from above, sparse setae present laterally; mesoscutum 1.33 X as long as wide, notauli complete; scutellum small, moderately convex, almost as wide as long, apically with blunt spine extending upto propodeum; mesopleuron smooth; metapleuron with white setae towards posterior end (Plate 52: C). Forewings 2.7 X as long as wide, without marginal fringe (Plate 52: G).

Metasoma: Sac like (Plate 52: H); T2 smooth and shiny; T3 strongly transverse; T3-T6 closely punctate; length to width ratio of metasomal tergites T2-T6 being: 0.36: 0.29; 0.04: 0.19; 0.06: 0.14; 0.09: 0.1; 0.09:0.08 respectively.

Host: Unknown

Specimens examined

2 f. INDIA: Kerala, Kaatilappara, Nelliyampathy, Palakkad; 02. i. 2012; Coll. Rajmohana; on card; Reg. No. ZSI/WGRS/IR.INV.4655; 2 f. INDIA: Kerala, Vellimala, Idukki; 08. iv. 2013; Coll. Rajmohana and Abhilash; on card; Reg. No. ZSI/WGRS/IR.INV.4752; 2 f. INDIA: Kerala, Botanical garden, University of Calicut; Malappuram; 14. xii. 2015; Coll. Ranjith; on card; Reg. No. ZSI/WGRS/IR.INV.5155.

Discussion

Eventhough *S. chamoliana* comes near to *S. indicum* Mani, the former differs in having OOL 1.5 X OD whereas OOL is twice OD in *S.indicum*. Also, the two species differs in the antennal measurements.

Remarks

This is the first report of *S. chamoliana* from Kerala.

2. *Synopeas (Sactogaster) indicum* Mani

(Plate 53)

Synopeas indicum Mani, 1975: 76. Original description.

Diagnosis

Body length 1.25 mm; OOL twice OD; scape 4.3 X as long as wide; club almost equal to scape; notauli complete.

Re-description

Female. Body length 1.25 mm (Plate 53: A). Black, A1-A6 yellowish brown, club dark brown; tegula black; ocelli black; eyes black.

Head: 1.2 X as wide as long in dorsal view (Plate 53: D); head in front view 2.05 X as wide as high (Plate 53: B); eyes large; IOS 1.3 X eye height; vertex sloping behind, finely reticulate; frons flat, reticulate; OOL twice OD; LOL 1.75 X OOL; POL 2 X LOL; eye height 3.75 X as long as temples; scape 4.3 X as long as wide, length to breadth ratio of antennal segments A1-A10 being: 0.23: 0.05; 0.06: 0.03; 0.03: 0.02; 0.03: 0.02; 0.03: 0.02; 0.02: 0.02; 0.04: 0.04; 0.05: 0.06; 0.04: 0.06; 0.06: 0.06 respectively (Plate 53: F).

Mesosoma: Finely reticulate, 1.5 X as long as wide (Plate 53: G); mesoscutum 1.2 X as long as wide, notauli complete; scutellum small, moderately convex, almost as long as wide; apically with a spine, mesopleuron smooth; metapleuron with white setae towards posterior end (Plate 53: C). Forewings 2.59 X as long as wide (Plate 53: H), without marginal fringe.

Metasoma: Sac like, 2.5 X as long as wide (Plate 53: E); base of metasoma with white setae laterally; T2 smooth; T3-T6 with punctures; length to width ratio of metasomal tergites T2-T6 being: 0.4: 0.3; 0.03: 0.2; 0.06: 0.16: 0.09: 0.12; 0.16: 0.09 respectively.

Host: Unknown

Specimens examined

6 f. INDIA: Kerala, Ambukuthi, Wayanad; 05. iv. 2014; Coll. Anjana; on card; Reg. No. ZSI/WGRS/IR.INV.4643; 2 f. INDIA: Kerala, Dhasanaghatta, Wayanad; 10. xi. 2013; Coll. Abhilash; on card; Reg. No. ZSI/WGRS/IR.INV.4751; 6 f. INDIA: Kerala, Mathikettan shola; 17. ix. 2014; Coll. Emilyamma; on card; Reg. No. ZSI/WGRS/IR.INV.5336; f. INDIA: Kerala, Eravikulam, Idukki; 12. iv. 2012; Coll. Bijoy; on card; Reg. No. ZSI/WGRS/IR.INV.4754; f. INDIA: Kerala, Kakkayam Kozhikode; 30. xii. 2014; Coll. Kumar, on card, Reg. No. ZSI/WGRS/IR.INV.5194; f.

INDIA: Kerala, Kakkayam, Kozhikode; 29. xii. 2015; Coll. Ranjith, on card, Reg. No. ZSI/WGRS/IR.INV.5193; f. INDIA: Kerala, Mathikettan shola, Idukki; 19. ix. 2014; Coll. Emiliyamma, on card, Reg. No. ZSI/WGRS/IR.INV.5335; 2 f. INDIA: Kerala, Mathikettan shola, Idukki; 10. iv. 2012; Coll. Sureshan; on card; Reg. No. ZSI/WGRS/IR.INV.5337; f. INDIA: Kerala, Pandimotta, Kollam; 17. xii. 2015; Coll. Rajmohana; on card; Reg. No. ZSI/WGRS/IR.INV.5336; f. INDIA: Kerala, Munnar, Idukki; 19. ix. 2014; Coll. Emiliyamma; on card, Reg. No. ZSI/WGRS/IR.INV.5335.

Discussion

The species comes near *S. hakonense* Ashmead. But *S. hakonensis* is having incomplete notauli which is complete in *S. indicum*. This character distinguishes the two species.

Remarks

This study reports *S. indicum* from Kerala for the first time.

3. *Synopeas (Sactogaster) ventricosum* Buhl

(Plate 54)

Synopeas ventricosus Buhl, 1997: 449. Original description.

Synopeas (Sactogaster) ventricosum: Buhl, 2014: 112. Emendation, new distribution record for Togo.

Diagnosis

Body length 1.52 mm; head from above 1.74 X as wide as long; OOL 2.5 X OD; scape 3.4 X as long as wide; A10 1.6 X as long as wide.

Re-description

Female. Body length 1.52 mm (Plate 54: A); Black, scape yellowish brown; A2- A6 brown; clava dark bown; legs brown except tarsi; tarsi except last tarsal segment yellow; last tarsal segment dark brown.

Head: 1.75 X as wide as long in dorsal view (Plate 54: G), strongly reticulate; head in front view 1.14 X as wide as high; eyes large; frons reticulate (Plate 54: E); IOS 1.18 X eye height; vertex sloping behind, finely reticulate; frons flat; OOL 2.5 X OD; LOL 1.4 X OOL; POL 2 X LOL; eye height 3 X as long as temples; scape 3.4 X as long as wide, A10 1.6 X as long as wide, length to breadth ratio of antennal segments A1-A10 being: 1.24: 0.07; 0.07: 0.04; 0.04: 0.02; 0.06: 0.03; 0.04: 0.03; 0.03: 0.03; 0.05: 0.05; 0.06: 0.07; 0.05: 0.07; 0.1: 0.06 respectively (Plate 54: C).

Mesosoma: Finely reticulate, 1.5 X as long as wide (Plate 54: D); pronotum hardly visible from above, laterally reticulate with sparse setae; mesoscutum 1.2 X as long as wide; notauli present, clearly visible in posterior region; scutellum fully covered with white setae with a strong spine, 1.2 X as long as wide; metapleuron with white setae towards posterior end (Plate 54: B). Forewing 3.02 X as long as wide (Plate 54: H), without marginal fringe.

Metasoma: Sac like (Plate 54: F); T2 smooth and shiny; T3 and T4 strongly transverse; T3-T6 closely punctuate; length to width ratio of metasomal tergites T2-T6 being: 0.42: 0.33; 0.05: 0.2; 0.07: 0.15; 0.1: 0.12; 0.15: 0.12 respectively.

Host: Unknown

Specimens examined

2 f, INDIA: Kerala, Mannavan shola, Idukki; 06. iv. 2012; Coll. Rajmohana; on card; Reg. No. ZSI/WGRS/IR.INV.5348.

Discussion

This species was described from Philippines by Buhl (1997a). The Indian specimens differ from the type material in its body color.

S. ventricosum comes near to Nearctic species *S. anomaliventre* (Ashmead) but head twice as wide as long, longer notauli and metasoma 1.5 X as long as head and mesosoma combined differentiate this species from the latter.

Remarks

This forms the first report of *S. ventricosum* from India.

4. *Synopeas (Sactogaster) westwoodi* Buhl

(Plate 55)

Synopeas westwoodi Buhl, 2009: 912. Original description.

Diagnosis

Body length 1.55 mm; OOL 1.3 X OD; notauli incomplete; scape 3.8 X as long as wide; hyperoccipital carina present; head 1.9 X as wide as long.

Re-description

Female. Body length 1.55 mm (Plate 55: A); Black, basal portion of scape yellow, rest dark brown; pedicel and rest of the segments dark brown; tegula black; legs dark brown, apical portion of tibia yellow, tarsi yellow, last tarsal segment dark brown; forewing faintly brownish.

Head: 1.9 X as wide as long in dorsal view (Plate 55: B), reticulate with a weak hyperoccipital carina; head in front view 1.12 X as wide as high (Plate 55: G); eyes large; frons reticulate; IOS 1.44 X eye height; vertex sloping behind; frons flat; OOL 1.3 X OD; LOL 1.25 X OOL; POL 2.6 X LOL; eye

height 2.6 X as long as temples; scape 3.8 X as long as wide; length to breadth ratio of antennal segments A1-A10 being: 0.23: 0.06; 0.08: 0.04; 0.04: 0.03; 0.06: 0.03; 0.03: 0.03; 0.03: 0.03; 0.05: 0.04; 0.06: 0.06; 0.06: 0.06; 0.08: 0.05 respectively (Plate 55: C).

Mesosoma: Finely reticulate, 1.54 X as long as wide (Plate 55: D); sides of pronotum reticulate anteriorly, sparse setae present laterally; mesoscutum 1.3 X as long as wide, notauli incomplete; scutellum 1.07 X as long as wide with a strong dark spine; mesopleura smooth; metapleura with white setae towards the posterior end (Plate 55: F). Forewing faintly brownish, 2.38 X as long as wide without marginal fringe (Plate 55: E).

Metasoma: Sac like, 2.42 X as long as wide (Plate 55: H); T2 reticulate at posterior margin; T3-T6 fully reticulate; length to width ratio of metasomal tergites T2-T6 being: 0.42: 0.33; 0.05: 0.2; 0.08: 0.16; 0.1: 0.12; 0.16: 0.11 respectively.

Host: Unknown

Specimens examined

2 f. INDIA: Kerala, Mettap, Idukki; 07. iv. 2012; Coll. Rajmohana; on card; Reg. No. ZSI/WGRS/IR.INV.5346. f. INDIA: Kerala, Mettap, Idukki; 11. iv. 2012; Coll. Rajmohana; on card; Reg. No. ZSI/WGRS/IR.INV.4753.

Discussion

This species was described by Buhl from Vietnam based on a single female. The species is most similar to the Palearctic species *S. ventralis* Westwood but the strongly margined occiput and presence of notauli makes it different from *S. ventralis.*

Remarks

This is the first report of *S. westwoodi* from India.

9. Genus *TRICHACOIDES* Dodd

Trichacoides Dodd, 1914: 416. Original description. Type: *Trichacoides scutellaris* Dodd, by monotypy and original designation.

Diagnostic characters

Antennae ten segmented; notauli present or absent; scutellum raised from mesonotum, convex, covered with dense, rather short, sharp spines.

Distribution: Australian, Oriental, Neotropical

Host: Parasitoids of Cecidomyiidae

Discussion

This genus is very close to genus *Platygaster* Latreille in its general appearance and also in having antenna without a distinct clava. However, these two genera differ in their scutellum. The scutellum of *Trichacoides* is with short or long spines though out. In *Platygaster*, such spines are usually absent.

Remarks

This genus is represented by seven species from the World and three species from Oriental Region as well as from India. The present work reports three species from Kerala, out of which, one is described as new to science. A key to species of India and a distribution map of this genus and its species in Kerala are also provided (Plate 60).

KEY TO INDIAN SPECIES OF *TRICHACOIDES* DODD

(Modified from Anjana *et al*. 2015b; based on females)

1. Notauli present; T2 with at least some striations (Plate 57: Figure H)…….....2

- Notauli absent; T2 smooth (Plate 58: Figure E)…..... ..... ***T. levigatus* sp. nov.**

2. Notauli complete, almost touching anterolateral margin of mesoscutum (Plate 59: Figure D)…..... 3

- Notauli incomplete, confined to apical mesoscutum (Plate 7: Figure D)……..... ***T. indicus* Jackson**

3. Head 1.3 X as wide as long; scape 3.46 X as long as wide; mesopleura with no longitudinal striations..... .... ***T. ranganabettensis* Veenakumari & Buhl**

- Head 1.7 X as wide as long; scape 5 X as long as wide; mesopleura with extensive longitudinal striations (Plate 59: Figure E)..... ....***T. rugosiscutellum* Buhl**

5. *Trichacoides indicus* Jackson

(Plate 57)

Trichacoides indicus Jackson, 1968: 121. Original description.

Diagnosis

Body length 0.98 mm. Median frons between eyes weakly reticulate; OOL greater than LOL; transverse striae beneath and within ocellar triangle distinct; hyperoccipital carina absent; A10 in females 2 X as long as wide; lateral area of pronotum with fine longitudinal striae or reticulations; notauli

present; 6–7 longitudinal striae arising from two deep anterior pits on basal T2 and extending to 0.7 of T2 laterally, median T2 with one or two longitudinal striae.

Re-description

Female. Body length 0.98 mm (Plate 57: A). Body black; antennae dark brown; legs except tibia and tarsi dark brown; tibia and tarsi except the last tarsal segment yellow; tegula black.

Head: 2.12 X as wide as long in dorsal view (Plate 57: C), 1.03 X as wide as mesosoma, rounded without hyperoccipital carina; vertex transversely striate with sparsely arranged white setae; several transverse striae present above toruli (Plate 57: B); sparse setae present laterally; median frons between eyes weakly reticulate; distinct transverse striae beneath and within ocellar triangle; occiput with complete concentric curved striations in posterior half; OOL 3.5 X OD; OOL 1.16 X LOL; POL 1.7 X LOL; IOS 1.79 X eye height; eye height 3 X as long as temples; head 1.25 X as wide as high in anterior view; scape 5 X as long as wide, pedicel 0.3 X scape, A9 1.66 X as long as wide, length to breadth ratio of antennal segments A1-A10 being: 0.2: 0.04; 0.06: 0.04; 0.02: 0.02; 0.03: 0.03; 0.03: 0.03 0.04: 0.04; 0.04: 0.04; 0.04: 0.04; 0.05: 0.03; 0.08: 0.04 respectively (Plate 57: F).

Mesosoma: 1.3 X as long as wide (Plate 57: D); mesoscutum finely reticulate, 1.04 X as wide as long; anterior part of pronotum flat, lateral areas with fine longitudinal striae; mesonotum reticulate; admedian lines present; incomplete notauli present; scutellum in lateral view strongly arched above level of mesonotum, surface covered with short, sharp spines; epomia well developed; mesopleuron and metapleuron smooth, latter fully covered with irregular white setae (Plate 57: E). Forewings 2.22 X long as wide, with fine

and dense microtrichia, marginal cilia of forewing very short, 0.1 of wing width (Plate 57: G).

Metasoma: 1.8 X as long as wide; T1 with strong longitudinal ridges; 6–7 longitudinal striae arising from two deep anterior pits on basal T2 and extending to 0.7 of T2 laterally; median T2 with one or two longitudinal striae, but not reaching even to its one third medially; T3–T6 smooth; length to width ratio of metasomal tergites T1-T6 being: 0.06: 0.12; 0.28: 0.25; 0.03: 0.21; 0.03: 0.16; 0.02: 0.10; 0.03: 0.06 respectively (Plate 57: H).

Host: Unknown cecidomyiid (Diptera) in leaf galls of *Mimosops elengi* L. The leaf galls when cut open were found to be unichambered, perfoliate, green, glabrous, indehiscent and sessile, with a prominent keel like process (carinae) on either side.When cut open, each gall possesed a small gall cavity. *T. indicus* can be considered a solitary species as only one gall inducer was present per gall, evident by dissection of a few galls. The parasitoids emergence hole was seen on the abaxial side of the gall.

Specimens examined

3 f. INDIA: Kerala, Malabar Christian College, Kozhikode; 03. viii. 2015; Coll. Athira; on card; Reg. No. ZSI/WGRS/IR.INV.4897.

Discussion

Eventhough the specimens studied come very close to the description of *T. indicus* by Jackson (1968), slight differences were noted in the measurements of the antennal segments and also in the striations of T2, but these characters were seen in the *paratypes* of this species. Basal striae on T2 were extending to 0.7 of the segment in the *paratypes* as well as the specimens in the study. All species of this genus described till date except *T. indicus*, are having a

distinct, complete notauli which is incomplete in *T. indicus* and also this species is much small in size compared to other species.

Remarks

This species was reported for the first time from Kerala by Anjana and Rajmohana (2015b).

6. *Trichacoides levigatus* sp. nov.

(Plate 58)

Diagnosis

Body length 1.09 mm; black, small species; notauli and hyperoccipital carina absent; scape 6.25 X as long as wide, pedicel 0.24 of scape, A3 as long as wide, A4 elongate.

Description

Holotype. Female. Body length 1.09 mm (Plate 58: A). Body including eyes and ocelli black; A1- A6 yellow, clava dark brown; coxae black, femur and tibia and last tarsal segments dark brown; other tarsal segments yellow, tegula black.

Head: 1.85 X as wide as long in dorsal view (Plate 58: F), as wide as mesosoma, hyperoccipital carina absent; occiput, vertex and frons completely reticulate; OOL half OD; LOL 9 X OOL; POL 2 X LOL; IOS 1.29 X eye height; eye height 2.6 X as long as temples; head 1.13 X as wide as high in frontal view; scape 6.25 X as long as wide; pedicel 0.24 of scape; A3 as long as wide; A4 elongate; length to breadth ratio of antennal segments A1-A10 being: 0.25: 0.04; 0.06: 0.03; 0.02: 0.02; 0.05: 0.03; 0.03: 0.02; 0.03: 0.02; 0.06: 0.04; 0.05: 0.04; 0.05: 0.04; 0.08: 0.04 respectively (Plate 58: B).

Mesosoma: 1.3 X as long as wide (excluding tegula) (Plate 58: C); mesoscutum strongly reticulate with short sharp spines medially (clear in lateral view), 1.03 X as wide as long; anterior part of pronotum flat, reticulate; lateral areas with sparse striae; epomia well developed; notauli completely absent; scutellum in lateral view strongly arched above level of mesonotum, surface covered with short sharp spines; mesopleuron and metapleuron smooth, latter with white setae (Plate 58: D), propodeum with dense white setae laterally. Forewings 2.38 X long as wide, with regularly arranged microtrichia (Plate 58: H).

Metasoma: 1.32 X as long as wide; T1 with white setae laterally; T2 without any striations, smooth and shiny; length to width ratio of metasomal tergites T1-T6 being: 0.06: 0.18; 0.28: 0.34; 0.03: 0.28; 0.03: 0.25; 0.03: 0.19; 0.03: 0.08 respectively (Plate 58: E).

Host: Unknown

Specimen examined

Holotype. INDIA: Kerala, University of Calicut, Malappuram; 14. xii. 2015; Malaise trap; Coll. Ranjith; on card; Reg. No. ZSI/WGRS/IR.INV.6217.

Etymology

Species is named '*levigatus*' since its having a smooth metasoma (*levigatus* in latin meaning smooth).

Discussion

Comes near *T. indicus* in its small size, measurement of A10 and length of metasoma. But differs from *T. indicus* in not having notauli. Also, the new species is having distinctly sculptured frons and occiput. T2 is smooth in *T. levigatus* sp. nov., whereas it is striate (upto 0.7) in *T. indicus*. The new species differs from all other known species of *Trichacoides* in absence of notauli.

7. *Trichacoides rugosiscutellum* (Buhl)

(Plate 59)

Platygaster rugosiscutellum Buhl, 1995: 72. Original description.

Trichacoides rugosiscutellum: Buhl, 1997: 439. Generic transfer, description.

Diagnosis

Body length 3.24 mm; OOL greater than LOL; scape 5.12 X as long as wide; A7-A9 subequal; upper frons reticulate; lower frons transversely striate; interocellar area and vertex coriaceously reticulate.

Re-description

Female. Body length 3.24 mm (Plate 59: A). Body black; antennae dark brown; legs except tibia and tarsi dark brown; tibia and tarsi except the last tarsal segment yellow; tegula black.

Head: 1.77 X as wide as long in dorsal view (Plate 59: B), 1.1 X as wide as mesosoma, rounded without hyperoccipital carina; upper frons reticulate, lower frons above toruli transversely striate (Plate 59: F); median frons weakly reticulate towards eye; interocellar area and vertex coriaceously reticulate; occiput with complete U shaped striae; OOL 2.2 X OD; OOL 1.57 X LOL; POL 2.43 X LOL; IOS 1.35 X eye height; eye height 2 X as long as temples; scape 5.12 X as long as wide; A7-A9 subequal; length to breadth ratio of antennal segments A1-A10 being: 0.41: 0.08; 0.13: 0.05; 0.07: 0.04; 0.10: 0.06; 0.09: 0.06; 0.09: 0.06; 0.1: 0.08; 0.1: 0.08; 0.1: 0.08; 0.13: 0.07 (Plate 59: G) respectively.

Mesosoma: 1.56 X as long as wide; mesoscutum 1.24 X as long as wide (Plate 59: C); anterior part of pronotum flat, admedian lines present; complete notauli present, internotaular area strongly reticulate, rest with sparse spines; lateral pronotal area coriaceous in anterior half with yellowish

setae; epomia well developed; scutellum in lateral view strongly arched above level of mesonotum, surface covered with short, sharp spines, 1.08 X as long as wide; mesopleuron with 4-5 longitudinal striae medially; metapleuron smooth, fully covered with irregular yellowish setae (Plate 59: E). Forewings 2.78 X as long as wide, with fine and dense microtrichia (Plate 59: H).

Metasoma: 2.95 X as long as wide; T1 with strong longitudinal ridges; T2 with 2 deep anterior pits and 5-6 longitudinal striae on either side of median projection upto 0.33 of T2, T2 1.5 X as long as T3-T6 combined; T3-T6 smooth; length to width ratio of metasomal tergites T1-T6 being: 0.20: 0.29; 0.95: 0.61; 0.11: 0.55; 0.12: 0.44; 0.16: 0. 34; 0.24: 0.21 respectively (Plate 59: C).

Host: Unknown

Specimens examined

f. INDIA: Kerala, Mangaladevi, Periyar Tiger Reserve, Idukki; 04. ix. 2015; Coll. Nikhil; on card; Reg. No. ZSI/WGRS/IR.INV.5005; f. INDIA: Kerala, Kozhikode, Kakkayam; 29. xii. 2015; Coll. Ranjith; on card, Reg. No. ZSI/WGRS/IR.INV.5202.

Discussion

The specimen from India shows much similarity to *T. rugosiscutellum* Buhl (1995) except in few characters. Vertex is coriaceously sculptured in Indian specimen while somewhat shiny, with faint microsculpture from Australasian Region. Also, reticulations are seen around median ocelli in Indian specimen while it is smooth with some traces of irregular punctuation in the specimen from Australasian Region.

Remarks

Trichacoides rugosiscutellum was reported from India for the first time by Anjana and Rajmohana (2016d).

4.2.1: SUBFAMILY SCELIOTRACHELINAE

Diagnostic characters

Body short and stout, dorsoventrally flattened; head transverse; antennae inserted close to mouth; metasoma sessile; forewings usually wide with a knobbed submarginal vein (except in some genus like *Isolia* Förster). Most of the genera are characterized with distinct foamy structures on propodeum.

4.2.2: A KEY TO INDIAN GENERA OF SCELIOTRACHELINAE
(Based on females)

1. Forewings without knobbed submarginal vein (Plate 67: Figure C)..... .....*Isolia* **Förster**

- Forewings with knobbed submarginal vein (Plate 62: Figure G)…….2

2. Claval segments fused into a single solid clava; T2 usually with a fan of striae anteriolaterally……..…….. …….***Amitus*** **Haldeman**

- Clava not fused into a single segment, distinct clavomeres present; T2 without fan like striae anteriolaterally…… .....……...….3

3. Propodeum with distinct foamy structures; scape with remarkably expanded lamella…..... .. ***Plutomerus*** **Masner & Huggert**

- Propodeum with or without foamy structures; scape without wide lamella …….....……..4

4. Submarginal vein of forewing with slightly upcurved rounded knob; notauli absent… .....… ***Allotropa*** **Förster**

- Submaginal vein short, straight; notauli distinct in some species or atleast abbreviated anteriorly…… .....….***Fidiobia*** **Ashmead**

4.2.3: TAXONOMIC DESCRIPTIONS

10. Genus *ALLOTROPA* Förster

Allotropa Förster, 1856: 106, 109. Original description. Type: *Inostemma mecrida* Walker, by monotypy. Keyed.

Eurostemma Szelényi, 1938a: 102. Original description. Type: *Inostemma europus* Walker, by monotypy and original designation. Synonymized by Vlug & Graham (1984).

Nasdia Nixon, 1942: 462. Original description. Type: Nasdia prosper Nixon, by monotypy and original designation. Synonymized by Masner & Huggert (1989).

Platytropa Kozlov, 1977: 79, 80. Original description. Type: *Platytropa helenae* Kozlov, by monotypy and original description. Keyed. Synonymized by Masner & Huggert (1989).

Diagnostic characters

Flattened dorsoventrally; OOL less than LOL; antennae 9 segmented in both sexes; clava in female nonabrupt with 3 segments; scape in both sexes with very short lamella; notauli absent; scutellar suture foveolate; propodeum with a single keel; forewing with a slightly upcurved submarginal vein, knobbed at the apex; metasoma with indistinct lateral edge with very broad laterotergite.

Distribution: Worldwide

Biology: Parasitoids of mealybugs (Pseudococcidae) (Vlug 1995)

Discussion

A very distinct genus of Sceliotrachelinae since it is having long broadly spindle-shaped metasoma, slightly upcurved submarginal vein and in having remarkably wider head. Only *Errolium* Masner and Huggert come somewhat similar to *Allotropa*, but only because of the similarity in wing venation.

Remarks

The genus is represented by 33 species from the World and four species from Oriental Region. From India, three species and from Kerala, only one species were described so far. Here, two new species are described from Kerala. A

key to species of India and a distribution map of this genus and its species in Kerala are also provided (Plate 63).

KEY TO INDIAN SPECIES OF *ALLOTROPA* FÖRSTER

(Based on females)

1. Scutellum smooth.....2

- Scutellum reticulate.....3

2. Hyperoccipital carina completely absent; frons smooth; body golden yellow..... ***A. shobhanae* sp. nov.**

- Hyperoccipital carina weakly developed; frons reticulate; body black or brownish black 4

3. Scape 4.06 X as long as wide; LOL 21 X LOL .... ***A. gundlupetensis* Veenakumari and Buhl**

- Scape 3.4 X as long as wide; LOL 7 X OOL…….....***A. shyama* sp. nov.**

4. Scape 5.3 X as long as wide; A8 1.62 X as long as wide .... ***A. nigra* Veenakumari and Buhl**

- Scape 4.8 X as long as wide; A8 1.15 X as long as wide..... .... ***A. vanajae* Veenakumari and Buhl**

1. *Allotropa shobhanae* sp. nov.

(Plate 61)

Diagnosis

Body length 0.68 mm; golden yellow; almost smooth bodied.

Description

Holotype. Female. Body length 0.68 mm (Plate 62: A); golden yellow; eyes black; ocelli black.

Head: 2.07 X as wide as long in dorsal view (Plate 62: C); 1.17 X as wide as mesosoma; head in front view 1.4 X as wide as high (Plate 62: E); IOS 1.64 X eye height; OOL 0.36 of OD; LOL 11 X OOL; POL 19 X LOL; occiput, vertex and lower frons covered with white setae; temples very narrow; antennae with sparse white setae, scape 3.5 X as long as wide, length to breadth ratio of antennal segments A1-A9 being: 0.11: 0.03; 0.05: 0.02; 0.03: 0.02; 0.02: 0.02; 0.02: 0.02; 0.02: 0.03; 0.03: 0.04; 0.02: 0.05; 0.03: 0.05 respectively (Plate 62: G).

Mesosoma: Flattened, as long as wide (Plate 62: D); pronotum visible from above; mesoscutum 1.3 X as wide as long; notauli absent; scutellum 1.7 X as wide as long; mesopleuron with a depression, rest smooth; metapleuron with white seate (Plate 62: H); propodeum laterally with white setae. Forewing 2.08 X as long as wide (Plate 62: F).

Metasoma: Smooth, 1.67 X as long as wide; T2 1.17 X as long as wide; length to width ratio of metasomal tergites T1-T6 being: 0.04: 0.1; 0.21: 0.18; 0.02: 0.13; 0.02: 0.1; 0.01: 0.05; 0.01: 0.03 respectively (Plate 62: B).

Host: Unknown

Specimen examined

Holotype. f. INDIA: Kerala, Vellayani, Trivandrum; 30. iv. 2011; Coll. Shameem K; on card; Reg. No. ZSI/WGRS/IR.INV.6219.

Etymology

The species is named '*shobhanae*' after the name of author's mother, for the encouragement and support extended by her.

Discussion

Species of genus *Allotropa* are usually black in colour. The golden yellow color of this species makes it different from all other Indian species of this

genus. A similar species was described from Guam, viz. *A. thompsoni* Fullaway. *A. thompsoni* differs from *A. shobhanae* since the former is having notauli and fuscous cloud in the middle of forewing disc.

2. *Allotropa shyama* sp. nov.

(Plate 62)

Diagnosis

Body length 0.91 mm; head 1.8 X as wide as long; OOL 0.69 X OD; scape 3.4 X as long as wide, A7 and A8 subequal.

Description

Holotype. Female. Body length 0.91 mm (Plate 61: A); A1-A6 and legs yellow; A7-A9 dark brown; tegula brown; submarginal vein light brown; last segment of tarsi slightly darkened; T1 yellow.

Head: 1.8 X as wide as long in dorsal view (Plate 61: C); 1.1 X as wide as mesosoma; head in front view 1.3 X as wide as high (Plate 61: F); IOS 1.3 X eye height; eyes large; OOL 0.69 of OD; LOL 7 X OOL; POL 2 X LOL; occiput, vertex and lower frons covered with white setae; temples very narrow; antennae with sparse white setae; scape 3.4 X as long as wide, 1.09 X as long as A7-A9 combined; A7 and A8 subequal; length to breadth ratio of antennal segments A1-A9 being: 0.15:0.05; 0.06: 0.03; 0.04: 0.02; 0.02: 0.02; 0.03: 0.02; 0.03: 0.02; 0.04:0.04; 0.04: 0.04; 0.06: 0.03 respectively (Plate 61: D).

Mesosoma: 1.1 X as long as wide, slightly convex anteriorly (Plate 61: B); pronotum visible from above, posterior sides of lateral pronotum setose; mesoscutum 1.13 X as long as wide, finely reticulate with dense white setae towards anterior region and sparse setae towards posterior part; notauli

absent; scutellum semicircular, 1.5 X as wide as long; densely setose towards posterior region; propodeum fully covered with white setae; mesopleuron with a medial depression; posterior margin of mesopleuron with 3-4 transverse ridges; metapleuron fully covered with white setae (Plate 61: H). Forewings 3.2 X as long as wide, with fine microtrichia; submarginal vein reaching upto 0.35 of forewing; marginal cilia on posterior margin of forewing 0.15 of wing width (Plate 61: G).

Metasoma: Spindled shaped, 1.97 X as long as wide; T1 with white lateral setae; T2 costate at anterior margin and with white setae laterally, rest smooth and shining; T3- T6 entirely smooth and shiny; length to width ratio of metasomal tergites T1-T6 being: 0.07: 0.12; 0.27: 0.29; 0.03: 0.16; 0.02: 0.13; 0.02: 0.08; 0.06: 0.04 respectively (Plate 61: E).

Host: Unknown

Specimen examined

Holotype. f. INDIA, Kerala, Mullaperiyar, Idukki; 06. iv. 2013; Coll. Rajmohana. K; on card; Reg. No. ZSI/WGRS/IR.INV.6219.

Etymology

The species is named '*shyama*' after its body coloration, (shyama = black)

Discussion

The new species comes near *A. gundlupetensis* Veenakumari and Buhl in having reticulate scutellum and head 1.3 X as wide as high. But the scape is 4.06 X as long as wide and LOL is 21 X OOL in *A. gundlupetensis* whereas scape is 3.4 X as long as wide and LOL is only 7 X OOL in *A. shyama* sp. nov.

3. *Allotropa vanajae* Veenakumari and Buhl

Allotropa vanajae Veenakumari, Buhl, Mohanraj & Khan, 2013: 225. Original description.

Diagnosis

Female. Body length 0.82 mm; head 1.6 X as wide as high; hyperoccipital carina weakly developed; vertex elongately reticulate; temples almost absent; POL: LOL: OOL in the ratios, 119: 66: 3; IOS 1.3 X eyeheight; mesosoma flattened; mesosnotum scaly reticulate; mesopleura smooth, mesopleural depression with a horse shoe shaped declivity. Forewings 2.85 X as long as wide, submarginal vein 0.4 of forewing length, metasoma spindle shaped, 1.95 X as long as wide; T1 costate with several lateral striae; T2 smooth.

Distribution: Kutilangai: Malappuram (Kerala); Parampadam: Thrissur (Kerala).

Remarks

The species is not represented in the present collection.

11. Genus *FIDIOBIA* Ashmead

Fidiobia Ashmead, 1894: 170. Original description. Type: *Fidiobia flavipes* Ashmead, by monotypy.

Rosneta Brues, 1909: 157. Original description. Type: *Rosneta tritici* Brues, by monotypy and original designation. Synonymized by Fouts (1924).

Triclavus Brèthes, 1916: 411. Original description. Type: *Triclavus bonaeriensis* Brèthes, by monotypy. Synonymized by Masner, in Krombein & Burks (1967).

Fahringeria Kieffer, 1921: 68. Original description. Type: *Fahringeria synergorum* Kieffer, by monotypy. Synonymized by Masner & Huggert (1989).

Platyllotropa Szelényi, 1938b: 126. Original description. Type: *Platyllotropa gallicola* Szelényi, by monotypy and original designation. Synonymized with *Triclavus* Brèthes by Ogloblin (1944).

Diagnostic characters

Squat and stocky to elongate; body slightly depressed dorsoventrally, usually melanic, with bright colored appendages; vertex rounded; temples rather long; posterior ocellus close to inner orbit; antenna nine segmented in both sexes, females with three segmented clava; mesoscutum flattened; scutellar disc strongly flattened; propodeum with foamy structures and with two short median keels; forewing with short tubular submarginal vein; T2 of most species with two depressions anteriolaterally.

Distribution: Worldwide

Biology: Primary solitary endoparasites in eggs of weevils (Curculionidae) and leaf beetles (Chrysomelidae) (Vlug 1995).

Discussion

This is a large and Worldwide genus. The close relatives of *Fidiobia* are *Platystasius* Nixon, *Plutomerus* Masner and Huggert and *Neobia* Masner and Huggert. *Platystasius* and *Neobia* are still not reported from India. *Plutomerus* is more apomorphic when compared to *Fidiobia* and can be differentiated

from the latter in having specialized cephalic structures like sharply crested vertex, narrow temples and strongly expanded scape.

Remarks

Twenty six species of this genus are described from the World. From India as well as from the Oriental Region, only two species have so far been described. The present work reports one species which is a first report from Kerala. A key to species of India and a distribution map of this genus and its species in Kerala are also provided (Plate 65).

KEY TO INDIAN SPECIES OF *FIDIOBIA* ASHMEAD

(Based on females)

1. Notauli parallel, uniformely broad, intenotaular area foveate reticulate; LOL 4.3 X OOL…..***F. virakthamati*** **Veenakumari and Buhl**

- Notauli broad, cone shaped with five longitudinal striae in each notaulus; LOL 3.3 X OOL.....***F. nagarajae*** **Veenakumari and Buhl**

1. *Fidiobia nagarajae* Veenakumari, Buhl & Rajmohana

(Plate 64)

Fidiobia nagarajae Veenakumari, Buhl, Rajmohana K. & Mohanraj, 2012: 472. Original description, diagnosis.

Diagnosis

Body length 0.89 mm; black; head 1.89 X as wide as mesosoma; notauli broad; cone shaped, reaching half of mesonotum; with longitudinal striae in each notaulus; female metasoma wider than mesosoma.

Re-description

Female. Body length 0.89 mm (Plate 64: A). Body black, antennal segments except clava yellowish brown; antennal clava dark brown; legs including coxae yellowish brown; submarginal vein yellowish brown; tegula dark brown.

Head: Transverse, strongly sculptured, 1.89 X as wide as long in dorsal view (Plate 64: B), 1.15 X as wide as mesosoma; eyes large, bare; vertex beneath posterior ocelli reticulate; IOS 1.2 X eye height (Plate 64: F); temples absent; ocelli large; POL 3.25 X OOL; LOL 1.54 X OOL; OD 1.1 X OOL; scape 4 X as long as wide; length to breadth ratio of antennal segments A1-A9 being: 0.79: 0.19, 0.23: 0.12, 0.18: 0.09, 0.11: 0.09, 0.07: 0.09, 0.08: 0.11, 0.19: 0.23, 0.20: 0.25, 0.32: 0.15 respectively (Plate 64: D).

Mesosoma: 1.1 X as long as wide, sculptured (Plate 64: C); pronotum with scattered white setae; clearly visible from above; striations present in upper lateral side of pronotum, rest smooth; mesoscutum convex, 1.3 X as wide as long; mesonotum scaly reticulate; notauli broad; cone shaped, reaching half of mesonotum with longitudinal striae in each notaulus; scutellum 1.78 X as wide as long; mesopleuron smooth; metapleuron with white setae and foamy structures (Plate 64: H); metanotum with a triangular foamy structure; propodeum with long white setae; fully covered with foamy structures. Forewings transparent with densely packed microtrichia, 2.8 X as long as wide; marginal cilia absent, submarginal vein present which is knobbed at apical portion; submarginal vein on forewing reaching only upto 0.03 of wing length (Plate 64: G).

Metasoma: 1.36 X as long as wide; T2 glabrous, as wide as mesoscutum; T2 with two basal pits; length to width ratio of metasomal tergites T1-T2 being: 0.8: 0.25, 0.3: 0.28 respectively (Plate 64: E).

Host: Unknown

Specimens studied

f. INDIA: Kerala, Kolassery, Kannur; 24. v. 2014; Coll. Anjana. M; yellow pan trap; on card; Reg. No. ZSI/WGRC/IR.INV. 4227; f. INDIA: Kerala, Punathur, Karsargod; 09. ii. 2007; Coll. Rajmohana on card; Reg. No. ZSI/WGRC/IR.INV.4642.

Discussion

Similar to *Fidiobia semistriata* Buhl, O'Connor & Ashe (2009) from Sulawesi, but the species differs in having head wider relative to mesosoma, scaly reticulate mesonotum and female metasoma wider than mesosoma. Afrotropical *F. zebra* Buhl (2010) is also characterized with wide longitudinally striate notauli, but the entire hind part of mesoscutum of this species is longitudinally striate.

Remarks

This work brings out the first report of the genus as well as the species from Kerala.

12. Genus *ISOLIA* Förster

Isolia Förster, 1878: 46. Original description. Type: *Isolia foersteri* Szabó, designated by Szabó (1959).

Diagnostic characters

Robust, stocky; light coloured to black species; female antenna with abrupt 3 segmented clava; male antenna thread like; pronotal shoulders well developed; notauli abbreviate anteriorly; scutellum broadly transverse, subrectangular with scutellar pits reduced to points and scutellar rim not defined; propodeum with foamy structures, forewings without tubular veins; metasoma short and broad with wide laterotergites.

Distribution: Oriental Region, Palearctic Region.

Biology: Hosts and habits are unknown.

Discussion

Isolia is closely related to *Pulchrisolia* Szabó from which it differs by the lack of a transverse ledge on the lower frons, the moderate development of the interantennal process, as well as the tubular submarginal vein in the forewing.

