TAXONOMIC STUDIES OF EURYTOMIDAE (HYMENOPTERA: CHALCIDOIDEA) OF KERALA STATE

Thesis
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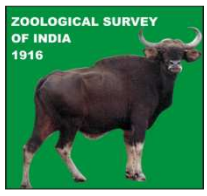
NIKHIL K.



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भारत सरकार
Govt. of India
पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय
Min. of Environment, Forests and Climatic Change

तारः जूलसुर- कालीकट
Tele: ZOOLSUR-CALICUT
दूरभाष/फैक्स/Phone/Fax:0495-2771929& 2771324
प्रभारी अधिकारी/ Officer-in-Charge: 2771324
ई-मैल/E-mail: zoolsurcalicut@dataone.in

भारतीय प्राणी सर्वेक्षण
ZOOLOGICAL SURVEY OF INDIA
पश्चिमी घाट प्रादेशिक केंद्र
Western Ghat Regional Centre
कोषिकोड, केरल/**Kozhikode**-673 006, Kerala

Date……..

CERTIFICATE

This is to certify that this thesis entitled, ***"Taxonomic Studies of Eurytomidae (Hymenoptera: Chalcidoidea) of Kerala State"*** is an authentic record of the work carried out by **Mr. Nikhil. K** from July 2012 to July 2016 under my guidance and supervision in partial fulfilment of the requirements of the Degree of Doctor of Philosophy in Zoology (faculty of Science) of the University of Calicut. No part of the thesis has been submitted either partly or fully to any other University or Institution for the award of any degree.

It is further certified that the candidate has passed the Ph. D qualifying examination of University of Calicut held in June 2013.

Dr. P. M. SURESHAN
Scientist- D,
Officer-in-Charge & Research guide

DECLARATION

I do hereby declare that the thesis entitled ***"Taxonomic Studies of Eurytomidae (Hymenoptera: Chalcidoidea) of Kerala State"*** is an authentic record of the work carried out by me under the supervision of Dr. P. M. Sureshan, Scientist D and Officer-in-Charge, Western Ghats Regional Centre, Zoological Survey of India, Kozhikode and no part of the thesis has previously formed the basis for the award of any Degree or Diploma as stipulated in the Statutes of the University of Calicut.

Calicut, **Nikhil. K**

. 07. 2016

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Dedicated to

My Beloved Teacher Prof. Dr. T. C. Narendran, FASc.

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CHAPTER 1
INTRODUCTION

"Sound taxonomy is the foundation of all meaningful research in Biology. It has great relevance in various fields like biodiversity, ecology, agriculture, medicine etc." (Narendran, 2001). The importance of this statement is increasing day by day because of the swelling number of workers in various fields like biology, ecology, evolution, zoogeography, economic and medical entomology, etc. Their work includes the detailed study and identification of the systematic position of a single species or a limited set of species. The nontaxonomists can seek help from taxonomists to know the exact identity of the specimens on which they are planning to work. The main criticism against Taxonomy is that it does not need high field work or intelligence and the identification can be made easily by just running the key. But according to Narendran (2001) "Research in taxonomy needs hard field oriented work involving dangerous situations". A taxonomist needs several hours or days, looking through his microscope for identifying a single specimen and he needs dedication and intelligence for analyzing various characters. To identify a species authentically, expertise developed through years is called for.

Biodiversity - the key factor of the existence of life on earth - is under threat due to high rate of extinction. Conservation of the existing flora and fauna is one of the best method for maintaining the biodiversity. And for the conservation we want to know the existing biodiversity, and for this taxonomy is an essential tool.

1.1. Hymenoptera: a species rich group

Order Hymenoptera, one of the most species rich insect orders in Class Insecta, contains 132 families, 8423 extant genera with an additional 685 extinct genera and 1,53,088 extant species, in addition to 2429 extinct species (Aguiar *et al.,* 2013). Hymenopterans are found in most terrestrial environments and play key roles in many ecosystems, notably as pollinators of flowering plants, as parasitoids and predators of phytophagous insects (Ronquist, 1999).

The Order Hymenoptera has two suborders viz. Symphyta and Apocrita. Symphyta are commonly called as sawflies due to their saw like structure on ovipositor. Apocrita has two divisions viz. Parasitica and Aculeata. The social wasps having predatory nature and stinging capacity to humans are mainly included in Aculeata. And the Parasitica or Parasitic hymenoptera contains the wasp species which are ecto or endo parasitic in nature. The parasitic hymenopterans are one of the most important groups of insects to human beings due to their potential in biological control. More than 85% of species used in classical biological control programs are parasitic hymenopterans (Greathead, 1986).

1.2. Super family - Chalcidoidea

Among the hymenopteran super families Chalcidoidea has its own place with 23 families, 2045 genera and 22,784 species from all over the World (Aguiar *et al.,* 2013). The members of this superfamily show diversity in structure, biology and behavior. And they have a special mark in biological control programs. Over 800 species are recorded as useful biocontrol agents against insect pests (Narendran, 2013). Majority of the species under Chalcidoidea are entomophagus and some are phytophagus in nature and few of them are both entomophagus and phytophagus in nature. The

entomophagous species show high diversity in host preference, they parasitise several species belonging to Coleoptera, Diptera, Heteroptera, Hymenoptera, Lepidoptera, Neuroptera, Orthoptera, Odonata, Psocoptera, Siphonaptera, Thysanoptera and some species of Arachnida.

The chalcids or members of Chalcidoidea were easily identified by their prominent taxonomic characters, the most important of them are, fore wing with reduced wing venation and no closed cells, presence of prepectus and many of them are having bright metallic coloration.

1.3. Family: Eurytomidae

Eurytomidae is one of the species rich families of super family Chalcidoidea, which contains 72 valid genera and 1621 species (Noyes, 2016) from the world. The eurytomids are widely distributed throughout the world. They have wide host associations, which include primary parasitoids, secondary parasitoids, gall makers, entomophagous and phytophagous forms. Normally the eurytomids are black, brown or yellow (*Sycophila*) in color with an exception of genus *Chryseida* Spinola having bright metallic color. Even though Eurytomidae contains 72 genera more than half of the species are included under the genus *Eurytoma*, and naturally it is the most species rich genus in this family. Due to the high number of members in the genus, *Eurytoma* shows high degree of variations and similarities between species and according to many authors *Eurytoma* may have many species complex.

Taxonomic Position of Eurytomidae

According to many authors the number of subfamilies of Eurytomidae varies. The major ones are; Burks (1971) divided the family Eurytomidae into 8 subfamilies Viz. Aximinae, Eudecatominae, Eurytominae, Harmolitinae, Heimbrinae, Philoleminae, Prodecatominae and Rileyinae. Zerova (1988) divided the family into seven subfamilies by excluding the subfamilies

Prodecatominae and Philoleminae from Burk's classification and added a new subfamily Buresiinae, the author included the subfamilies Prodecatominae and Philoleminae under the subfamily Eurytominae. Boucek (1988) recognized that there are only three subfamilies in family Eurytomidae namely Rileyinae, Eurytominae and Heimbrinae. Lotfalizadeh *et al* (2007) added a new subfamily Buresiinae Boucek (to the concept of Boucek, 1988) and considered that Eurytomidae have four subfamilies. Gates (2008 (a)) recognized that family Eurytomidae have only three subfamilies by synonymising the subfamily Buresiinae to subfamily Eurytominae. The most acceptable classification of Eurytomidae are

1. Boucek (1988).
2. Narendran in 1994 also accepted the classification proposed by Boucek.
3. Gates (2008 (a)).

The members of the family Eurytomidae are common in all Zoogeographical realms. At subfamily level Eurytominae is cosmopolitan in distribution. But the subfamily Heimbraine is present only in Neotropical regions, and the subfamily Rileyinae found mainly in Neotropical regions and also representation with less number of species in Africa, Australia, Europe and Central Asia. Eurytominae is the largest subfamily in Eurytomidae having 64 genera, the subfamily Rileyinae has 6 genera and Heimbraine has 2 genera. In the Oriental Region, only Eurytominae is present. There is a high difference in the number of genera while comparing Eurytominae with the other two subfamilies and it is also expressed in the case of its host associations. The Eurytominae has wide host range while comparing with the other two subfamilies. Rileyinae are mainly egg parasitoids of gall forming cecidomyiids. Heimbraine are associated with wood boring beetles.

The best references for Eurytomidae of Oriental region are Boucek, 1988 for Australasian Region and Narendran, 1994 for Indian Subcontinent. The Oriental Eurytomidae have 281 species under 35 genera (Noyes, 2016), as like other regions the most species rich genera are *Eurytoma* followed by *Bruchophagus*. Narendran (1984-2013) made the highest contribution to the Oriental Eurytomidae, and about 50% of the Oriental species are authored by him, the percentage become higher if we take the number of species in India or Kerala.

Economic Importance

Some of the members of Eurytominae are exclusively phytophagous and they include the genera *Austrodecatoma* Girault, *Ausystole* Boucek, *Risbecoma* Subba Rao, *Systole* Walker and *Tetramesa* Walker. Many of these genera and the species having phytophagous nature act as pests or may cause negative influence on the cultivated or beneficial crops. The genus *Austrodecatoma* mainly feed on gall fruits of *Atalantia* (Rutaceae), *Ausystole* are mainly associated with seeds of legume. The members of the genus *Systole* are seed eaters especially the seeds of Umbellifera, but in Kerala the *Systole* is mainly found associated with galls of *Calycopteris* species (Combretaceae), eg: *Systole calycopterae* Narendran. The larval stages of *Tetramesa* are feeding the soft tissues present inside the internodes of grass stem eg: *Tetramesa tritici* (Fitch) infest on stems of wheat. In the Oriental region especially in India the members of the genus *Tetramesa* are mainly associated with agricultural crops especially rice and vegetables. In addition to these genera, there are also phytophagous species in many other large genera like *Bruchophagus*, *Eurytoma* etc. for example *Bruchophagus fellis* (Girault) cause galls on citrus plant and it is also important that not all species under these genera are phytophagus in nature.