Remarks

The genus is represented by ten species from the World, three species from Oriental Region and two species from India. The present work reports two species from Kerala, out of which one is described as new to science and the other is a first report from Kerala. A key to species from India and a distribution map of this genus and its species in Kerala are provided (Plate 68).

KEY TO INDIAN SPECIES OF *ISOLIA* FÖRSTER

(Based on females)

1. Scutellum with longitudinal striae at least in posterior half 2

- Scutellum without longitudinal striae, only with very faint reticulations anterioriomedially, rest smooth…..... ***I. kalingae*** **Veenakumari and Buhl**

2. T2 smooth; scutellum 1.6 X as wide as long …… ..... ***I. indica*** **Buhl**

- T2 elongately reticulate; scutellum 1.25 X as wide as long..... .....…***I. keralensis*** **sp. nov.**

1. *Isolia indica* Buhl

(Plate 66)

Isolia indica Buhl, 2008: 389. Original description, diagnosis.

Diagnosis

Body length 0.87 mm; head 2 X as wide as long; OOL 3.3 X OD; vertex and occiput reticulate, scutellum 1.95 X as wide as long.

Re-description

Female. Body length 0.87 mm (Plate 66: A). Head and mesosoma black; antennal segments except clava yellow; antennal clava dark brown; legs including coxae yellowish brown; tegula yellow.

Head: 2 X as wide as long in dorsal view (Plate 66: D), 1.0 X as wide as mesosoma; occiput reticulate; eyes bare; IOS 1.6 X eye height; temples absent; POL 1.3 X OOL; OOL 1.9 X LOL; OOL 3.3 X OD; scape 3.6 X as long as wide; length to breadth ratio of antennal segments A1-A9 being: 0.19:

0.05, 0.05: 0.03, 0.02: 0.03, 0.01: 0.03, 0.01: 0.02, 0.01: 0.03, 0.05: 0.05, 0.05: 0.05, 0.09: 0.03 respectively (Plate 66: C).

Mesosoma: 1.15 X as wide as long (Plate 66: E), sculptured; sides of pronotum finely reticulate; notauli absent; mesoscutum 1.5 X as wide as long; mesonotum smooth; scutellum 1.95 X as wide as long; mesopleuron longitudinally striate in upper half, rest smooth; metapleuron with white setae and foamy structures (Plate 66: G); propodeum covered with foamy structures. Forewings with slight brown tinge and with densely packed microtrichia, 2.4 X as long as wide, marginal cilia absent (Plate 66: H).

Metasoma: 1.2 X as long as wide; T1 with fine white setae; T2 smooth; length to width ratio of metasomal tergites T1-T6 being: 0.08: 0.35, 0.19: 0.39, 0.10: 0.35, 0.08: 0.25, 0.06: 0.23, 0.05: 0.13 respectively (Plate 66: B).

Host: Unknown

Specimens examined

2 f. INDIA: Kerala, Mavoor, Kozhikode; 30. ii. 2015, Coll. Shweta. M, on card, Reg. No.ZSI/WGRC/IR.INV.4226; f. INDIA: Kerala, Mayanad, Kozhikode; 13. ii. 2014; Coll. Shweta. M; on card; Reg. No. ZSI/WGRC/IR.INV.4225; 2 f. INDIA: Kerala, Good Rickal range, Pathanamthitta; 06. iii. 2010; Coll. K.C. Gopi and Party; on card; Reg. No. ZSI/WGRC/IR.INV.4087.

Discussion

Color of metasoma and sparsely setose T1 differentiate *I. indica* from *I. kalingae,* the second species described from India in which metasoma is black in color and T1 is densely setose.

Remarks

I. indica is reported for the first time from Kerala through this study.

2. *Isolia keralensis* sp. nov.

(Plate 67)

Diagnosis

Body length 1.09 mm; A1 3.25 X as long as wide; A5 subequal to A6; scutellum with longitudinal striae; propodeum with dense foamy structures; T1 fully covered with white hairs, T2 elongately reticulate.

Description

Holotype. Female. Body length 1.09 mm (Plate 67: A). Black, eyes white; tegulae brown; legs including coxae dark brown.

Head: 2.5 X as wide as long in dorsal view (Plate 67: E), 1.09 X as wide as mesosoma; occiput, vertex and frons coriaceously reticulate; eyes bare; IOS 1.27 X eye height (Plate 67: D); eye height 6.33 X as long as temples; POL 1.8 X OOL; OOL 1.25 X LOL; OOL 1.67 X OD; scape 3.25 X as long as wide; length to breadth ratio of antennal segments A1-A9 being: 0.26: 0.08; 0.07: 0.03; 0.04: 0.03; 0.03: 0.03; 0.02: 0.03; 0.02: 0.03; 0.03: 0.04; 0.07: 0.06; 0.05: 0.06; 0.07: 0.03 respectively (Plate 67: F).

Mesosoma: 1.09 X as wide as long, sculptured (Plate 67: G); sides of pronotum reticulate; notauli absent; mesoscutum 1.56 X as wide as long, reticulate; scutellum 1.25 X as wide as long; mesopleuron with prominent longitudinal striae in upper half, rest smooth; metapleuron with white setae and dense foamy structures (Plate 67: B); propodeum covered with foamy

structures. Forewings 2.41 X as long as wide, with dense microtrichia (Plate 67: C).

Metasoma: 1.19 X as long as wide; T1 fully covered with white setae; base of T2 with short white setae, T2 elongately reticulate; length to width ratio of metasomal tergites T1-T6 being: 0.11: 0.44; 0.37: 0.49; 0.01: 0.30; 0.01: 0.24; 0.02: 0.17; 0.03: 0.09 respectively (Plate 67: H).

Host: Unknown

Specimens examined

Holotype. f. INDIA: Kerala, Idaykkadu, Kasargod; 10. xi. 2015; Coll. Sinu; on card; Reg. No. ZSI/WGRC/IR.INV.6220; 3 f. INDIA: Kerala, Koythatta, Kasargod; Coll. Sinu; on card; Reg. No. ZSI/WGRS/IR.INV.6221.

Etymology

The species is named '*keralensis*' since this is the first species of this genus described from Kerala.

Discussion

The new species comes near *I. kalingae* Veenakumari and Buhl (2015) in its body colour and in the striae present beneath the tegula. But the new species shows great differences that, the scutellum in *I. kalingae* is with faint reticulations anteriomedially and rest smooth whereas in *I. keralensis*, scutellum is with several longitudinal striae. Also, T2 is smooth in *I. kalingae* whereas, T2 is elongately reticulate in *I. keralensis.* In *I. indica*, the scutellum is 1.6 X as wide as long whereas in *I. keralensis*, the scutellum is only 1.25 X as wide as long.

4.3. Parasitoid-Host/ Parasitoid- Host plant association

Platygastrinae are parasitoids of Cecidomyiid gall midges and are usually koinobionts and Sceliotrachelinae are parasitoids of homopterous families like Pseudococcidae and Aleyrodidae (Vlug 1995). The compiled host data recorded so far from India (from Vlug 1995 & Rajmohana and Divya 2011) along with the new records obtained in the study period is given (Table 4. 3).

Table 4. 3. Parasitoid-Host/ Parasitoid- Host plant association

Subfamily	Parasitoid	Host	Associated Plant
Platygastrinae	*Anectadius bengalensis* Kieffer	Unknown Cecidomyiid	*Artemisia* sp.
	Anectadius striolatus Kieffer	Unknown Cecidomyiid	Leaf gall of *Barringtonia acutangula* (Linn.) Garten◇ *Lasioptera textor* Kieffer
	Inostemma apsyllae Austin	*Apsylla cistella* (Buckton) (Homoptera)	*Mangifera indica* L. (mango)
	Inostemma indicum Mani	*Neolasioptera cephalandrae* Mani	*Coccinia indica* Wight and Arn. *Cephalandra indica* Noudin◇
	Inostemma oculare Austin	*Procontarinia matteiana* Kieffer & Cecconion	*Mangifera indica* L. (mango)
	Platygaster narendrani Ushakumari	Unknown Cecidomyiid	*Lufa cylindrica* (L.) Roem◇
	Platygaster oryzae Cameron	Unknown Cecidomyiid	*Cecidomyia oryzae* Wood- Mason
	Platygaster foersteri Gahan	*Orseolia oryzae* Wood Mason	*Ischaemum ciliare* Retzius
	Platygaster luteipes Buhl	Unknown Cecidomyiid	*Piper nigrum* L.◇ *Strobilanthus* sp.◇

	Platygaster ramachandrai (Rao)	Unknown Cecidomyiid	*Andropogon schoenanthus* L.
	Platygaster reticulatus sp. nov.	Unknown Cecidomyiid	*Coccinia indica* Wight & Arn.◆
	Platygaster rusticus sp. nov.	Unknown Cecidomyiid	*Oryza sativa* L.◆
	Platygaster salvadorae Rao	*Thomasiniana salvadore*	*Salvadora perscica* L.
	Proleptacis fici Rao	*Diodiplosis oryzae* Rao	*Ficus glomerata* Roxb.
	Synopeas procon Austin	*Procontarinia matteiana* Kieffer & Cecconion	*Mangifera indica* (mango) L.
	Synopeas temporale Austin	*Procontarinia matteiana* Kieffer & Cecconion	*Mangifera indica* (mango) L.
	Trichacoides indicus Jackson	*Procontarinia matteiana* Kieffer & Cecconi	*Mangifera indica* (mango) L. *Mimosops elengi* L.◆
Sceliotrachelinae	*Amitus japonica* Ashmead	*Maconellicoccus hirsutus* (Green)	Unknown
	Amitus vignus Anjana *et al.*	*Zaphanera sp.*	*Vigna trilobata* (L.) Verdc.◆
	Isolia indica Buhl	*Aleuroclava grewiae* Sundararaj & David	*Scolopia crenata* (Wight & Arn.)◆

◆Parasitoid- Host plant associations obtained during the study period

4.4. CHECK- LIST OF PLATYGASTRINAE AND SCELIOTRACHELINAE OF INDIA

Genus *Allotropa* Förster, 1856

1. ***Allotropa gundlupetensis*** Veenakumari and Buhl, 2013

   Distribution in India: Hundlupet (Karnataka)

2. ***Allotropa nigra*** Veenakumari and Buhl, 2013

   Distribution in India: Khorda Kadurai (Odisha)

3. ***Allotropa vanajae*** Veenakumari and Buhl, 2013

   Distribution in India: Kutilangai: Malppuram (Kerala); Parampadam: Thrissur (Kerala); Kengeri: Bangalore (Karnataka); Kanakapura: Ramanagara (Karnataka); Coimbatore (Tamil Nadu); Kale Amb: Hamipuri (Himachal Pradesh); Thaldskin: Jowal (Meghalaya); Nandi hills: Chikkaballapur (Karnataka)

4. ***Allotropa shobhanae*** sp. nov.

   Distribution in India: Vellayani: Trivandrum (Kerala)

5. ***Allotropa shyama*** sp. nov.

   Distribution in India: Mullaperiyar: Idukki (Kerala)

Genus *Amblyaspis* Förster, 1856

6. ***Amblyaspis ashmeadi*** Veenakumari and Buhl, 2013

   Distribution in India: Hebbal: Bangalore (Karnataka); Kengeri: Bangalore (Karnataka); Nandi hills: Chikkaballapur (Karnataka); Lalbagh: Bangalore (Karnataka); GKVK: Bangalore (Karnataka); Gajamugam: Nilambur: Malappuram (Kerala); Pattiyar: Silent Valley: Palakkad (Kerala)

7. ***Amblyaspis charvakae*** Veenakumari and Buhl, 2013

Distribution in India: Attur: Bangalore (Karnataka)

8. ***Amblyaspis dalhousianus*** (Mukerjee), 1978

Distribution in India: Ahla: Dalhousie (Himachal Pradesh)

9. ***Amblyaspis emarginata*** Anjana and Rajmohana, 2015

Distribution in India: Anchuruli: Idukki (Kerala)

10. ***Amblyaspis fabrei*** Veenakumari and Buhl, 2013

Distribution in India: Mandya (Karnataka); Malleshwaram: Bangalore (Karnataka); Hebbal: Bangalore (Karnataka)

11. ***Amblyaspis hirsuta*** Anjana and Rajmohana, 2015

Distribution in India: Anjuruli: Idukki (Kerala)

12. ***Amblyaspis khasiana*** Veenakumari and Buhl, 2015

Distribution in India: Ri Bhoi: Umiam: Central Agricultural University (Meghalaya)

13. ***Amblyaspis kurinjii*** Veenakumari and Buhl, 2015

Distribution in India: Dindigul: Shenbaganur (Tamil Nadu)

14. ***Amblyaspis narendrani*** Anjana and Rajmohana, 2015

Distribution in India: Manalar: Idukki (Kerala)

15. ***Amblyaspis tipusultani*** Veenakumari and Buhl, 2013

Distribution in India: Srirangapattana (Karnataka)

16. ***Amblyaspis panhalensis*** Veenakumari and Buhl, 2013

Distribution in India: Panhala (Maharashtra); Matia Pada: Puri (Orissa)

17. ***Amblyaspis shivanki*** sp. nov.

Distribution in India: Pandimotta: Kollam (Kerala)

Genus *Amitus* Haldeman, 1850

18. ***Amitus japonica*** Ashmead, 1904, in Mukerjee, 1978

    Host: *Maconellicoccus hirsutus* (Green)

    Distribution in India: Hasimara (North Bengal)

19. ***Amitus sikkimensis*** Veenakumari and Buhl, 2014

    Distribution in India: Hanumontok: Gangtok (Sikkim); Kabi: Mangan (Sikkim)

20. ***Amitus kiefferi*** Veenakumari and Buhl, 2014

    Distribution in India: Bangalore (Karnataka); Attur: Bangalore (Karnataka); Mandya (Karnataka); Doddaballapur: Bangalore (Karnataka)

21. ***Amitus vignus*** Anjana, Rajmohana, Vimala and Sundararaj, 2016

    Host: whitefly *Zaphanera* sp. (Aleyrodidae) on *Vigna trilobata*

    Distribution in India: Bhiwandi: Mumbai (Maharashtra)

Genus *Anectadius* Kieffer, 1905

22. ***Anectadius bengalensis*** Kieffer, 1905

    Host: Gall midge on *Artemisia* sp.

    Distribution in India: West Bengal

23. ***Anectadius striolatus*** Kieffer, 1905

    Host: *Lasioptera textor* Kieffer; Leaf gall of *Barringtonia acutangula* (Linn.) Garten

    Distribution in India: Bengal; Chemmad: Malappuram (Kerala)

Genus *Fidiobia* Ashmead, 1894

24. ***Fidiobia nagarajae*** Veenakumari and Buhl, 2012

Distribution in India: Attur: Bangalore (Karnataka); Nandi hills: Chikkaballapur (Karnataka); Hebbal: Bangalore (Karnataka); Kolassery: Kannur (Kerala); Punathur: Kasargod (Kerala)

25. ***Fidiobia virakthamati*** Veenakumari and Buhl, 2012

Distribution in India: Attur: Bangalore (Karnataka); Dodballapur: Bangalore (Karnataka); Hebbal: Bangalore (Karnataka); Maddur: Mandya (Karnataka)

Genus *Gastrotrypes* Brues, 1922

26. ***Gastrotrypes keralensis*** Anjana and Rajmohana, 2016

Distribution in India: Manalar: Periyar Tiger Reserve: Idukki (Kerala); Chelavoor: Kozhikode (Kerala)

27. ***Gastrotrypes longicaudatus*** Veenakumari and Buhl, 2015

Distribution in India: Gandhi Krishi Vigyana Kendra: Bangalore (Karnataka)

28. ***Gastrotrypes manii*** Veenakumari and Buhl, 2015

Distribution in India: Garacharma: Central Agricultural Research Institute: South Andaman (Andaman Islands)

29. ***Gastrotrypes vindhyensis*** (Mukerjee 1978)

Distribution in India: Chelavoor: Kozhikode (Kerala); Anchuruli: Periyar Tiger Reserve: Idukki (Kerala

Genus ***Inostemma* Haliday, 1833**

30. ***Inostemma anamalaianum*** Mukerjee, 1981

Distribution in India: Valparai: Annamalai (Tamil Nadu)

31. ***Inostemma apsyllae*** Austin, 1984

Host: *Apsylla cistella* (Buckton) (Homoptera) on *Mangifera indica* (mango) (associated with Cecidomyiidae, predating on psyllid)

Distribution in India: Sitapur (Uttar Pradesh); University of Calicut: Malappuram (Kerala)

32. ***Inostemma berijamum*** Mani, 1975

Distribution in India: Kodaikkanal (Tamil Nadu); Mettap: Idukki (Kerala)

33. ***Inostemma coorgense*** Mukerjee, 1981

Distribution in India: Nelgi: Coorg (Karnataka)

34. ***Inostemma dalhousianus***, Mukerjee, 1981

Distribution in India: Ahla: Dalhousie

35. ***Inostemma indica*** Mani, 1941

Host: Larvae of *Neolasioptera cephalandrae* Mani (Cecydomyiidae: Diptera), producing galls on stem of *Coccinia indica*.

Distribution in India: Kottakkal: Malappuram (Kerala); New Delhi

36. ***Inostemma nelgiense*** Mukerjee, 1981

Distribution in India: Nelgi: Coorg (Karnataka)

37. ***Inostemma oculare*** Austin, 1984

Host: *Procontarinia matteiana* Kieffer & Cecconion on *Mangifera indica* (mango).

Distribution in India: Varanasi (Uttar Pradesh)

38. ***Inostemma parvocornus*** sp. nov.

Distribution in India: Mettap: Idukki (Kerala)

39. ***Inostemma shencottahense*** Mukerjee, 1981

Distribution in India: Shencottah gap (Kerala- Tamil Nadu Boarder), Peechiparai: Kanyakumari (Tamil Nadu)

Genus ***Isocybus*** **Förster, 1856**

40. ***Isocybus dhenkundensis*** Mukerjee, 1978

Distribution in India: Dhenkund (Himachal Pradesh)

41. ***Isocybus indicus*** Mani, 1975

Distribution in India: Mahabaleshwar (Maharashtra)

Genus *Isolia* Förster, 1878

42. ***Isolia indica*** Buhl, 2008

Host: *Aleuroclava grewiae* on *Scolopia crenata*

Distribution in India: Hebbal: Bangalore (Karnataka); Attur: Bangalore (Karnataka); Mandya (Karnataka); Mavoor: Kozhikode (Kerala); Mayanad: Kozhikode (Kerala); Good Rickal range: Pathanamthitta (Kerala)

43. ***Isolia kalingae*** Veenakumari and Buhl, 2015

Distribution in India: Orissa University of Agricultural Technology: Bhubaneswar (Odisha)

44. ***Isolia keralensis*** sp. nov.

Distribution in India: Idaykkadu: Kasargod (Kerala); Koythatta: Kasargod (Kerala)

Genus ***Isostasius*** **Förster, 1856**

45. ***Isostasius poroicus*** Mukerjee, 1891

    Distribution in India: North Bengal

Genus *Iphitrachelus* Haliday, 1836

46. ***Iphitrachelus lar*** Haliday, 1836

    Distribution in India: Ranipuram: Kasargod (Kerala)

47. ***Iphitrachelus neogracilis*** sp. nov.

    Distribution in India: Mayanad: Kozhikode (Kerala)

48. ***Iphitrachelus shajii*** sp. nov.

    Distribution in India: Eravikulam: Idukki (Kerala); University of Calicut: Malappuram (Kerala); Idaykkadu: Kasargod (Kerala)

Genus *Leptacis* Förster, 1856

49. ***Leptacis agastmuniae*** Mukerjee, 1992

    Distribution in India: Agastmuni: Chamoli (Uttarakhand)

50. ***Leptacis atturensis*** Mukerjee, 1981

    Distribution in India: Attur, Hudukeri (Karnataka); Pambadum shola: Idukki (Kerala)

51. ***Leptacis bengalensis*** Mukerjee, 1981

    Distribution in India: Poro North (West Bengal)

52. ***Leptacis brachycerus*** Mukerjee, 1981

    Distribution in India: Appangala (Karnataka)

53. ***Leptacis coorgensis*** Mukerjee, 1981

    Distribution in India: Hudukeri: Coorg (Karnataka)

54. ***Leptacis indica*** Mukerjee, 1978

Distribution in India: Pune (Maharashtra)

55. ***Leptacis keralensis*** Ushakumari and Narendran, 2007

Distribution in India: University of Calicut: Malappuram (Kerala)

56. ***Leptacis konkanensis*** Mukerjee, 1981

Distribution in India: Mahabaleshwar (Maharashtra)

57. ***Leptacis lata*** sp. nov.

Distribution in India: Achankovil: Kottavasal: Kollam (Kerala)

58. ***Leptacis malabarensis*** Ushakumari and Narendran, 2007

Distribution in India: Muthanga: Wayanad (Kerala)

59. ***Leptacis maldarensis*** Mukerjee, 1981

Distribution in India: Maldare: Attur (Karnataka); Kakkayam: Kozhikode (Kerala)

60. ***Leptacis manii*** sp. nov.

Distribution in India: Panaikkode: Trivandrum (Kerala)

61. ***Leptacis pilosa*** sp. nov.

Distribution in India: Munnar: Idukki (Kerala)

62. ***Leptacis pulla*** Buhl, 2002

Distribution in India: Janakikadu: Kozhikode (Kerala); University of Calicut: Malappuram (Kerala)

63. ***Leptacis robusta*** sp. nov.

Distribution in India: Thoppimudi: Tattekkad: Ernakulam (Kerala)

64. ***Leptacis stom*** Ushakumari and Narendran, 2007

Distribution in India: Kozhikode (Kerala)

65. ***Leptacis tegulata*** Buhl, 2008

Distribution in India: Mayanad: Kozhikode (Kerala); Chethalayam: Wayanad (Kerala); University of Calicut: Malappuram (Kerala)

66. ***Leptacis tenuispinae*** sp. nov.

Distribution in India: University of Calicut: Malppuram (Kerala); Parathodu: Silent Valley: Palakkad (Kerala)

67. ***Leptacis thanensis*** Mukerjee, 1981

Distribution in India: Mumbai (Maharashtra)

68. ***Leptacis thrissurensis*** Ushakumari and Narendran, 2007

Distribution in India: Thrissur (Kerala)

69. ***Leptacis transoceanica*** Buhl, 2008

Distribution in India: Mathikettan shola: Idukki (Kerala)

70. ***Leptacis yercaudensis*** Mukerjee, 1981

Distribution in India: Yercaud (Tamil Nadu)

Genus *Platygaster* Latreille, 1809

71. ***Platygaster achterbergiana*** Buhl, 2009

Distribution in India: Ambukuthi: Muthanga: Wayanad (Kerala)

72. ***Platygaster coorgensis*** (Mukerjee) 1978

Synonym: *Anopedias coorgensis* Mukerjee, 1978

Distribution in India: Coorg (Karnataka)

73. ***Platygaster foersteri*** Gahan, 1919

Host: Gall on *Ischaemum ciliare Orseolia oryzae* (Wood- Mason) on *Oryza* sp.

Distribution in India: Coimbatore (Tamil Nadu)

74. ***Platygaster galbus*** Ushakumari, 2004

Distribution in India: Coorg (Karnataka), Thrissur (Kerala)

75. ***Platygaster indica*** Mukerjee, 1978

Distribution in India: Naggar (Himachal Pradesh)

76. ***Platygaster inderdaadi*** Vlug, 1995

Synonym: *Eritrissomerus indicus* Mukerjee, 1978

Distribution in India: Berjam Lake, Kodaikkanal Hills (Tamil Nadu)

77. ***Platygaster keralicus*** Ushakumari, 2004

Distribution in India: Vellanikkara: Thrissur (Kerala)

78. ***Platygaster luteipes*** Buhl, 2008

Host: Globular and robust galls of mature leaves on black pepper

Distribution in India: Ayiroor: Trivandrum (Kerala); Braemore Estate: Trivandrum (Kerala); Vellayani: Trivandrum (Kerala); Venganoor: Trivandrum (Kerala); Palakkal: Malappuram (Kerala); Janakikkadu: Kozhikode (Kerala); Dhasanaghatta: Wayanad (Kerala)

79. ***Platygaster malabarica*** (Mukerjee), 1978

Distribution in India: Pathanamthitta (Kerala)

80. ***Platygaster minima*** Mukerjee, 1978

Distribution in India: Idukki (Kerala)

81. ***Platygaster narendrani*** Ushakumari, 2004

Host: Stem galls of *Lufa cylindrica* (L.) Roem

Distribution in India: Thrissur (Kerala); Mathikettan shola: Idukki (Kerala); Churulipetti: Chinnar: Idukki (Kerala); Chimmony Dam: Thrissur (Kerala); University of Calicut (Malappuram); Vettichira (Malappuram)

82. ***Platygaster nigrocoxatus*** Ushakumari, 2004

Distribution in India: Kolakkadavu: Alappey (Kerala)

83. ***Platygaster neostriatitergites*** Veenakumari and Buhl, 2013

Distribution in India: Ponmudi: Trivandrum (Kerala); Mullaperiyar: Idukki (Kerala); Anjuruli: Idukki (Kerala); Kakkayam: Kozhikode (Kerala); Nandi hills: Chikkaballapur (Karnataka); Pekkavu: Pathanamthitta (Kerala); Pandipath: Trivandrum (Kerala); Pandimotta: Kollam (Kerala); Parepally: Changanassery: Kottayam (Kerala)

84. ***Platygaster oryzae*** Cameron, 1891

Host: *Cecidomyia oryzae* Wood- Mason on paddy

Distribution in India: Moughyr (Bihar)

85. ***Platygaster panchganni*** Mani, 1975

Distribution in India: Mahabaleshwar (Maharashtra)

86. ***Platygaster ramachandrai*** (Rao), 1950

Synonym: *Polygnotus ramachandrai* Rao, 1950

Host: Parasitoids from gall on *Andropogon schoenanthus* L.

Distribution in India: Coimbatore (Tamil Nadu)

87. ***Platygaster sasii*** Ushakumari, 2004

Distribution in India: Thrissur (Kerala); Parambikulam: Palakkad (Kerala); Kakkavayal: Kozhikode (Kerala); Aralam: Kannur (Kerala); Mullaperiyar: Idukki (Kerala); Marayoor: Idukki (Kerala); Gavi: Pathanamthitta (Kerala); Ranipuram: Kasargod (Kerala); Kakkayam: Kozhikode (Kerala); Mathikettan shola: Idukki (Kerala)

88. ***Platygaster salvadorae*** Rao, 1950

Host: *Thomasiniana salvadore* on *Salvadora perscica*

Distribution in India: Agra (Uttar Pradesh)

89. ***Platygaster satara*** Mani, 1975

Distribution in India: Kelghar- Meta on Satara Mahabaleshwar road (Western Ghats)

90. ***Platygaster tanus*** Ushakumari, 2004

Distribution in India: University of Calicut: Malappuram (Kerala)

91. ***Platygaster tibialis*** Kieffer, 1905

Distribution in India: West Bengal

92. ***Platygaster zantanus*** Ushakumari, 2004

Distribution in India: Malappuram (Kerala)

93. ***Platygaster neogalbus*** sp. nov.

Distribution in India: Pathanamthitta: Gavi (Kerala)

94. ***Platygaster kesaavrita*** sp. nov.

Distribution in India: Rajamalai shola: Idukki (Kerala)

95. ***Platygaster caudatus*** sp. nov.

Distribution in India: Pandimotta: Kollam (Kerala); Vellimala: Idukki (Kerala); Rajamalai shola: Idukki (Kerala)

96. ***Platygaster reticulatus*** sp. nov.

Distribution in India: Vettichira: Malappuram (Kerala)

97. ***Platygaster rusticus*** sp. nov.

Distribution in India: Pattambi: Palakkad (Kerala)

Genus *Plutomereus* Masner and Huggert, 1989

98. ***Plutomerus veereshi*** Veenakumari and Buhl, 2012

Distribution in India: Attur: Bangalore (Karnataka); Gandhi Krishi Vigyana Kendra: Bangalore (Karnataka)

Genus *Proleptacis* Kieffer, 1926

99. ***Proleptacis fici*** Rao, 1950

Host: *Diodiplosis oryzae* Rao from leaf galls on *Ficus glomerata*

Distribution in India: Agra (Uttar Pradesh)

100. ***Proleptacis oryzae*** Rao, 1950

Host: *Pachydiplosis oryzae* Mani

Distribution in India: Cuttack (Orissa)

Genus *Sacespalus* Kieffer, 1917

101. ***Sacespalus indicus*** Mani, 1975

Distribution in India: Mahabaleshwar (Maharashtra)

Genus *Synopeas* Förster, 1856

102. ***Synopeas aeros*** (Ushakumari and Narendran), 2007

Synonym: *Leptacis aeros* Ushakumari and Narendran, 2007

Distribution in India: Arattupuzha: Thrissur (Kerala)

103. ***Synopeas aitkeni*** Veenakumari and Buhl, 2014

Distribution in India: Doddaballapur: Bangalore (Karnataka); Nandi hills: Chikkaballapur: Channigiri (Karnataka); Skandagiri: Nandi hills: Chikkaballapur (Karnataka); Kolar: Gowribidanur (Karnataka); Gandhi Krishi Vigyana Kendra: Bangalore (Karnataka); Sarjansai: Dhenkaanal (Odisha)

104. ***Synopeas alus*** (Ushakumari and Narendran), 2007

Synonym: *Leptacis alus* Ushakumari and Narendran, 2007

Distribution in India: Thrissur (Kerala)

105. ***Synopeas asiaticum*** (Ushakumari and Narendran), 2007

Synonym: *Leptacis asiaticum* Ushakumari and Narendran, 2007

Distribution in India: Thrissur (Kerala)

106. ***Synopeas atturense*** Mukerjee, 1981

Distribution in India: Attur (Karnataka)

107. ***Synopeas benazeer*** (Ushakumari and Narendran), 2007

Synonym: *Leptacis benazeer* Ushakumari and Narendran, 2007

Distribution in India: Cochin (Kerala)

108. ***Synopeas bengalensis*** Mukerjee, 1978

Distribution in India: Jaldhapura (West Bengal)

109. ***Synopeas* (*Sactogaster*) *chamoliana*** Mukerjee, 1992

Distribution in India: Agastmuni: Chamoli (Uttarakhand); Kaatilappara, Nelliyampathy: Palakkad (Kerala); Vellimala: Idukki (Kerala); Mettap, Idukki (Kerala); Botanical garden, University of Calicut, Malappuram (Kerala)

110. ***Synopeas diversum*** (Ushakumari and Narendran), 2007

Synonym: *Leptacis diversum* Ushakumari and Narendran, 2007

Distribution in India: Munnar: Idukki (Kerala)

111. ***Synopeas dohertyi*** Veenakumari and Buhl, 2014

Distribution in India: Panhala: Kolhapur (Maharashtra)

112. ***Synopeas halmaherense*** Buhl, 2008

Distribution in India: Kuningal: Tumkur (Karnataka)

113. ***Synopeas* (*Sactogaster*) *indicum*** Mani, 1975

Distribution in India: Satara (Maharashtra); Ambukuthi: Wayanad (Kerala); Dhasanaghatta: Wayanad (Kerala); Mathikettan shola: Idukki (Kerala); Eravikulam: Idukki (Kerala); Mettap: Idukki (Kerala)

114. ***Synopeas indopeninsularis*** Mani, 1975

Distribution in India: Mahabaleshwar (Maharashtra)

115. ***Synopeas mangiferae*** Austin, 1984

Distribution in India: Lucknow (Uttar Pradesh)

116. ***Synopeas manii*** (Ushakumari and Narendran), 2007

Synonym: *Leptacis manii* Ushakumari and Narendran, 2007

Distribution in India: Cochin (Kerala)

117. ***Synopeas mustum*** (Ushakumari and Narendran), 2007

Synonym: *Leptacis mustum* Ushakumari and Narendran, 2007

Distribution in India: Eravikulam: Idukki (Kerala)

118. ***Synopeas nuperum*** (Ushakumari and Narendran), 2007

Synonym: *Leptacis nuperus* Ushakumari and Narendran, 2007

Distribution in India: Malappuram (Kerala)

119. ***Synopeas procon*** Austin, 1984

Host: *Procontarinia matteiana* Kieffer & Cecconion on *Mangifera indica* (mango)

Distribution in India: Lucknow (Uttar Pradesh)

120. ***Synopeas saltaense*** Buhl, 2003

Distribution in India: Arattupuzha: Thrissur (Kerala)

121. ***Synopeas scaposum*** (Ushakumari and Narendran), 2007

Synonym: *Leptacis scaposus* Ushakumari and Narendran, 2007

Distribution in India: Malappuram (Kerala)

122. ***Synopeas* (*Sactogaster*) *ribhoiense*** Veenakumari and Buhl, 2015

Distribution in India: Ri Bhoi: Umiam: Central Agricultural University (Meghalaya)

123. ***Synopeas tehriensis*** Mukerjee, 1992

Distribution in India: Tehri (Uttarakhand)

124. ***Synopeas temporale*** Austin, 1984

Host: *Procontarinia matteiana* Kieffer & Cecconion on *Mangifera indica* (mango)

Distribution in India: Lucknow (Uttar Pradesh)

125. ***Synopeas* (*Sactogaster*) *ventricosum*** Buhl, 1997

Distribution in India: Mannavan shola: Idukki (Kerala)

126. ***Synopeas* (*Sactogaster*) *westwoodi*** Buhl, 2009

Distribution in India: Mettap: Idukki (Kerala)

Genus *Trichacoides* Dodd, 1914

127. ***Trichacoides indicus*** Jackson, 1968

Host: *Procontarinia matteiana* Kieffer & Cecconi on *Mangifera indica* (mango); cecidomyiid leaf galls (Diptera) on *Mimosops elengi*

Distribution in India: Anand (Gujarat); Malabar Christian College: Kozhikode (Kerala)

128. ***Trichacoides rugosiscutellum*** (Buhl), 1995

Distribution in India: Mangaladevi: Periyar Tiger Reserve: Idukki (Kerala); Kakkayam: Kozhikode (Kerala); Kakkayam: Kozhikode (Kerala)

129. ***Trichacoides randanabettensis*** Veenakumari and Buhl, 2013

Distribution in India: Ranganathaswamy Betta: Tumkur (Karnataka); Nandi Hills: Chikkaballapur (Karnataka)

130. ***Trichacoides levigatus*** sp. nov.

Distribution in India: University of Calicut: Malappuram (Kerala)

Genus *Trichacis* Förster, 1856

131. ***Trichacis khajjiara*** Mani, 1975

Distribution in India: Kahjjiar (Himachal Pradesh)

CHAPTER V

SIGNIFICANT FINDINGS

The list of new species, new records (Table 5. 1) and significant findings (Figure 5. 4) of the present study are given below:

Table 5. 1. New species and new records in subfamilies Platygastrinae and Sceliotrachelinae

Sub family	Species	
	New species	**New records**
Platygastrinae	1. *Amblyaspis shivanki* sp. nov. 2. *Inostemma parvocornus* sp. nov. 3. *Iphitrachelus neogracilis* sp. nov. 4. *Iphitrachelus shajii* sp. nov. 5. *Leptacis lata* sp. nov. 6. *Leptacis manii* sp. nov. 7. *Leptacis pilosa* sp. nov. 8. *Leptacis robusta* sp. nov. 9. *Leptacis tenuispinae* sp. nov. 10. *Platygaster caudata* sp. nov. 11. *Platygaster kesaavrita* sp. nov. 12. *Platygaster neogalbus* sp. nov. 13. *Platygaster reticulates* sp. nov. 14. *Platygaster rusticus* sp. nov. 15. *Trichacoides shivanki* sp. nov. 16. *Amblyaspis emarginata* Anjana and Rajmohana ★ 17. *Amblyaspis hirsuta* Anjana and Rajmohana ★ 18. *Amblyaspis narendrani* Anjana and Rajmohana ★ 19. *Gastrotrypes keralensis* Anjana and Rajmohana ★	**From India** 1. *Leptacis atturensis* Mukerjee 2. *Leptacis pulla* Buhl 3. *Leptacis tegulata* Buhl 4. *Leptacis transoceanica* Buhl 5. *Platygaster achterbergiana* Buhl 6. *Synopeas ventricosum* Buhl 7. *Synopeas westwoodi* Buhl 8. *Trichacoides ranganabettensis* Veenakumari and Buhl **From Kerala** 1. *Amblyaspis ashmeadi* Veenakumari and Buhl 2. *Anectadius striolatus* Kieffer 3. *Gastrotrypes vindhyensis* (Mukerjee) 4. *Inostemma apsyllae* Austin 5. *Inostemma berijamum* Mani 6. *Inostemma indicum* Mani 7. *Leptacis maldarensis* Mukerjee 8. *Platygaster neostriatitergites* Veenakumari and Buhl 9. *Synopeas chamoliana* Mukerjee 10. *Synopeas indicum* Mani 11. *Trichacoides indicus* Jackson 12. *Trichacoides rugosiscutellum* Buhl
Sceliotrachelinae	**New species**	**New species records from Kerala**
	1. *Allotropa shobhanae* sp. nov. 2. *Allotropa shyama* sp. nov. 3. *Isolia keralensis* sp. nov.	1. *Fidiobia nagarajae* Veenakumari, Buhl and Rajmohana 2. *Isolia indica* Buhl

★New species published as a part of this work

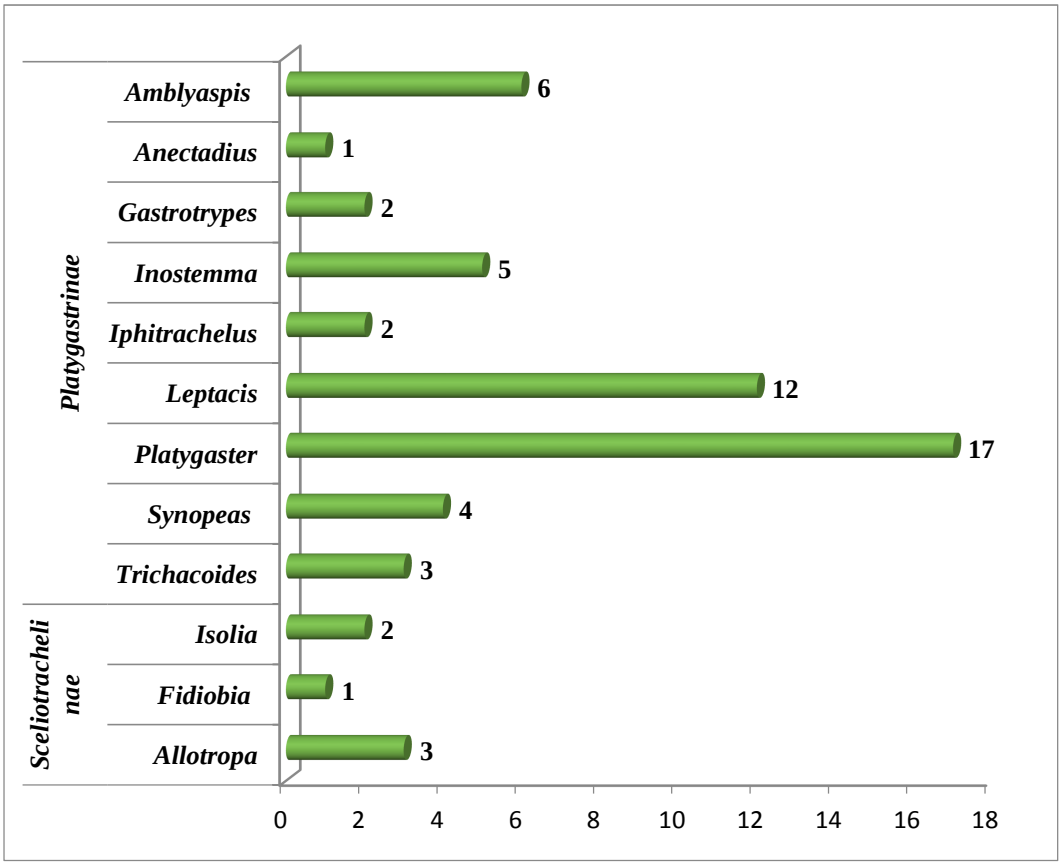


Figure 5. 1. Total number of species treated under each subfamily and genus

- **New species and new reports**

This work brings to light 22 new species (Table 5. 1) under the two subfamilies Platygastrinae and Sceliotrachelinae (18 unpublished, 4 published). Apart from the 6 genera reported earlier, this work reports 6 more genera from Kerala. Also, 8 species from India and 22 species from Kerala are reported for the first time.