The eurytomids also show entomophagous nature and such members are present in many genera especially in *Bruchophagus* and *Eurytoma*. The entomophagous forms in Eurytomidae are mainly primary or secondary parasitoids. Among this, most of them are primary parasitoids but a few are secondary parasitoids which mainly parasitize members of family Ichneumonidae and Braconidae. Some of the examples are, *Eurytoma* sp. infesting on *Quadrastichus erythrinae* (Erythrina Gall wasp), *Philolema braconidis* Ferrière infest on *Diaphania indica* Saunders, *Eurytoma chinnarensis* Sureshan and Narendran associated with *Bracon* sp. (Braconidae). *Eurytoma parva* Phillips infests first and second instars of *Tetramesa tritici* (Fitch), this *Eurytoma* shows phytophagy before or after consuming the host. The similar case also happens in the larvae of *Eurytoma brunniventris* Ratzeburg which is associated with oaks and feed both the gall forming larvae and the tissues in gall.

Importance in Biological Control

The family Eurytomidae also pose due importance in biological control. An important aspect in this regard is the phytophagous forms of eurytomids shows best results in biological control. The phytophagous eurytomids are used against the weeds or invasive plants in the agricultural fields, eg: *Tetramesa romana* (Walker) has been successfully used against *Aurundo donax* Linnaeus in USA. *Aurundo donax* Linnaeus is a bamboo like plant, which is cultivated for ornamental and fibre uses in Europe, South Asia, including North Africa and Arabian Peninsula. This plant was introduced to USA in early 1500s and quickly become naturalised with fast growth. But the exponential increase in the number of this single species led to loss of biodiversity, damage to bridges, stream bank erosion etc. The U.S. Government was under stress to cop up with high cost for the safe implementation of mechanical or chemical control methods to manage this

issue. After studying the impact of parasitoid, the U.S. Department of Agriculture (USDA) gave sanction to the field release of *Tetramesa romana* (Walker) against *Aurundo donax* Linnaeus. Another example is *Eurytoma* sp. which was found to be good as biological control agent against *Quadrastichus erythrinae* Kim by the study conducted by the Agricultural department of Hawaii, and successfully implemented it in 2007. Delvare in 1988 found that *Eurytoma oryzivora* Delvare is a good parasitoid against the African stem borer *Maliarpha separatella* Ragonot in Africa.

1.4. Significance of the Study

India is blessed with rich biodiversity and one of the megadiversity countries with four hot spots, the Eastern Himalayas, the Western Ghats, Sundaland and Indo-Burma Border. Regarding the hymenopteran diversity of India, about 60% of them are concentrated in the area from Kashmir to Nagaland, about 20% are present in the hilly areas of Eastern and Western ghats and the remaining 20% are present in the plains of Central and North India. The family Eurytomidae in India have 24 genera and 183 species. Among the 183 eurytomid species of India, more than 70% are reported from Western Ghats and the majority are from Southern Western Ghats (this may be due to the highest diversity of Eurytomidae in Western Ghats and also due to the studies of Dr. T. C. Narendran by his monumental work "Eurytomidae and Torymidae of Indian Sub continent" in 1994).

Major studies on Eurytomidae of Kerala are hardly reported after 1994. Molecular phylogenic studies on Eurytominae (Lotfalizadeh *et al.*, 2007), the generic composition of Eurytomidae underwent several changes and synonymies. These changes in the generic composition will have major effect on the faunal taxonomy of this region. Both of these factors reveal the importance of the studies on taxonomy of Eurytomidae. Taxonomic descriptions of the new and existing species, dichotomous Key for the

identification of genera and species, distribution of species, host parasite list and checklist will become a significant platform for further applied studies based on Eurytomids.

The Eurytomid fauna of Kerala is represented by 96 species under 14 genera (Noyes, 2016).

1.5. Objectives of the present study

1. Surveying of eurytomid species from all districts of Kerala.
2. Identifying, describing new taxa and redescribing little known taxa.
3. Preparation of dichotomous keys for identification of genera and species.
4. Distribution of genera and species in the State.
5. Host-parasite list of the genera and species studied.

The specimen samples for the present study were collected from all 14 districts of Kerala. During the course of the study, more than 1200 specimens are examined which included the specimens deposited in Zoological Survey of India, Western Ghat Regional Centre, Kozhikode. The collected specimens mainly included the already described species under the genera *Eurytoma* Walker and *Bruchophagus* Ashmead. The specimens belonging to the genera *Philolema* Cameron, *Prodecatoma* Ashmead, *Neobephrata* Narendran and Padmasenan, *Sycophila* Walker, *Systole* Walker and *Tetramesa* Walker have good number of described and new species, which are described in the present work.

Describing all the genera, species and new species of the family Eurytomidae of Kerala are beyond the scope of the present study. But taxonomic revision of the genera *Philolema* Cameron, *Prodecatoma*

Ashmead, *Neobephrata* Narendran and Padmasenan, *Sycophila* Walker, *Systole* Walker and *Tetramesa* Walker are highly necessary because, many of the species under these genera should need taxonomic redescriptions for their correct identification. So the genera *Philolema*, *Prodecatoma*, *Neobephrata*, *Sycophila*, *Systole* and *Tetramesa* are taken for complete taxonomic analysis. Diagnosis, distribution details and key to species of all the remaining genera (*Aximopsis* Ashmead, *Bruchophagus* Ashmead, *Eurytoma* Walker, *Eurytomocharis* Ashmead, *Fronsoma* Narendran, *Plutarchia* Girault, *Ramdasoma* Narendran and *Risbecoma* Subba Rao) are provided.

CHAPTER 2
REVIEW OF LITERATURE

The family Eurytomidae is one of the species rich families of Super family Chalcidoidea. The names FABRICIUS, LATREILLE, WALKER, ILLIGER, ROSSI, SPINOLA etc. stand out as pioneer workers in this family. ASHMEAD (1888-1905), CAMERON (1884-1913), GIRAULT (1911-1938), MASI (1917-1943), PHILLIPS (1918-1936), PECK (1951-1963), ERDOS (1952-1964), BOUCEK (1952-1988), ZEROVA (1974-2012), NARENDRAN (1984-2013) also made significant contributions to the study of Eurytomidae. Among these, the most excellent publications are by BOUCEK in 1988 and NARENDRAN in 1994. BOUCEK made a taxonomic revision on Australasian fauna of Chalcidoidea and NARENDRAN made revision of 'Eurytomidae and Torymidae of Indian Sub Continent' as a monograph. Except NARENDRAN only a very few works were done on Eurytomidae in India. MANI (1938), BURKS (1958), JOSEPH and ABDURAHIMAN (1968), MUKERJEE (1981), BOUCEK (1983), SUBBA RAO (1974-1986), NARENDRAN (1984-2013), NARENDRAN and PADMASENAN (1990, 1991), SURESHAN (2004, 2005), SURESHAN *et al.* (2013) published papers on Indian and Oriental Eurytomidae.

The studies of Eurytomid wasps may begin with REAUMUR in 1737, who identified an insect specimen as a 'wasp species' which was later identified as *Cynips serratulae* by FABRICIUS in 1798 (new combination to this species was given by LATREILLE in 1809 as *Eurytoma serratulae*). In the year 1781 SCHRANK described the species *Eurytoma aterrima* under the

name *Cynips aterrima*. FABRICIUS in 1787 described the species *Eurytoma sphegum* under the name *Ichneumon sphegum*. ROSSI in 1790 described two new species viz. *Chrysis adonidum* and *Chrysis plumata* which were later transferred to *Eurytoma aterrima* SCHRANK by LATREILLE 1809. SWEDERUS in 1795 described the species *Eurytoma appendigaster* under the name *Pteromalus appendigaster*.

In the year 1798 FABRICIUS described the species *Eurytoma verticillata* under the name *Ichneumon verticillatum*. PANZER in 1801 described the species *Eurytoma abrotani* under the name *Chalcis abrotani*. Apart from this, a significant contribution to this family was done by ILLIGER in 1807, who erected the genera *Eurytoma* with type species *Chalcis abrotani* PANZER, he also included several species to this genus in the same publication, it is the oldest genus in the family Eurytomidae. LATREILLE by his publications in the years 1809 and 1810 considered *Eurytoma* as a valid genus. In 1811 SPINOLA erected a new genus *Decatoma* with type species *Chrysis adonidum* ROSSI (which was later synonymised under *Eurytoma* by HINCKS in 1944). In 1829 CURTIS in his publication, 'A guide to an arrangement of British Insects', treated *Eurytoma* and *Decatoma* as valid genera.

In the year 1832 WALKER through his famous work, 'Monographia Chaciditum', erected the Family Eurytomidae with *Eurytoma* ILLIGER as type genus, formerly some of the species of Eurytomidae treated under the family Chalcididae due to their resemblance (in the latter case also the same thing happened were may be mainly due to the similarities of these families). In addition to this, in the same publication, he described two new genera under the family Eurytomidae viz. *Systole* and *Isosoma* (BOUCEK in 1988 placed *Isosoma* WALKER as Junior primary homonym of *Isosoma* Billberg) and several new species. Later SPINOLA in 1840 described the genus

Chryseida with type species *Chryseida superciliosa*. This genus has the peculiar difference with its metallic coloration from other related genera. In 1846 AGASSIZ described a new genus namely *Enneatoma* (Nomen nudum by PECK in 1963). Again WALKER in 1848 described the genera *Tetramesa* with type species *Tetramesa iarbas* in his publication 'List of specimens of hymenopterous insects in the collection of British Museum'. WALKER continued his research on Eurytomidae by describing two genera in 1862 viz. *Axima* and *Sosxetra* with type species *Axima spinifrons* and *Sosxetra transversa* respectively (in 1864 WALKER find out that the *Sosxetra* was junior primary homonym of his own genus *Sosxetra* Walker, 1862, and he replaced the name as *Eudoxinna*).