- **First report of the female of three species from the World**

Only male of the following species were known from the World till date.

✓ *Leptacis atturensis* Mukerjee

- ✓ *Leptacis maldarensis* Mukerjee
- ✓ *Platygaster neostriatitergites* Veenakumari and Buhl

The females of the above three species are reported from the World for the first time. *Leptacis atturensis* (Plate 27) was collected from Pambadum shola, Idukki; Kakkayam, Kozhikode; Mavoor, Kozhikode, *Leptacis maldarensis* (Plate 29) from Kakkayam, Kozhikode; and *Platygaster neostriatitergites* (Plate 46) was collected from 9 localities of 6 districts in Kerala.

- **First report of the male of *Platygaster luteipes* Buhl from the world**

Only female of species *Platygaster luteipes* Buhl was known to the world. This investigation also resulted in the first report of male sex of *Platygaster luteipes* Buhl from India which was reared from the leaf galls of black pepper, collected from various localities of Trivandrum district.

- **First report of *Iphitrachelus lar* Haliday from Kerala**

Even though mentions of *Iphitrachelus lar* Haliday from India were made by Megyaszai (1999), no proper description of this species was made. The present investigation could document this species from India, also reporting it for the first time from Kerala (specimen studied was male). The specimen was collected from Ranipuram, Kasargod district.

- **Parasitoid- Host plant association obtained during the study (from Kerala)**

10 parasitoid- host plant associations were recorded as a part of this study (Table 4. 3). The parasitoids were found emerged from the galls of unknown cecidomyiids.

- ***Holotypes* studied as a part of this study**

Since *Holotype* study is one of the most important part of any taxonomic research, type specimens at NBAIR, Bangalore (21 no. s) and ZSI, Kozhikode (13 no. s) were studied in detail while erecting new species in this study and 7 species were re-described by studying the *Holotypes* at ZSI, WGRC, Kozhikode.

***Holotypes* studied at NBAIR**

1. *Allotropa gundlupetensis* Veenakumari and Buhl
2. *Allotropa vanajae* Veenakumari and Buhl
3. *Allotropa nigra* Veenakumari and Buhl
4. *Amblyaspis fabrei* Veenakumari and Buhl
5. *Amblyaspis khasiana* Veenakumari and Buhl
6. *Amblyaspis panhalensis* Veenakumari and Buhl
7. *Amblyaspis charvakae* Veenakumari and Buhl
8. *Amblyaspis tipusultani* Veenakumari and Buhl
9. *Amblyaspis ashmeadi* Veenakumari and Buhl
10. *Amblyaspis kurinjii* Veenakumari and Buhl
11. *Amitus kiefferi* Veenakumari and Buhl
12. *Amitus sikkimensis* Veenakumari and Buhl
13. *Fidiobia virakthamati* Veenakumari, Buhl and Rajmohana
14. *Gastrotrypes longicaudatus* Veenakumari and Buhl
15. *Gastrotrypes manii* Veenakumari and Buhl
16. *Isolia kalingae* Veenakumari and Buhl
17. *Platygaster neostriatitergites* Veenakumari and Buhl
18. *Synopeas aitkeni* Veenakumari and Buhl
19. *Synopeas dohertyi*Veenakumari and Buhl

20. *Synopeas* (*Sactogaster*) *ribhoiense* Veenakumari and Buhl

21. *Trichacoides ranganabettensis* Veenakumari and Buhl

***Holotypes* studied at ZSI, Kozhikode**

1. *Amitus keralensis* Ushakumari
2. *Anopedias aguilus* Ushakumari
3. *Anopedias novissimus* Ushakumari
4. *Isostasius malabaricus* Ushakumari
5. *Leptacis keralensis* Ushakumari and Narendran
6. *Leptacis malabarensis* Ushakumari and Narendran
7. *Platygaster galbus* Ushakumari
8. *Platygaster keralicus* Ushakumari
9. *Platygaster narendrani* Ushakumari
10. *Platygaster nigrocoxatus* Ushakumari
11. *Platygaster sasii* Ushakumari
12. *Platygaster tanus* Ushakumari
13. *Platygaster zantanus* Ushakumari

- **Generic/ Species Transfers**

Some generic/species transfers were made studying the *Holotypes* of platygastrids in the depository, at Zoological Survey of India, Kozhikode. *Isostasius malabaricus* Ushakumari (Reg. No. ZSI/WGRC/IR.INV.4580) was found to be *Inostemma apsyllae* Austin (Plate19) on detailed study under high magnification (160 x). Also, *Amitus keralensis* Ushakumari (Reg. No. ZSI/WGRC/IR.INV.6807) was found to be *Gastrotrypes* sp. while *Anopedias aguilus* Ushakumari (Reg. No. ZSI/WGRC/ IR.INV.6808) and *Anopedias novissimus* Ushakumari (Reg. No. ZSI/WGRC/ IR.INV.6809) have been transferred to *Synopeas* sp.

- **Extralimital**

Some reared specimens outside Kerala were identified and studied upto species level and host data of two species were recorded.

✓ A new species of *Amitus* Haldeman (Hymenoptera: Platygastridae: Platygastrinae) emerged from the parasitized puparium of the whitefly *Zaphanera* sp. (Aleyrodidae) on *Vigna trilobata,* was identified and described from Bhiwandi, Mumbai, Maharashtra. A key to Indian species was also prepared (given on cover page).

✓ *Isolia indica* Buhl (Hymenoptera: Platygastridae: Sceliotrachelinae), a parasitoid of whitefly *Aleuroclava grewiae* on *Scolopia crenata* was recorded from Udane, Maharashtra. The host data of this genus is recorded for the first time from the World.

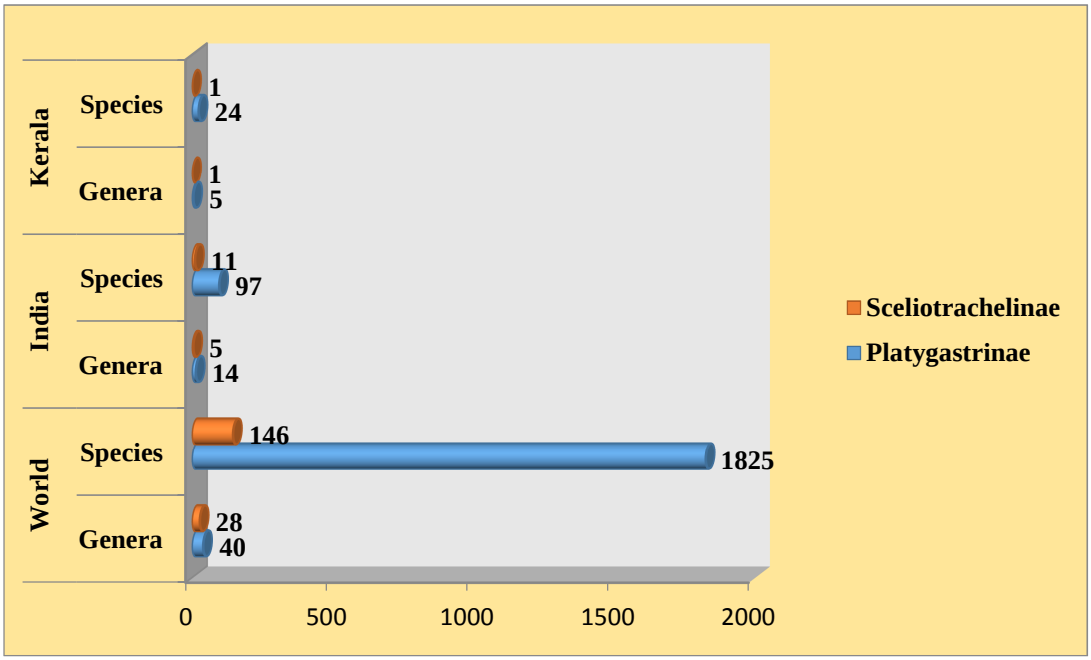


Figure 5. 2. Status of Platygastrinae and Sceliotrachelinae before study

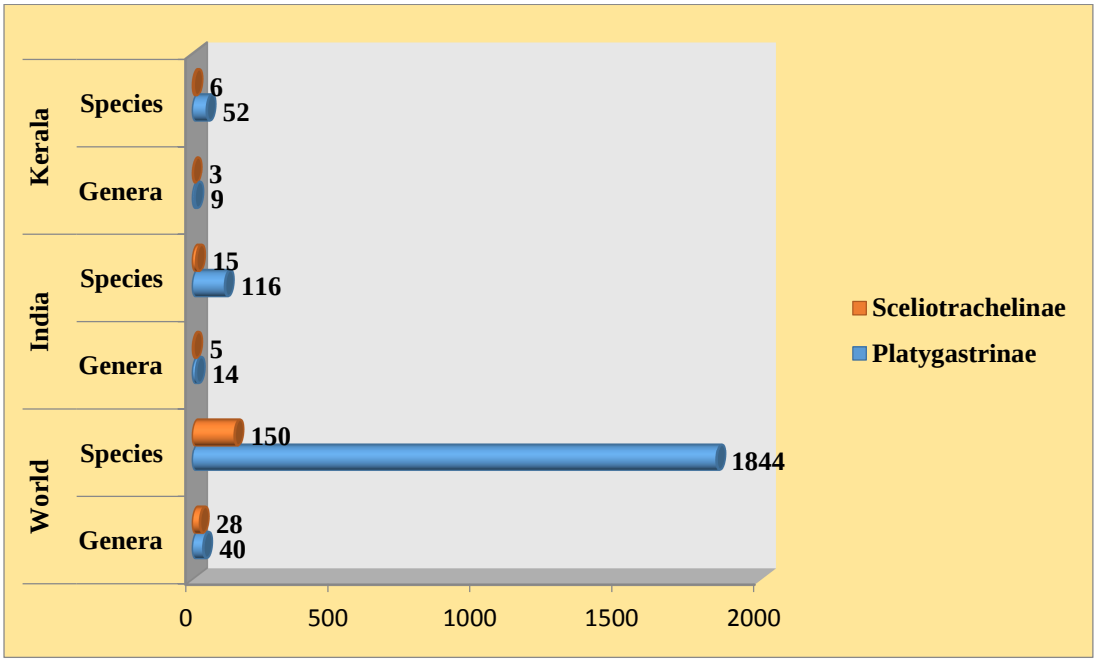


Figure 5. 3. Status of Platygastrinae and Sceliotrachelinae after study

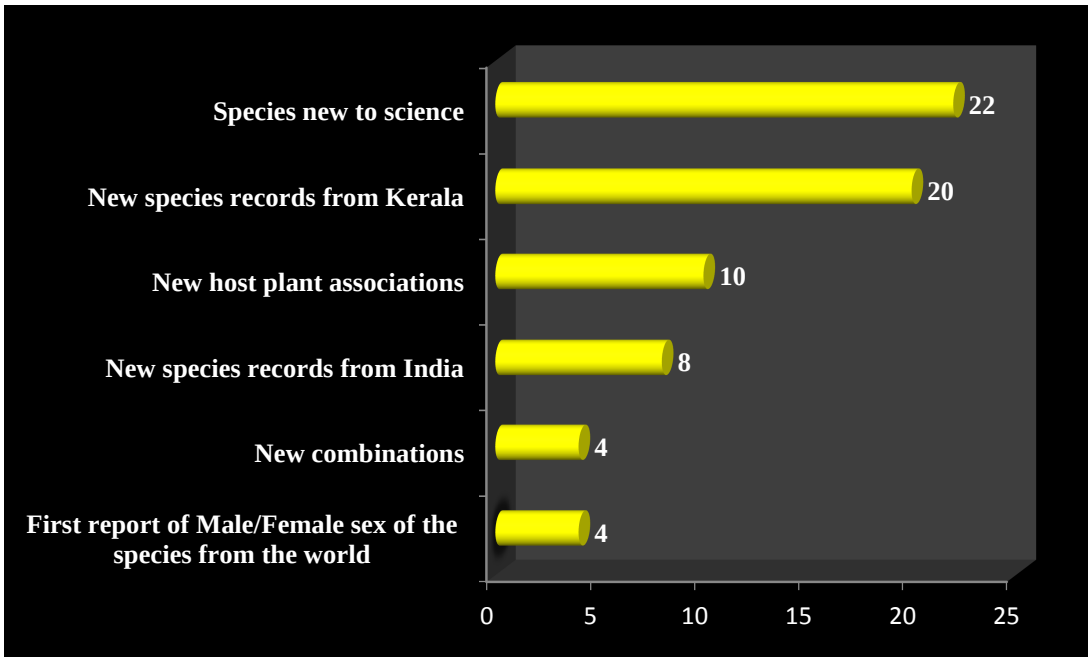


Figure 5. 4. New findings of the study

CHAPTER VI

SUMMARY

Taxonomic studies on the two subfamilies of Platygastridae, viz. Platygastrinae and Sceliotrachelinae of Kerala state were carried out in the present study. The results indicate that an immense diversity is exhibited by subfamily Platygastrinae. Compared to Platygastrinae, subfamily Sceliotrachelinae is represented by lesser number of species indicating their rarity.

Only five genera of subfamily Platygastrinae and one genus of subfamily Sceliotrachelinae was reported earlier from Kerala (Rajmohana 2006; Veenakumari *et al.* 2013). The present investigation revealed the existence of six more genera from Kerala under these two subfamilies.

In this study a total of 58 species have been treated, of which 22 species have been described as new to science.

Table 6. 1. The number of identified genera and species in each subfamily

Subfamily	Total number of genera treated	Total number of species treated	Total number of new species	Generic reports for the first time from Kerala	Species reports for the first time from Kerala	Species reports for the first time from India
Platygastrinae	9	52	19	4	20	8
Sceliotrachelinae	3	6	3	2	2	0

The study has contributed to our knowledge on the taxonomy and as well as biological aspects of the members of these little known subfamilies. Ample scope exists for exploring the hosts of these parasitoids, since only scanty reords are available currently on this group. Molecular investigation can bring more clarity regarding generic and species relationships .

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APPENDIX

COLLECTION LOCALITIES

COLLECTION LOCALITIES WITH CO-ORDINATES				
Sl. No.	**DISTRICT**	**LOCALITIES**	**LATITUDE (^{0} N)**	**LONGITUDE (^{0} E)**
1.	KASARGOD	Idaykkadu	12.43^{0}N	75.20 ^{0}E
2.		Kanjangadu	12.51^{0}N	74.98^{0}E
3.		Punathur	12.51^{0}N	74.98^{0}E
4.		Ranipuram	12.42^{0}N	75.36^{0}E
5.	KANNUR	Aralam	11.96^{0}N	75.77^{0}E
6.		Kolassery	11.77^{0}N	75.49^{0}E
7.	KOZHIKODE	Chelavoor	11.29^{0}N	75.84^{0}E
8.		Janakikaadu	11.63^{0}N	75.86^{0}E
9.		Kakkayam	11.54^{0}N	75.89^{0}E
10		Kakkavayal	11.64^{0}N	76.14^{0}E
11		Kattangal	11.31^{0}N	75.93^{0}E
12.		Malabar Christian College	11.26^{0}N	75.77^{0}E
13.		Marayoor	10.27^{0}N	77.16^{0}E
14.		Mayanad	11.28^{0}N	75.85^{0}E
15.		Mavoor	11.26^{0}N	75.94^{0}E
16.	WAYANAD	Ambukuthi	11.62^{0}N	76.23^{0}E
17.		Chethalayam	11.74^{0}N	76.23^{0}E
18.		Dhasanaghatta	11.7^{0}N	76.08^{0}E
19.		Muthanga	11.66^{0}N	76.36^{0}E

20.	MALAPPURAM	Kozhikode University Campus	11.13^0N	75.89^0E
21.		Chemmad	11.04^0N	75.91^0E
22.		Gajamugam, Nilambur	11.27^0N	76.23^0E
23.		Kottakkal	$11.00\ ^0$N	75.99^0E
24.		Palakkal	10.47^0N	76.21^0E
25.		Vettichira	10.93^0N	76.02^0E
26.	THRISSUR	Chimmony Dam	10.45^0N	76.5^0E
27.		Parampadam	10.85^0N	76.27^0E
28.		Vellanikkara	10.54^0N	76.27^0E
29.	PALAKKAD	Kaatilappara, Nelliyampathy	10.53^0N	76.69^0E
30.		Parambikulam	10.44^0N	76.82^0E
31.		Pattambi	10.8^0N	76.19^0E
32.		Pudunagaram	10.68^0N	76.68^0E
33.		Silent Valley	10.99^0N	76.46^0E
34.	ERNAKULAM	Thoppimudi, Tattekkad	10.1^0N	76.7^0E
35.	ALAPPUZHA	Ambalappuzha	9.37^0N	76.35^0E
36.		Amboori	8.5^0N	77.19^0E
37.		Karumadi	9.38^0N	76.38^0E
38.		Kollakadavu	9.25^0N	76.58^0E

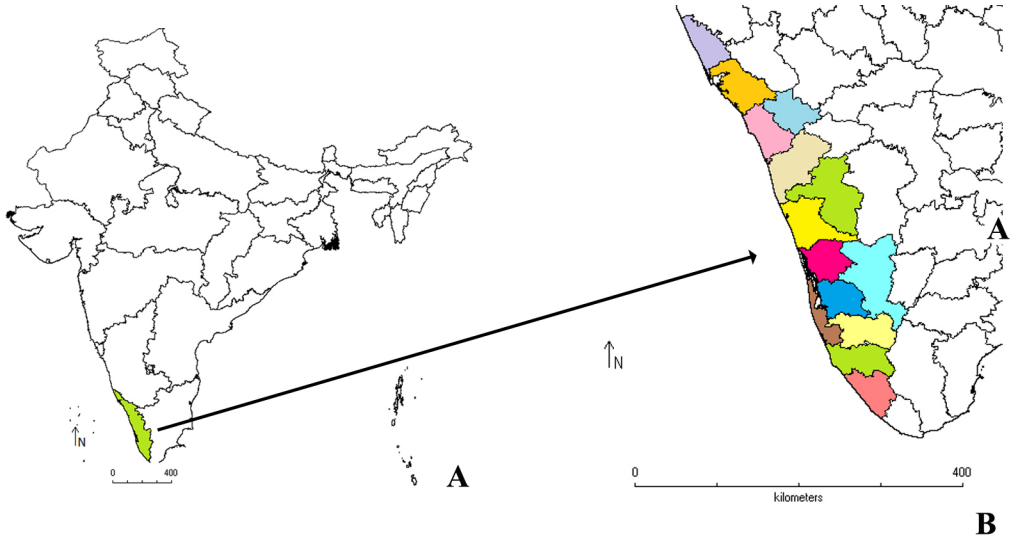
39.	KOTTAYAM	Changanassery	9.44^0N	76.53^0E
40.		Parathodu	9.42^0N	76.67^0E
41.	IDUKKI	Anjuruli	9.76^0N	77.08^0E
42.		Chinnar	9.66^0N	76.99^0E
43.		Eravikulam	10.13^0N	77.05^0E
44.		Manalar, PTR	9.81^0N	76.92^0E
45.		Mannavan Shola	10.2^0N	77.08^0E
46.		Mangaladevi, PTR	9.81^0N	76.92^0E
47.		Mathikettan Shola	9.98^0N	77.24^0E
48.		Mettap	10.3^0N	77.09^0E
49.		Mullaperiyar	9.52^0N	77.14^0E
50.		Munnar	10.08^0N	77.05^0E
51.		Pambadum shola	10.14^0N	77.25^0E
52.		Rajmalai shoal	10.13^0N	77.05^0E
53.		Vellimala	9.7^0N	77.16^0E
54.	PATHANAMTHITTA	Gavi	9.43^0N	77.16^0E
55.		Good Rickal Range	9.26^0N	76.78^0E
56.		Pekkavu	9.49^0N	76.66^0E
57.	KOLLAM	Achankovil, Kottavasal	9.09^0N	77.12^0E
58.		Pandimotta	8.85^0N	77.21^0E
59.	TRIVANDRUM	Ayiroor	8.75^0N	76.7^0E
60.		Braemore Estate	8.76^0N	77.09^0E
61.		Pandipath	8.61^0N	77.24^0E
62.		Ponmudi	8.75^0N	77.11^0E
63.		Vellayani	8.43^0N	76.99^0E
64.		Venganoor	8.4^0N	77.01^0E

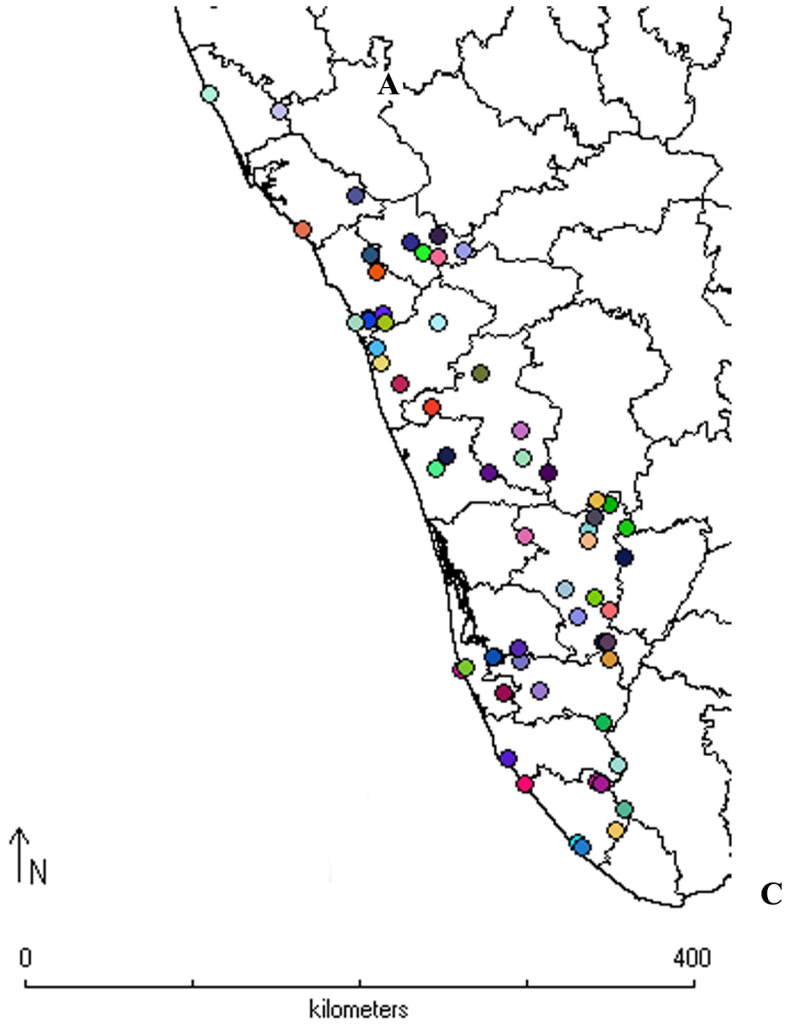
PLATE 2



Figure A. Labomed CZM6 stereo microscope B. Leica M 205A stereo microscope C. Sweeping grasslands in the forest D. Yellow pan traps E. Malaise trap F. Sweepnet G. Aspirator

PLATE 1





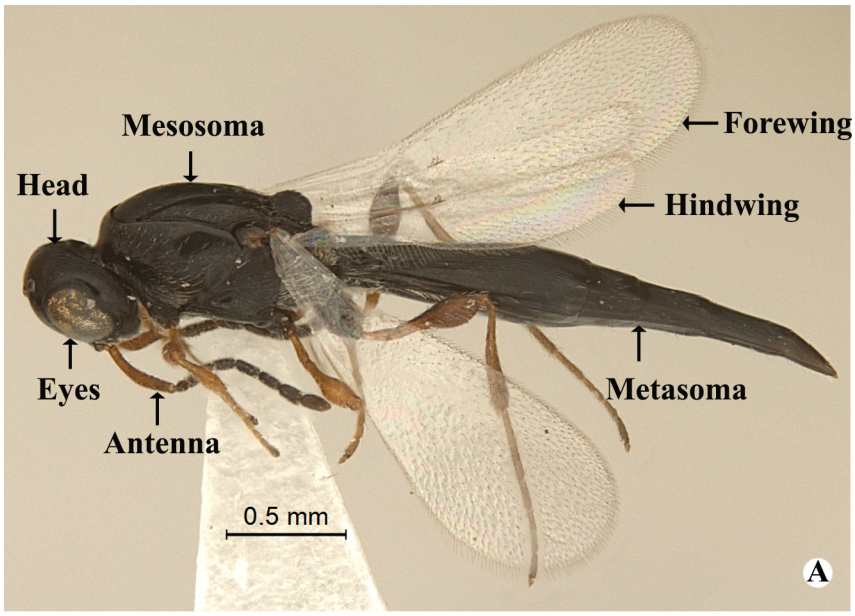
Figures A-B. Map showing study area C. Map indicating collection localities

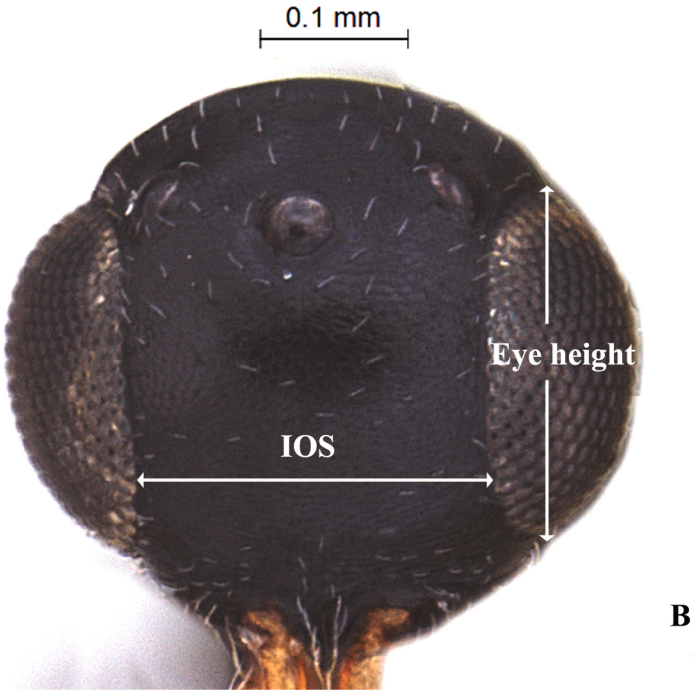
PLATE 3



Figures A- D. Collection areas. A. Shola patches B. Dam side C. Wildlife Sanctuary D. Backyard

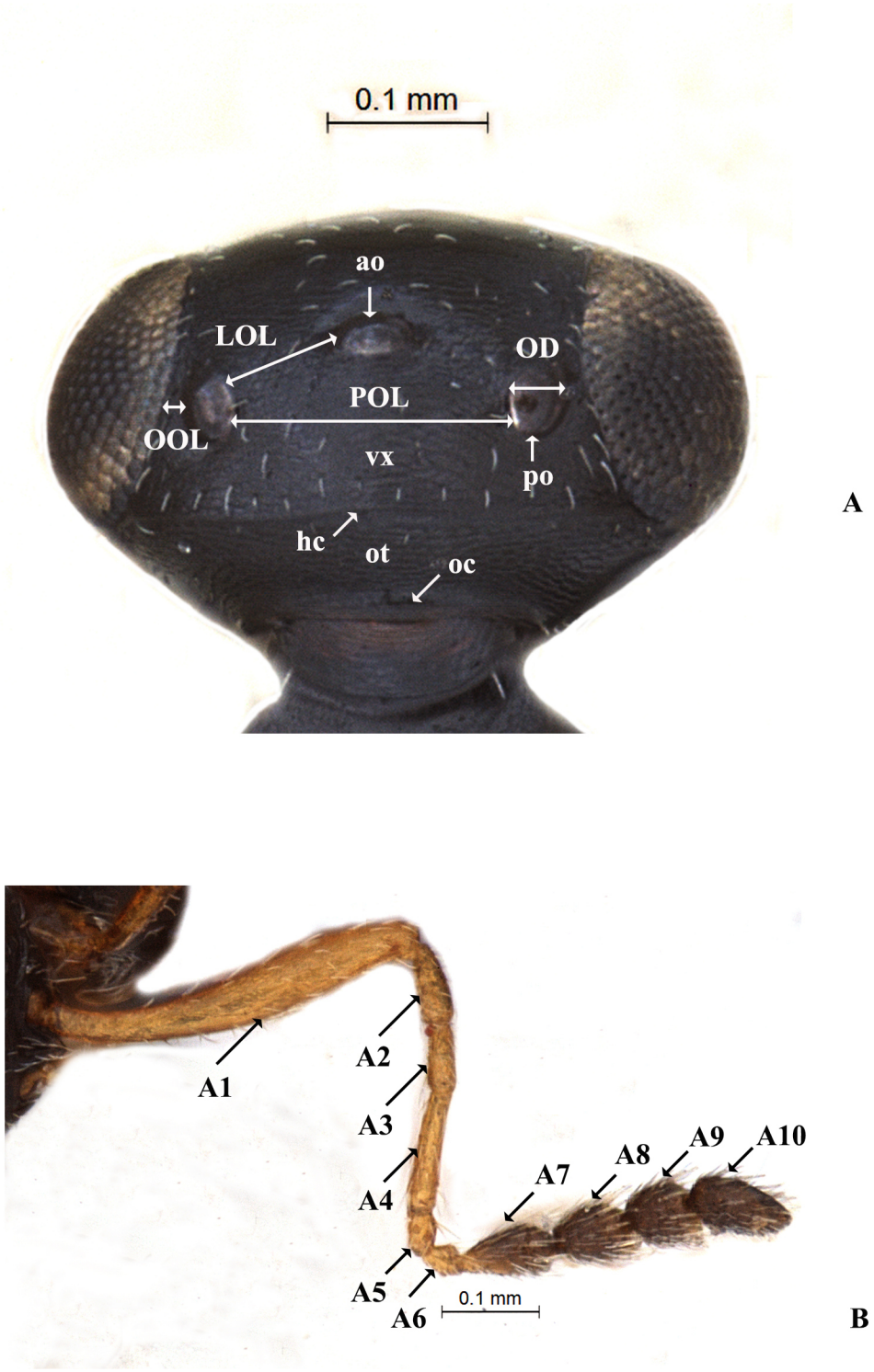
PLATE 4





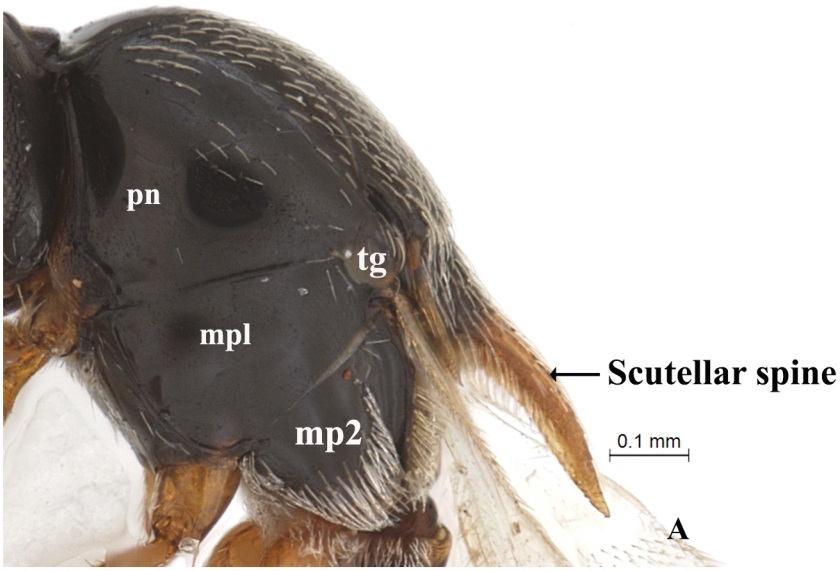
Figures A-B. Taxonomic terminology. A. Habitus B. Head front view

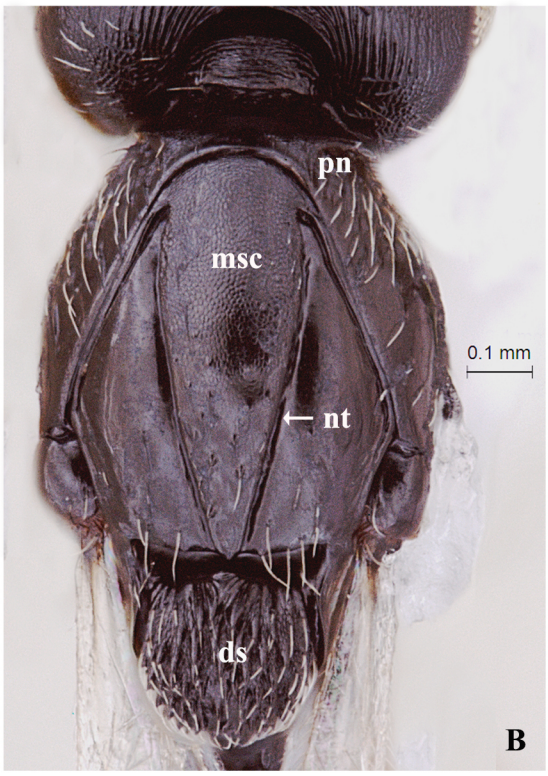
PLATE 5



Figures A- B. Taxonomic terminology. A. Head dorsal view B. Antenna

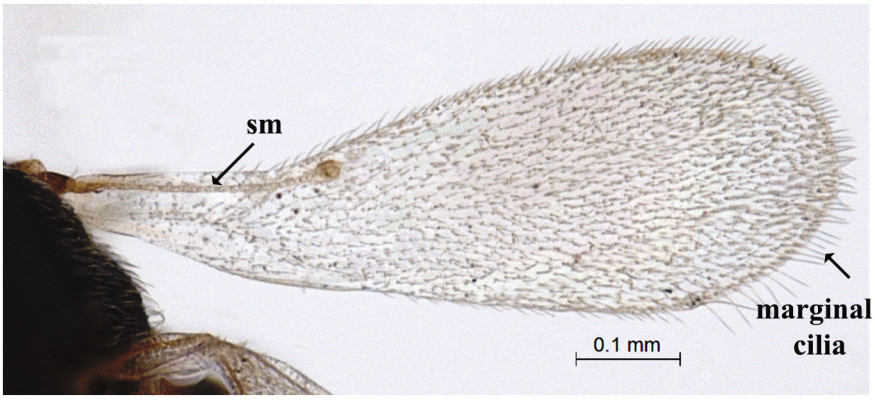
PLATE 6





Figures A-B. Taxonomic terminology A. Mesosoma lateral view B. Mesosoma dorsal view

PLATE 7

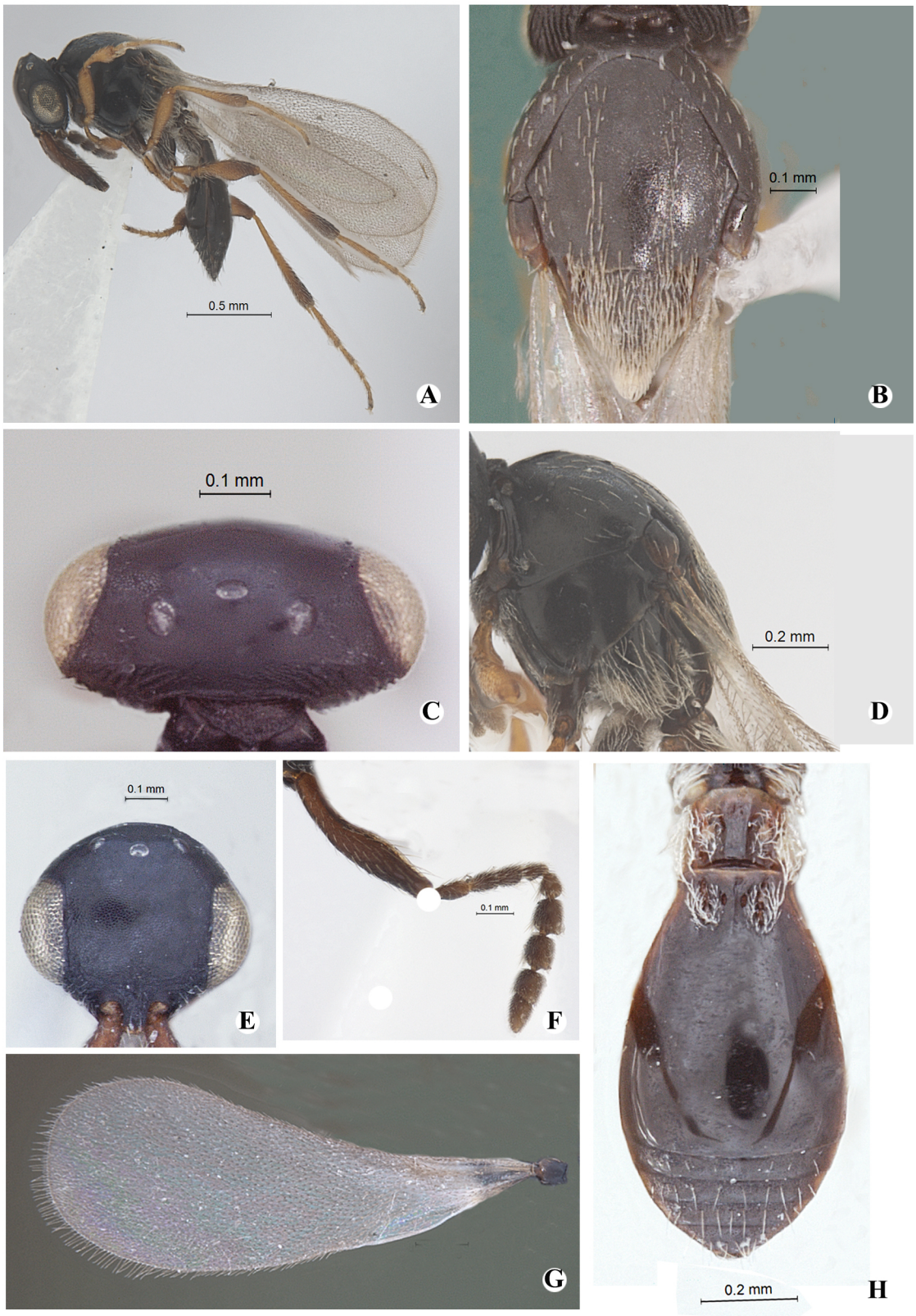


A



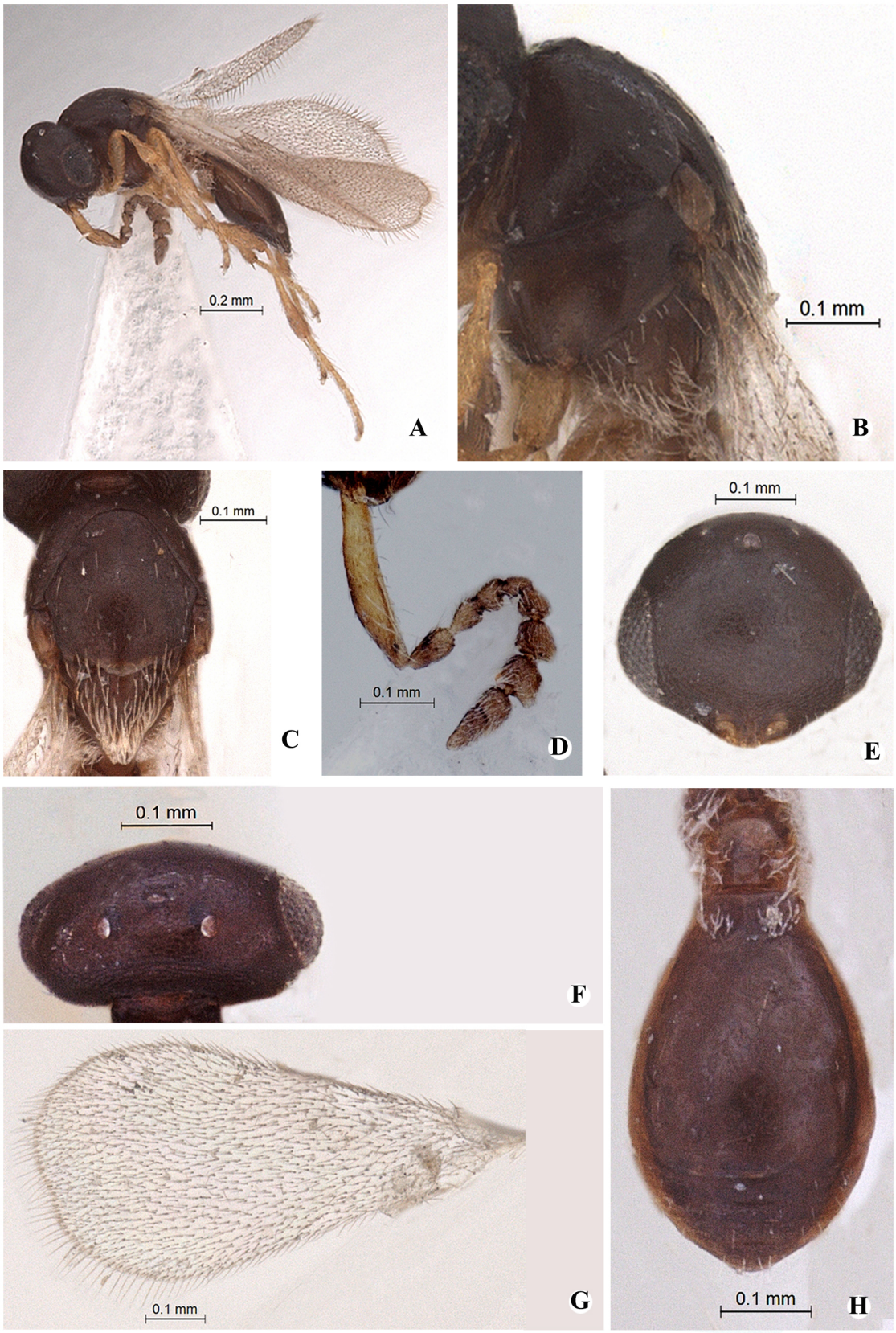
Figures A-B. Taxonomic terminology. A Forewing B. Metasoma dorsal view