MOTSCHULSKY in the year 1863 described the genus *Harmolita* with *Harmolita longicornis* as type species (CLARIDGE in 1961 placed *Harmolita* as synonym of *Tetramesa* WALKER). WALKER continued his research on Eurytomidae by his publication, 'Notes on Chalcidiae Part. I. Eurytomidae' in the year 1871 and described three new genera viz. *Aiolomorphus*, *Sycophila* and *Philachyra* with type species *Aiolomorphus rhopaloides*, *Sycophila decatomoides* and *Philachyra ips* respectively (later the generic composition of *Philachyra* underwent several changes and PECK in 1963 synonymised it to *Tetramesa* WALKER). RONDANI in 1872 described the genera *Tineomyza* with *Tineomyza pistacina* as type species (but in 1974 BOUCEK placed *Tineomyza* as synonym of *Sycophila* WALKER). Again WALKER in the year 1875 described two new genera viz. *Isanisa* and *Pseudisa* with type species *Sycophila decatomodies* and *Pseudisa smicroides* respectively (in 1988 BOUCEK placed the two genera as synonym of *Sycophila* WALKER).

CAMERON in the year 1884 erected the subfamily Aximinae with *Axima* WALKER as type genus (STAGE and SNELLING in 1986 found out

Aximinae was synonym of Eurytominae WALKER). In the same publication he described the genus *Bepharata* with *ruficollis* as type species. In the year 1888 ASHMEAD contributed much to the family Eurytomidae by his publication 'A revised generic table of Eurytominae with description of new species', he described several new genera and species viz. *Bruchophagus*, *Systolodes*, *Eurytomocharis*, *Isosomodes*, *Evoxysoma*, *Phylloxeroxenus*, *Reileya*, *Decatomidea, Eudecatoma*, *Isosomocharis*, *Isosomorpha* and *Xanthosoma* with type species *Bruchophagus borealis*, *Systolodes brevicornis*, *Eurytomocharis minuta*, *Isosoma gigantea*, *Systole brachyptera*, *Eurytoma phylloxerae*, *Reileya cecidomyiae*, *Decatomidea xanthochroa*, *Decatoma batatoides*, *Isosomocharis sulcata*, *Isosomorpha europae* and *Xanthosoma nigricornis* respectively (the generic status of *Systolodes*, *Evoxysoma*, *Decatomidea, Eudecatoma*, *Isosomocharis*, *Isosomorpha* and *Xanthosoma* were then underwent several changes). In the year 1889 HOWARD proposed a replacement name for *Rileya* as *Ashmeadia* (but DOGANLAR in 1992 placed *Ashmeadia* as synonym of *Rileya*). ASHMEAD in 1894 described several new species and he accepted the generic status of several genera under Eurytomidae.

DALLA TORE in 1898 in his great work on systematics and synonyms of Chalcididae and Proctotrupidae namely '*Catalogus Hymenopterorum hucusque descriptorum systematicus et synonymicus.* V. *Chalcididae et Proctotrupidae*' described several new species of Eurytomidae and treated many genera as valid and found many synonymies. ASHMEAD in 1900 erected the genus *Macrorileya* with *Rileya oecanthi* as type species. ASHMEAD continued his research on Eurytomidae by his monumental work on Classification of the 'Chalcid flies', in 1904. In the same publication he had described five new tribes viz. Aximini, Decatomini, Eurytomini, Isosomini and Rileyini with a key to separate them. ASHMEAD also described four new genera in the same paper viz. *Aximopsis*, *Aximogastra*,

Prodecatoma and *Neorileya* along with several new species. He also provided key to genera to each tribe. In 1905 MAYR made revision of European species of *Decatoma* and added several new species under this genus. In 1907 CAMERON made significant contribution to family Eurytomidae by erecting the subfamily Eurytominae and nowadays it is the richest subfamily in relation with number of genera and species. For erecting this subfamily he used *Eurytoma* as type genus.

CAMERON again in the year 1908 described the genera *Philolema* with type species *carinigena*. CAMERON continued his research on Eurytomidae by the publication in the year 1909 'A contribution to the knowledge of the parasitic Hymenoptera of Argentina', he described the genera *Heimbra* with *acuticollis* as type species. In the same year BRUES in his work on North American parasitic Hymenoptera, described the genus *Bephratoides* with type species *maculates*. In 1910 KIEFFER *et al* described the genus *Proseurytoma* with *gallarum* as type species. CRAWFORD in the same year described the genus *Calorileya* with type species *cearae* (DOGANLAR in 1992 found that this genus was a synonym of *Rileya*).

CAMERON in the year 1911 through his publication 'Description of new genera and species of Chalcididae', described three genera viz. *Mesoeurytoma*, *Stireurytoma* and *Achantheurytoma* with *cariniceps*, *carinata* and *spinifera* as type species respectively (*Mesoeurytoma* and *Stireurytoma* was transferred to *Aximopsis* and *Achantheurytoma* transferred to *Philolema* by LOTFALIZADEH *et al* in 2007). In the same year GIRAULT described the genus *Urios* with *Urios vestali* as type species in his publication 'Notes on hymenopteran Chalcidoidea with description of several new genera and species' (PECK in the year 1963 transferred this genus to *Tetramesa*). GIRAULT continued his research on Chalcidoidea by his publication in the year 1913 entitled 'Some Chalcidoid Hymenoptera from North Queensland',

described five genera viz. *Axanthosoma*, *Bephratoides*, *Eurysystole*, *Phylloxeroxenoides* and *Bephratella* with type species *nigra*, *paraguayensis*, *vulgaris*, *niger* and *nympha* respectively (BOUCEK in the year 1988 found that *Eurysystole* and *Phylloxeroxenoides* are synonyms of B*ruchophagus*, GIRAULT in the year 1915 synonymised *Bephratella* as *Eurytoma*), he also proposed replacement name for some genera in the same publication. In the same year CAMERON described the genus *Xenopelte* with type species *Xenopelte couridae* (later it was transferred to *Rileya* by DE SANTIS in 1979). BRETHES made a contribution to the family Eurytomidae in the same year by describing the genus *Xanthosomodes* with type species *albiangulatus* (GATES in 2014 found that this genus is synonym of *Tetramesa*).

Again GIRAULT in the year 1915 made a significant contribution to the family Eurytomidae by his monumental work on 'Australian Chalcidoidea' and he described two new genera viz. *Pararileya* and *Exanthosoma* with type species *spadix* and *funeralis* respectively (BOUCEK in 1988 transferred *Pararileya* to *Rileya* and *Exanthosoma* to *Tetramesa*). In the same publication, he treated fifty five species of *Eurytoma* and among them thirty were new species. He also provided much information about the existing species and genera and provided a key to separate the Australian species of *Eurytoma*.

In the year 1917, MASI described the genus *Eurytomidia* with *Eurytomidia dubia* as type species in his publication 'Chalcididae of Seychelles Islands' along with several new species (LOTFALIZADEH *et al* in the year 2007 found that the genus *Eurytomidia* was synonym of *Eurytoma*). In the same year DODD described the genus *Hexeurytoma* with *grandis* as type species. GAHAN in the year 1918 made a significant contribution to the genus *Rileya* through his publication 'A synopsis of the species belonging to the Chalcodid genus *Rileya*'. In this publication he

provided separate keys for the identification of male and female species, he included fifteen species which includes four new species. BRETHES in the same year described the genus *Tragiicola* with *Tragiicola haumani* as type species (DE SANTIS in 1967 find out that this genus was synonym of *Rileya*). PHILLIPS and EMERY made a very significant contribution to the genus *Harmolita* in the same year with their publication 'A revision of Chalcid flies of the genus *Harmolita* of America and North Mexico', and included thiry three species in this publication and among that nineteen were new to Science. In the year 1920 SILVESTRI described the genus *Archirileya* with type species *Archirileya inopinata* (this genus was transferred to *Macrorileya* by LOTFALIZADEH *et al* in 2007).

In the year 1922, BRUES described the genus *Conoaxima* with *aztecicida* as type species and along with two new species (this genus was synonymised to *Aximopsis* by LOTFALIZADEH *et al* in 2007). GIRAULT continued his research on Eurytomidae by his publication in the year 1925 and described two genera viz. *Austrodecatoma* and *Plutarchia* with type species *Eudecatoma trinotata* and *Plutarchia bicarinativentris* respectively. BALDUF in the year 1932 made a revision on the tribe Decatomini of America and North Mexico and he included thirty four species in the publication along with nineteen new species. PHILLIPS continued his research in the genus *Harmolita* through his publication in the year 1936 'A second revision of the Chalcid flies of the genus *Harmolita* (Isosoma) of America and North Mexico'. In this publication, he included sixty three species along with twenty new species. Again GIRAULT in the year 1938 described the genus *Astrophotismus* with *ater* as type species. In the same year MASI described the genus *Decatomella* with *indica* as type species (MANI in 1938 placed this genus as Nomen nudum).