PLATE 8



Figures A- H. *Amblyaspis ashmeadi* Veenakumari and Buhl (Female). A. Habitus B. Mesosoma dorsal view C. Head dorsal view D. Mesosoma lateral view E. Head front view F. Antenna G. Forewing H. Metasoma dorsal view

PLATE 9



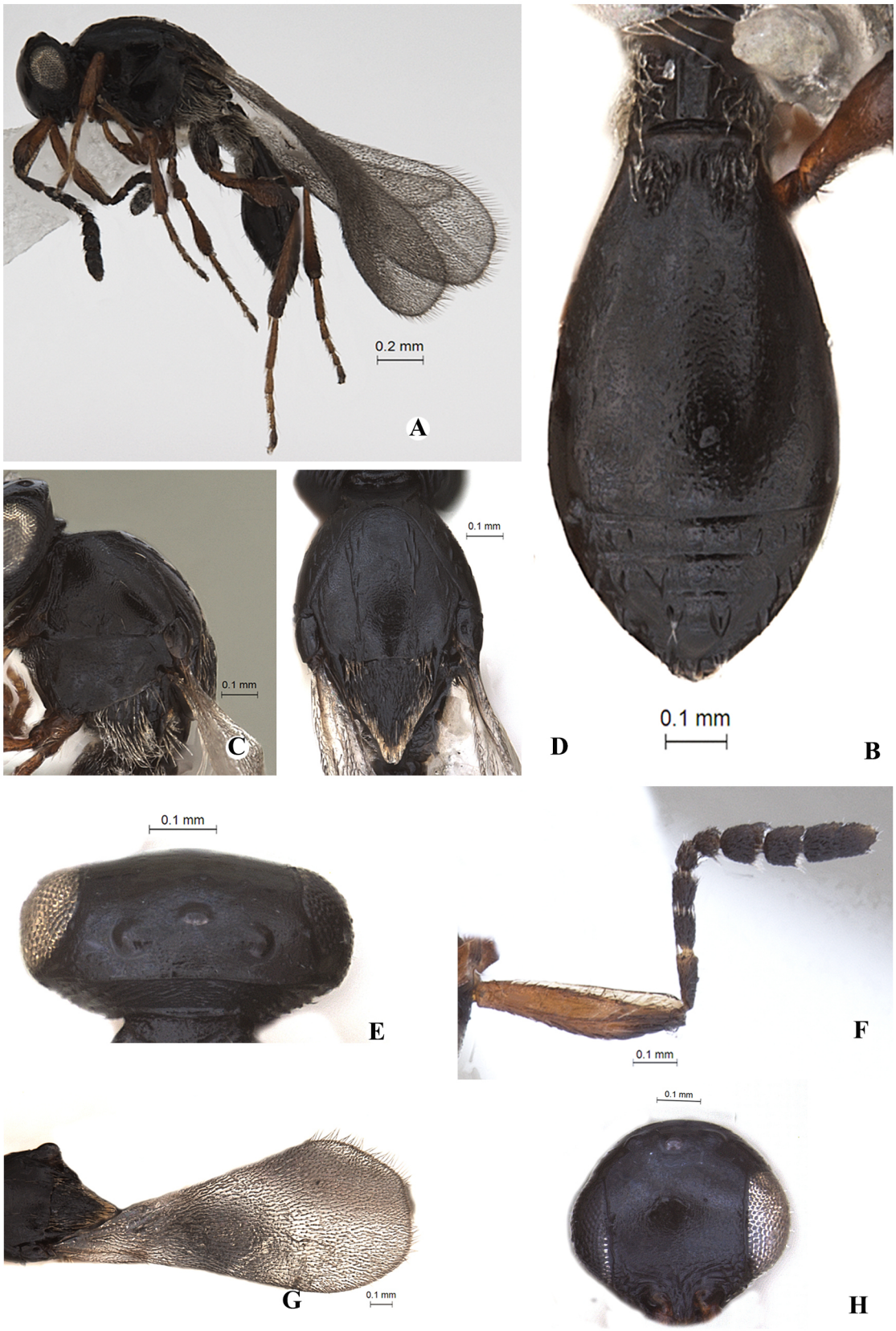
Figures A- H. *Amblyaspis emarginata* Anjana and Rajmohana (Female). A. Habitus B. Mesosoma lateral view C. Mesosoma dorsal view D. Antenna E. Head front view F. Head dorsal view G. Forewing H. Metasoma dorsal view

PLATE 11



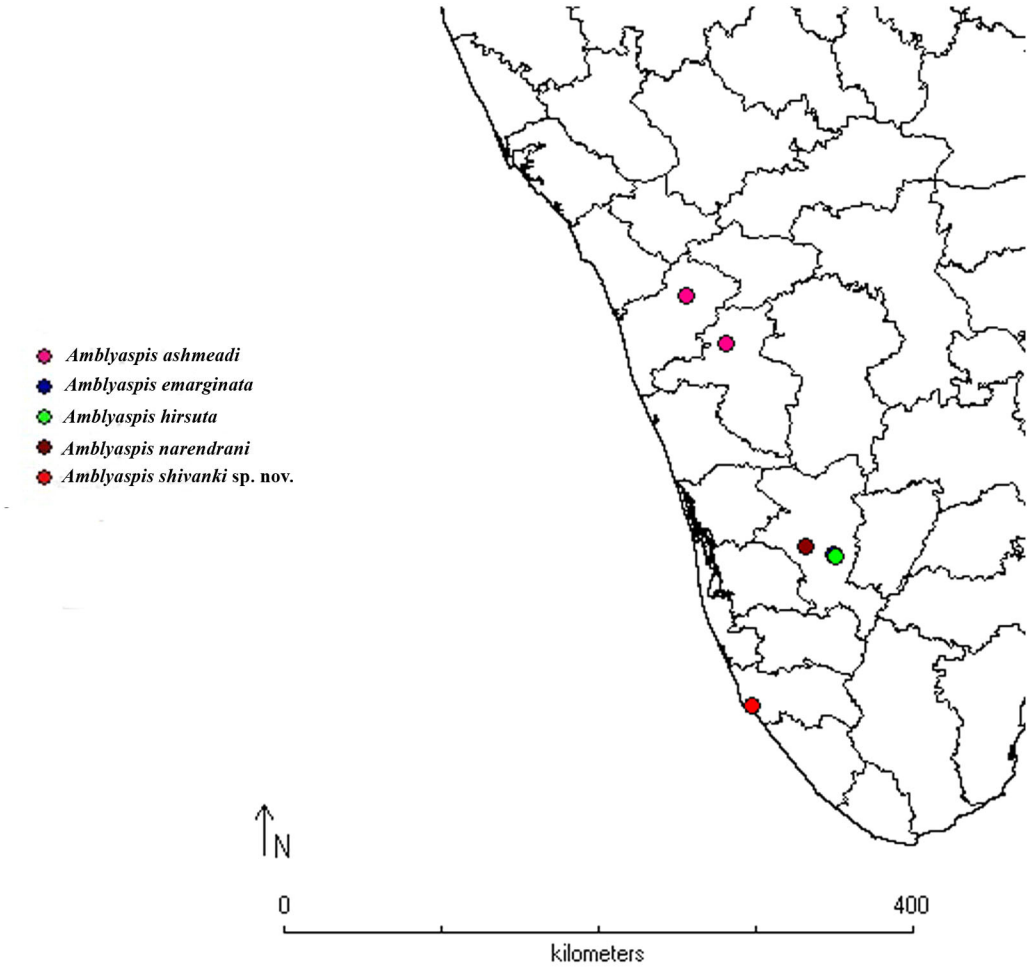
Figures A- H. *Amblyaspis narendrani* Anjana and Rajmohana (Female). A. Habitus B. Metasoma dorsal view C. Head front view D. Head dorsal view E. Mesosoma dorsal view F. Antenna G. Mesosoma lateral view H. Forewing

PLATE 12



Figures A- H. *Amblyaspis shivanki* sp. nov. (Female). A. Habitus B. Metasoma dorsal view C. Mesosoma lateral view D. Mesosoma dorsal view E. Head dorsal view F. Antenna G. Forewing H. Head front view

PLATE 13



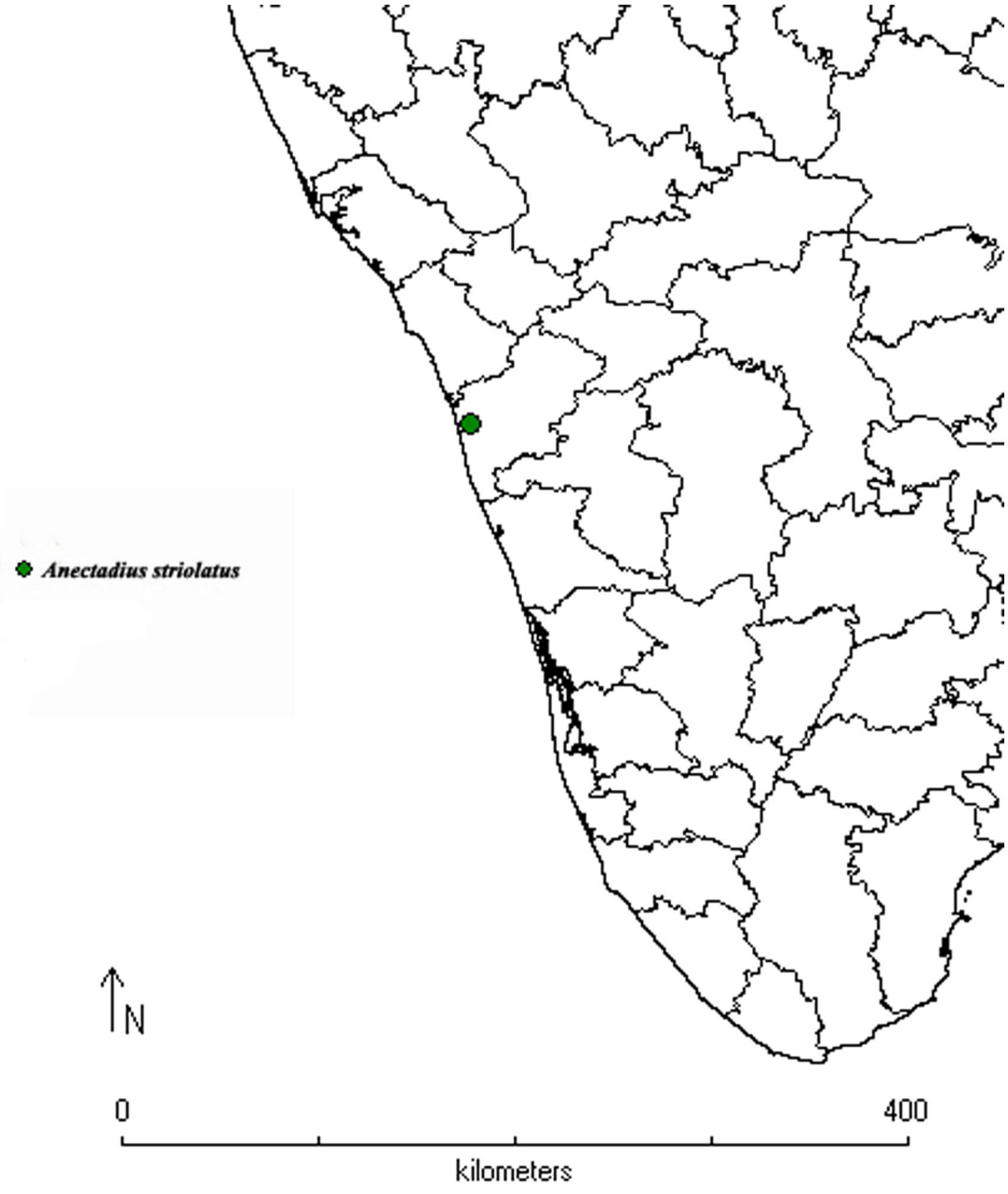
Distribution of genus *Amblyaspis* Förster and its species in Kerala

PLATE 14



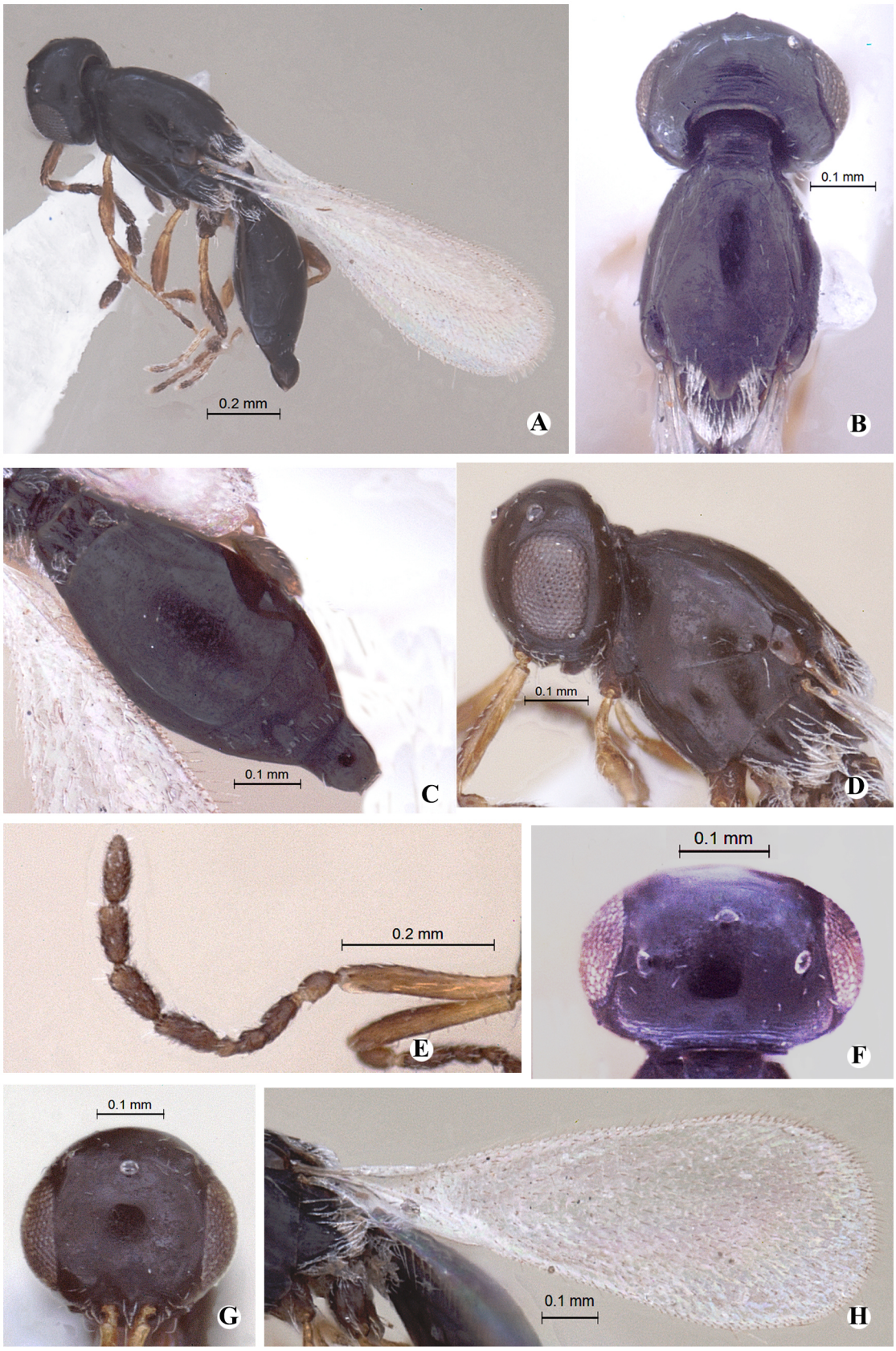
Figures A- H. *Anectadius striolatus* Kieffer (Female). A. Habitus B. Head front view C. Mesosoma dorsal view D. Antenna E. Mesososma lateral view F. Head dorsal view G. Forewing H. Metasoma dorsal view

PLATE 15



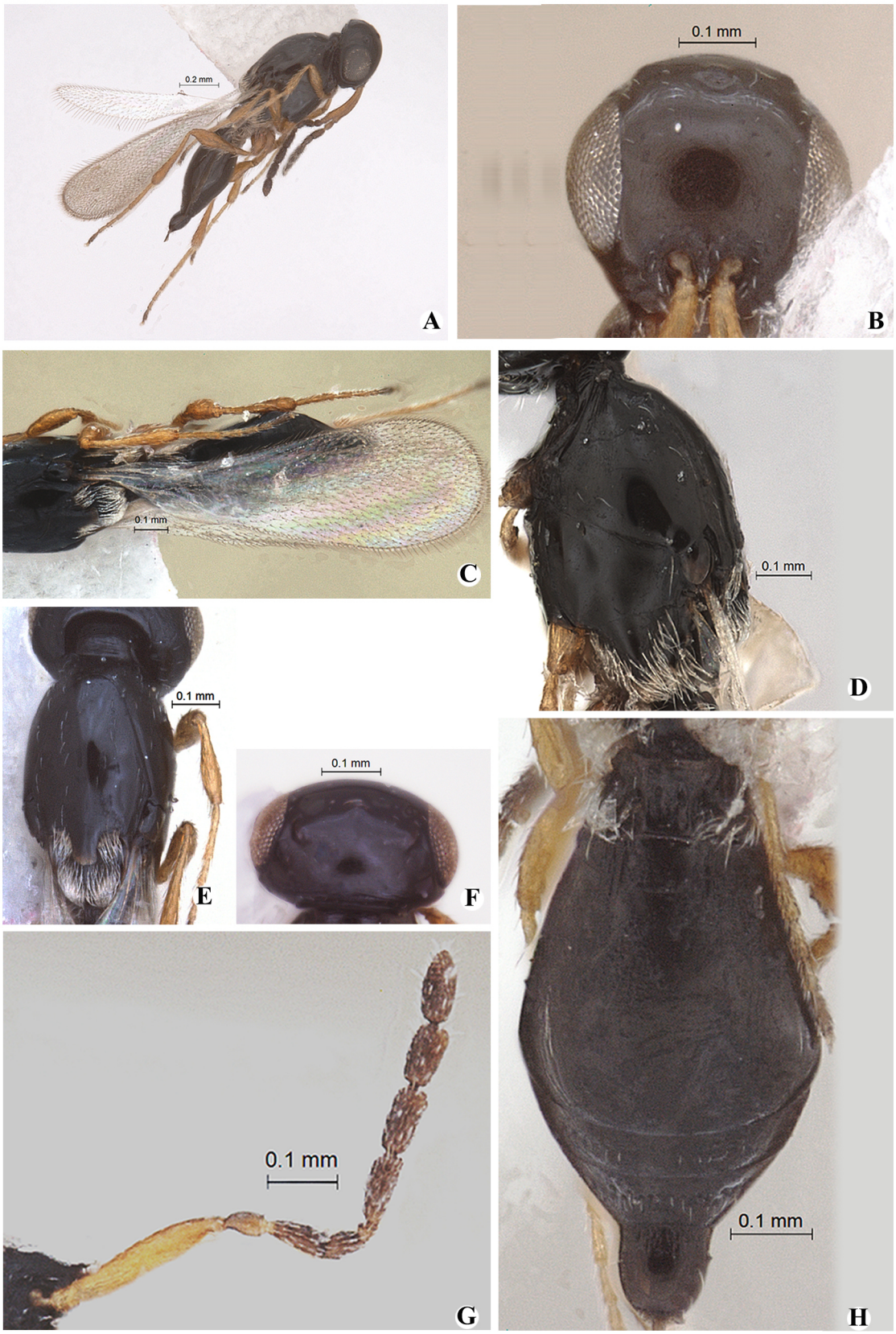
Distribution of genus *Anectadius* Kieffer and its species in Kerala

PLATE 16



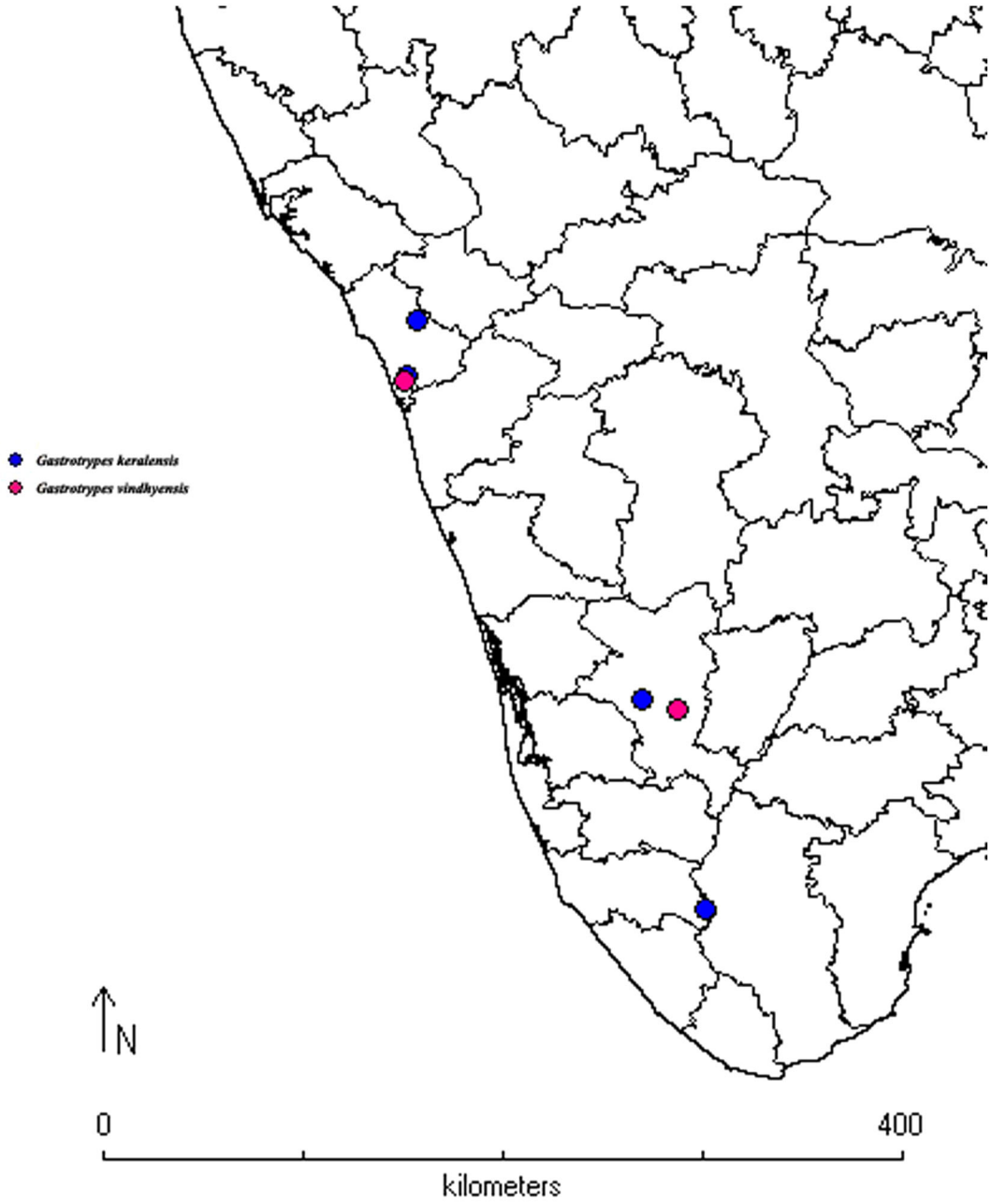
Figures A- H. *Gastrotrypes keralensis* Anjana and Rajmohana (Female). A. Habitus B. Mesosoma dorsal view C. Metasoma dorsal view D. Mesosoma lateral view E. Antenna F. Head dorsal view G. Head front view H. Forewing

PLATE 17



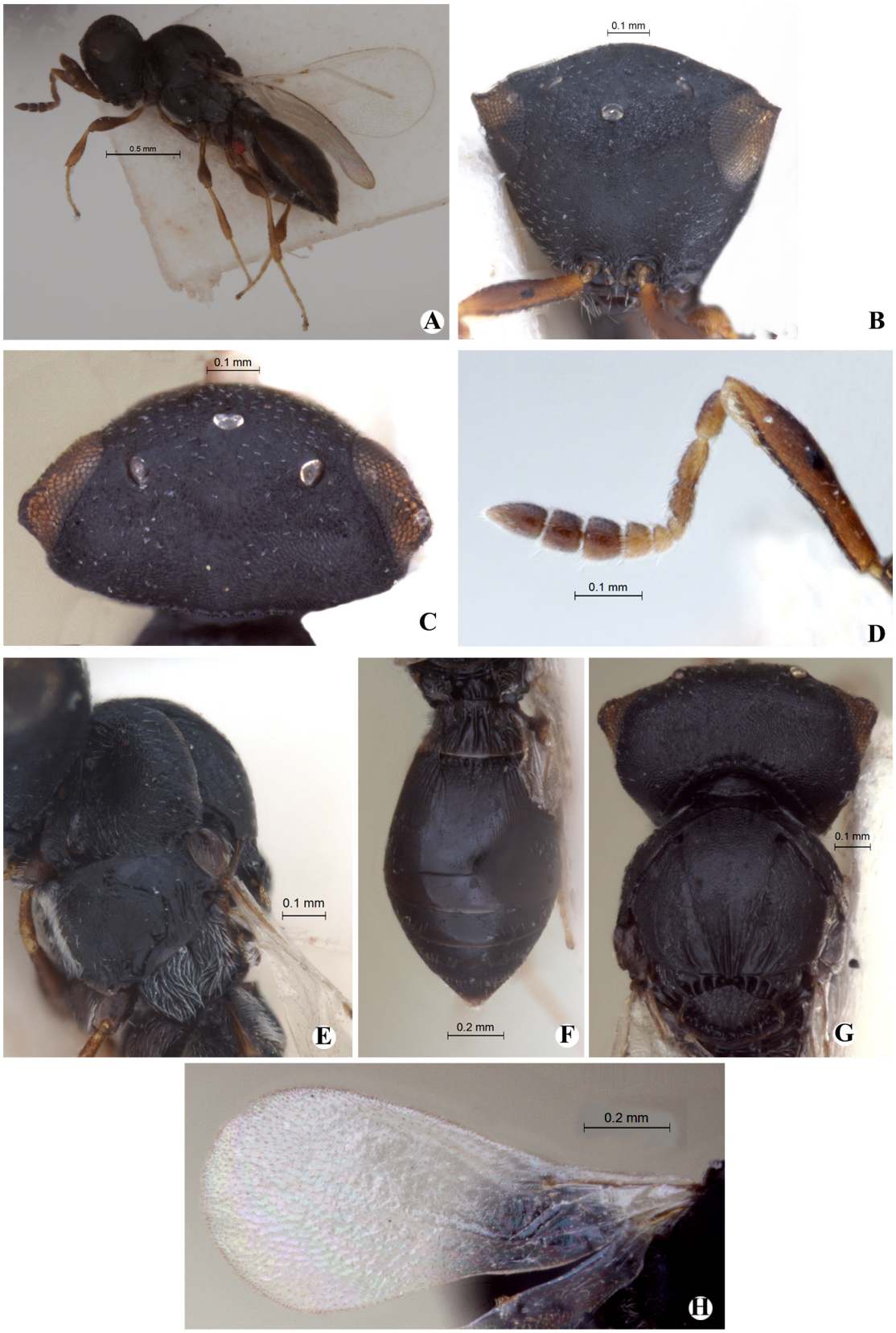
Figures A- H. *Gastrotrypes vindhyensis* Mukerjee (Female). A. Habitus B. Head front view C. Forewing D. Mesosoma lateral view E. Mesosoma dorsal view F. Head dorsal view G. Antenna H. Metasoma dorsal view

PLATE 18



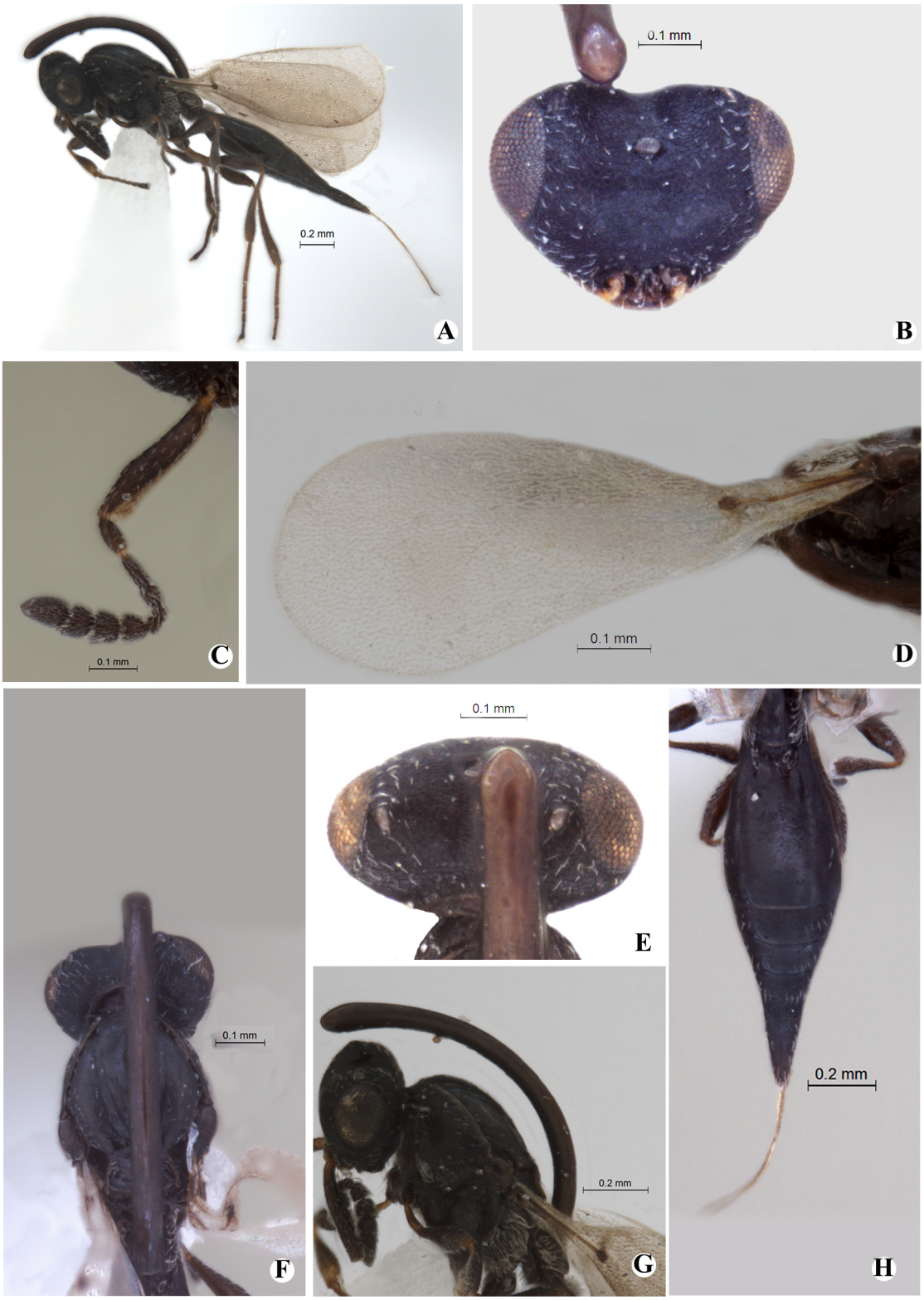
Distribution of genus *Gastrotrypes* Brues and its species in Kerala

PLATE 19



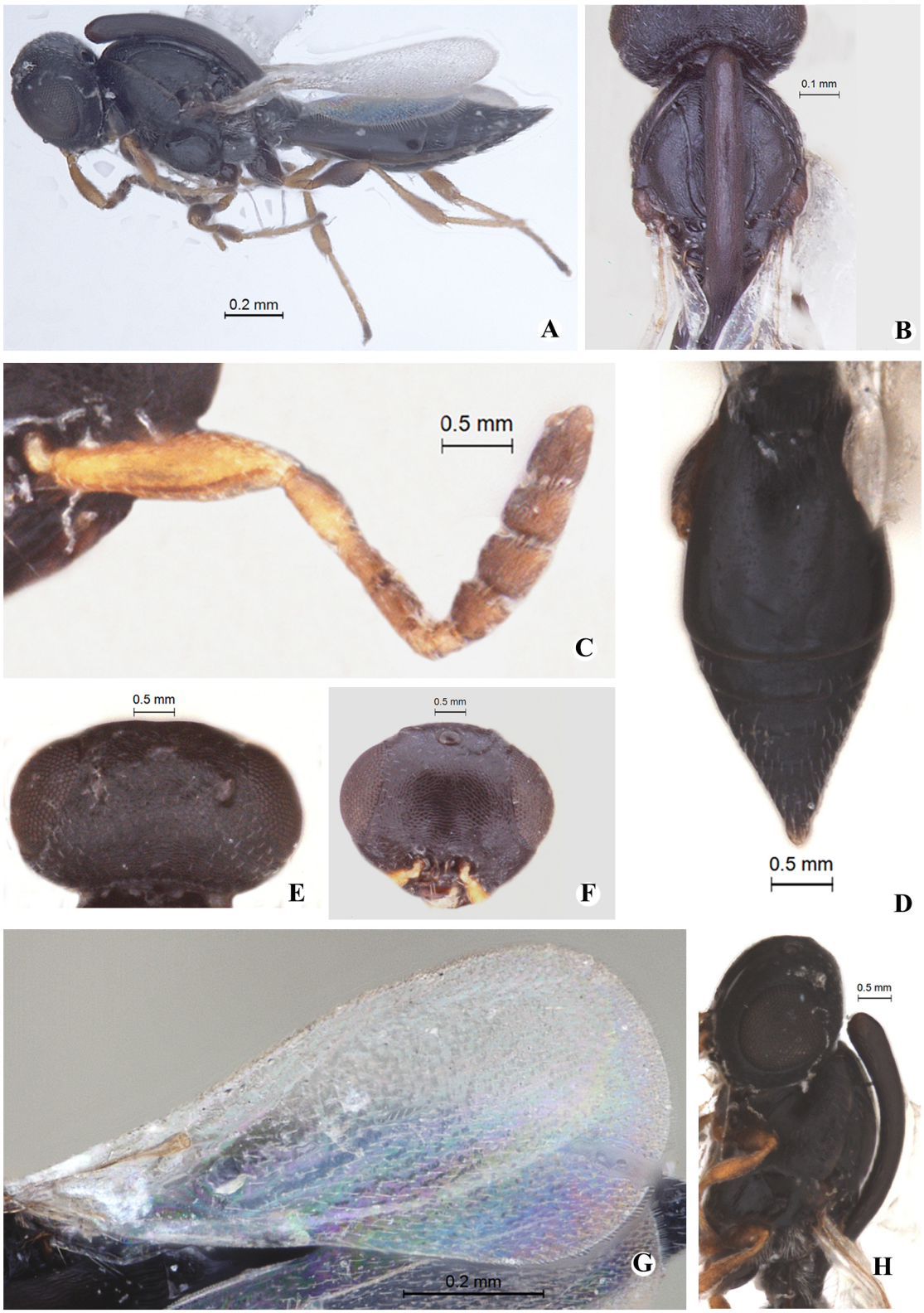
Figures A- H. *Inostemma apsyllae* Austin (Female). A. Habitus B. Head front view C. Head dorsal view D. Antenna E. Mesosoma lateral view F. Metasoma dorsal view G. Mesosoma dorsal view H. Forewing

PLATE 20



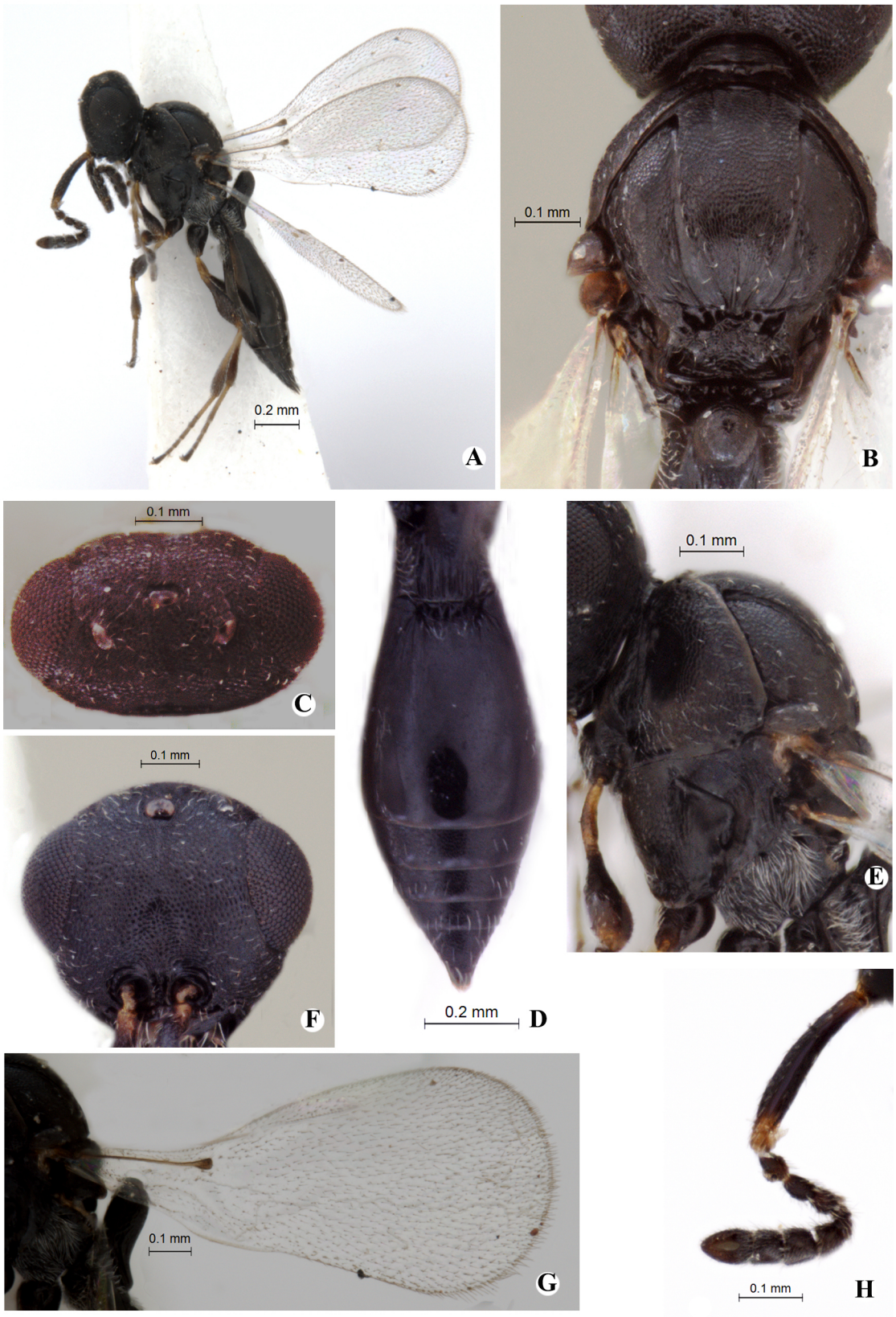
Figures A- H. *Inostemma berijamum* Mani (Female). A. Habitus B. Head front view C. Antenna D. Forewing E. Head dorsal view F. Mesosoma dorsal view G. Mesosoma lateral view H. Metasoma dorsal view

PLATE 21



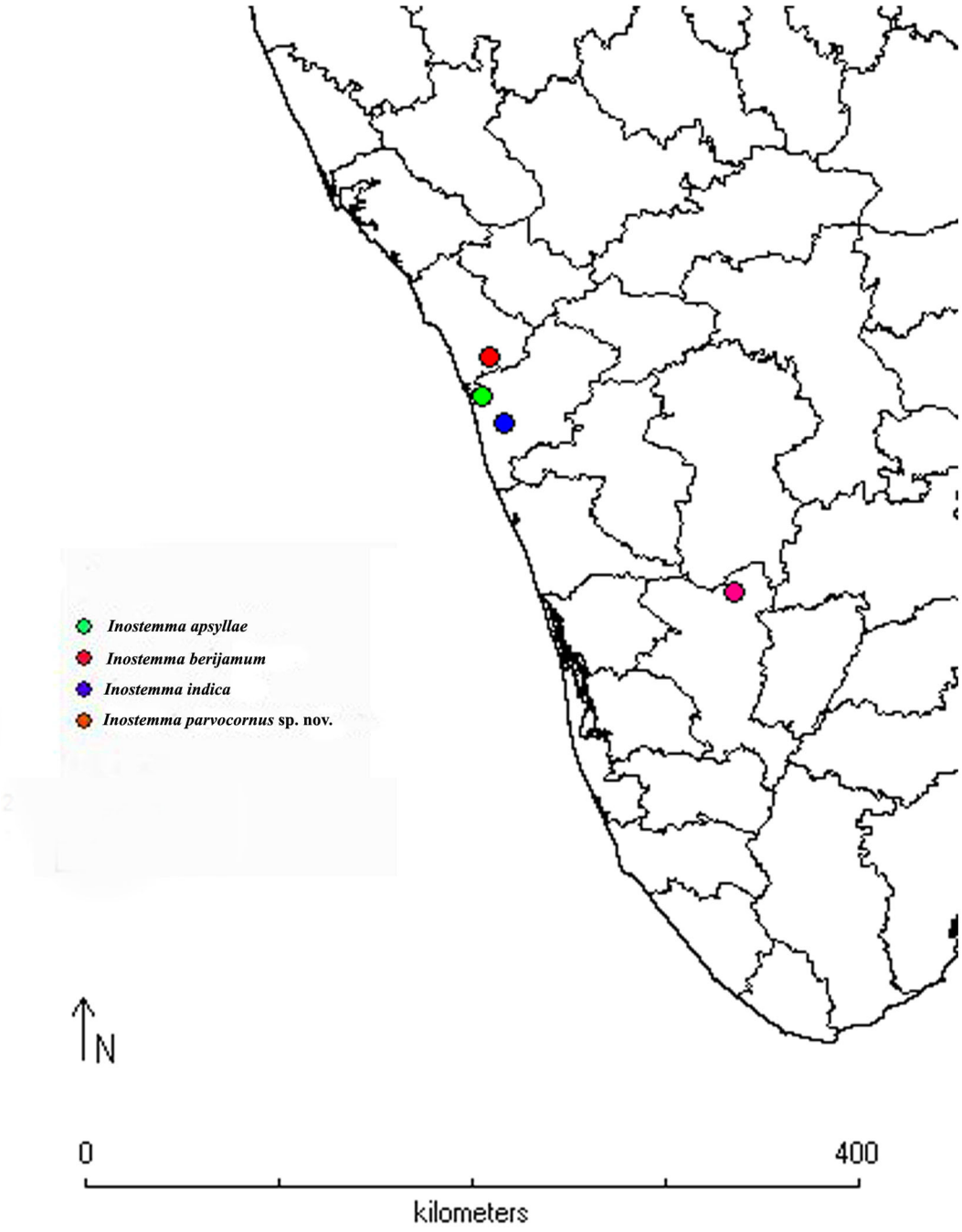
Figures A- H. *Inostemma indicum* Mani (Female). A. Habitus B. Mesosoma dorsal view C. Antenna D. Metasoma dorsal view E. Head dorsal view F. Head front view G. Forewing H. Mesosoma lateral view

PLATE 22



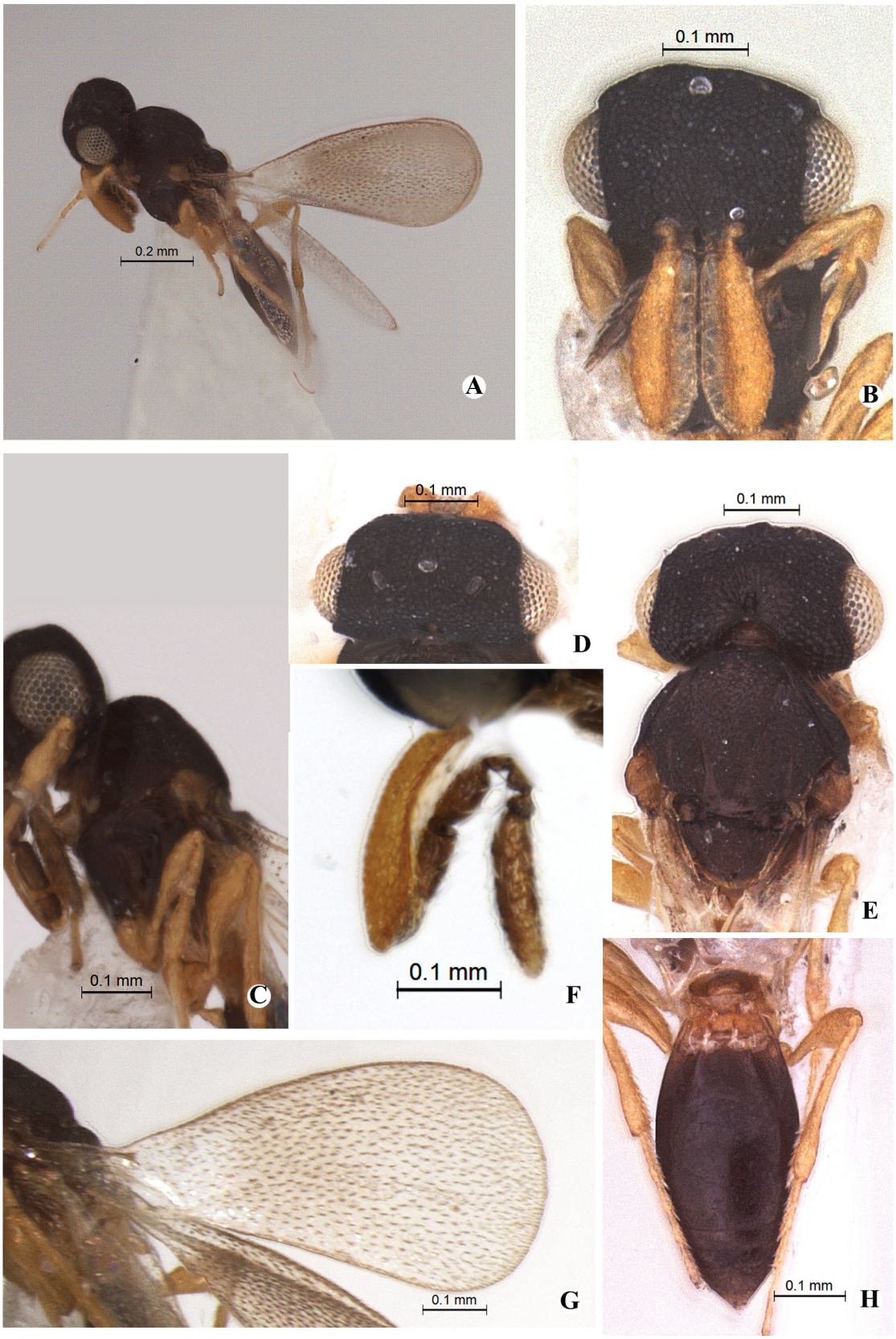
Figures A- H. *Inostemma parvocornus* sp. nov. (Female). A. Habitus B. Mesosoma dorsal view C. Head dorsal view D. Metasoma dorsal view E. Mesosoma lateral view F. Head front view G. Forewing H. Antenna

PLATE 23



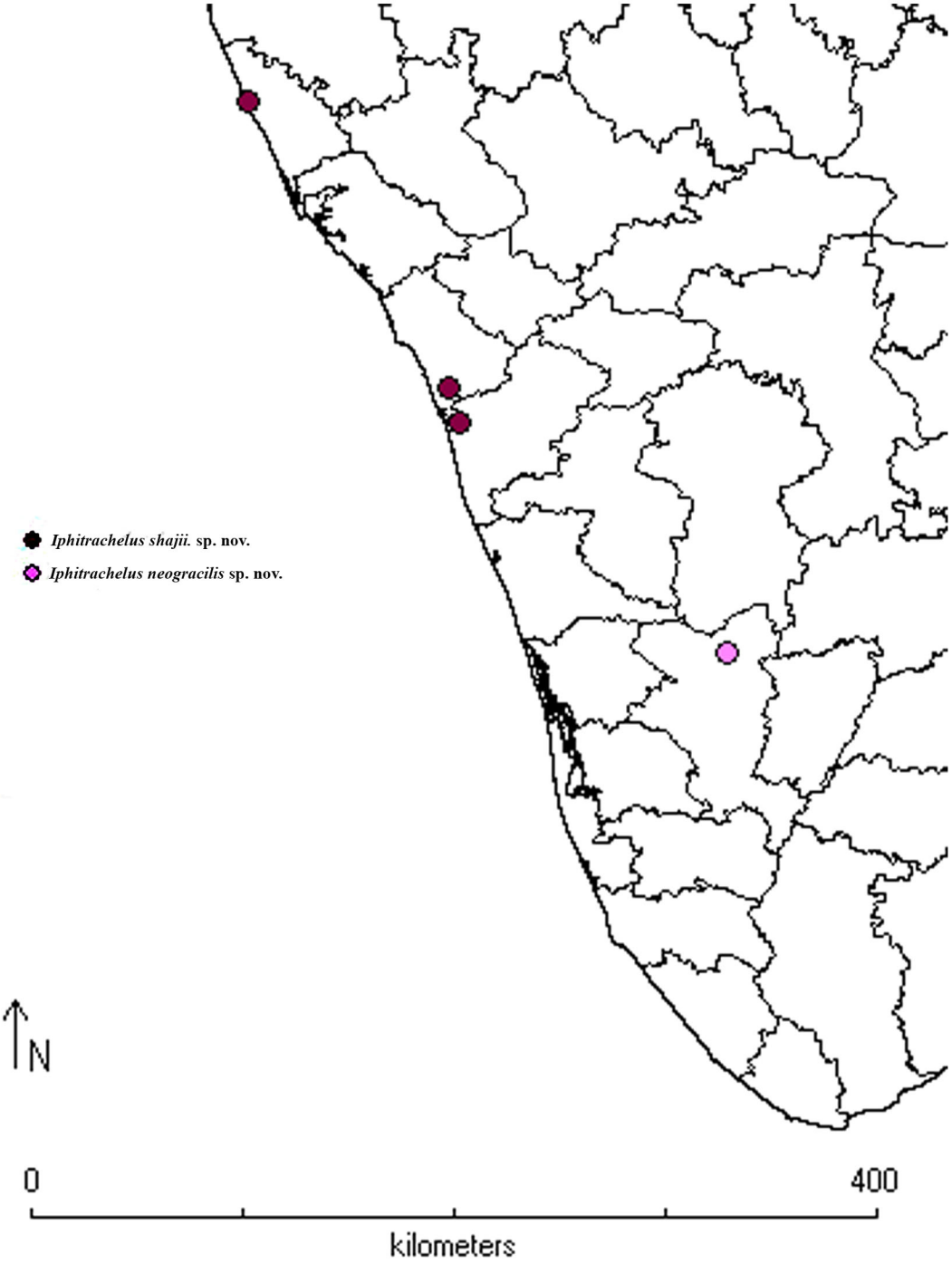
Distribution of genus *Inostemma* Haliday and its species in Kerala

PLATE 25



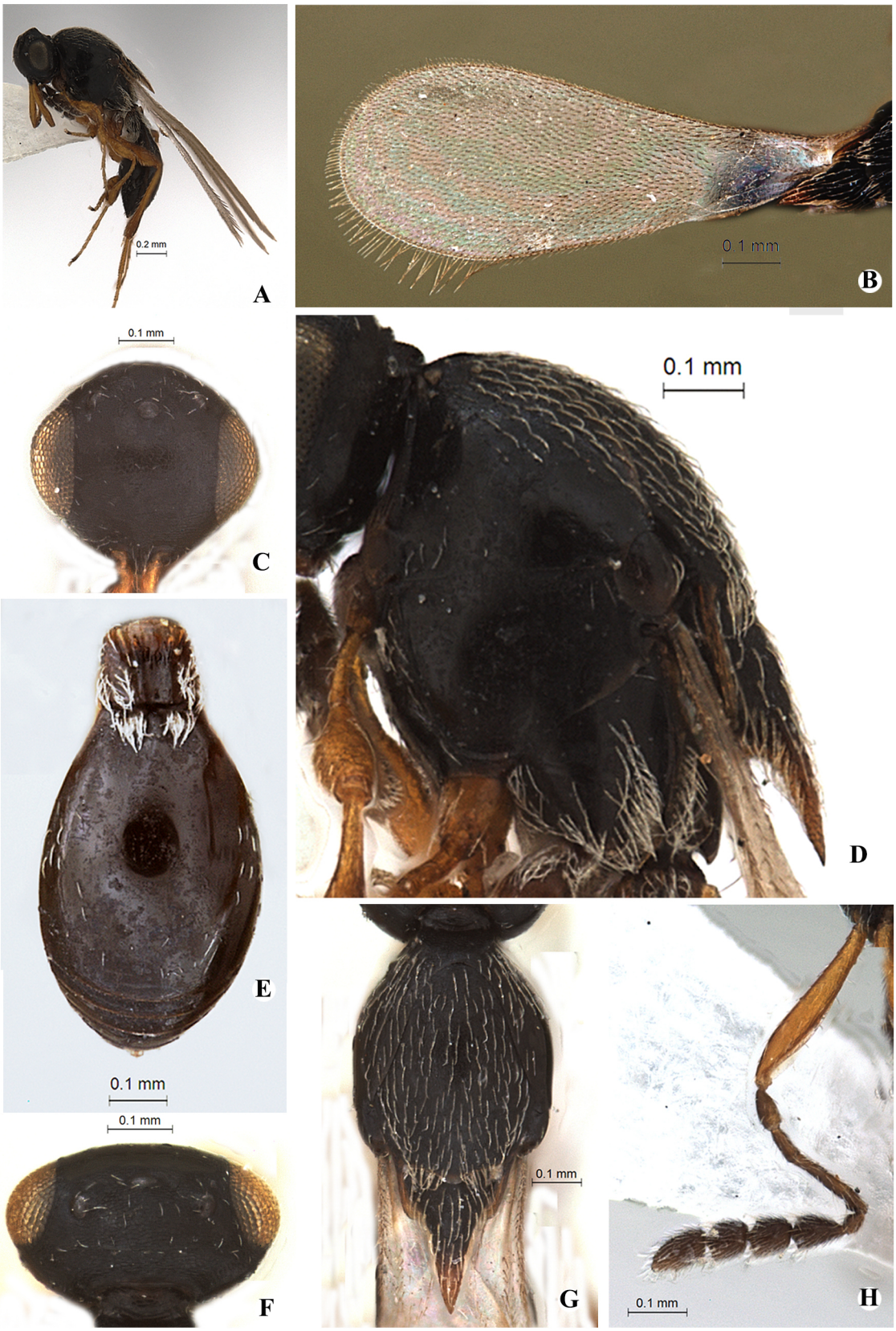
Figures A- H. *Iphitrachelus shajii* sp. nov. (Female). A. Habitus B. Head front view C. Mesosoma lateral view D. Head dorsal view E. Antenna F. Mesosoma dorsal view G. Forewing H. Metasoma dorsal view

PLATE 26



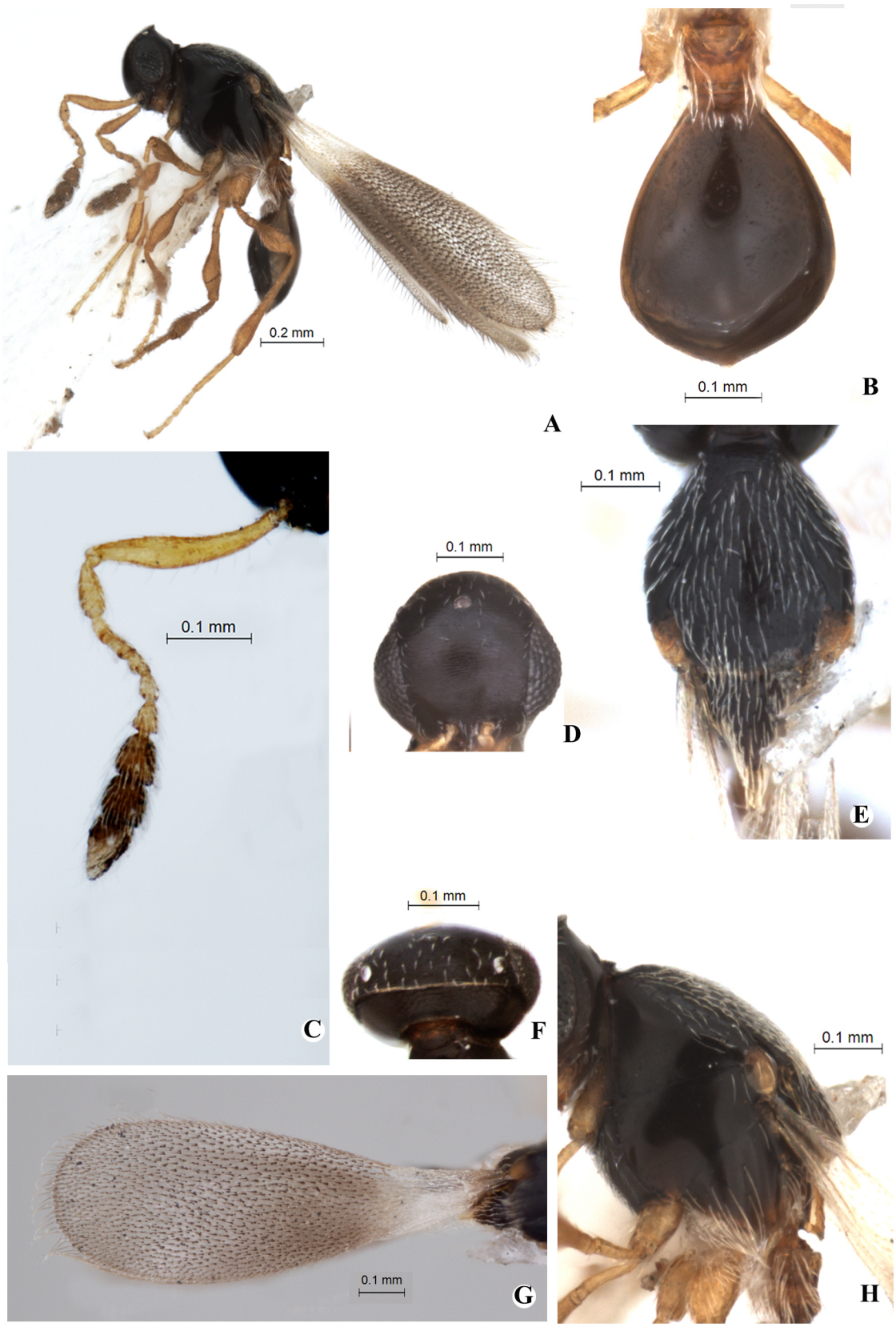
Distribution of genus *Iphitrachelus* Haliday and its species in Kerala

PLATE 27



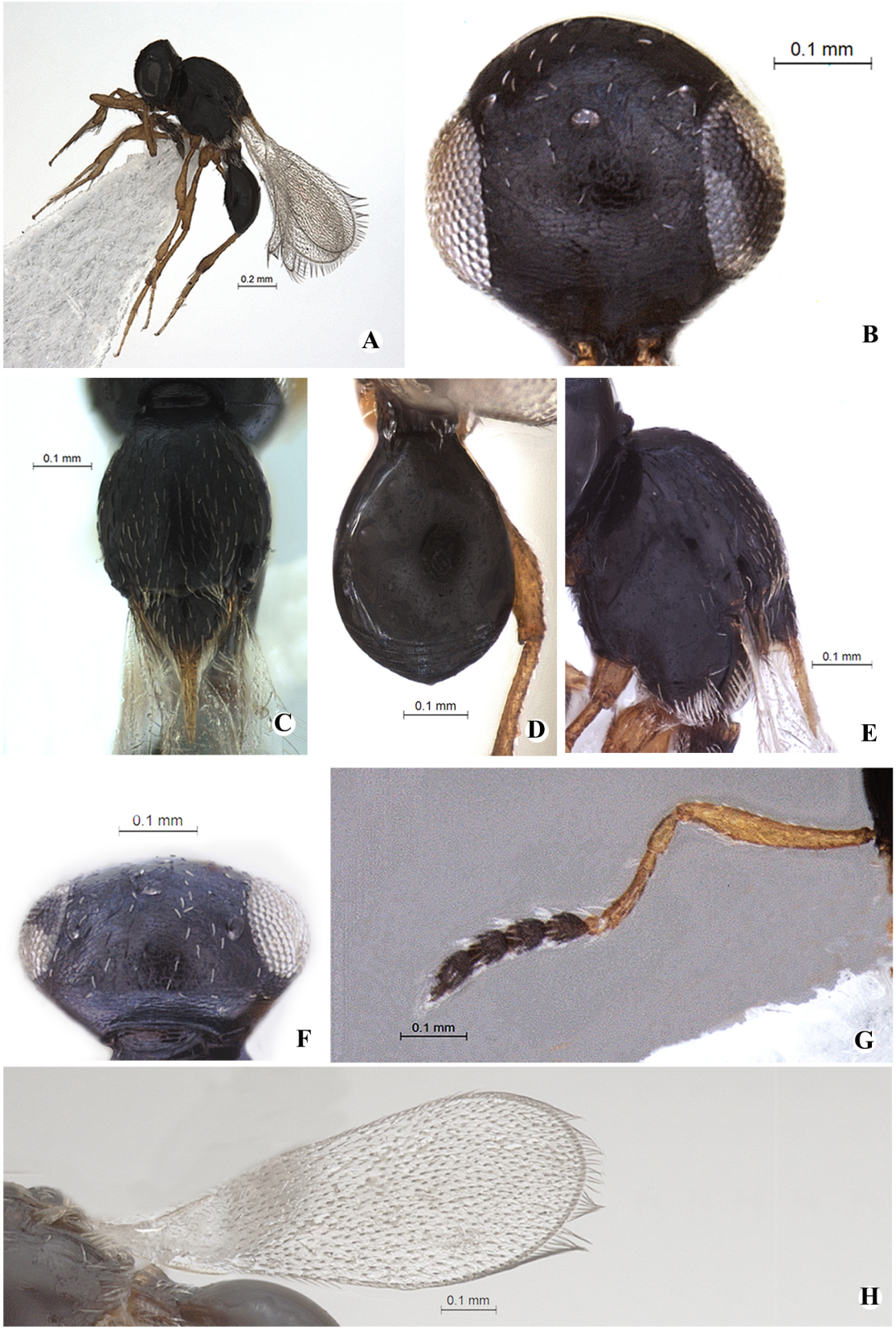
Figures A- H. *Leptacis atturensis* Mukerjee (Female). A. Habitus B. Forewing C. Head front view D. Mesosoma lateral view E. Metasoma dorsal view F. Head dorsal view G. Mesosoma dorsal view H. Antenna

PLATE 28



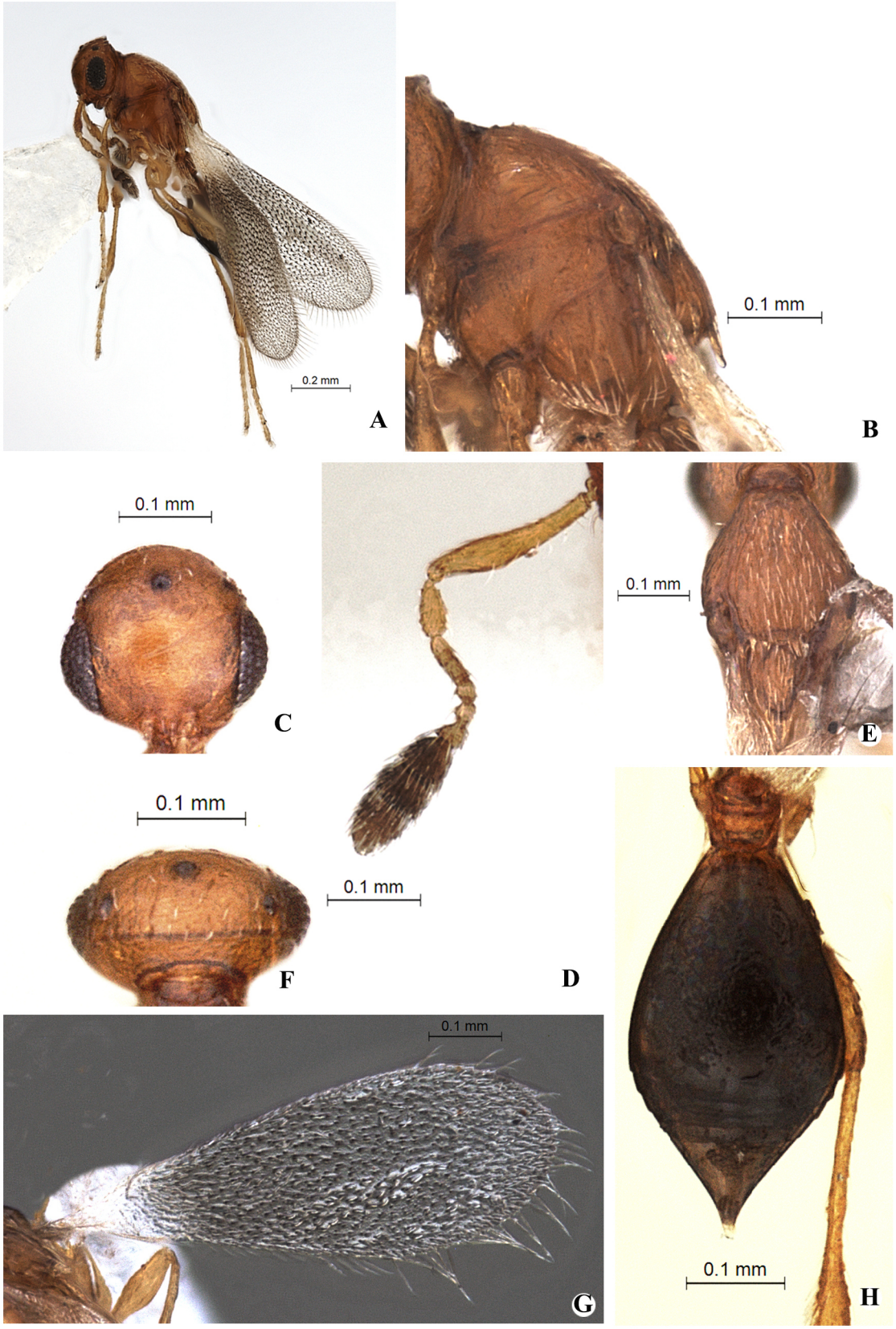
Figures A- H. *Leptacis lata* sp. nov. (Female). A. Habitus B. Metasoma dorsal view C. Antenna D. Head front view E. Mesosoma dorsal view F. Head dorsal view G. Forewing H. Mesosoma lateral view

PLATE 29



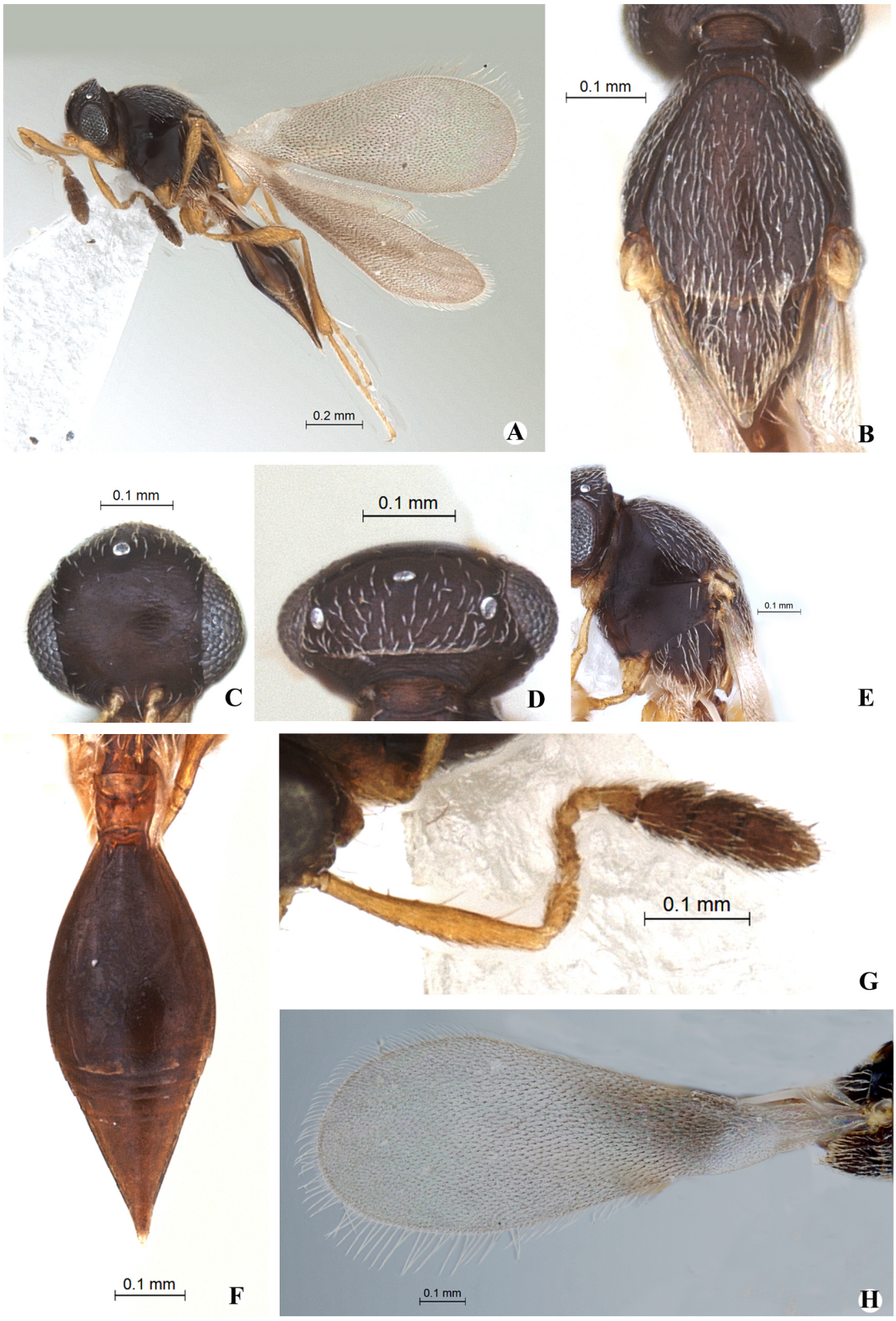
Figures A- H *Leptacis maldarensis* Mukerjee (Female). A. Habitus B. Head front view C. Mesosoma dorsal view D. Metasoma dorsal view E. Mesosoma lateral view F. Head dorsal view G. Antenna H. Forewing

PLATE 30



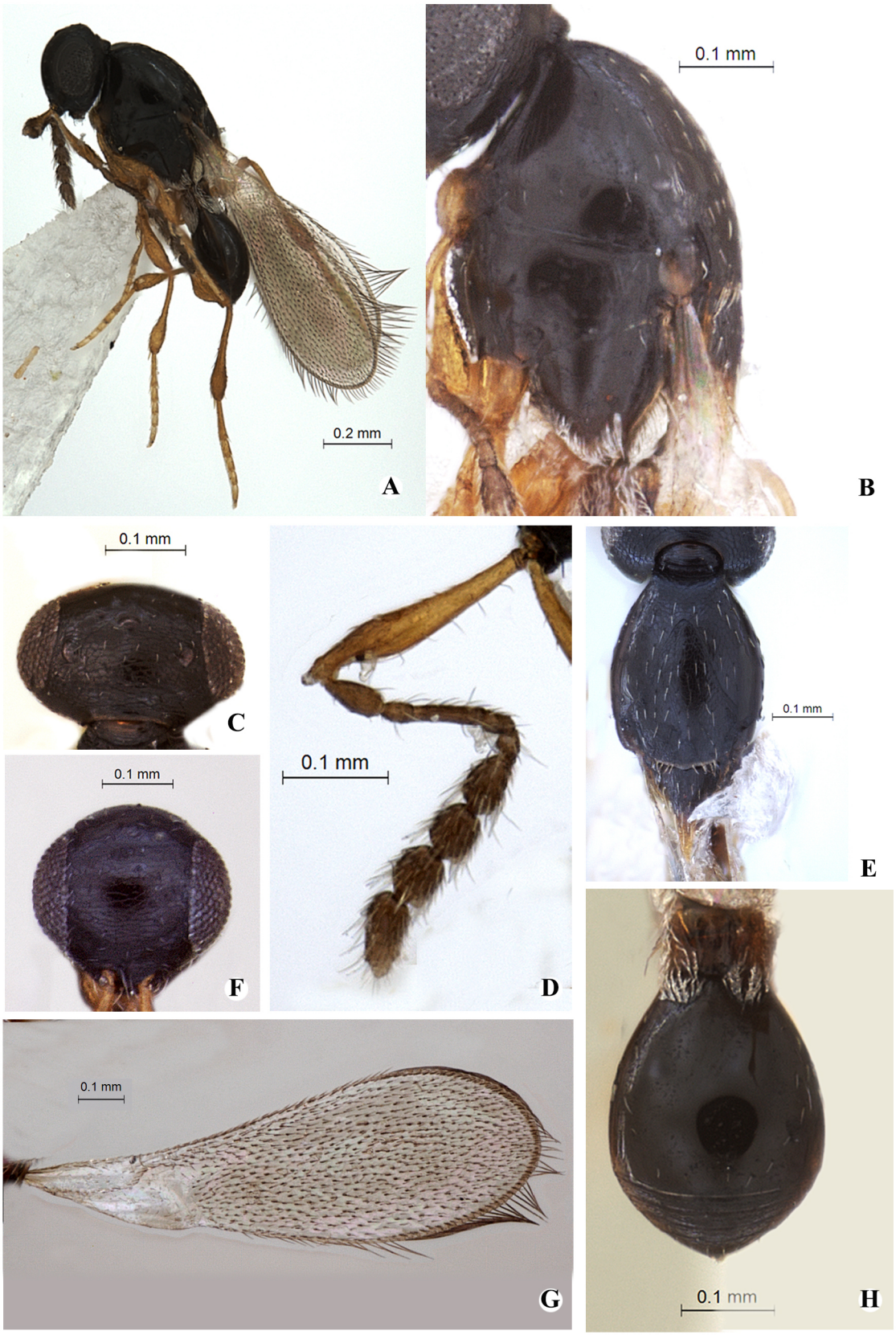
Figures A- H. *Leptacis manii* sp. nov. (Female). A. Habitus B. Mesosoma lateral view C. Head front view D. Antenna E. Mesosoma dorsal view F. Head dorsal view G. orewing H. Metasoma dorsal view

PLATE 31



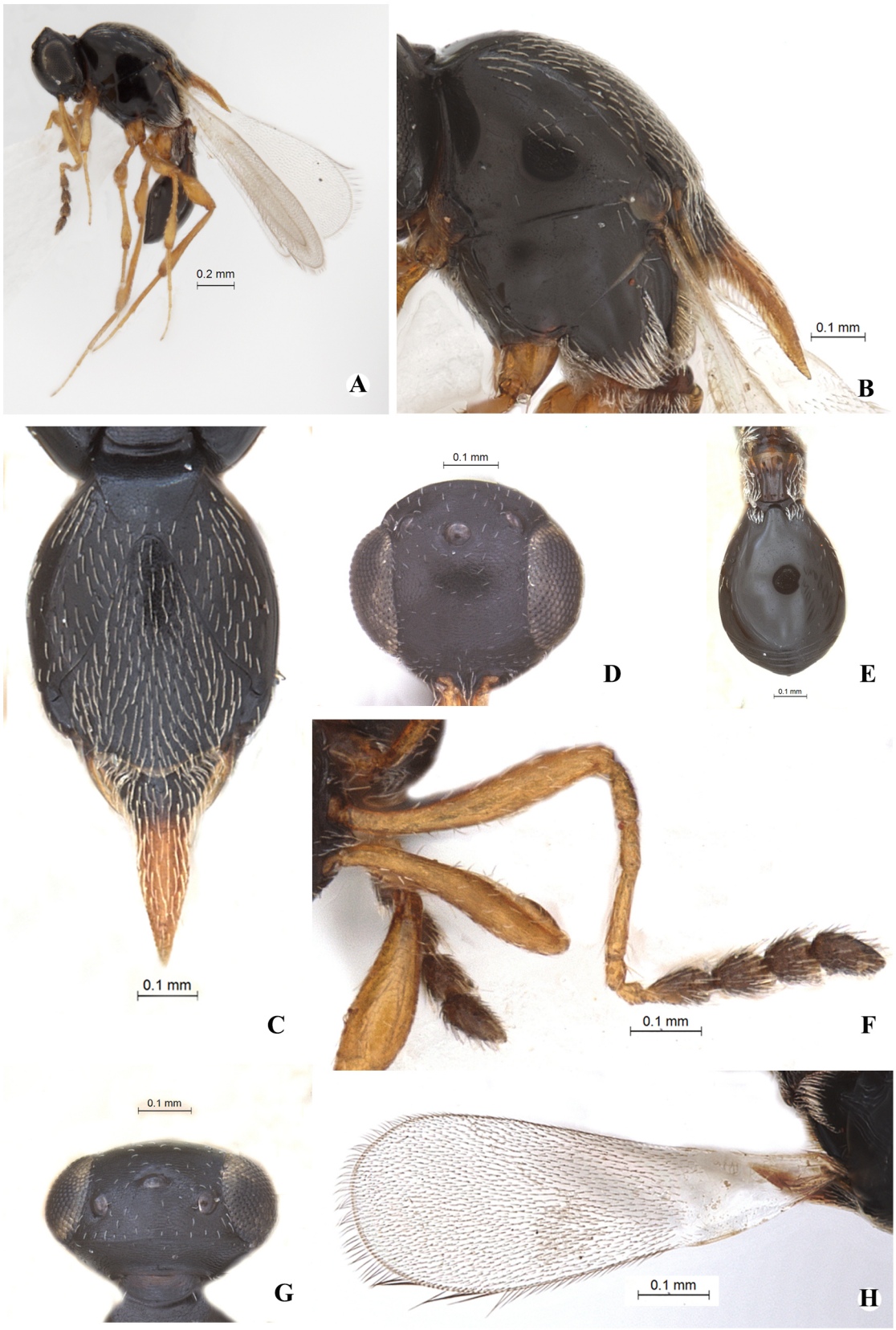
Figures A- H. *Leptacis pilosa* sp. nov. (Female). A. Habitus B. Mesosoma dorsal view C. Head front view D. Head dorsal view E. Mesosoma lateral view F. Metasoma dorsal view G. Antenna H. Forewing