MASI again in the year 1943 described two genera viz. *Eurytomaria* and *Prodecatoma* with type species *Eurytomaria aximoides* and *Prodecatoma bannensis* respectively (*Eurytomaria* was synonymised under *Aximopsis* by LOTFALIZADEH *et al* in 2007). In the year 1950, FERRIERE elevated the status of the tribe Harmolitini to subfamily as Harmolitinae with *Harmolita* as type genus (BURKS in 1971 proposed it as a synonym of Eurytominae). BUGBEE in the year 1951 described the genus *Tenuipetioulus* with *Eurytoma albipes* as type species. In the same publication he described two new species and additional information on two existing species. In the same year PECK made valuable contributions to Hymenoptera and also for Eurytomidae of America and North Mexico by his 'Synoptic catalog of Hymenoptera of America and North Mexico''. Through this catalog, he contributed a lot towards the rearrangement of taxa in Eurytomidae which included the synonyms of *Sycophila* and *Tetramesa*. GAHAN in the same year published some synonymies and new combinations in Chalcidoidea, which treated *Bephratoides* and *Bephrata*.

BOUCEK in the year 1952 described the genus *Anarchirileya* with type species *femorata* (this genus was synonymised to *Macrorileya* by LOTFALIZADEH *et al* in 2007). In the same year RISBEC described the genus *Prodecatomidea* with *bekiliensis* as type species from Madagascar Islands. In the same year ERDOS described the genus *Gahaniola* with *Harmolita phyllostachitis* as type species (later ZEROVA in 1976 found this genus as a synonym of *Tetramesa*). BOUCEK and NOVICKY in the year 1954 described the genus *Ipideurytoma* with type species *Ipideurytoma spessivtsevi* (ZEROVA in 1978 (a) found this genus as a synonym of *Eurytoma*). In the same publication, the authors gave genus status for *Bruchophagus*. In the year 1955 ERDOS described the genus *Biro-Lajosia* with *Biro-Lajosia metallica* as type species (the generic status of this genus underwent several changes and was transferred to *Bruchophagus* by

LOTFALIZADEH *et al* in 2007). In the same year NIKOLSKAYA described the genus *Nikanoria* with *Nikanoria pavlovskii* as type species (the generic status of this genus underwent several changes and was transferred to *Bruchophagus* by LOTFALIZADEH *et al* in 2007). In the year 1956 BURKS gave valid status to the genus *Chryseida* and described a new species under it.

ERDOS in year 1957 erected three sub genera namely *Dieurytoma*, *Hydateurytoma*, *Moneurytoma* under the genus *Eurytoma* with *Eurytoma amygdali*, *Eurytoma palustris*, *Eurytoma aquatic* as type species. In the same publication he described the genus *Sidonia* with *Sidonia podagrica* as type species (LOTFALIZADEH *et al* in 2007 found this genus as a synonym of *Macrorileya*). BURKS continued his research and made significant contribution to Eurytomidae by his publication in the year 1958 'A synoptic catalog of Hymenoptera of America and North Mexico', which included the catalog of Eurytomidae of that region and list of synonymies. In the same year BOUCEK in his publication 'To the taxonomy of the European species of *Schizonotus* and *Caenocrepis* parasites of economic importance', found several synonyms and new combination for various genera and species. In 1959 CLARIDGE made additional notes to genus *Systole* and he included two described species under this genus.

CLARIDGE continued his research in Eurytomidae by his publication 'An advance towards a natural classification of eurytomid genera with particular reference to British forms' in the year 1961. By this publication he erected the subfamily *Eudecatominae* with *Eudecatoma* as type genus (BURKS in 1971 found this subfamily as a synonym of subfamily Eurytominae), in the same publication he described the genus *Ahtola* with *Isosoma atrum* as type species (LOTFALIZADEH *et al* in 2007 made this genus as synonym of *Bruchophagus*). In year 1963 PECK published one of his monumental work entitled 'A catalogue of the Nearctic Chalcidoidea', and

stated Eurytomidae have five subfamilies and he found many synonyms of various genera of Eurytomidae. In the year 1964 ERDOS described the genus *Endobia* with *Endobia donacis* as type species. KALINA in the year 1969 described the genus *Pseudosystole* with *Pseudosystole hofferi* as type species (LOTFALIZADEH *et al* in 2007 made this genus as synonym of *Systole*). In the same year BOUCEK erected the tribe *Buresiini* with *Buresium* as type genus (GATES in 2008 (a) placed this tribe as synonym of Eurytominae). In the same publication, he described the genus *Buresium* with *Buresium rufum* as type species.

KALINA in the year 1970 described the genus *Pseudotetramesa* with *doksensis* as type species. In the year 1971 BURKS through his monumental work 'A synopsis of the genera of the family of Eurytomidae', erected three subfamilies, ten new genera and several new species, the subfamilies were Philoleminae, Prodecatominae and Heimbrinae with *Philolema*, *Prodecatoma* and *Heimbra* as type genera. By this publication he divided the family Eurytomidae in to eight subfamilies viz. Aximinae, Eudecatominae, Eurytominae, Harmolitinae, Heimbrinae, Philoleminae, Prodecatominae and Rileyinae. The genera described in this publication were *Aranedra*, *Banyoma*, *Striateurytoma*, *Bruchodape*, *Cathilaria*, *Exeurytoma*, *Foutsia*, *Desantisca* and *Platyrileya* with type species *Aranedra millsi*, *Banyoma philippinensis*, *Bephrata striatipes*, *Bruchodape ignota*, *Harmolita opuntiae*, *Exeurytoma caraganae*, *Foutsia philodendra*, *Eurytoma latrodecti* and *Platyrileya cururipe* respectively (LOTFALIZADEH *et al* in 2007 found that the genera *Agriotoma* and *Striateurytoma* were synonyms of *Bephratoides* and the genus *Desantisca* was the synonym of *Philolema*).

ZEROVA in the year 1974 described the genus *Tetramesella* with type species *luppovae*. In the same year SUBBA RAO made redescriptions for the genera *Plutarchia* and *Axanthosoma* with the addition of new species. In the

same year BOUCEK in his publication 'On the Chalcidoidea described by Rondani', listed the synonyms of different genera of Eurytomidae. DE SANTIS in the year 1975 described the genus *Boucekiana* with *tetracampoide* as type species in his publication 'Two new Eurytomidae of Argentina'. SZELENYI in the year 1976 made significant contributions to Eurytomidae of Mangolia by his publication Mongolian Eurytomids. HEDQVIST in the same year in his publication 'Notes on Chalcidoidea', described several new species under the genus *Eurytoma*. In the same year ZEROVA, in his publication on Hymenoptera treated the Family Eurytomidae and list out the synonyms for subfamilies Rileyinae and Harmolitinae.

In the year 1978 SUBBA RAO through his publication treated the subfamily *Rileyinae* and the tribe *Philolemini* as valid subfamily and tribe in Eurytomidae. In the same publication he described three genera viz. *Burksoma*, *Heimbrella* and *Risbecoma* with type species *Burksoma scimitar*, *Heimbrella rotundigaster* and *Eurytoma bruchocida* respectively. He also treated several existing genera as valid under family Eurytomidae. In the same year ZEROVA (a) made significant contributions to the Eurytomidae of Ukraine by his publication 'Fauna Ukraini', and through this he erected the sub genus *Trichosystole* under the genus *systole* with type species *Systole salvia* and also found synonyms for several genera and species. In the same year with another publication (b) by the same author made a review of the genus *Nikanoria*. BOUCEK *et al* in the same year degraded the status of the genus *Ahtola* to subgenus by his publication 'Handbooks for the Identification of British Insects'.

YOSHIMOTO and GIBSON in 1979 described the genus *Aplatoides* with *Aplatoides diabolus* as type species from Brazil (LOTFALIZADEH *et al* in 2007 found the genus *Aplatoides* as the synonym of *Axima*). In the same year LIAO described the genus *Homodecatoma* with type species

Homodecatoma mallotae and with description for five new species from China. In the same year DE SANTIS made a catalog on Chalcidoid hymenopterans of America, in that work he made the list of valid species and list of synonyms for each family. In the year 1980 HEDQVIST described the genus *Pseudrileya* with *Pseudrileya brasiliensis* as type species (GATES in 2008 (a) found this genus as synonym of *Rileya*). In the same year DE SANTIS published a catalog on parasitic Hymenoptera of Brazil, through which he treated several genera of Eurytomidae as valid and also included the list of synonyms. BOUCEK *et al* in the year 1981 described two genera viz. *Ficomila* and *Syceurytoma* with type species *Ficomila curtivena* and *Syceurytoma ficus* respectively. In the same year MUKERJEE in his publication 'On collection of Eurytomidae from India', described the genus *Odonteurytoma* under tribe Eurytomini and subfamily Eurytominae with type species *Odonteurytoma tanjorensis* (the generic status of *Odonteurytoma* underwent several changes and now it is a synonym of *Philolema*). In the same paper, he has also given valid status to several described earlier genera.

BOUCEK in the year 1983 described the genus *Masneroma* with *Masneroma angulifera* as type species. In the same publication he gave additional informations for the genus *Buresium*. In the same year ZEROVA and LINDEMAN published their work entitled A review on Palaearctic species of Eurytomidae associated with Xylophagous insects. In the year 1986 STAGE and SNELLING in their publication 'The subfamilies of Eurytomidae and systematics of the subfamily Heimbrinae', proposed that only three subfamilies are valid under Eurytomidae viz. Eurytominae, Heimbrinae and Rileyinae and others were synonyms of these and mainly of Eurytominae. In the same paper they described the genus *Symbra* with *Symbra cordobensis* as type species. In the same year SUBBA RAO described the genus *Mangoma* with *Mangoma spinidorsum* as type species.