PLATE 32



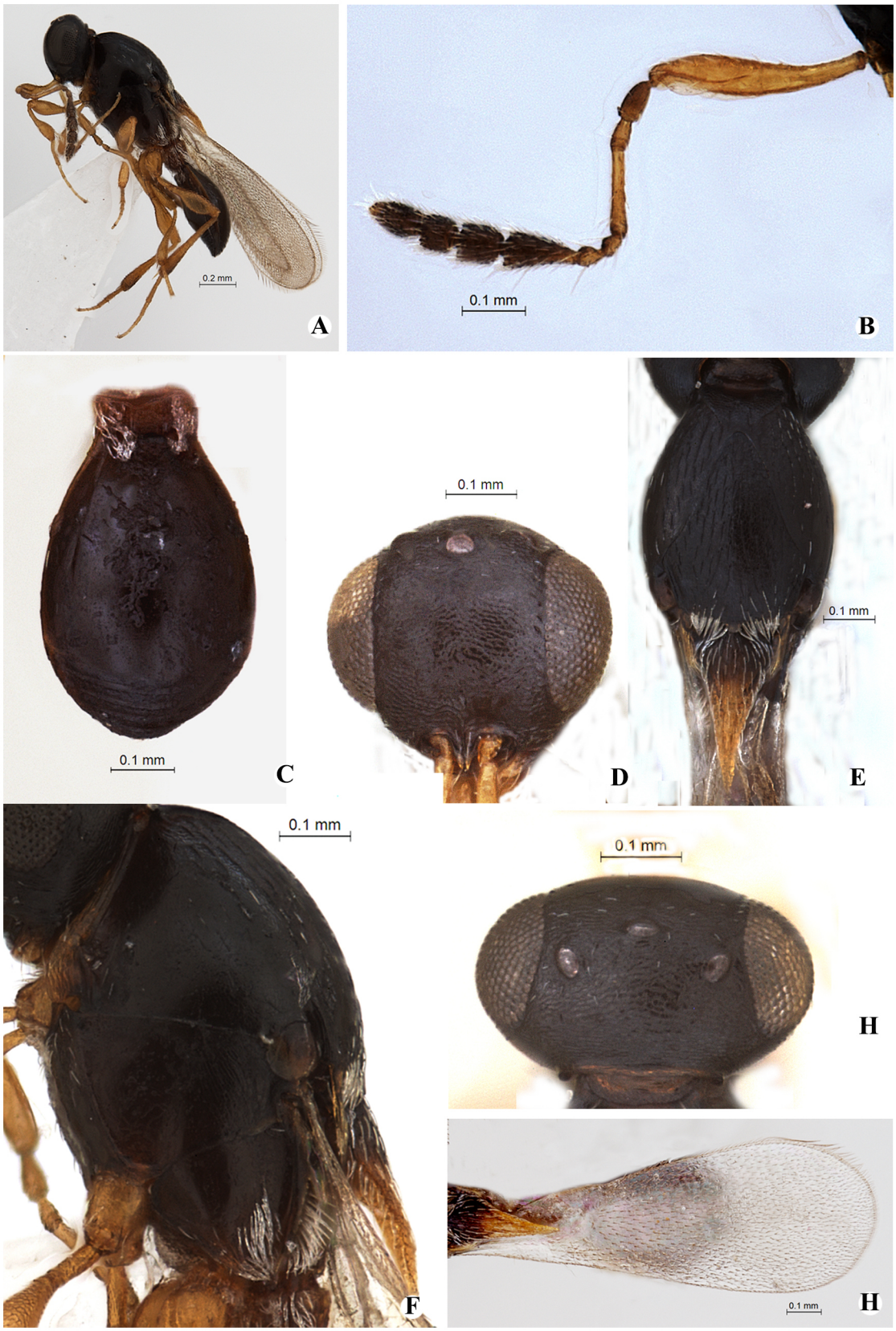
Figures A- H. *Leptacis pulla* Buhl (Female). A. Habitus B. Mesosoma lateral view C. Head dorsal view D. Antenna E. Mesosoma dorsal view F. Head front view G. Forewing H. Metasoma dorsal view

PLATE 33



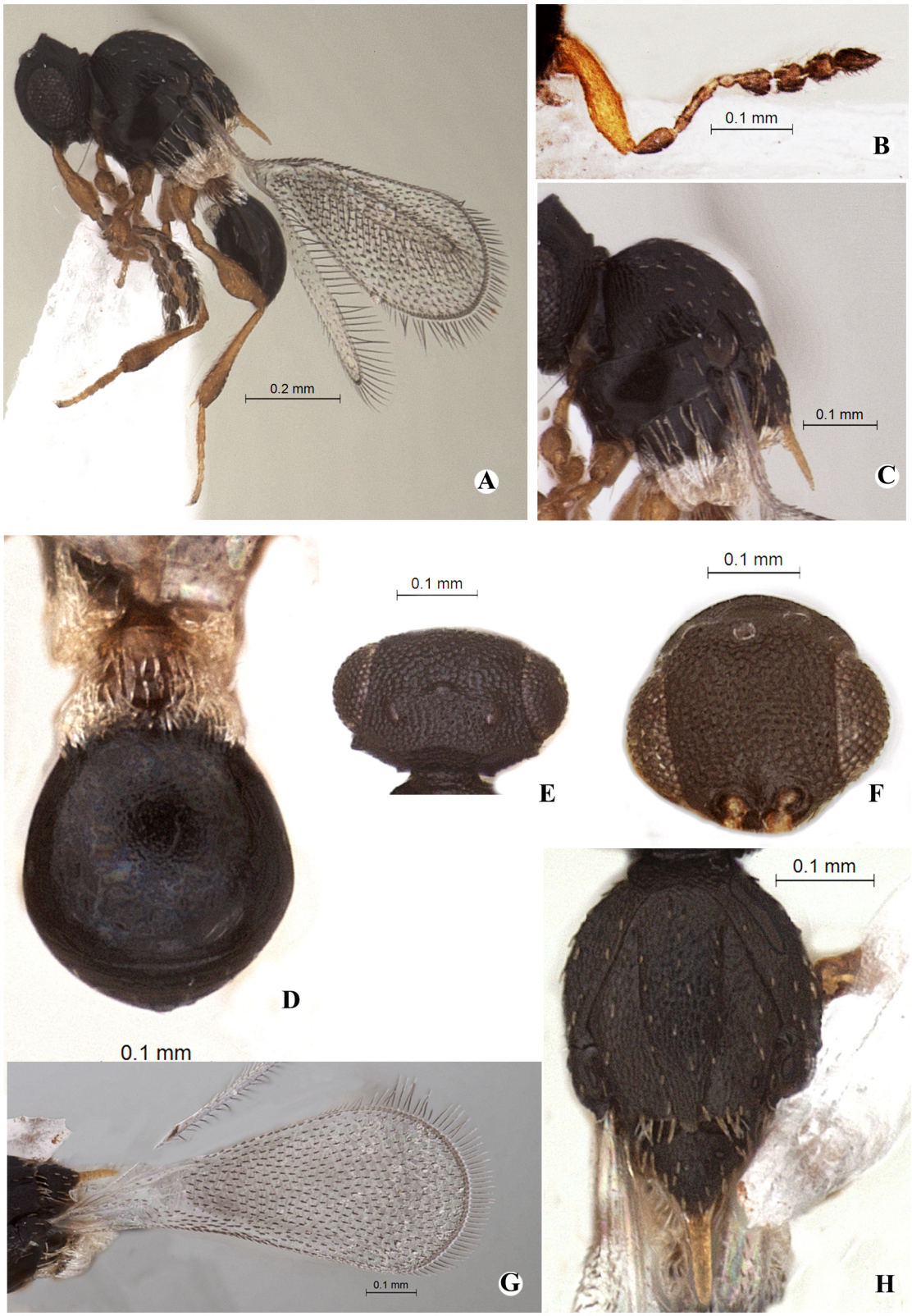
Figures A- H. *Leptacis robusta* sp. nov. (Female). A. Habitus B. Mesosoma lateral view C. Mesosoma dorsal view D. Head front view E. Metasoma dorsal view F. Antenna G. Head dorsal view H. Forewing

PLATE 34



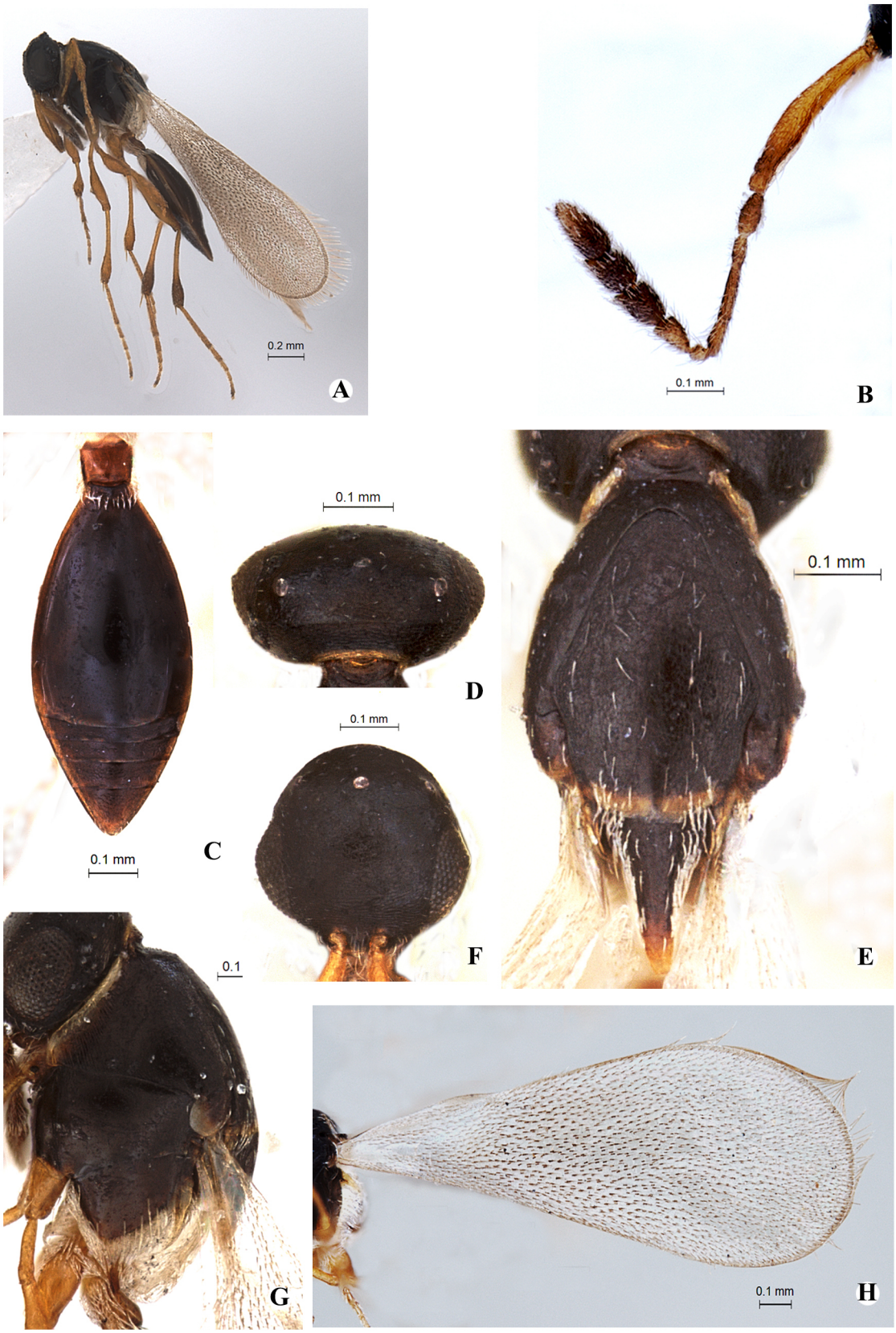
Figures A- H. *Leptacis tegulata* Buhl (Female). A. Habitus B. Antenna C. Metasoma dorsal view D. Head front view E. Mesosoma dorsal view F. Mesosoma lateral view G. Head dorsal view H. Forewing

PLATE 35



Figures A- H. *Leptacis tenuispinae* sp. nov. (Female). A. Habitus B. Antenna C. Mesosoma lateral view D. Metasoma dorsal view E. Head dorsal view F. Head front view G. Forewing H. Mesosoma dorsal view

PLATE 36



Figures A- H. *Leptacis transoceanica* Buhl (Female). A. Habitus B. Antenna C. Metasoma dorsal view D. Head dorsal view E. Mesosoma dorsal view F. Head front view G. Mesosoma lateral view H. Forewing

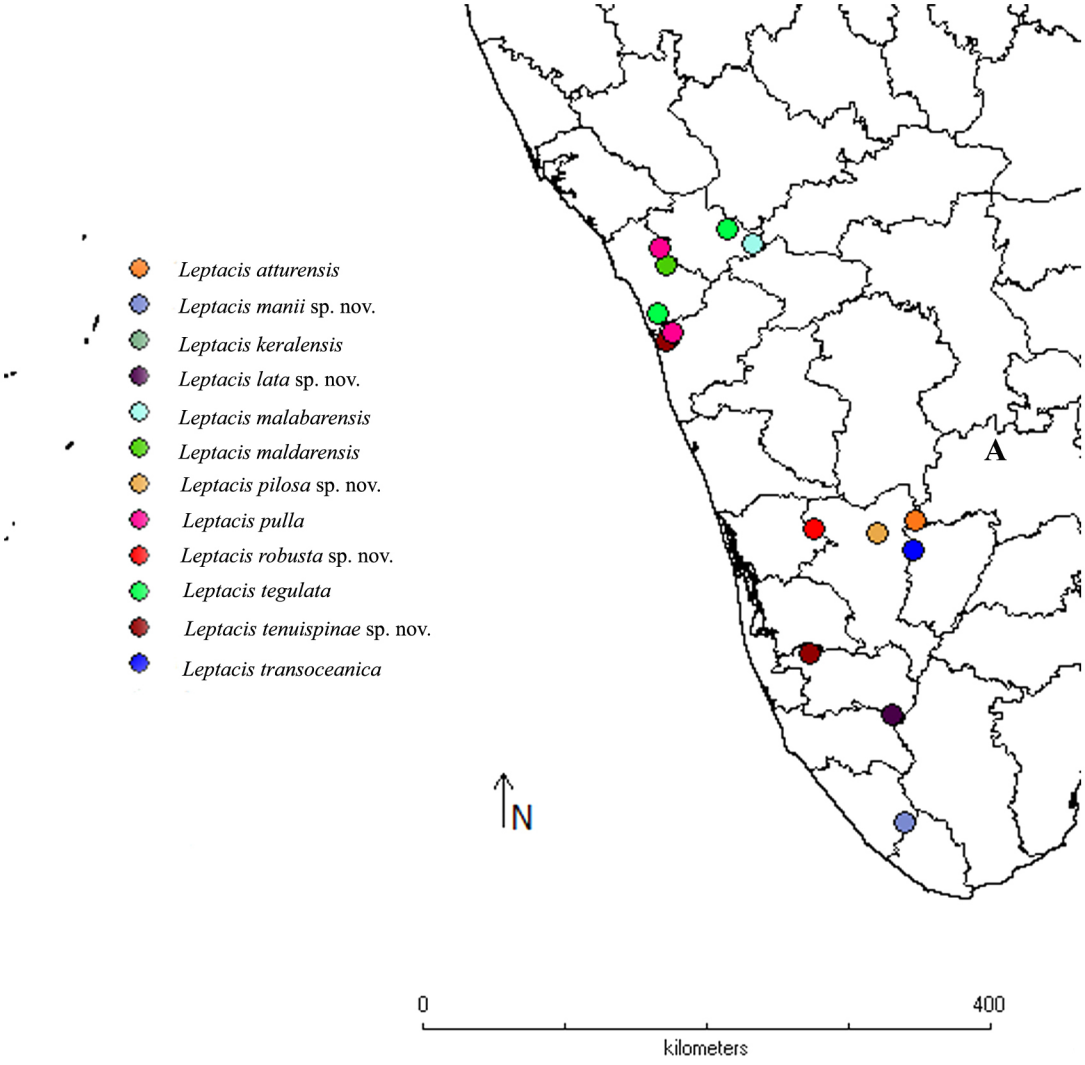
PLATE 37





Figures A- B. Holotypes (ZSI, Calicut). A. *Leptacis keralensis* Ushakumari and Narendran B. *Leptacis malabarensis* Ushakumari and Narendran

PLATE 38



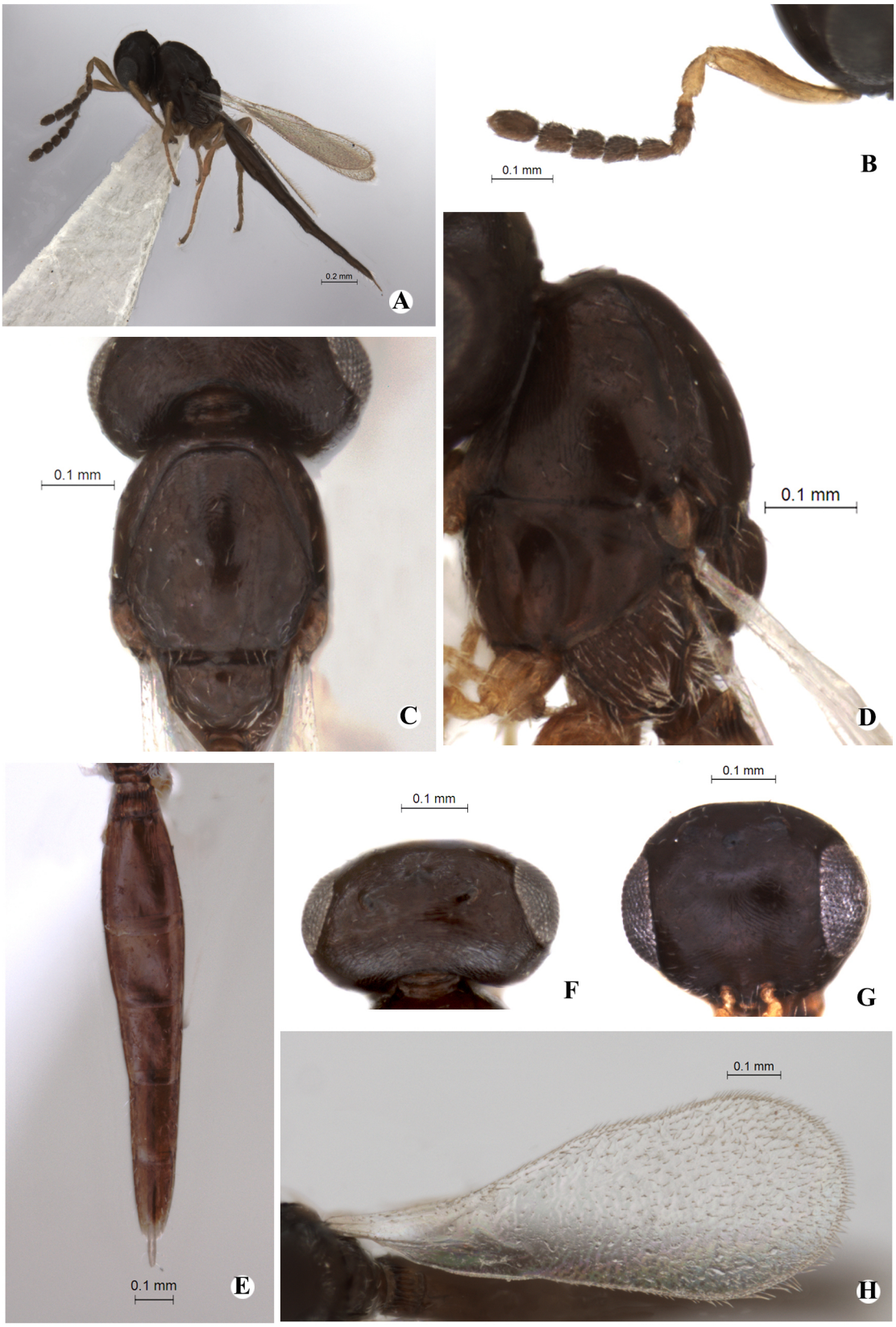
Distribution of genus *Leptacis* Förster and its species in Kerala

PLATE 39



Figures A- H. *Platygaster achterbergiana* Buhl (Female). A. Habitus B. Mesosoma lateral view C. Mesosoma dorsal view D. Antenna E. Head front view F. Head dorsal view G. Forewing H. Metasoma dorsal view

PLATE 40



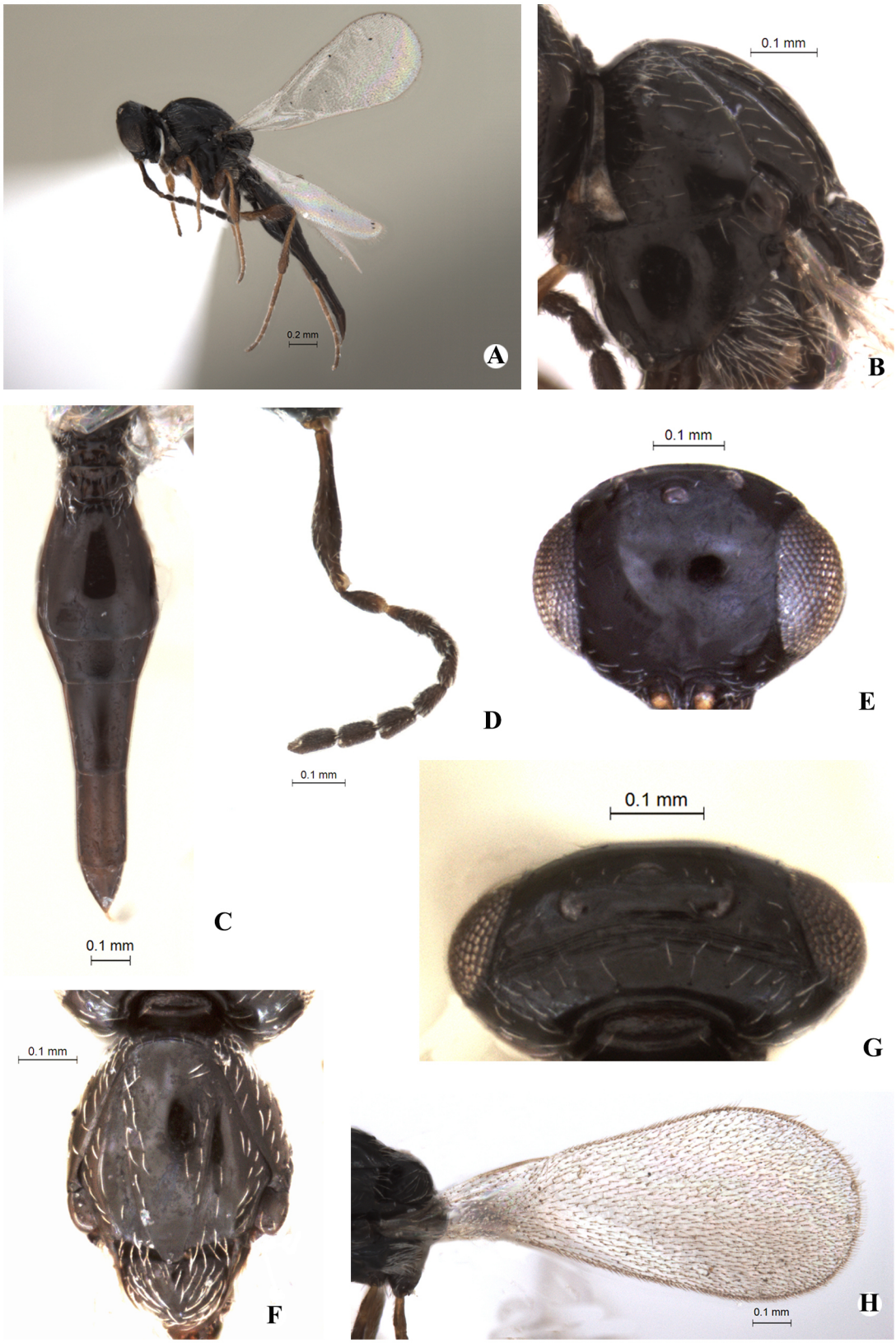
Figures A- H. *Platygaster caudata* sp. nov. (Female). A. Habitus B. Antenna C. Mesosoma dorsal view D. Mesosoma lateral view E. Metasoma dorsal view F. Head dorsal view G. Head front view H. Forewing

PLATE 41



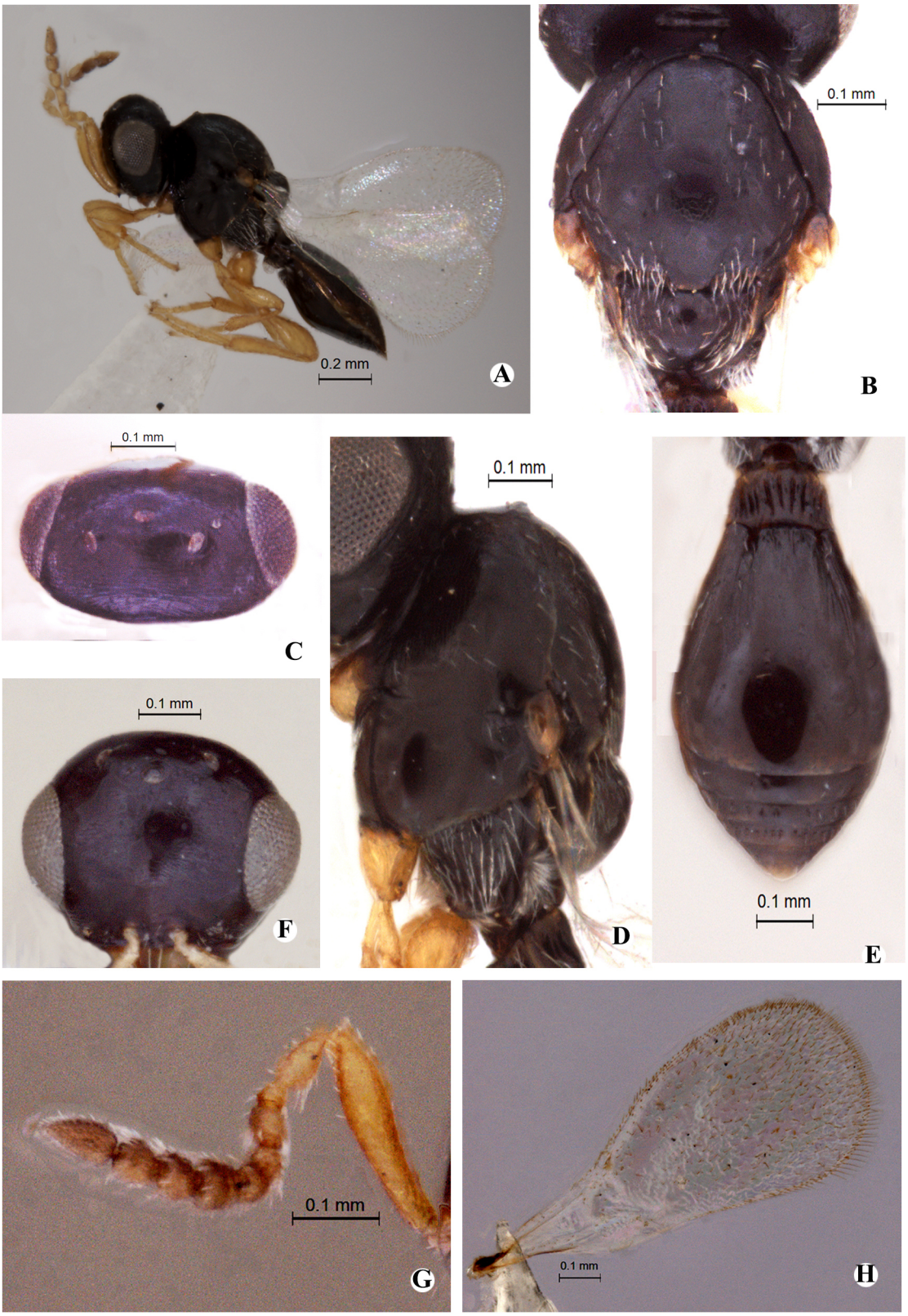
Figures A- B. Holotypes (ZSI, Calicut). A. *Platygaster galbus* Ushakumari B. *Platygaster keralicus* Ushakumari C. Metasoma (dorsal) of *P. keralicus*- T2 with striations

PLATE 42



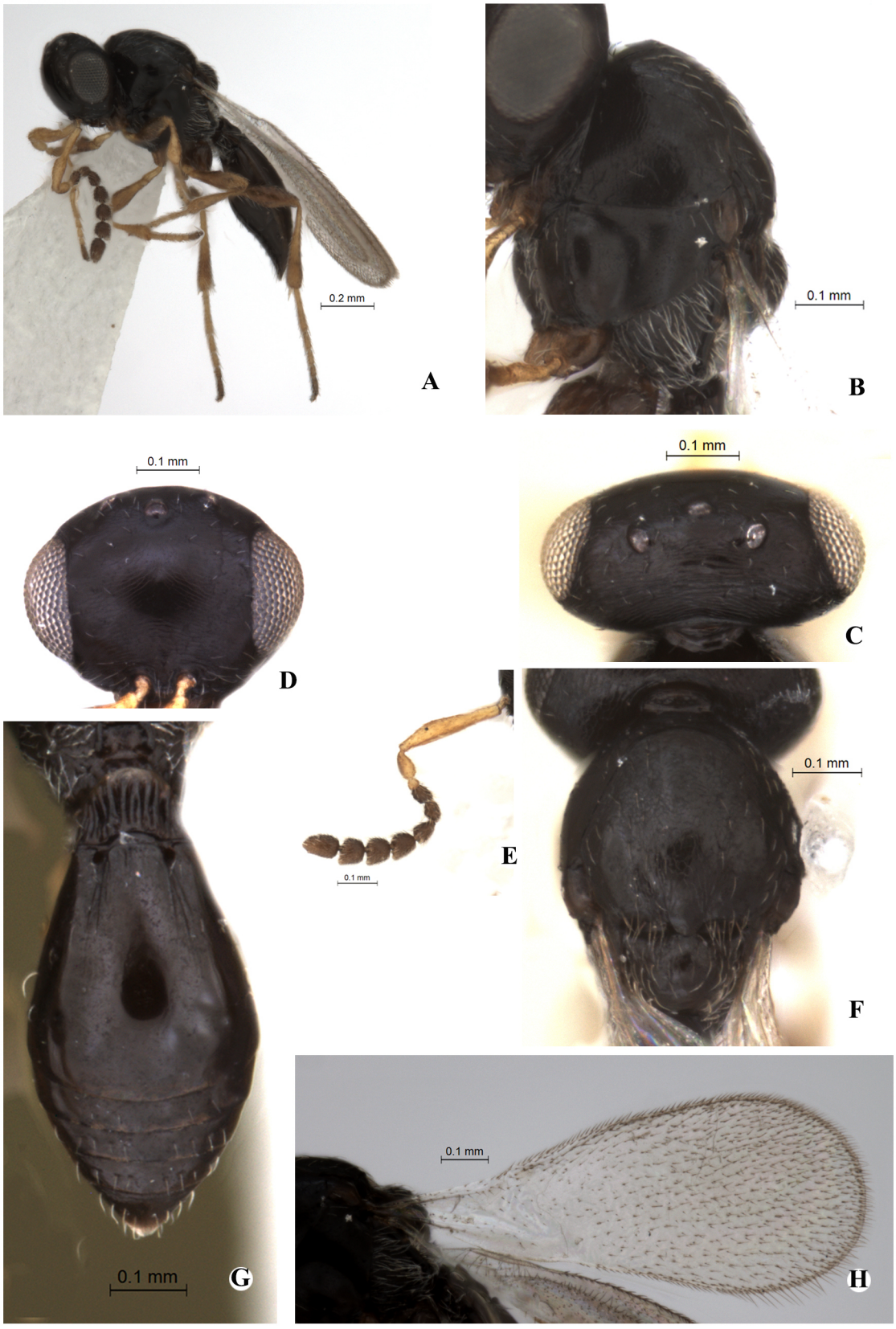
Figures A- H. *Platygaster kesaavrita* sp. nov. (Female). A. Habitus B. Mesosoma lateral view C. Metasoma dorsal view D. Antenna E. Head front view F. Mesosoma dorsal view G. Head dorsal view H. Forewing

PLATE 43



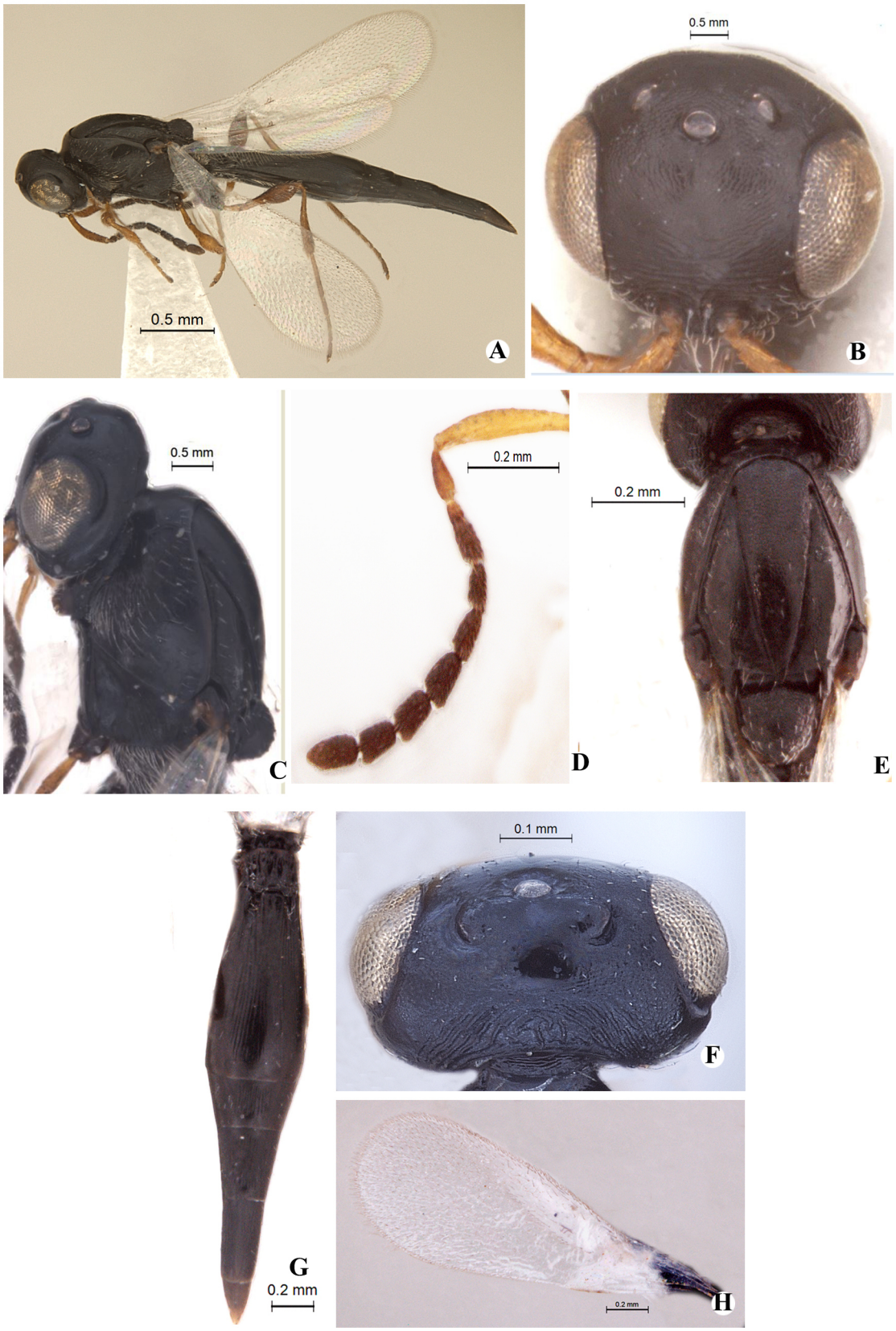
Figures A- H. *Platygaster luteipes* Buhl (Female). A. Habitus B. Mesosoma dorsal view C. Head dorsal view D. Mesosoma lateral view E. Metasoma dorsal view F. Head front view G. Antenna H. Forewing

PLATE 44



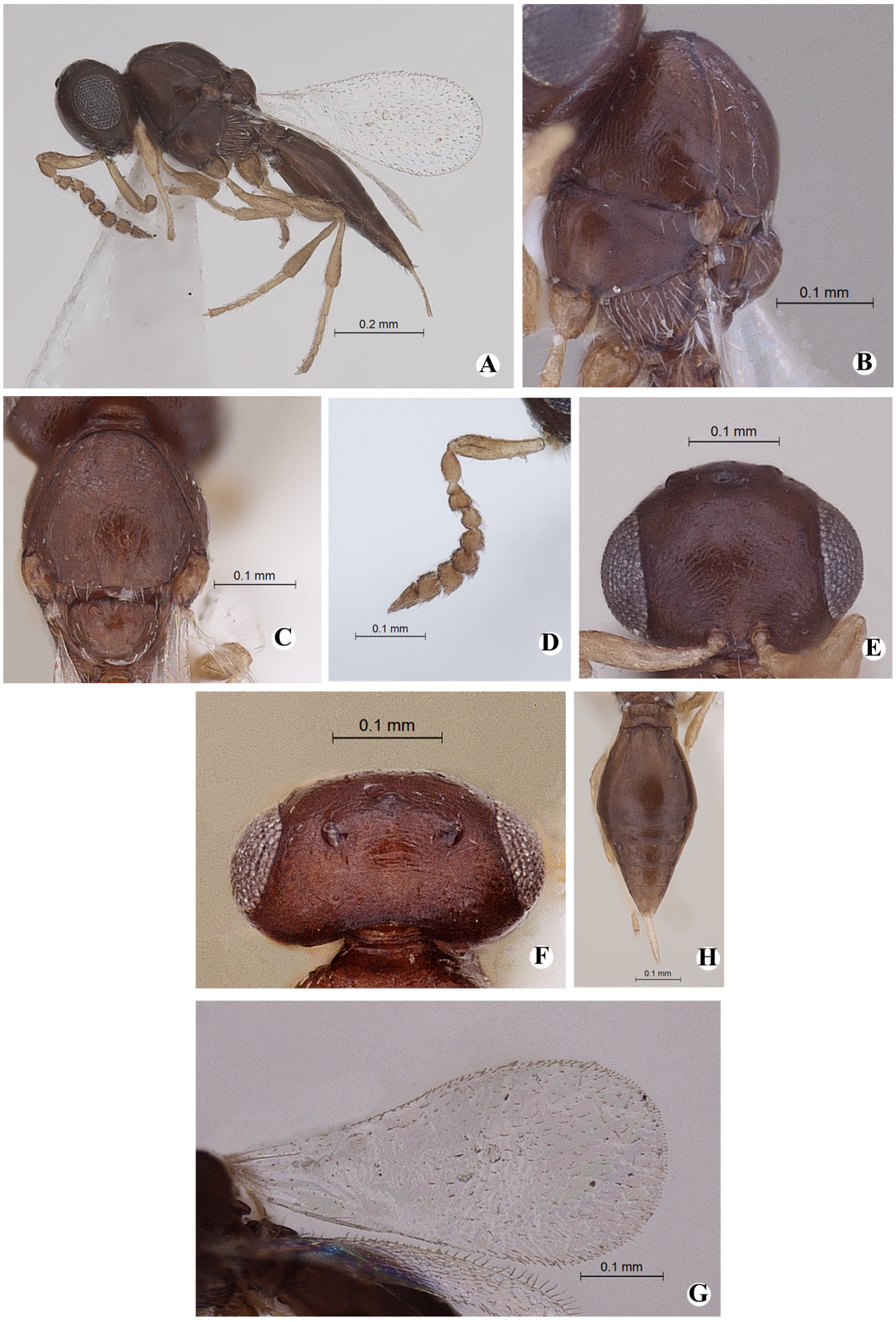
Figures A- H. *Platygaster narendrani* Ushakumari (Female). A. Habitus B. Mesosoma lateral view C. Head dorsal view D. Head front view E. Antenna F. Mesosoma dorsal view G. Metasoma dorsal view H. Forewing