ZEROVA in the same year made a review of Eurytomidae of USSR which was related to a poisonous weed.

In 1988 BOUCEK by his monumental work on Australasian Chalcidoidea, contributed a lot to the Family Eurytomidae. According him the Old world had only two subfamilies viz. Eurytominae and Rileyinae and the subfamily Heimbrinae was only present in Neotropical regions. Regarding the generic level classification he made a very good dichotomous key for identification of genera of Eurytomidae of Australasian region. In this publication he described six new genera, among that two from subfamily Rileyinae viz. *Matna* and *Dougiola* with type species *Matna fallax* and *Systole koebelei* Ashmead respectively (GATES in 2008 (a) synonymised the genus *Matna* to *Austrophotismus*) and four from the subfamily Eurytominae viz. *Giraultoma*, *Houstonia*, *Ausystole* and *Stigmeurytoma* with type species *Xanthosoma pulchricorpus* Girault, *Houstonia zani*, *Eurysystole beenleighi* Girault and *Eurytoma eucalypti* Ashmead. In this publication he also included several new species and list of synonyms and valid species under each genus with their distribution. In the same year ZEROVA through his publication on 'The main trends of evolution and the system of chalcids of the family Eurytomidae', proposed that the Eurytomidae had seven subfamilies viz. Aximinae, Buresiinae, Eudecatominae, Eurytominae, Harmolitinae, Rileyinae and Heimbrinae. In the same publication he also described the tribe Archirileyini with *Archirileya* Silvestri as type genus under the subfamily Rileyinae. In the same year DELVARE made the revision of *Eurytoma* of West Africa described by Risbeck and in that publication DELVARE treated the genus *Bruchphagus* and *Eurytoma* as valid genera.

In the year 1989 NARENDRAN and PADMASENAN described the genus *Neobephrata* with *Neobephrata petiolata* as type species. In the same year he also described the genus *Ramanuja* with *Ramanuja swarnamus* as

type species. NARENDRAN and PADMASENAN in the year 1990 made another significant study on the genus *Plutarchia* of India with description of several new species. In the year 1991 NARENDRAN and PADMASENAN made significant study on Oriental *Aximopsis* with descriptions of several new species. In the same year ZEROVA FURSOV made significant contributions to the Palaearctic species of *Eurytoma*, by their study on *Eurytoma* developing in stone fruits. ZEROVA in the year 1992 described the sub genus *Parabruchophagus* with type species *Bruchophagus tauricus* under the genus *Bruchophagus*. In the same year DOGANLAR made significant study on the genus *Rileya* with description of new species and list of synonyms.

In the year 1994 NARENDRAN made a great contribution to the family Eurytomidae by his monograph on 'Eurytomidae and Torymidae of Indian subcontinent', which is one of the most cited literature related to the taxonomy of Eurytomidae. In this publication he made an entire revision of all Eurytomid wasps of Indian subcontinent under the section Eurytomidae of the monograph. He provided a good key for the identification of Eurytomid genera of Indian subcontinent along with description of nine new genera and several new species. Also provided dichotomous keys for the identification of the species under each genus. The new genera described viz. *Aximogastroma*, *Fronsoma*, *Neoeurytomaria*, *Gibsonoma*, *Philippinoma*, *Subbaella*, *Ramdasoma*, *Systolema* and *Townesoma* (LOTFALIZADEH *et al* in 2007 found that the genera *Aximogastroma* was the synonym of *Aximopsis*, genus *Neoeurytomaria* was synonym of *Fronsoma* and genus *Subbaella* was synonym of *Philolema*) with type species *Aximogastroma longigastris*, *Fronsoma caudata*, *Neoeurytomaria subbaraoi*, *Gibsonoma budhai*, *Philippinoma auratofronta*, *Subbaella negriensis*, *Ramdasoma peethodaris*, *Systolema hayati* and *Townesoma taiwanicus* respectively. In the same publication he gave redescriptions for many existing species and descriptions for new species, comparisons with other species and genera respectively, list

of synonyms etc. In the same year NARENDRAN and SHEELA described the genus *Zerovella* with *Zerovella taiwanica* as type species.

In the year 1995 ZEROVA made significant contribution to the subfamilies Eudecatominae and Eurytominae of Palaearctic region and in this publication he treated nine genera with additions of new species. In the year 1996 YANG through his publication associated with bark beetles described the genus *Phleudecatoma* with *Phleudecatoma platycladi* as type species with synonyms to several genera. In the same year ZEROVA cleared the systematic position of the genera *Eudecatoma* and *Sycophila*. In the year 2001 NARENDRAN and DAS described the genus *Axanthosomella* with *Axanthosomella gadagkari* as type species from India. In the year 2002 HONG erected five new genera viz. *Eoeurytomites*, *Fushuneurytomites*, *Liaoeurytomites*, *Sinoeurytomites* and *Zhuia* by using the evidence from Amber insects, but all the genera are now unavailable, because all the generic names were based on unavailable type species. CHEN *et al* in the year 2004 described the genus *Chryseurytoma* with type species *Chryseurytoma viridis* with a new record for the genus *Chryseida* in China. GATES *et al* in 2006 made clear the generic concept of *Aximopsis* by morphological character analyzing, and also described seven new species.

In 2007 LOTFALIZADEH *et al* made a significant contribution on Eurytomidae by studying the phylogeny of subfamily Eurytominae based on morphological characters. By this publication they strongly suggested that the family Eurytomidae was polyphyletic in origin and they transferred many described species under the genus *Eurytoma* to *Prodecatoma* or *Bruchophahus*. They made an addition of subfamily namely Buresiinae BOUCEK to the concept of BOUCEK, 1988 (GATES in 2008 (a) found that Buresiinae was synonym of Eurytominae). They proposed twenty two generic synonymies and thirty three species were transferred to various genera and

also confirmed that genus *Eurytoma* form species complexes. They also stated that there was a sister group relationship between subfamily Heimbraine of Eurytomidae and the family Chalcididae.

In the year 2008 (a) GATES made the systematic revision of the World Rileyinae as monograph. He used morphological character analysis for the work that included species descriptions, key to various genera and species, list of synonymies for tribe, genera etc. In the same year GATES with another publication (b) described the genus *Khamul* with type species *Khamul erwini* with description of five new species. GATES and HANSON in the year 2009 made revision on the genera *Bephrata* and *Isosomodes* with an addition of twenty two new species and key to separate the species. ZEROVA and SERYOGINA in the year 2011 upgraded the status of *Parabruchophagus* from sub genus to genus. In the year 2012 GATES and PEREZLACHAUD described the genus *Camponotophilus* with *Camponotophilus delvarei* as type species in his publication 'Description of *Campnotophilus delvarei* gen.n. and sp.n. (Hymenoptera: Chalcidoidea: Eurytomidae), with discussion of diagnostic characters' and also he discussed the diagnostic and phylogenetic importance in the same publication. ZEROVA in the same year, made clear the systematic position of the genus *Nikanoria* and also with descriptions of two species and synonymy. In the year 2013 SURESHAN *et al* described a new species under the genus *Eurytoma* viz. *Eurytoma chinnarensis* as type species. In the year 2014 GATES published nomenclatural notes on Eurytomidae. In this publication he made several new combinations, synonyms etc. In the same year DELVARE *et al* made revision and phylogeny of *Eurytoma morio* species group associated with bark and wood boring beetle, which included description of five new species, list of synonyms etc. NIKHIL and SURESHAN in the year 2015 described two new species under the genus *Tetramesa* viz. *Tetramesa neyyarensis* and *Tetramesa palakkadensis* through their publication "Description of two new species of

Tetramesa Walker (Eurytomidae: Chalcidoidea) from Kerala, India with a key to Indian species".

CHAPTER 3
MATERIALS AND METHODS

3.1. STUDY AREA (Plate. 1)

For the taxonomic studies of Eurytomidae, the specimens were collected from all the fourteen districts of Kerala. The methods used for collection may vary from case to case (which were explained in detail in the next session of the same chapter). Kerala is the south west State of India and occupy a unique position in the world map with a wide costal area. It shares its boundary with Tamil Nadu in eastern and southern sides and with Karnataka in Northern and Northeastern sides.

Kerala have an overall land area of 38864 square Kilometer, which forms 1.18% of the total land area of India. The most peculiar feature of Kerala is the presence of Western Ghats and coastal areas and Arabian Sea in entire length and blessed with high faunal diversity in terrestrial and aquatic habitats. The state lies between the north latitude 8.32187 and 12.75490 and east longitude 74.89400 and 77.15012.

Geography

Considering the geographical features of Kerala, the state can be divided in to three regions viz. high lands, mid lands and low lands. The high lands also called eastern high lands having an elevation above 76 meter which is mainly part of slopes of Western Ghats and generally having an average slope of 900 meter and with a number of peaks having height over 1800 meters. The highest peak is ‘Anamudi’ with 2695 meter height and located in Idukki district. The high lands mainly include forest areas and plantations, which cover an area of 18653.5 square Kilometer, which is 48% of the land area of the state. The fourty four rivers originate from this area and among

them 41 are flowing towards west and three to east. The high lands spread in almost all districts of Kerala except Alappuzha with major cultivated crops tea, coffee, rubber and cardamom.

Mid lands are areas present between the elevation ranges of 76 and 7.6 meter. Mid lands lie between high lands and low lands or between slopes of Western Ghats and coast. This land is highly suitable for cultivations of Arecanut, banana, cashew, coconut, ginger, pepper, rice, tapioca, vegetables etc. due to it its soil texture. The mid land covers an area of 16231.2 square kilometer and constitute 41.76% of the land area of the state.

Low land comes below the elevation of 7.6 meter. This part mainly includes the coastal areas formed mainly by deposition of sediments brought down by rivers which originates from high lands and also by the sand deposited due to sea waves. It covers an area of 3979.3 square kilometer and about 10.24% of the total land area of Kerala state. The district Alappuzha lies exclusively in low land and the main crops in these areas are Coconut and Paddy.

Field Surveys conducted/Participated

During the study period, field surveys to all fourteen districts of Kerala State were conducted. Collections were also made by being a part of the faunistic surveys conducted by Zoological Survey of India, Western Ghat Regional Centre, Kozhikode, to different types of ecosystems like deciduous forests (Plate. 3. Fig. 1&2), grasslands (Plate. 3. Fig. 3&4), Marshy wetlands (Plate. 3. Fig. 5) etc. As a part of AICOPTAX Project in which I am working as Senior Research Fellow, faunistic surveys to different States of India were also conducted and participated.

3.2. METHODS OF COLLECTION

a. Net Sweeping (Plate. 2. Fig. 2)

Net sweeping was found to be one of the best methods for collecting eurytomids as like that of many parasitic Hymenoptera. The main advantage of net sweeping is that we get plenty of specimens with high diversity in a short period of time while comparing with other techniques for collection. One of the main disadvantages of net sweeping is that we didn't get any data regarding the host, and sometimes the new or interesting species will be represented by single specimen or very low numbers and the chance for getting the same species in the same locality also will be less. Even though these disadvantages are there, net sweeping is considered as the best method for collecting diverse specimens of Eurytomidae.

The insect net used for collection is a modified type designed by NOYES, 1982. The modifications are done for increasing the number of specimens collected in a set of sweeping. The sides of net frame were made by aluminum measures 48cm x 46cm x 48cm. The triangular shape of the frame allows a larger area of vegetation to be covered while sweeping. The handle measures about 106- 122cms. The long handle allows sweeping underneath and overhanging bushes easier and extends the area covered in each sweep. The frame can be fitted to one end of the handle and can be easily separated when not in use. The net bag is made up of durable white cotton cloth or terelene cloth with 80cm length, which have fine meshes that permit easy passage of air but at the same time prevent escape of smaller insects of less than 1mm size. The open end of the bag is fixed in the triangle shaped end of the frame by sewing with canvas. The results obtained by using this type of net shows that the insects collected are roughly 10 times more than the insects obtained by the conventional type of round nets.

For getting better results the area which is selected for sweeping is also very important. Normally insect activity will be high in areas with highly diverse vegetation. Grass lands with good collection of flowering plants surrounded by bushes and trees normally forms a good site for collection of Eurytomids. The flowering or seeding stages of vegetable fields and other agricultural fields also show high results. The sweeping was done as described by NOYES 1982. The specimens from the net can be sucked up by using an aspirator (Plate. 2. Fig. 4).

The specimens collected by the aspirator, were killed by placing small cotton soaked with four or five drops of Ethyl acetate through the entry tube of the aspirator and immediately closing the tube. The aspirator was kept for 20-30 minutes to ensure that all the specimens in the aspirator were killed. The dead insects were transferred to the vials having 70% alcohol. A temporary label with locality, date of collection and name of collector was placed in the vial.

b. Malaise trap (Plate. 2. Fig. 1)

The suitable design of Malaise trap has been well defined by TOWNES in 1972. It is a tent like device made by terelene cloth with fine mesh, which works on the basis of the positive photo tactic and negatively geotropic behavior of insects. The malaise trap is one of the best methods to collect insects by passive method. The major parts of malaise trap are the tent like device with alcohol holding bottle, ropes and steel rods for fixing the trap in correct position. The flow of wind and the presence of sun light has significant role in determining the efficiency of the collection. Due to this reason the malaise trap should be fixed in an area with good sunlight especially on the area where alcohol carrying bottle is present. The passage of a slow wind through the open end of the tent is also good for getting smaller insects.

The insects which stuck accidentally and small insects which fly with the direction of wind are stuck up with the separator present in the tent and crawl up through the cloth or fly up due to photo tactic behavior and finally enter in to the bottle with 70% alcohol. The transferring of collections was made every week by draining the alcohol container and refilled it with fresh 70% alcohol. There are several modifications of the original malaise trap. For the collection the malaise trap made by Rescholar Equipments, India was used. The main advantage of this trap is that, it only needs to remove the collections once in a week and the collections can also be done by a non entomologist.

c. Yellow pan trap (Plate. 2. Fig. 3)

This trap is also called by the name Moericke trap, which works on the principle that insects are attracted to the yellow color. The pan used measures 6 - 7 cm deep and 30cm circle with bright yellow color. The tray was filled with water and a few drops of detergent solution are added to reduce the surface tension of water. The trap was placed in suitable habitat, with preference to shadow areas. Normally the tray was set in the morning and the collections were taken out in the evening. A small hand net was used to empty the tray and before transferring the specimens to 70% alcohol, the specimens were washed with fresh water to avoid deposition of detergent on the specimens which lead to damage or reduced visibility of the body parts. The washed specimens were transferred to the vials containing 70% alcohol. The yellow pan may not give good result if it is kept in a habitat with high number of yellow flowers (Narendran, 2001).

d. Rearing

The suspected hosts collected from the field were placed in suitable containers with cotton cloth lid till the emergence of the parasitoids. The host

materials include eggs, larva, pupa, galls, seeds, etc. It is a rewarding method for the collection of insect parasitoids. In some cases specialized emergence cages are required for lager plant parts. The emerged parasitoids were collected by using aspirator (Plate. 2. Fig. 4) or light trap method depending up on the nature of the parasitoid. The time of emergence of parasitoids may vary from host to host and it also depends up on the nature of host. The advantage of the rearing method is that we will get the informations about the host and its associates, its biological information, etc. In this method, there is also a high possibility of getting both sexes, and in the case of Eurytomidae or even in Chalcidoidea there are no distinguishable characters or key for the correct identification of males up to species level due to the high similarity at species level.

3.3. STORING AND PRESERVATION

a. Unmounted Material

The unmounted specimens were stored in air tight vials containing 70% alcohol and kept in refrigerator for better result. The preservatives were periodically changed and replaced with fresh alcohol.

b. Relaxing Material

Relaxing is required for the specimens which are killed by using Ethyl acetate and these specimens becomes more harder due to delay in transferring to alcohol. This technique is also used for remounting of specimens which are already mounted. For relaxing, the specimens were kept in relaxing chamber with glacial acetic acid. Relaxing chamber is nothing but an air tight rectangle box with a cotton bed. After 6-8 hours, due to the activity of glacial acetic acid, the specimens become soft and the mounting or spreading of legs and wings become easy without breakage.

3.4. MOUNTING

a. Card mounting

The methodology followed for mounting the eurytomid specimens in the present work was following NOYES, 1982 and NARENDRAN, 2001. The specimens were mounted on triangle card having length 14mm and a maximum width of 5mm. The materials used for card mounting are as follows:

1. Absolute alcohol
2. Cavity block
3. Blotting paper
4. Fine zero point brush
5. Table lamp with 60W bulb
6. Mounting cards (Ivory paper)
7. Entomological pins (No. 4)
8. Water soluble gum
9. Stereo zoom microscope

For best results the specimens should be mounted immediately after killing. But in continuous field trips this may not be possible hence the specimens are kept in 70% alcohol. While mounting, the specimens should be dried first by placing it in absolute alcohol for 10 minutes. In the case of freshly killed specimens, they are first transferred to 70% alcohol for 10-20 minutes and then transferred to absolute alcohol to avoid the collapsing of gaster in the case of soft bodied specimens. Generally the eurytomids have

hard body so if directly transferred to absolute alcohol, normally collapsing does not occur except in some species of *Tetramesa* and *Sycophila*.

The dried specimens were then transferred to blotting paper which was placed under table lamp with 60W bulb for one minute. The softly dried specimens were then placed under the stereo zoom microscope along with blotting paper and spread the legs, wings and antenna in correct position to make all body parts visible. By using an entomological pin a small drop of water soluble glue was placed on the tip of the triangle card with the help of a needle under microscope. The glue must be very less and adequate for holding the specimens, normally the amount of glue used is 2/3 volume of the mesosoma of the mounted specimen. A zero point brush was moistened with a drop of alcohol and specimen was picked with the brush on its left mesopleuron and placed it on the glue, making sure that the right mesopleuron was getting fixed with glue with a good visibility of the dorsal side of the mesosoma and gaster. The specimen was tilted so that it lied on its sides at about 45˚ to the card. Make sure that all the parts of the specimens were touched or supported by the card, if not such parts may be broken later. The specimen was gently pressed by using the brush to make it tightly attached with glue. Then the card was pinned using an entomological pin (Bohemia Insect pins No. 4: 38x0.55mm) using a pinning block.

The first label having data on the locality, date of collection and name of collector was taken from the temporary label which was made in field. The first label should be in the format, first the country name in capital letters followed by the name of the State both should be in the same line. The next line include name of the district of the collection locality and the exact collection locality. The exact date of collection was indicated in the next line and followed by the name of collector. If any host data is available then it was added as second label. The specimen mounted on card was then placed under

table lamp with 60W bulb for 5-6 hours to make it completely dry. The registering of the specimen was done after identification up to species level, with details of serial number, register number, scientific name, name of the person who identified the species, name of the locality, date of collection, name of collector and remarks. There was another label with scientific name and the name of the person who identified the specimen, which was added to each mounted specimens. Labels were printed in Microsoft word with Times New Roman as font and with a font size 5.