PLATE 46



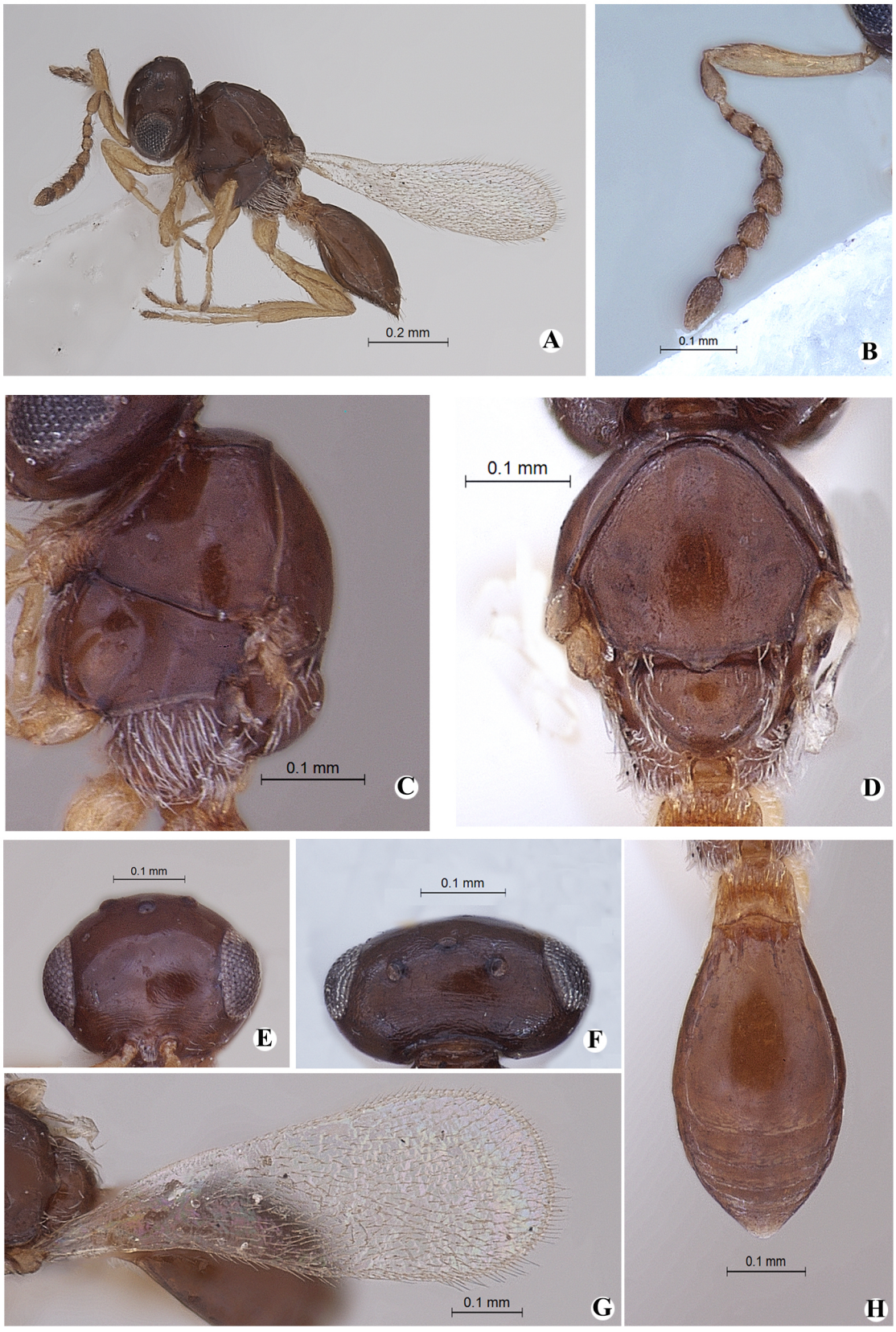
Figures A- H. *Platygaster neostriatitergites* Veenakumari and Buhl sp. nov. (Female). A. Habitus B. Head front view C. Mesosoma lateral view D. Antenna E. Mesosoma dorsal view F. Head dorsal view G. Metasoma dorsal view H. Forewing

PLATE 47



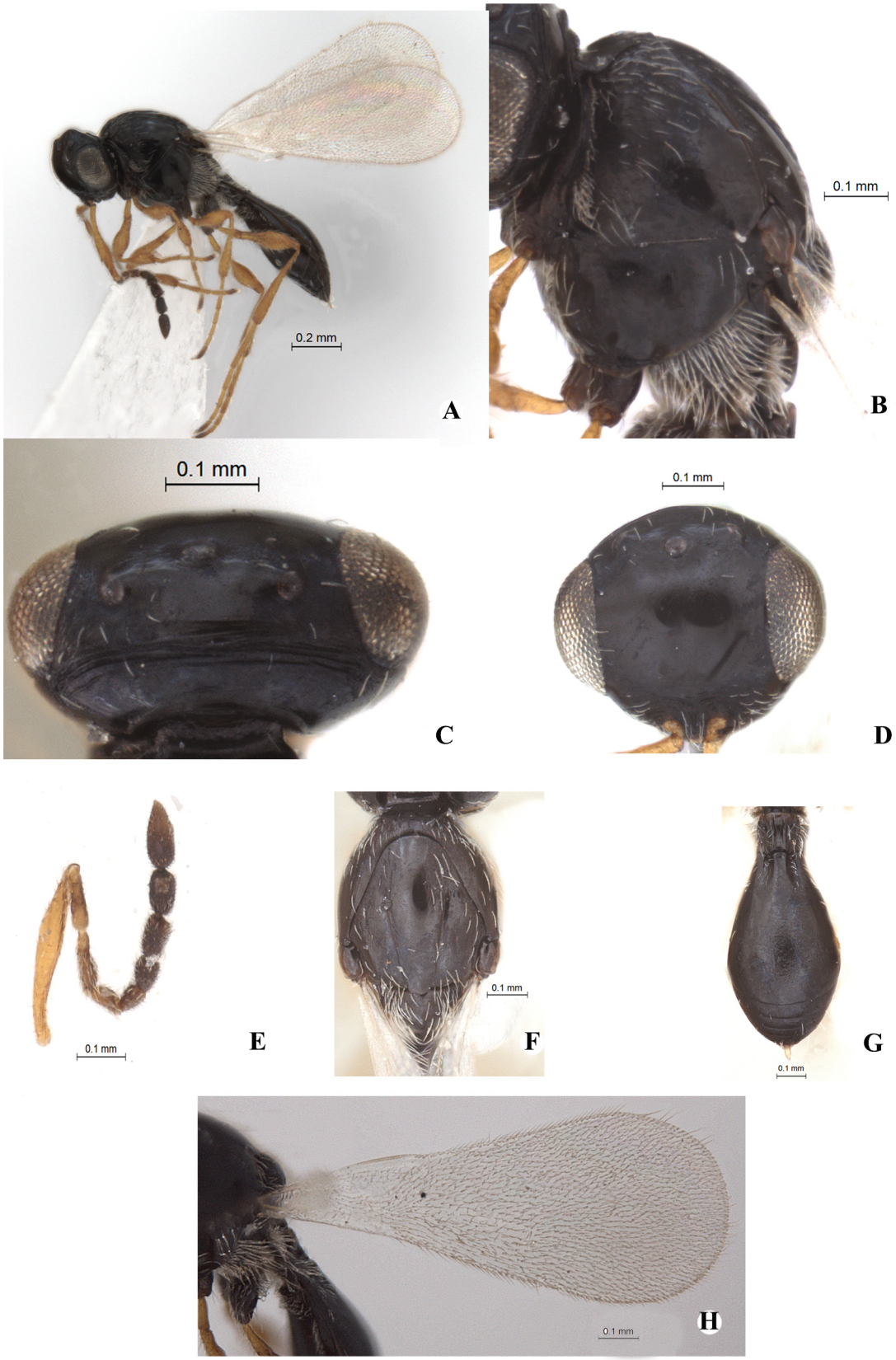
Figures A- H. *Platygaster reticulatus* sp. nov. (Female). A. Habitus B. Mesosoma lateral view C. Mesosoma dorsal view D. Antenna E. Head front view F. Head dorsal view G. Forewing H. Metasoma dorsal view

PLATE 48



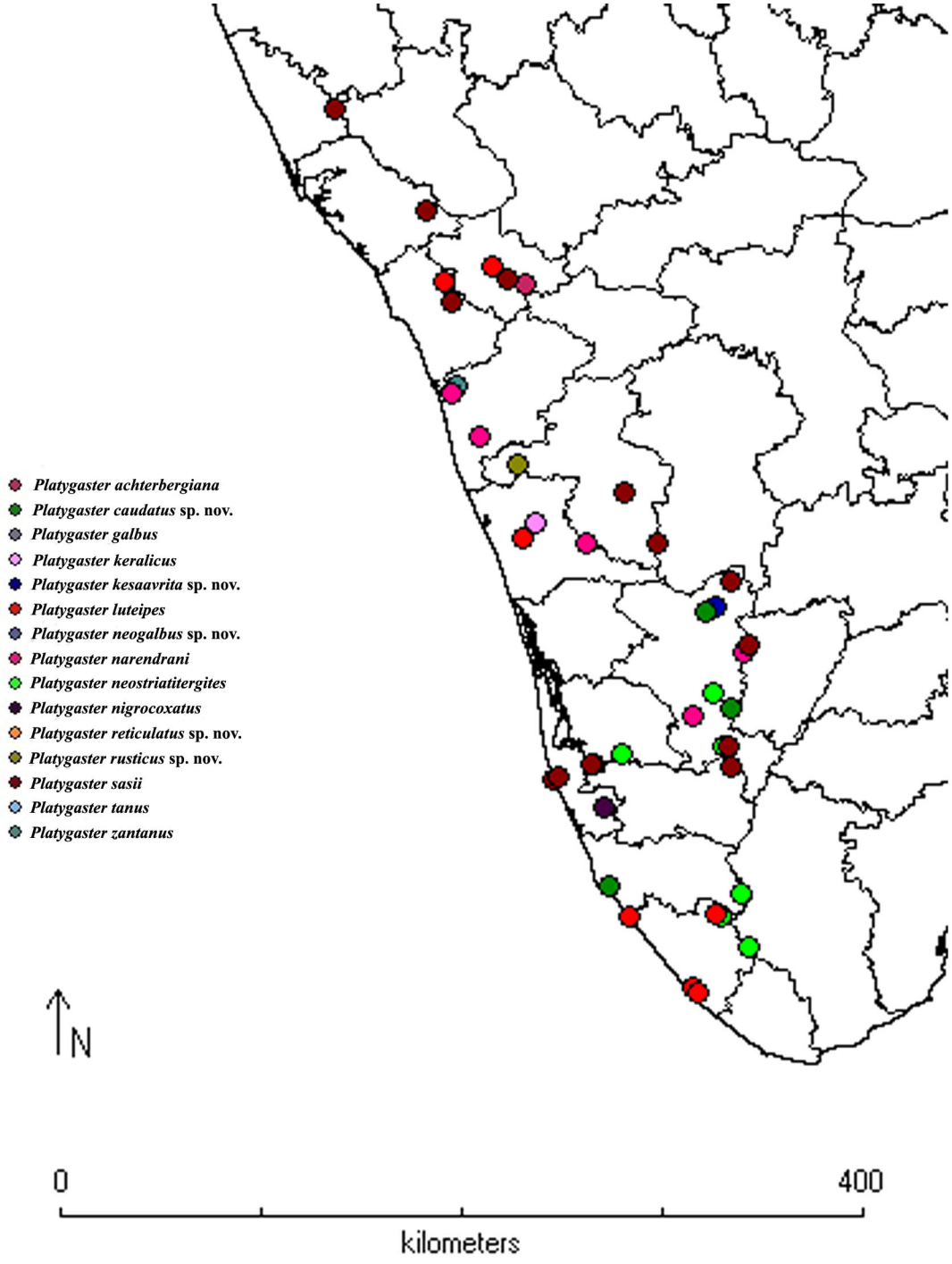
Figures A- H. *Platygaster rusticus* sp. nov. (Female). A. Habitus B. Antenna C. Mesosoma lateral view D. Mesosoma dorsal view E. Head front view F. Head dorsal view G. Forewing H. Metasoma dorsal view

PLATE 49



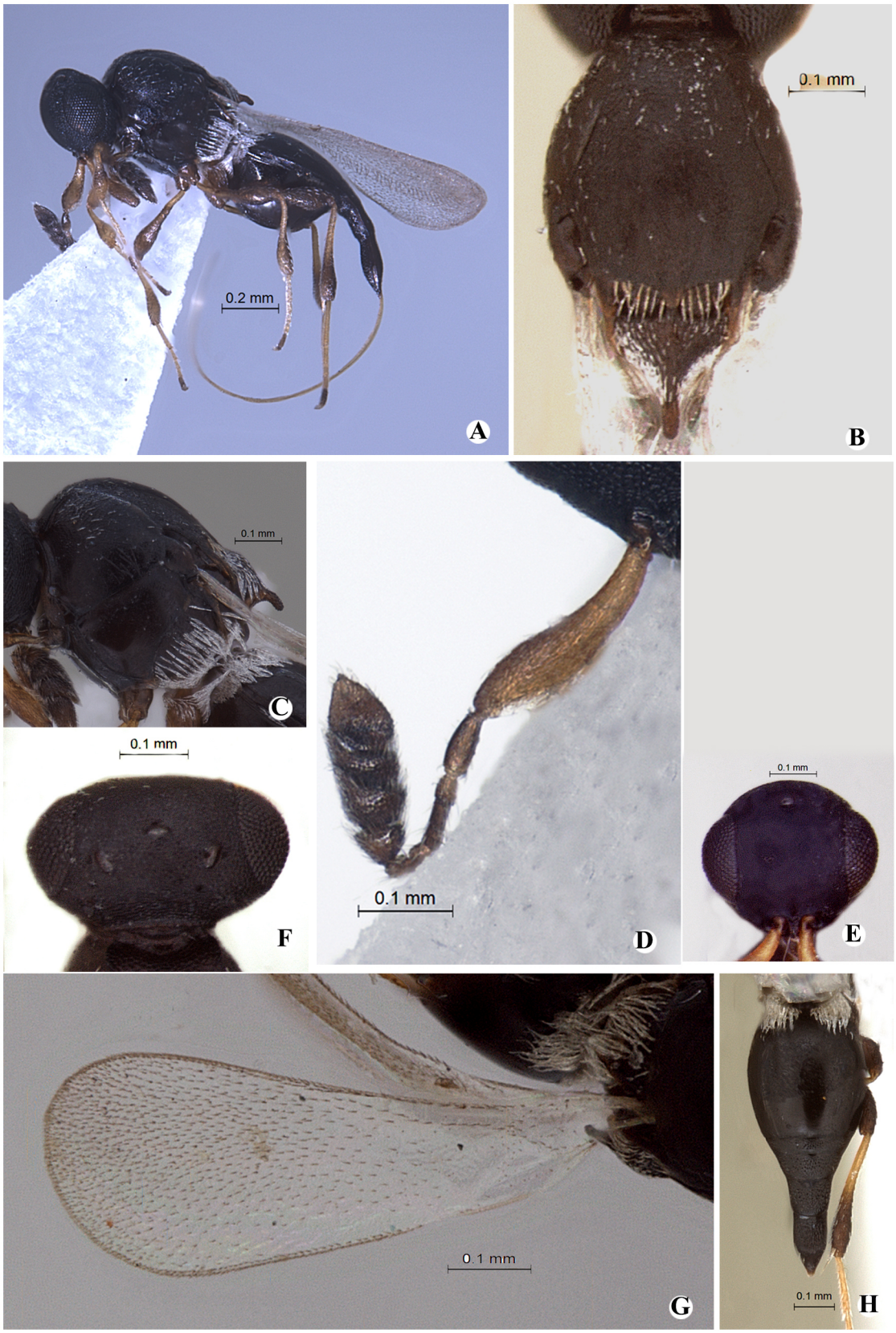
Figures A- H. *Platygaster sasii* Ushakumari (Female). A. Habitus B. Mesosoma lateral view C. Head dorsal view D. Head front view E. Antenna F. Mesosoma dorsal view G. Metasoma dorsal view H. Forewing

PLATE 51



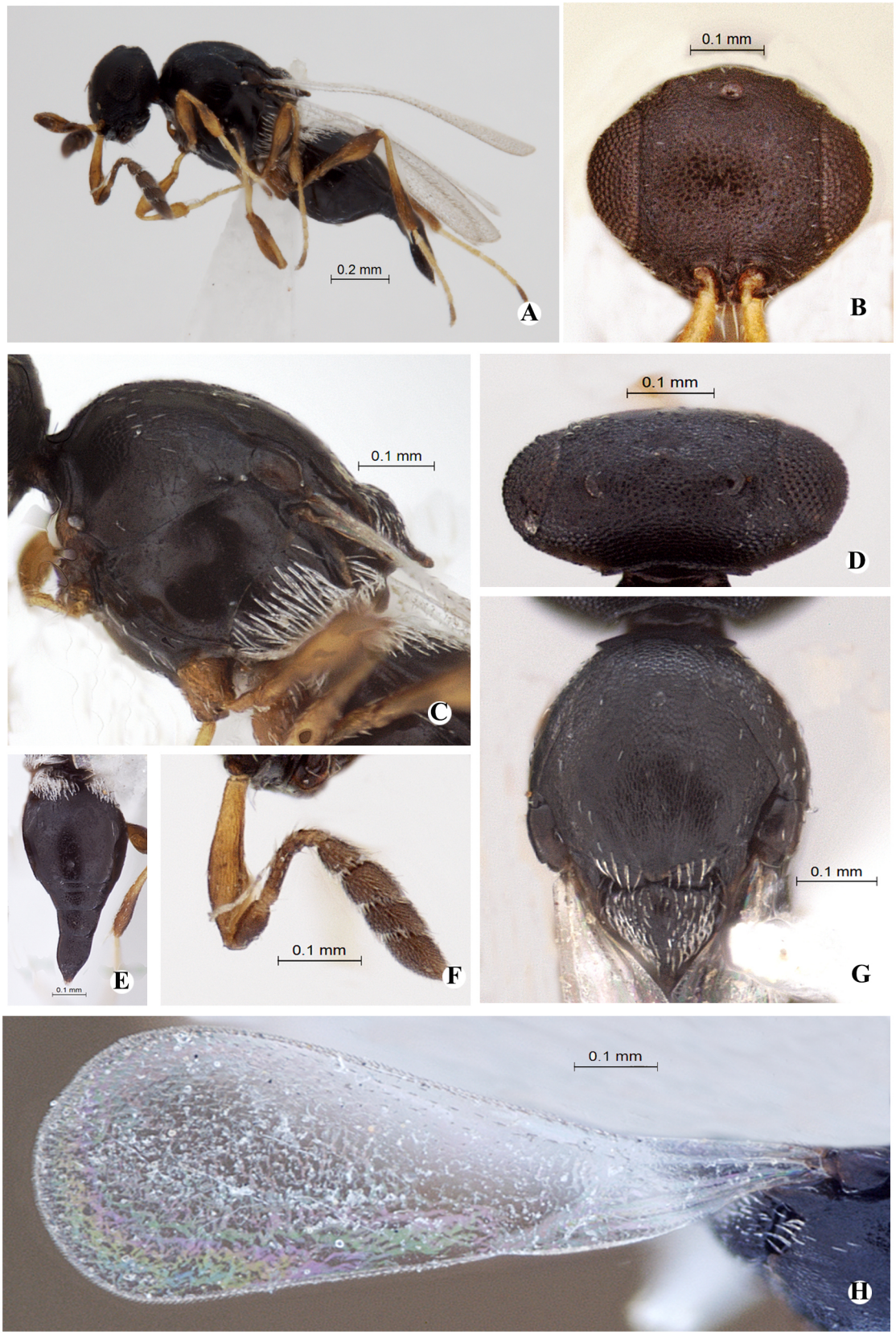
Distribution of genus *Platygaster* Latreille and its species in Kerala

PLATE 52



Figures A- H. *Synopeas (Sactogaster) chamoliana* Mukerjee (Female). A. Habitus B. Mesosoma dorsal view C. Mesosoma lateral view D. Antenna E. Head front view F. Head dorsal view G. Forewing H. Metasoma dorsal view

PLATE 53



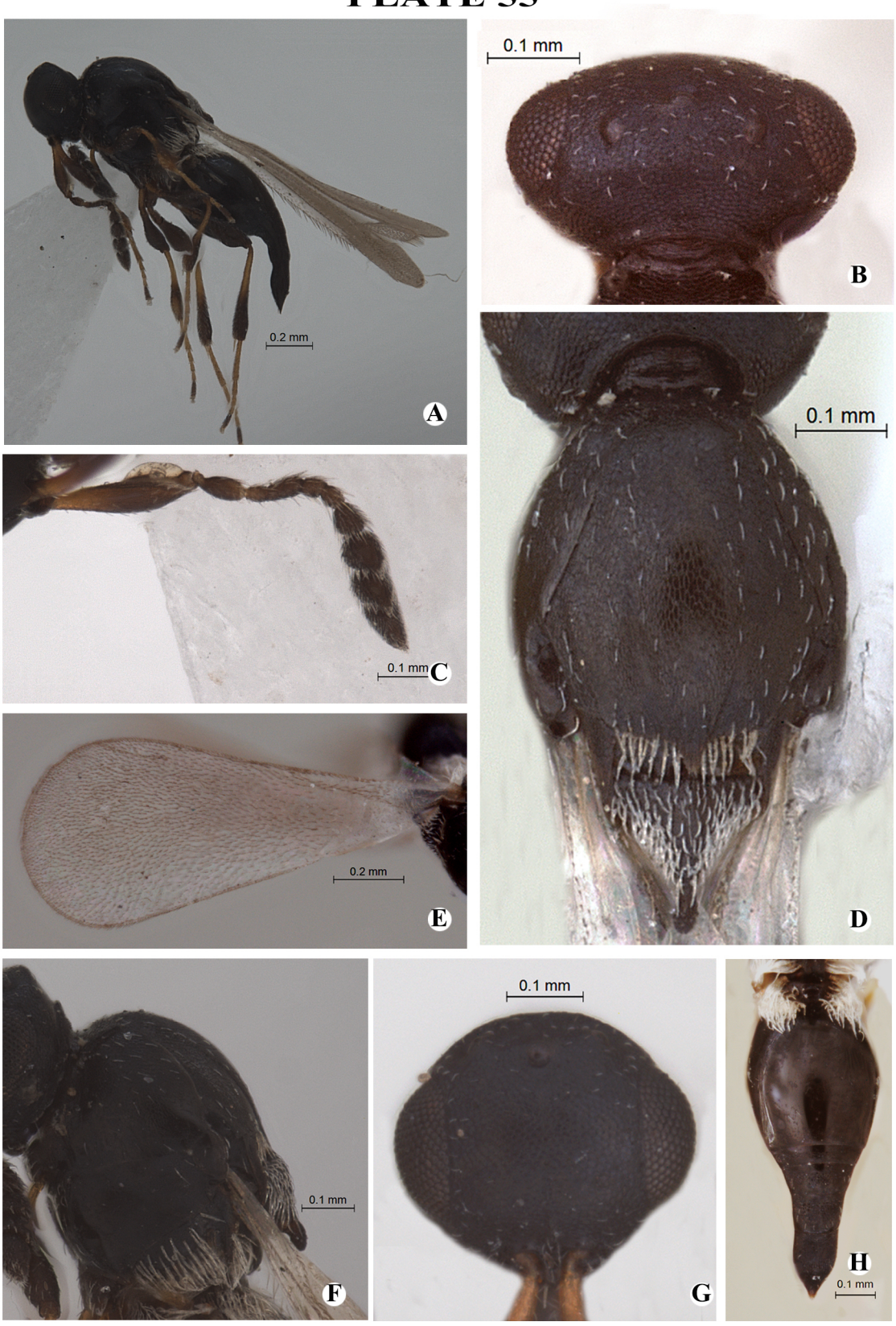
Figures A- H. *Synopeas (Sactogaster) indicum* Mani (Female). A. Habitus B. Mesosoma dorsal view C. Head dorsal view D. Mesosoma lateral view E. Head front view F. Antenna G. Forewing H. Metasoma dorsal view

PLATE 54



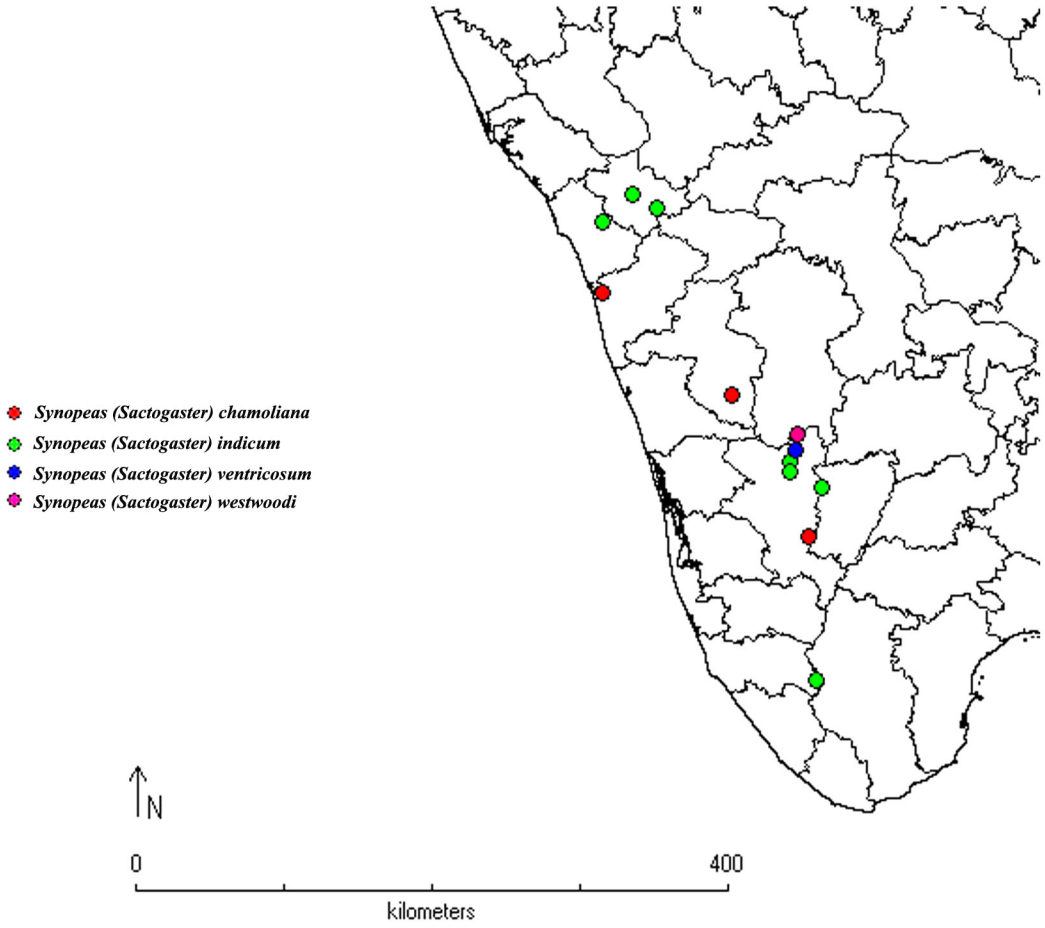
Figures A- H. *Synopeas (Sactogaster) ventricosum* Buhl (Female). A. Habitus B. Mesosoma lateral view C. Antenna D. Mesosoma dorsal view E. Head front view F. Metasoma dorsal view G. Head dorsal view H. Forewing

PLATE 55



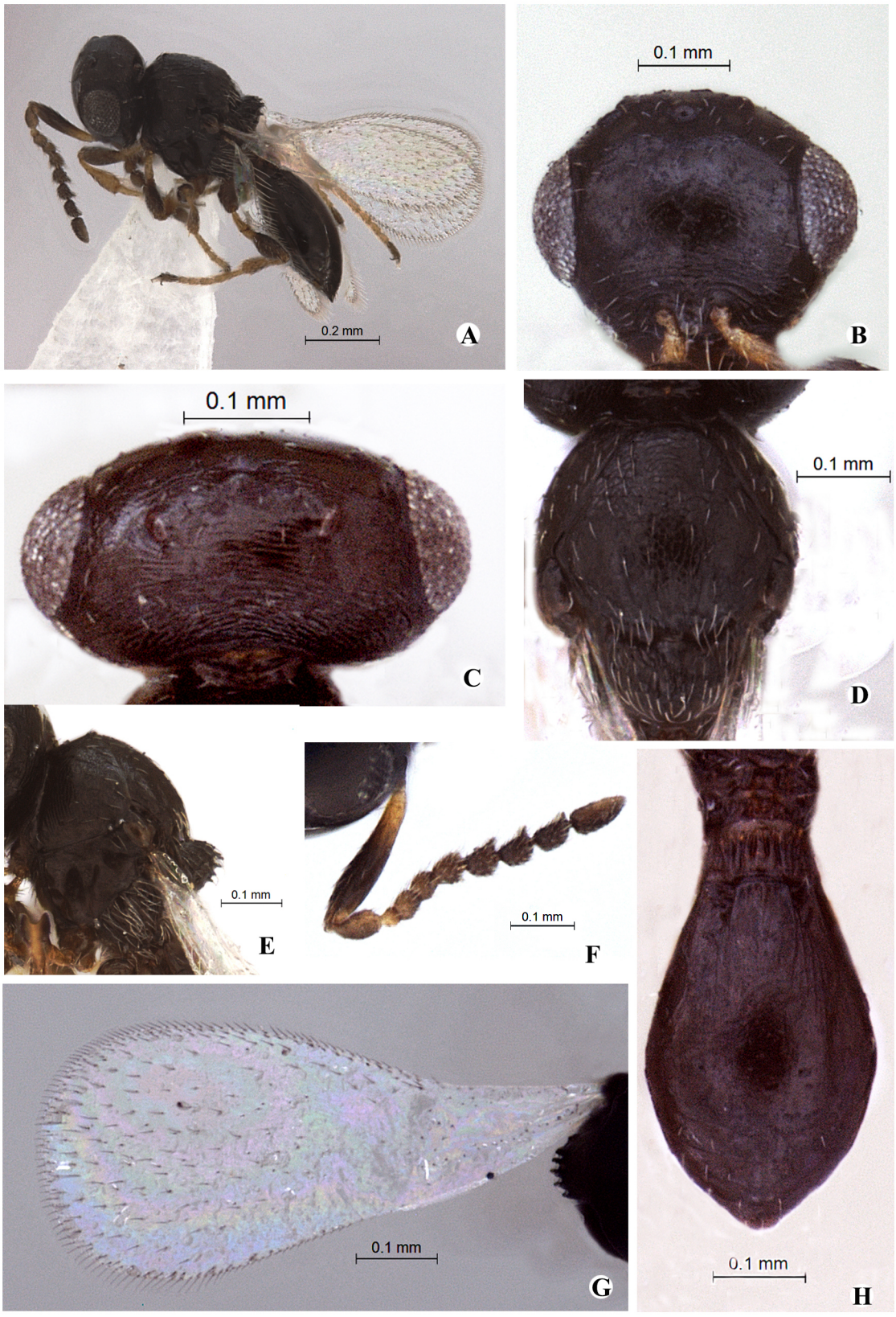
Figures A- H. *Synopeas (Sactogaster) westwoodi* Buhl (Female). A. Habitus B. Head dorsal view C. Antenna D. Mesosoma dorsal view E. Forewing F. Mesosoma lateral view G. Head front view H. Metasoma dorsal view

PLATE 56



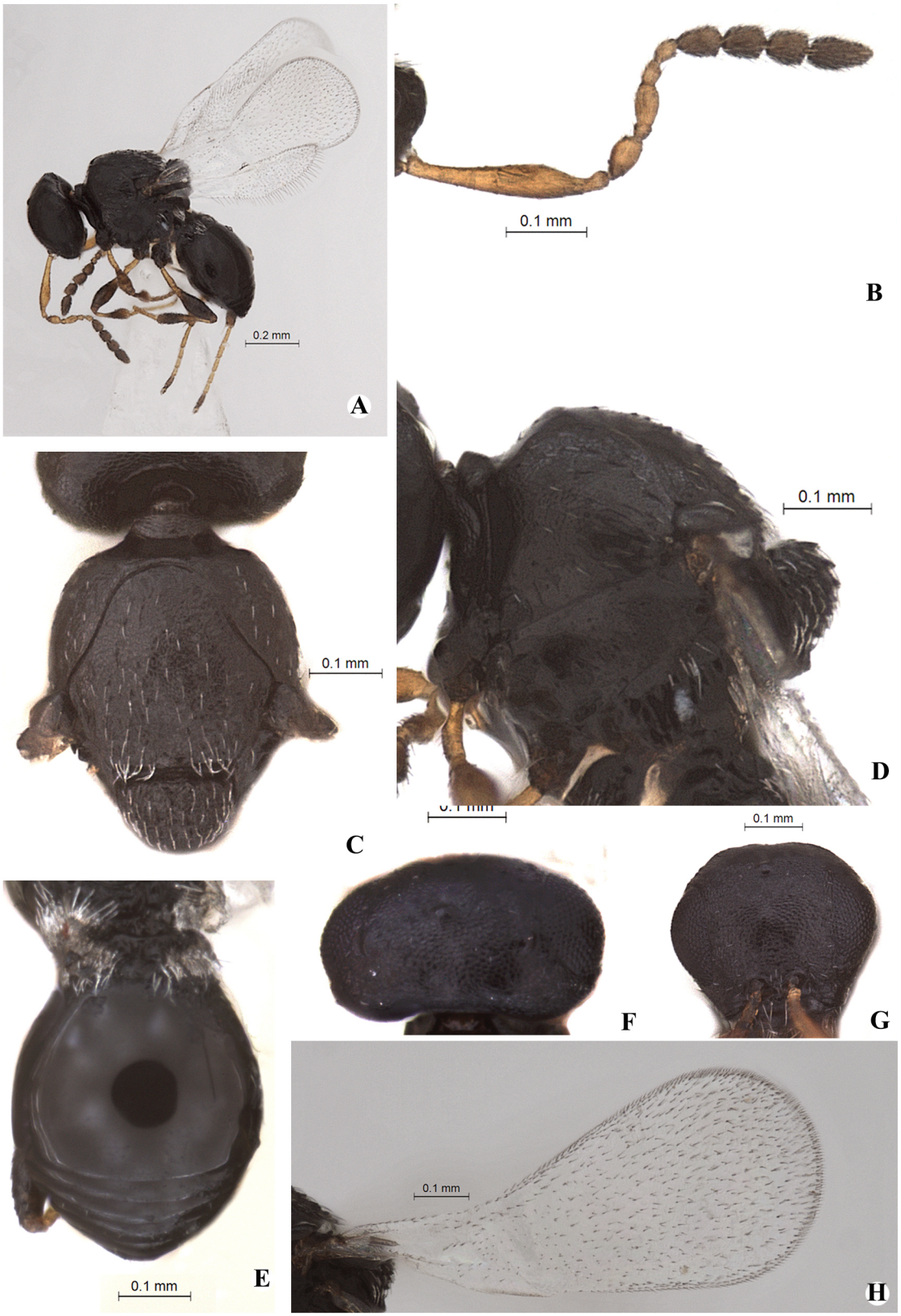
Distribution of *Synopeas (Sactogaster)* Förster and its species in Kerala

PLATE 57



Figures A- H. *Trichacoides indicus* Jackson (Female). A. Habitus B. Head front view C. Head dorsal view D. Mesosoma dorsal view E. Mesosoma lateral view F. Antenna G. Forewing H. Metasoma dorsal view

PLATE 58



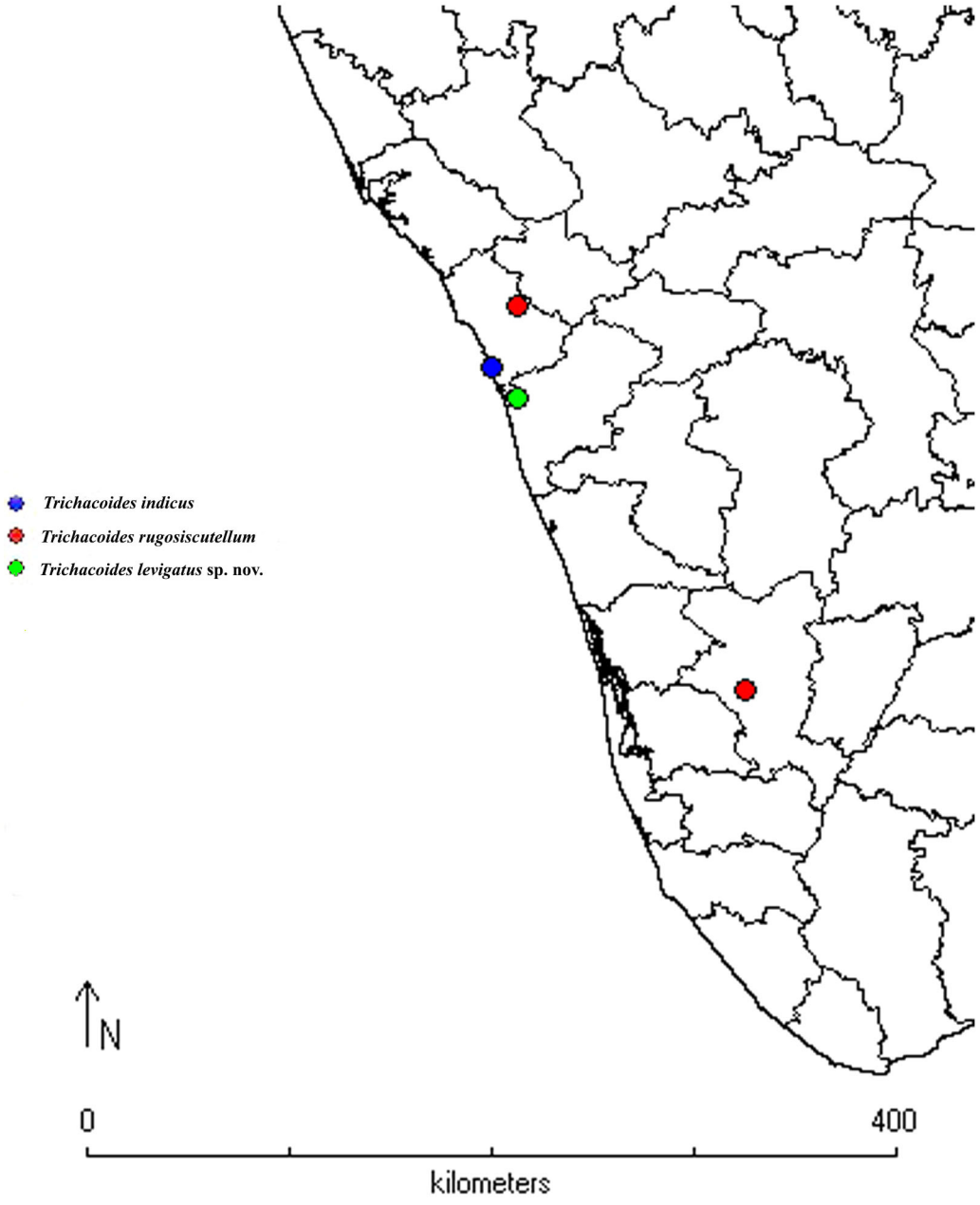
Figures A- H. *Trichacoides levigatus* sp. nov. (Female). A. Habitus B. Antenna C. Mesosoma dorsal view D. Mesosoma lateral view E. Metasoma dorsal view F. Head dorsal view G. Head front view H. Forewing

PLATE 59



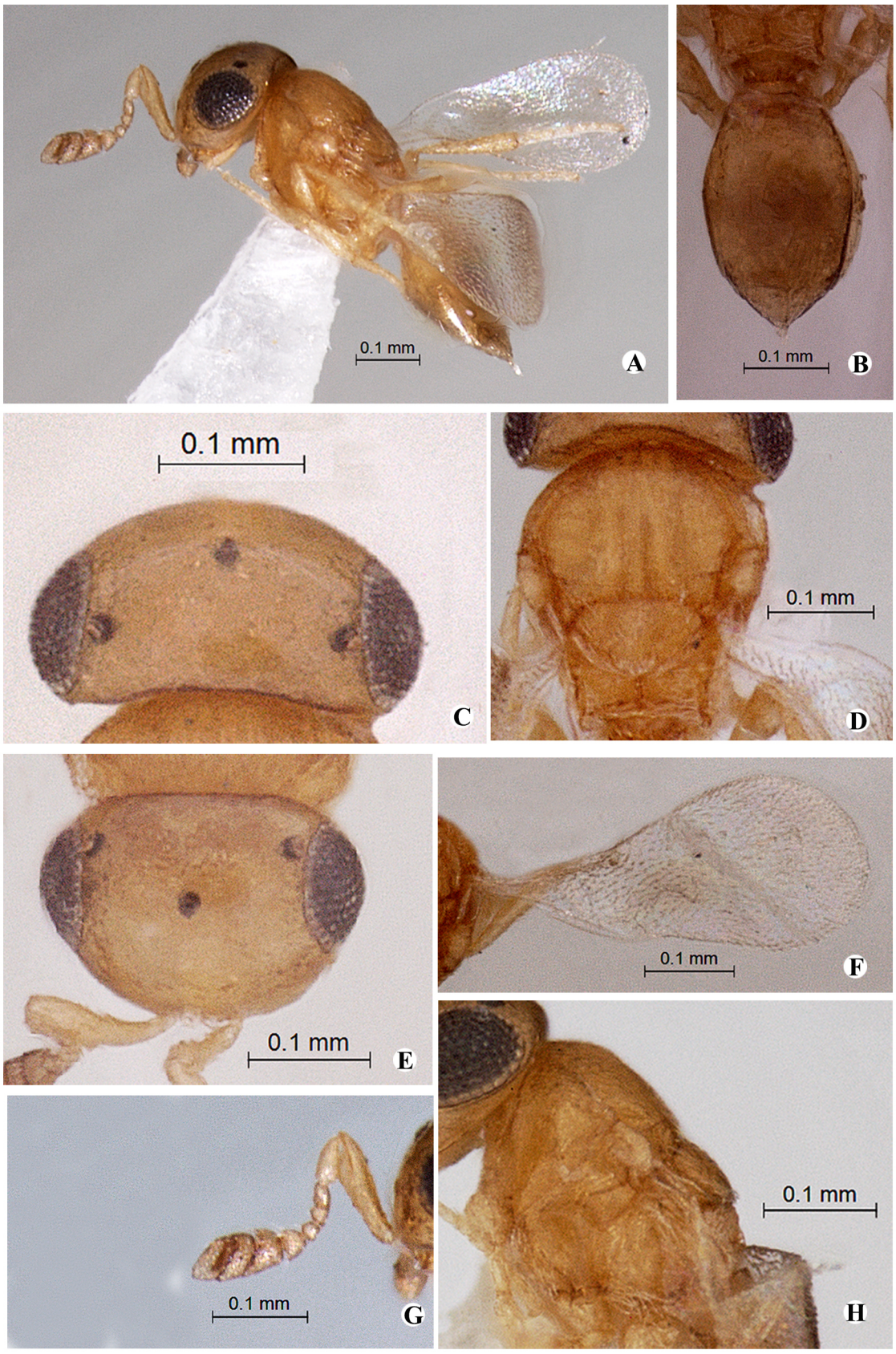
Figures A- H. *Trichacoides rugosiscutellum* Buhl (Female). A. Habitus B. Head dorsal view C. Metasoma dorsal view D. Mesosoma dorsal view E. Mesosoma lateral view F. Head front view G. Antenna H. Forewing

PLATE 60



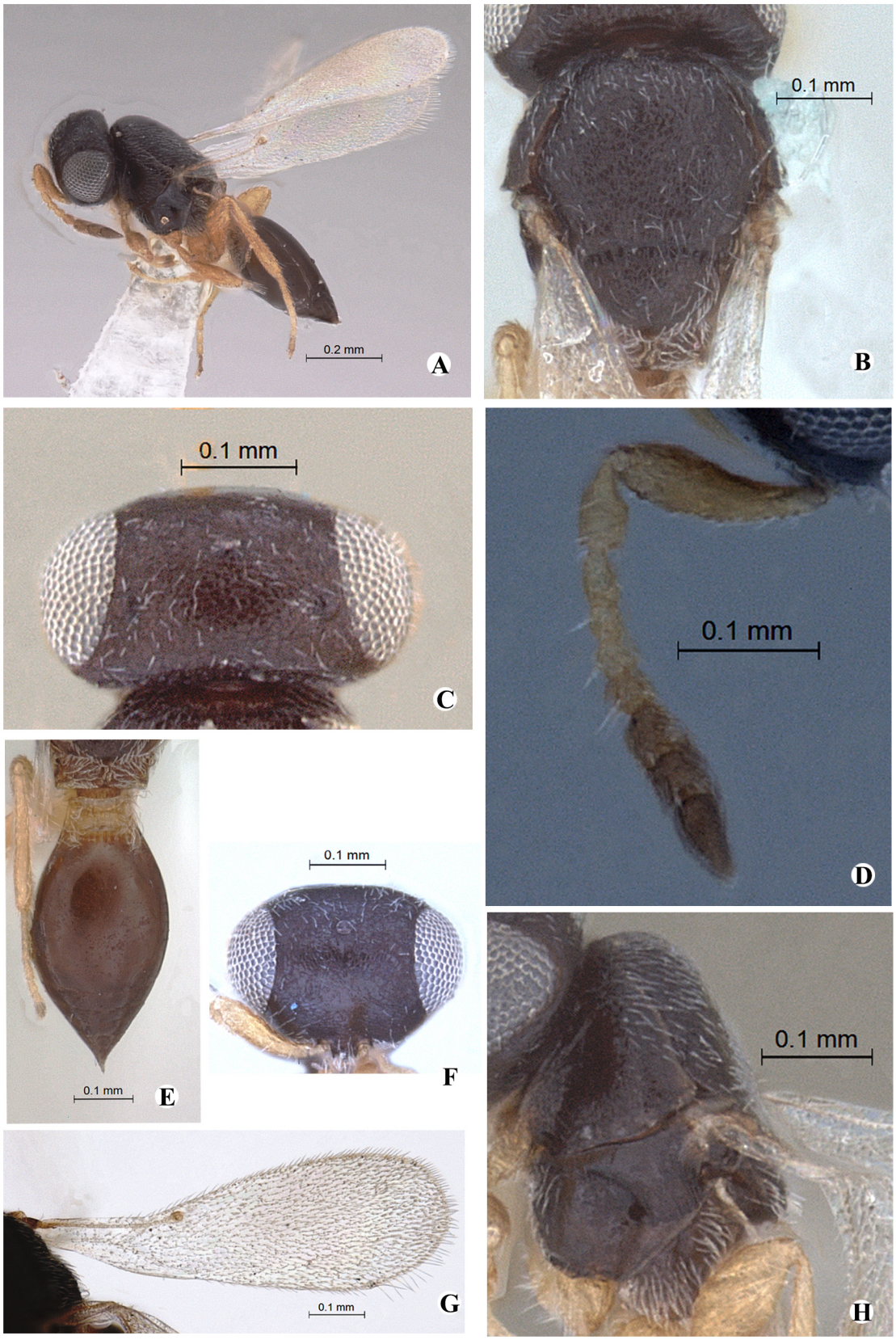
Distribution of genus *Trichacoides* Dodd and its species in Kerala

PLATE 61



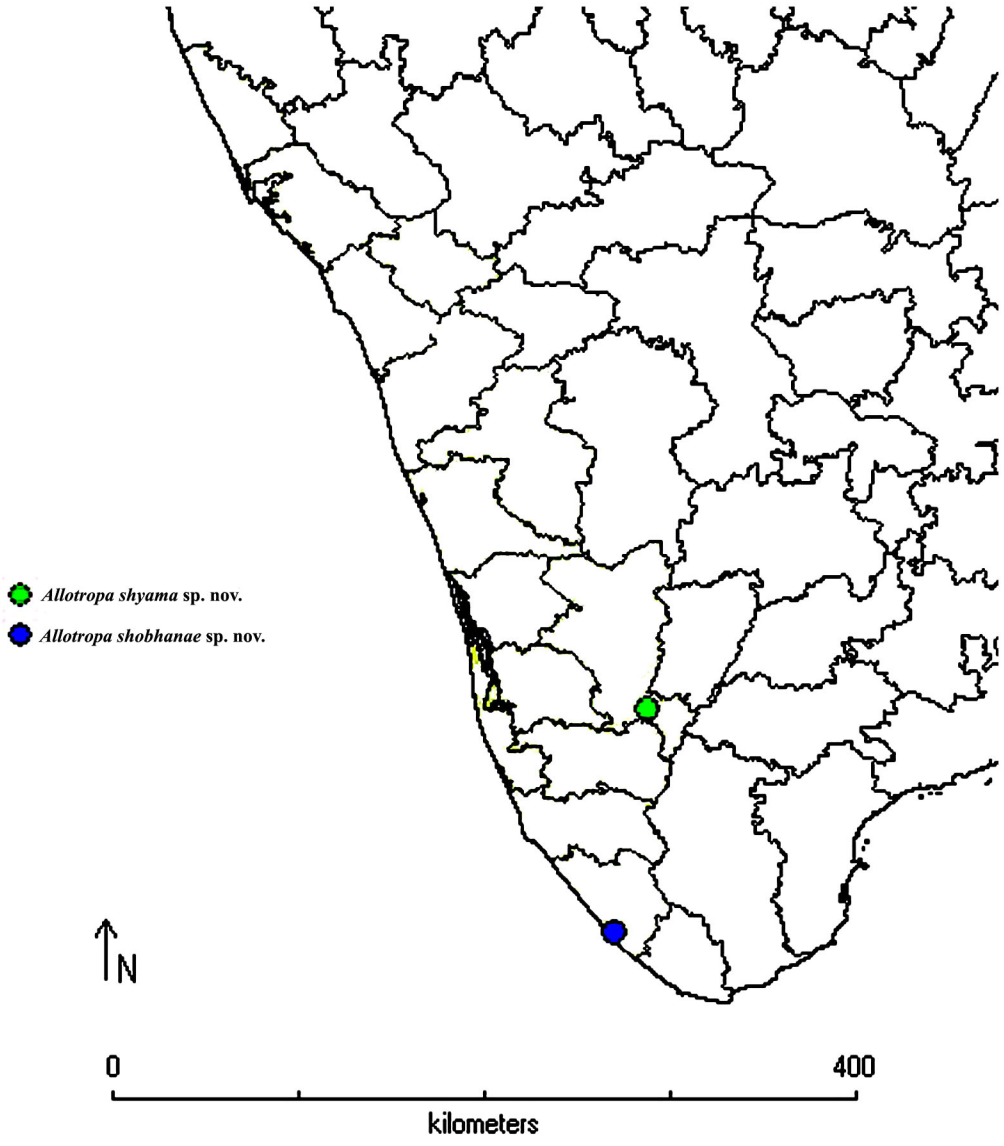
Figures A- H. *Allotropa shobhanae* sp. nov. (Female). A. Habitus B. Metasoma dorsal view C. Head dorsal view D. Mesosoma dorsal view E. Head front view F. Forewing G. Antenna H. Mesosoma lateral view

PLATE 62



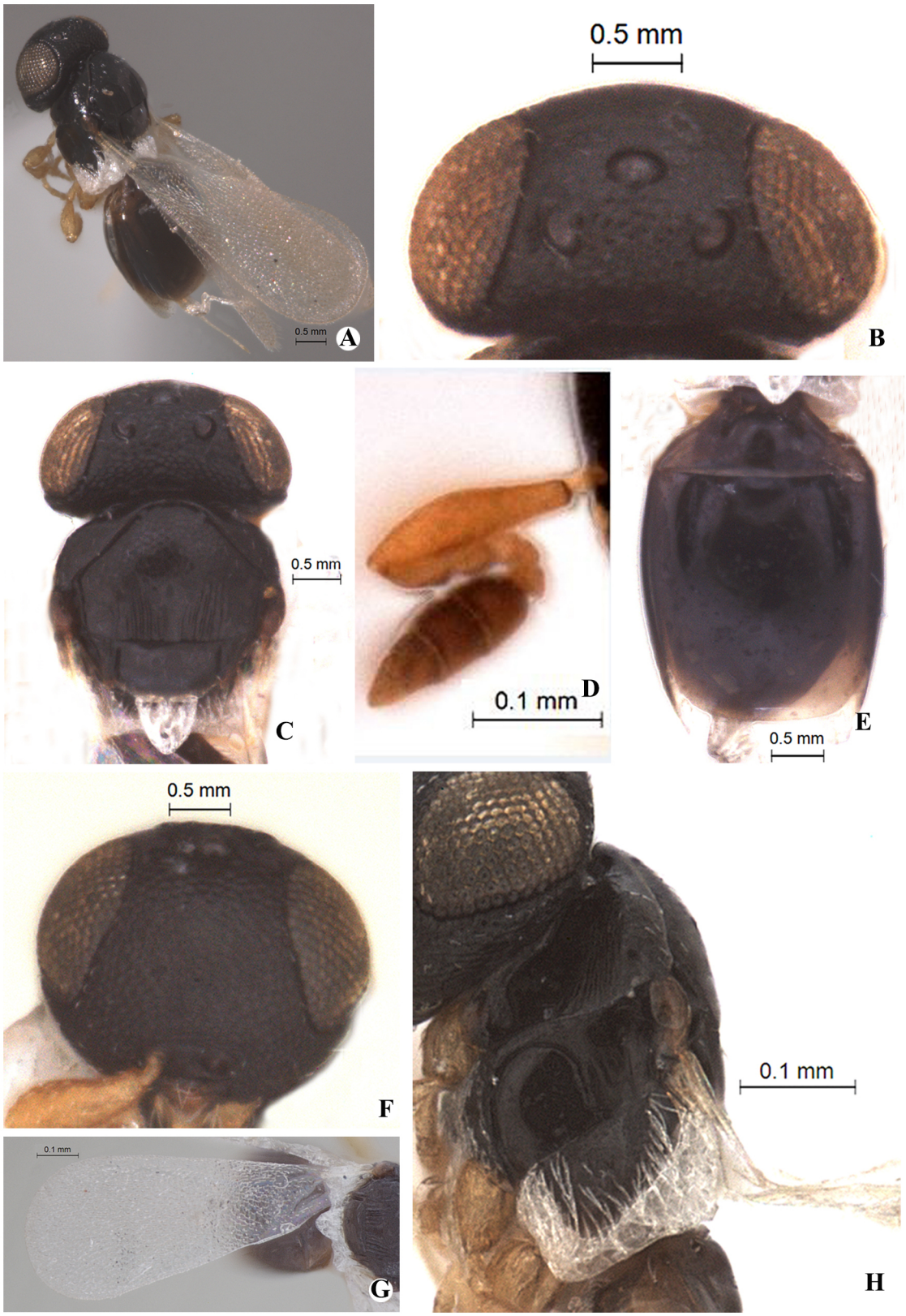
Figures A- H. *Allotropa shyama* sp. nov. (Female). A. Habitus B. Mesosoma dorsal view C. Head dorsal view D. Antenna F. Metasoma dorsal view F. Head front view G. Forewing H. Mesosoma lateral view

PLATE 63



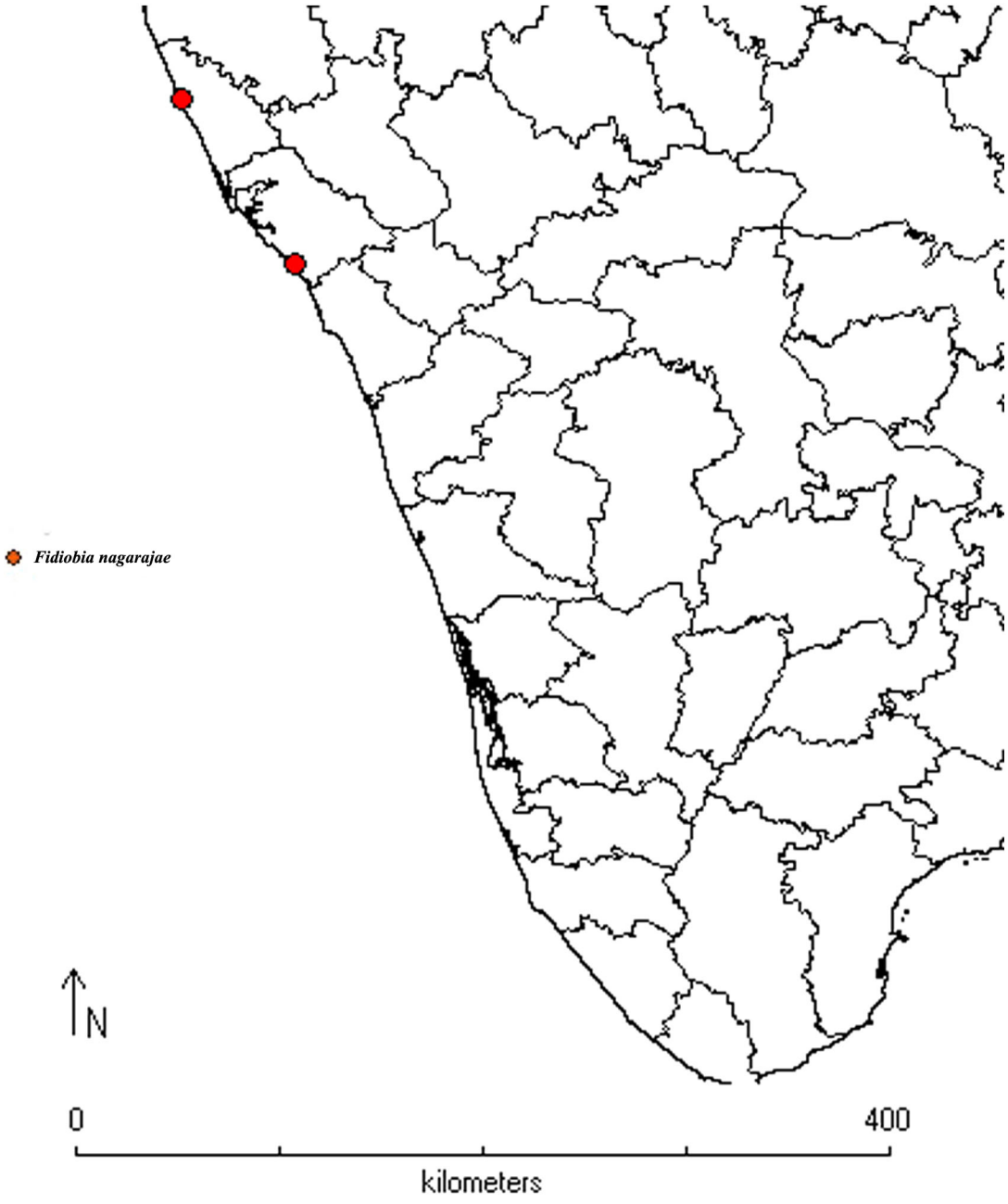
Distribution of genus *Allotropa* Förster and its species in Kerala

PLATE 64



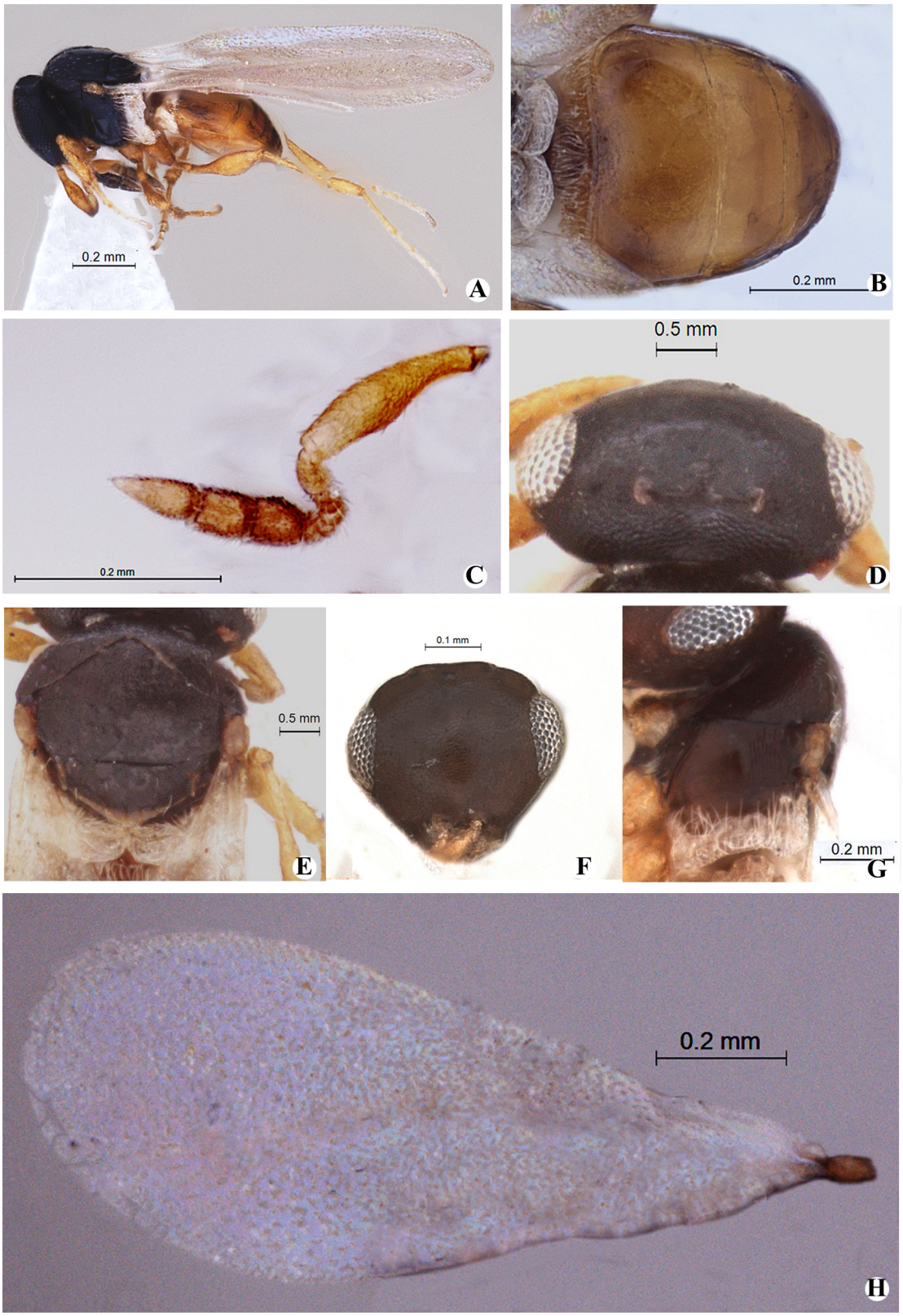
Figures A- H. *Fidiobia nagarajae* Veenakumari and Buhl (Female). A. Habitus B. Head dorsal view C. Mesosoma dorsal view D. Antenna E. Metasoma dorsal view F. Head front view G. Forewing H. Mesosoma lateral view

PLATE 65



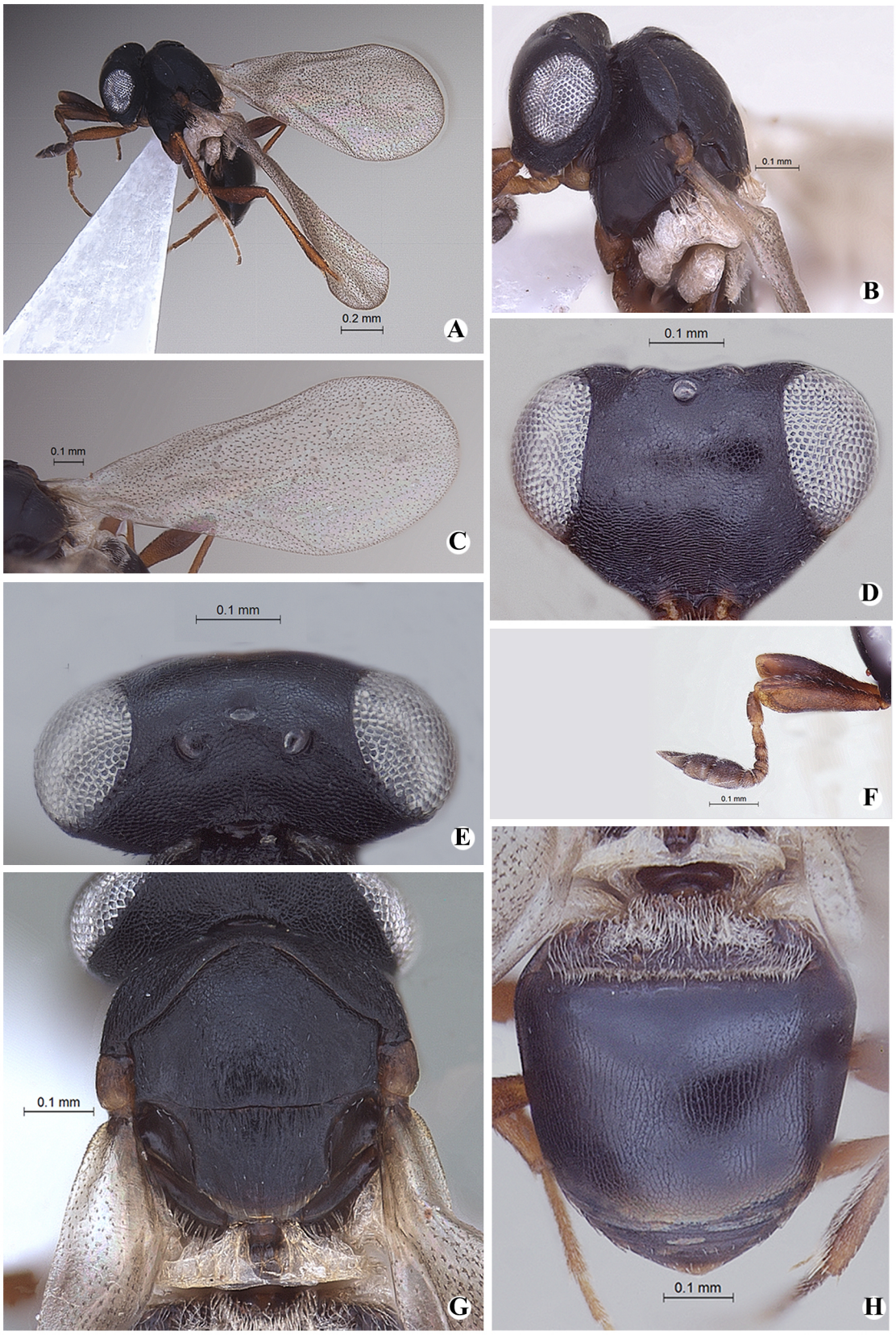
Distribution of genus *Fidiobia* Ashmead and its species in Kerala

PLATE 66



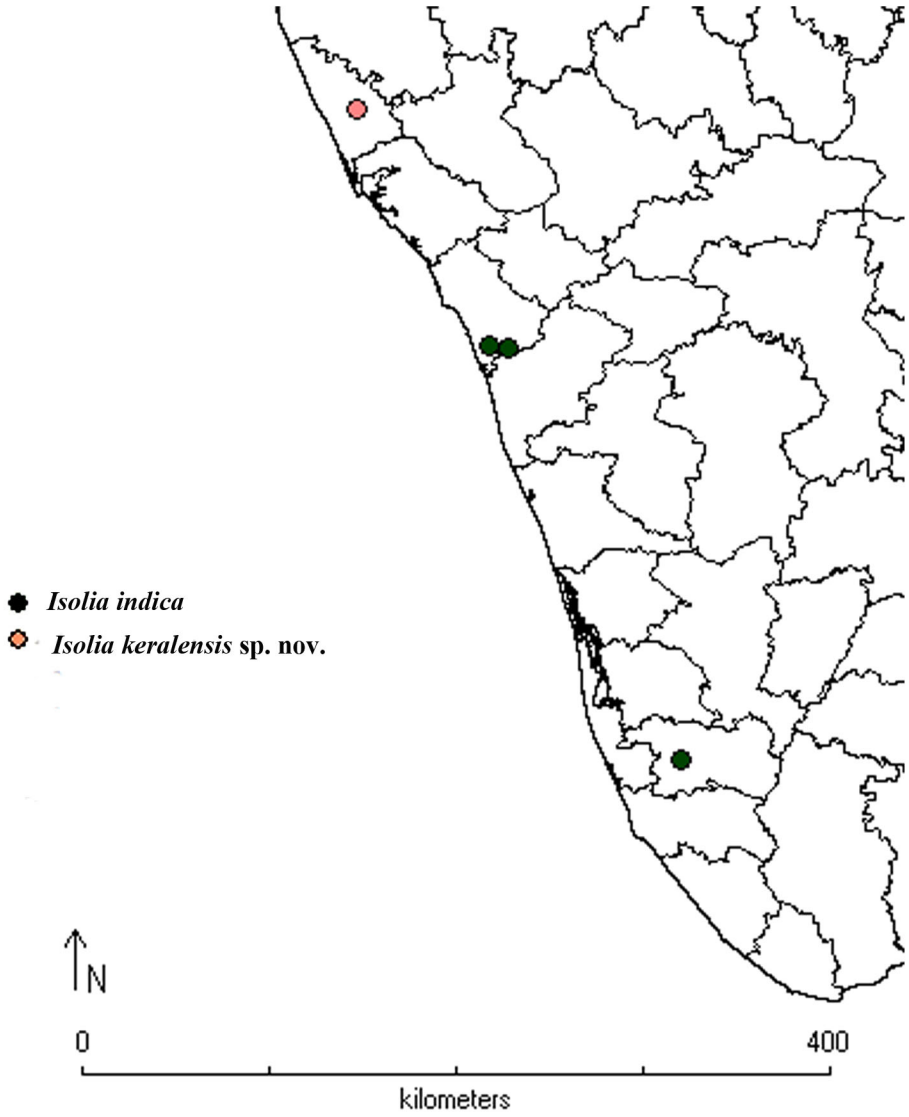
Figures A- H. *Isolia indica* Buhl (Female). A. Habitus B. Metasoma dorsal view C. Antenna D. Head dorsal view E. Mesosoma dorsal view F. Head front view G. Mesosoma lateral view H. Forewing

PLATE 67



Figures A- H. *Isolia keralensis* sp. nov. (Female). A. Habitus B. Mesosoma lateral view C. Forwing D. Head front view E. Head dorsal view F. Antenna G. Mesosoma dorsal view H. Metasoma dorsal view

PLATE 68



Distribution of genus *Isolia* Förster and its species in Kerala

PLATE 50

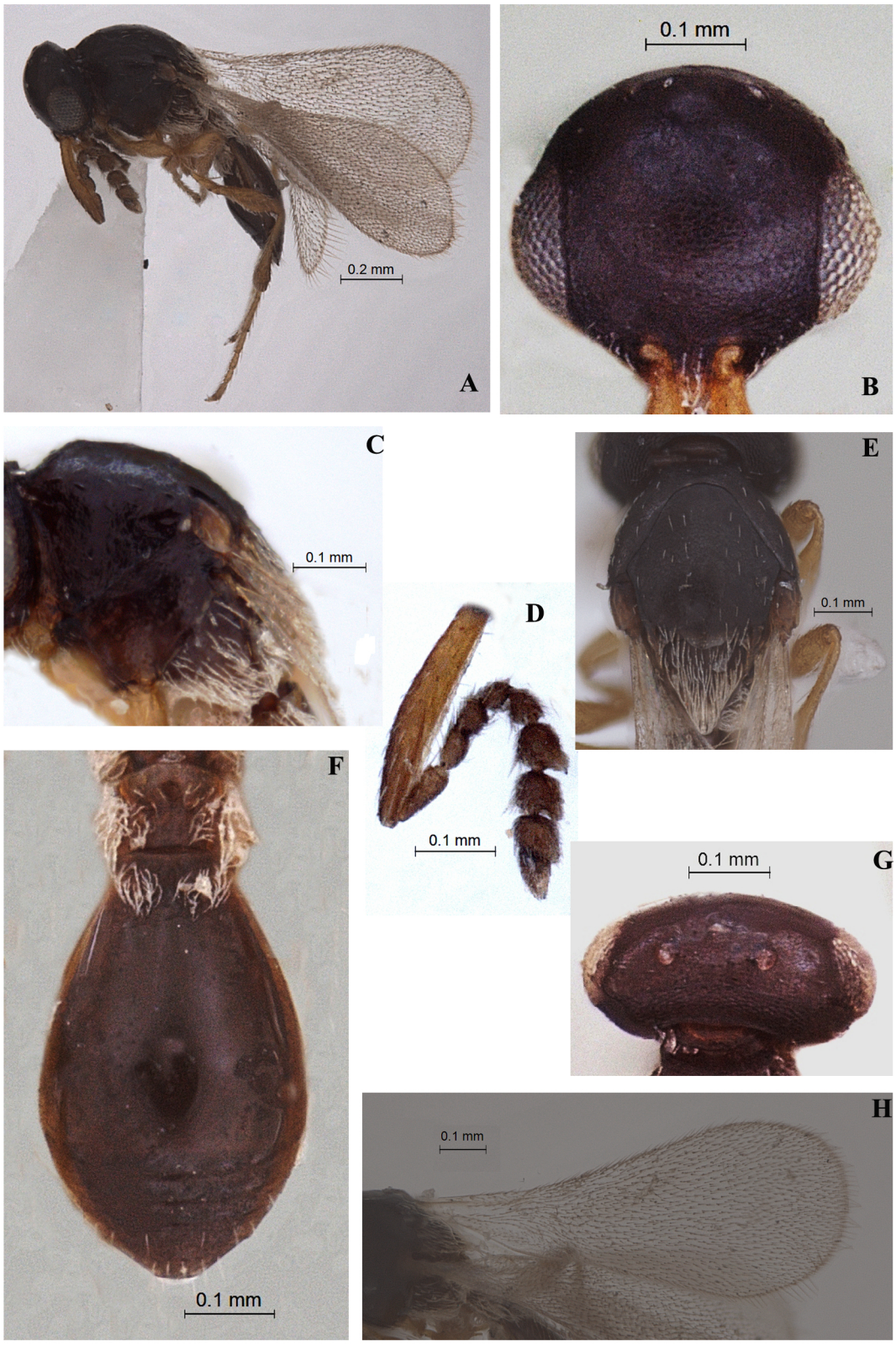






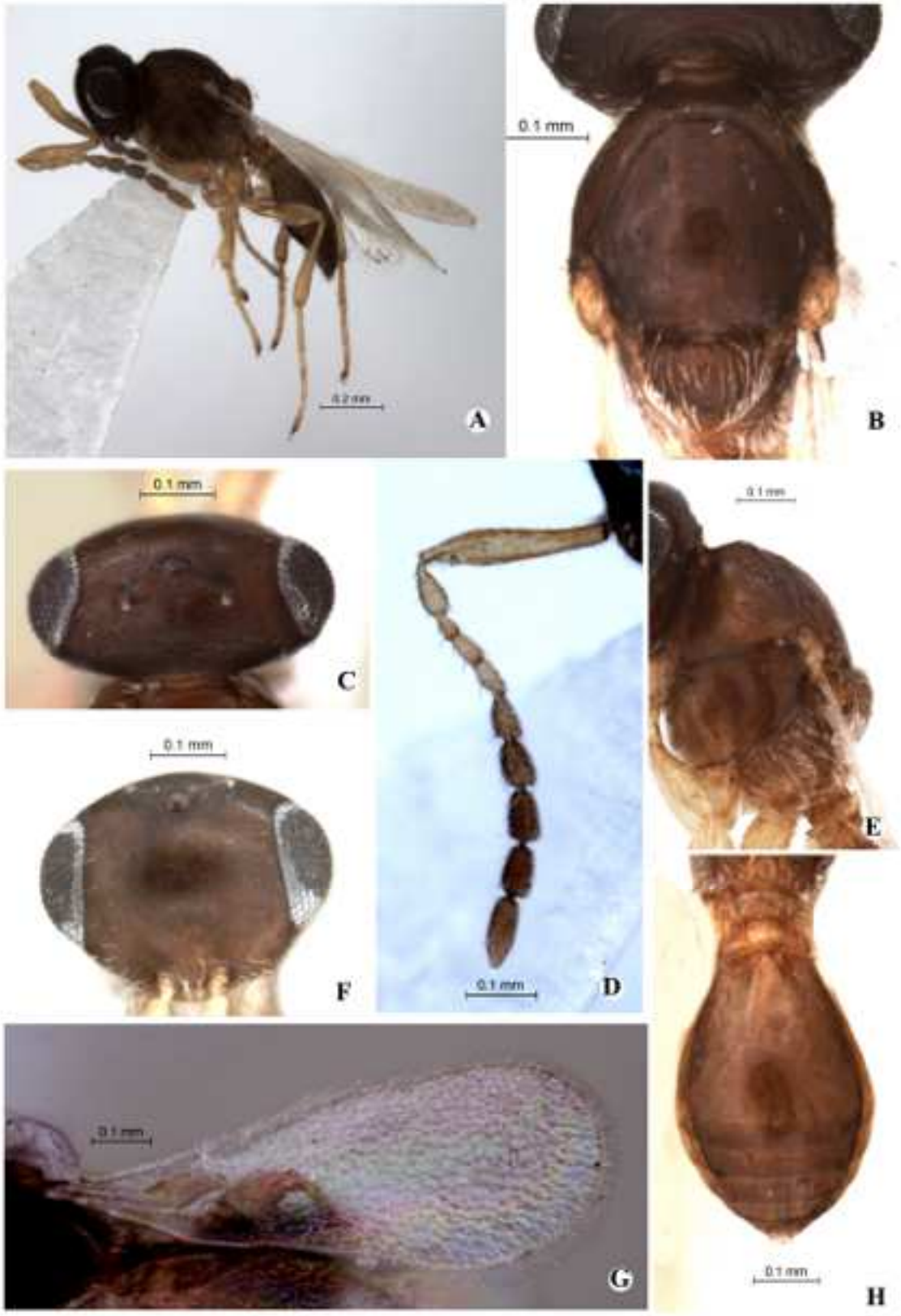
Figures A- C. Holotypes (ZSI, Calicut).
A. *Platygaster nigrocoxatus* Ushakumari
B. *Platygaster zantanus* Ushakumari
C. *Platygaster tanus* Ushakumari

PLATE 10



Figures A- H. *Amblyaspis hirsuta* Anjana and Rajmohana (Female). A. Habitus B. Head front view C. Mesosoma lateral view D. Antenna E. Mesosoma dorsal view F. Metasoma dorsal view G. Head dorsal view H. Forewing

PLATE 45



Figures A- H. *Platygaster neogalbus* sp. nov. (Female). A. Habitus B. Mesosoma dorsal view C. Head dorsal view D. Antenna E. Mesosoma lateral view F. Head front view G. Forewing H. Metasoma

PLATE 50



A



B



C

Figures A- C. Holotypes (ZSI, Calicut). A. *Platygaster nigrocoxatus* Ushakumari B. *Platygaster zantanus* Ushakumari C. *Platygaster tanus* Ushakumari

PLATE 10



Figures A- H. *Amblyaspis hirsuta* Anjana and Rajmohana (Female). A. Habitus B. Head front view C. Mesosoma lateral view D. Antenna E. Mesosoma dorsal view F. Metasoma dorsal view G. Head dorsal view H. Forewing

PLATE 24



Figures A- H. *Iphitrachelus neogracilis* sp. nov. (Female). A. Habitus B. Mesosoma dorsal view C. Mesosoma lateral view D. Head dorsal view E. Head front view F. Metasoma dorsal view G. Antenna H. Forewing