The sorting and mounting of specimens were done by using Labomed CZM6 microscope with an additional 2x objective lens. The card mounted specimens were observed under Leica M 60 and Leica S8 APO with LED illumination (Germany).The properly mounted and labeled specimens were stored in insect boxes and kept inside insect cabinets. Naphthalene balls and 1, 4- Dichlorobenzene were used as insecticide and fungicide to avoid damage of specimens caused by other small insects and fungi.

3.5. PHOTOGRAPHS AND MEASUREMENTS

Photos of the different parts of the specimens were taken by using DFC 450 camera attached with Leica S8 APO microscope (Plate. 2. Fig. 5). The editing of the images in a permissive level was done in Adobe Photoshop CS 5. The measurements were taken from the photographs taken by DFC 450, by using the specialized software Leica LAS V 4.0.

3.6. GPS

GPS by GARMIN etrex®H was used to gather information on latitude and longitude of collection localities of this study. The distribution maps of genera and species were generated using DIVA- GIS 7.5. Geographical co-ordinates of the collection localities has been provided in appendix.

3.7. IDENTIFICATION

Most of the literatures are available in Universal Chalcidoidea Database, Natural History Museum, London. The remaining literatures were obtained from the personal collections of Dr. T. C. Narendran and Dr. P. M. Sureshan.

The generic level identification was made by running the keys of Boucek, 1988 and Narendran, 1994. The species level identification was made by the keys of Narendran, 1994. Since several species in the monograph of Narendran, 1994 underwent generic transfer, the exact identity of species was made by comparing with original description and also by examining the type specimens. For the new and poorly described species under the genera *Neobephrata*, *Philolema*, *Prodecatoma*, *Sycophila*, *Systole* and *Tetramesa* complete descriptions were provided and for the already described species with good description, a short diagnosis with major characters were provided.

3.8. TERMINOLOGY (Plate. 4 & 5)

HEAD

Antenna: The paired sensory appendages present between compound eyes

Clypeus: The medial sclerite of the head just above the labrum.

Scrobe: The groove on head to accommodate the scape.

Sculpture: Specialized marking or pattern of impressions on the surface of body.

Scape: First segment of antenna after the base radicula.

Pedicel: Second segment of Antenna.

Ring segment 1 & 2: The third and fourth segment of antenna and these are the smallest segments.

F1 to F6: The funicular segments one to six. Ring segments are followed by funicular segments.

Clava: The last three segments of antennae.

Frons: The area of head between toruli and front ocellus.

Face: the area of head between toruli and clypeus.

Gena: The lateral part of head after compound eye up to post genal carina, and normally called the cheek.

Malar space: The shortest lateral distance between compound eye and base of mandible.

Malar sulcus: The vertical groove present in malar space.

Mandible: Paired highly sclerotized chewing lateral appendage of mouth parts, with teeth.

Toruli: The paired socket in front of head which accommodated the radicula of antenna.

Carina: A ridge or raised area.

Preorbital carina: The carina present between compound eye and scrobe.

Post orbital carina: The carina present between compound eye and post genal carina.

Post genal carina: the carina present between gena and occiput. Normally it is considered as the ventral edge of gena.

Ocelli: It is the simple eyes present on dorsal part of head, with a triangle shaped arrangement.

POL: The distance between posterior ocelli.

OOL: The shortest distance between one posterior ocelli and compound eye.

AOL: The shortest distance between posterior ocelli and anterior ocellus.

Vertex: It is the roof of head, the area between anterior ocellus to occiput.

MESOSOMA

Prepectus: The triangle shaped structure or sclerite present between lateral sides of pronotum and mesepisternum.

Mesopleuron: Lateral part of mesothorax.

Tegula: Small, almost rounded sclerite which cover the base of fore wing.

Scutellum: The middle region between mesoscutum and propodeum.

Pronotum: The first segment of mesosoma dorsally.

Mesoscutum: Pronotum followed by mesoscutum, it is the second segment of mesosoma.

Propodeum: It is the first segment of gaster which is immovably fused with mesosoma.

Petiole: The stalk like structure to connect the propodeum and gaster tergites.

Natauli: the longitudinal groove on mesoscutum, and usually it makes a median lobe on mesoscutum.

FOREWING

SMV: Sub marginal vein.

MV: Marginal vein.

PMV: Post marginal vein.

STV: Stigmal vein.

CC: Costal cell.

METASOMA

T1 to T7: Gaster tergites one to seven.

Tergites: The dorsal segments on gaster.

Sternites: The ventral segments of gaster.

Ovipositor Sheath: The bi layered protective sheath of ovipositor.

3.9. ABBREVIATIONS

QMB	:	Queensland Museum, Brisbane, Australia
BMNH	:	The Natural History Museum, London SW7 5BD, England
ZSIK	:	Zoological Survey of India, Western Ghat Regional Centre, Kozhikode.
ZSIC	:	National Zoological Collections, Zoological Survey of India, Kolkata.
PCAB	:	Priyadarsanan Collection, Ashoka Trust for Research in Ecology and the Environment (ATREE), Hebbal, Bangalore 560 024, India
CNC	:	Canadian National Collections of Insects and Arachnids, Ottawa, Canada
Col	:	Collector

CHAPTER 4
OBSERVATIONS AND RESULTS

Eurytomidae Walker

Eurytomidae Walker, 1832: 12-13. Type genus: *Eurytoma* Illiger.

Family: Eurytomidae Walker

Diagnosis: Species mostly with black, often brown or golden yellow in colour, metallic colour usually absent; pronotum quadrangular in dorsal view; piliferous dense punctuation on head and mesosoma; occipital carina absent; funicles usually five; prepectus present; toruli situated just above level of lower eye margin; mandibles bi dentate, tri dentate or qudra dentate; tarsi five segmented; no closed cells in forewing, veins are SMV, MV, PMV and STV; gaster convex and non collapsing, laterally compressed in most species.

Distribution: Cosmopolitan.

Biology: Members of the family Eurytomidae have extremely diverse host associations. Some species are phytophagous, others are entomophagous still others are both feeding on plant tissue before or after consuming host (Goulet and Huber, 1993).

Classification: According Boucek (1988), Narendran (1994) and Gates (2008), the family Eurytomidae having three subfamilies namely Eurytominae, Rileyinae and Hembrinae. Among this, the subfamily Eurytominae only has representation in Oriental Region.

Status of the taxa: The family Eurytomidae comprises 1.2% among the described species of Order Hymenoptera. It contains 5% of described species

in super family Chalcidoidea. Out of known Species of Eurytomidae from World, 13% are recorded from India and 6% from Kerala. Regarding generic level representation, it is 25% from India and 15% from Kerala.

KEY TO GENERA OF EURYTOMIDAE OF KERALA

(Modified from Narendran, 1994)

1. Posterior margin of gena carinate strongly or weakly or margined 2

- Posterior margin of gena not carinate or margined rounded or almost rounded…..... .11

2. Tl anteriorly with sublateral keels; Tl and T2 fused in females; T3 and T4 also fused in females.....*Plutarchia* Girault

- Tergites never fused, without strong sublateral keels 3

3. Hind coxa with a broad, dorsolateral channel; propodeum with a median longitudinal area elevated above surface of propodeum; petiole longer than hind coxa with a prominent ridge on dorsolateral sides; anterior margin of pronotum with a pair of small submedian tooth ……. …… ... .*Aximopsis* Ashmead

- Hind coxa without dorsolateral channel; petiole without prominent ridge on dorsolateral sides 4

4. Vertex with strong or weak transverse carina behind front ocellus joining lateral carinae; preorbital carina raised over frons; frons concave…… …… .... *Philolema* Cameron

- Vertex without transverse carina behind front ocellus 5

5. Propodeum with a short apical neck which extends bases of hind coxae;

funicle six segmented; face without radiating carinae; MV distinctly longer than PMV or STV; gaster petiolate…..*Ramdasoma* Narendran

- Propodeum without apical neck which extends bases of hind coxae; funicle less than six segments 6

6. Anterior ocellus located inside scrobe or separated by a transverse carina; anterior margin of pronotum carinate laterally, dorsomedian part ecarinate……..….. ..... ….7

- Anterior ocellus located outside scrobe… ..... …8

7. Face with three strong and raised carinae from clypeal margin; gaster sessile; basal club segment separated from other club segments so as to appear almost like a funicular segment; post marginal vein distinctly longer than marginal vein…..... . *Fronsoma* Narendran

- Face without three strong and raised carinae from clypeal margin, but several less strong carinae may present; gaster petiolate……..……. ……..... *Prodecatoma* Ashmead

8. Petiole long and slender, 1.3 to 1.5x longer than hind coxa; propodeum vertical or almost so, median area somewhat medially concave; gaster compressed from sides; T3 longest…….. ……..... *Neobephrata* Narendran & Padmasenan

- Petiole sub equal to hind coxa or less than as in the above alternate…… ……..... 9

9. Posterior margin of gena weakly carinate and marginal flange often separated by a groove; postgenal lamella does not extend ventrolaterally to meet the genal carina in most species; brownish or yellowish brown in colour ..... *Bruchophagus* Ashmead

- Posterior margin of gena strongly carinate 10

10. Postgenal lamella does not extend ventro laterally to meet genal carina; propodeum without median furrow; T4 occupying more than half dorsal length of gaster…….....*Eurytomocharis* Ashmead

- Postgenal lamella extend ventro laterally to meet genal carina; propodeum usually not vertical or not nearly vertical but sloping, median furrow may or may not be present; T4 occupying less than half dorsal length of gaster in many species…….....*Eurytoma* Illiger

11.Body slender, long; thorax long; gaster sessile; pronotum usually slightly expanding anteriorly, dorsolaterally with yellow markings; MV always distinctly longer thanSTV*;* sculpture on thoracic notum very weak….. ....*Tetramesa* Walker

- Body more compact; pronotum without dorsolateral markings…….. …..…….....…… 12

12.Tl the longest; T2 longer than any of the following ones; gaster petiolate; propodeum medially flat without conspicuous cross-carina anteriorly .... *Risbecoma* Subba Rao

- T3, T4 or T5 becomes longer segments…..... 13

13. MV enlarged, darkened, stigmated; PMV extremely short; STV shorter than MV; gaster petiolate, often compressed from sides; propodeum usually with wavy cross-carina which medially adheres to anterior margin.…….....….. *Sycophila* Walker

- MV not enlarged and not stigmated; gaster sessile; thoracic dorsum not distinctly punctuate; minutely reticulate-shagreenate, shallow scattered punctures…….....…*Systole* Walker

1. Genus: *Aximopsis* Ashmead

(Plate. 6. Fig. 1)

Aximopsis Ashmead, 1904: 259. Type species: *Aximopsis morio* Ashmead, by monotypy.

Mesoeurytoma Cameron, 1911: 28. Type species: *Mesoeurytoma cariniceps* Cameron, by monotypy [Synonimised by Lotfalizadeh *et al*., 2007].

Stireurytoma Cameron, 1911: 28. Type species: *Stireurytoma carinata* Cameron, by monotypy [Synonimised by Lotfalizadeh *et al*., 2007].

Conoaxima Brues, 1922: 154. Type species: *Conoaxima aztecicida* Brues, original designation [Synonimised by Lotfalizadeh *et al*., 2007].

Eurytomaria Masi, 1943: 66. Type species: *Eurytomaria aximoides* Masi, by monotypy [Synonimised by Lotfalizadeh *et al*., 2007].

Aximogastroma Narendran, 1994: 101. Type species: *Aximogastroma longigastris* Narendran, original designation and monotypy [Synonimised by Lotfalizadeh *et al*., 2007].

Diagnosis: Anterior ocellus situated inside scrobe; genotemporal margin carinate; occiput broadly concave; anterior margin of pronotum with a pair of submedian teeth or truncate median projection; hind coxa with a broad dorsolateral channel in some species; petiole with a prominent ridge on either side dorsally.

Distribution: India, Bolivia, Brazil, Cameroon, Colombia, Ecuador, Gabon, Indonesia, Ivory Coast.

Host: Primary hosts: *Pachyschelus* sp., *Taphrocerus* sp. (Buprestidae: Coleoptera). *Epilachna sparsa* (Coccinellidae: Coleoptera). *Scirpophaga novella* (Pyralidae: Lepidoptera).

Parasitoid host: *Pediobius foveolatus* (Eulophidae: Hymenoptera).

Plant associates: *Palm* sp. (Arecaceae). *Sapindus* sp. (Sapindaceae).

Remarks: Four species are reported from Kerala under this genus. The dichotomous key for identification of species is provided. Since the examined

collection does not contain any new species and the descriptions of the existing species are enough for identification, detailed descriptions were not given to avoid repetition.

Key to species of *Aximopsis* Ashmead of Kerala

(Modified from Narendran, 1994)

1. MV shorter than STV; PMV more than 2x MV..... ……..*Aximopsis nigriscaposa* Narendran & Padmasenan

- MV longer than STV; PMV less than 2x MV 2

2. MV 2x STV; POL 2x OOL …… …… ……..... *Aximopsis caudata* Narendran & Padmasenan

- MV shorter than 2x STV; POL greater than 2x OOL..... ..3

3. T4 longer than 2x length of T3; propodeum with median fovea; MV 1.6x STV……...*Aximopsis raoi* Narendran & Padmasenan

- T4 shorter than 1.5x length of T3; prpodeum without median fovea; MV 1.1x STV…. ..... *Aximopsis sapana* Narendran

2. Genus: *Bruchophagus* Ashmead

(Plate. 6. Fig. 8)

Bruchophagus Ashmead, 1888: 42, 43. Type species: *Bruchophagus borealis* Ashmead, by subsequent designation of, Ashmead, W.H. 1894.

Systolodes Ashmead, 1888: 42, 43. Type species: *Systolodes brevicornis* Ashmead, by subsequent monotypy [Synonimised by Girault, A.A. 1916].

Eurysystole Girault, 1913: 114. Type species: *Eurysystole vulgaris* Girault, original designation and monotypy [Synonimised by Boucek, Z. 1988].

Phylloxeroxenoides Girault, 1913: 82. Type species: *Phylloxeroxenoides niger* Girault, original designation and monotypy [Synonimised by Boucek, Z. 1988].

Birolajosia Erdös, 1955: 189. Type species: *BiroLajosia metallica* Erdös, by monotypy [Synonimised by Zerova, M.D. 1971].

Nikanoria Nikol'skaya, 1955: 335. Type species: *Nikanoria pavlovskii* Nikol'skaya, by monotypy [Synonimised by Lotfalizadeh *et al*., 2007].

Ahtola Claridge, 1961: 174. Type species: *Isosoma atrum* Walker, original designation [Synonimised by Lotfalizadeh *et al*., 2007].

Diagnosis: Posterior margin of gena weakly carinate; marginal flange often separated by a groove; post genal lamella not extending ventrolaterally to meet the genal carina; head and body often brownish or yellowish brown; dorsal surface of thorax with alveolate sculptures.

Distribution: India, Australia, Benin, Bulgaria, Germany, Guyana, Hungary, Iraq, Morocco, Pakistan, China, South Africa, Spain, United Kingdom, USA, Uzbekistan.

Host: Primary hosts: *Lasioderma Serricorne* (Anobiidae: Coleoptera)., *Psectrosema indicum, Psectrosema parvum, Psectrosema reticulatum* (Cecidomyiidae: Diptera)., *Acraspis* sp., *Pediaspis* sp. (Cynipidae: Hymenoptera)., *Eurytoma gallephedrae* (Eurytomidae: Hymenoptera)., *Tanostigmodes tambotis* (Tanaostigmatidae: Hymenoptera).

Plant hosts: *Asphodelus ramosus* (Asphodelaceae)., *Acacia lingifolia, Albizia lebbeck, Alhangi graecorum, Astragalus nutallianus, Onobrychis vicifolia* (Fabaceae)., *Quercus prinus* (Fagaceae).

Parasitoid host: *Ormyrus brunneipes* (Ormyridae: Hymenoptera).

Remarks: There are 13 species reported from Kerala under this genus. The dichotomous key for identification of species is provided. Since the examined collection does not contain any new species and the descriptions of the existing species are enough for identification, detailed descriptions were not given to avoid repetition and to make the thesis practically handy.

Key to Species of *Bruchophagus* Ashmead of Kerala

(Modified from Narendran, 1994)

1. MV distinctly longer than STV 2

- MV equal to or shorter than STV 10

2. PMV distinctly shorter than MV 3

- PMV equal to or longer than MV 9

3. Antennal formula 11162; face with several strong radiating carinae……..……... *Bruchophagus noyesi* Narendran

- Antennal formula 11153; face without such strong carina…… …… .....……4

4. POL greater than 2.1x OOL 5

- POL less than or equal to 2.1x OOL..... .8

5. Propodeum without median fovea; face with pale yellow patches between antennal base and clypeus……*Bruchophagus manii* Narendran

- Propodeum with median fovea; face without yellow patches..... .6

6. Scape not reaching level of vertex; STV longer than PMV; POL 2.6x OOL..... *Bruchophagus apoorvus* Narendran

- Scape reaching level of vertex; STV shorter than PMV; POL greater than or equal to 3x OOL…..... .7

7. Pronotal collar with a yellow spot; gaster sessile…… ……. ……..... *Bruchophagus grassius* Narendran

- Pronotal collar without yellow spot; gaster petiolate……..
……*Bruchophagus rexus* Narendran

8. Scape exceeding level of vertex; scape 2.4x F1; median fovea of propodeum without median carina…….
…….....*Bruchophagus prathiaegus* Narendran

- Scape not reaching level of vertex; scape 1.7x F1; median fovea of propodeum with median carina……..…. ….
…….....*Bruchophagus grewiae* Narendran

9. Head and body mostly brownish yellow; POL 4x OOL……
…….....*Bruchophagus peethavarnus* Narendran

- Head and body black; POL 3x OOL .....*Bruchophagus lyubai* Narendran

10. Propodum with distinct median carina.....…11

- Propodeum without median carina or with irregular median caina……12

11. T3 2x T4; POL 4x OOL; scape 2.3x F1…….
……..... *Bruchophagus shonanethrus* Narendran

- T3 sub equal to T4; POL 3x OOL; scape 4.5x F1.....
…… ..... …*Bruchophagus tagorei* Narendran

12. Head and body brownish red in colour; petiole with a tooth on either side…….*Bruchophagus shonagastrus* Narendran

- Head and body brownish or black in colour; petiole without tooth on either side……*Bruchophagus mandelai* Narendran

3. Genus: *Eurytoma* Illiger

(Plate. 6. Fig. 2)

Eurytoma Illiger, 1807: 192. Type species: *Chalcis abrotani* Panzer, by subsequent designation of, Westwood, J.O., 1839.

Decatoma Spinola, 1811: 151. Type species: *Chrysis adonidum* Rossi, by subsequent designation of, Ashmead, W.H., 1904 [Synonimised by Hincks, W. D., 1944]

Bephratella Girault, 1913: 95. Type species: *Bephratella nympha* Girault, original designation [Synonimised by Girault, 1915]

Eurytomidia Masi, 1917: 137. Type species: *Eurytomidia dubia* Masi, by monotypy [Synonimised by Lotfalizadeh *et al*., 2007]

Ipideurytoma Boucek & Novicky, 1954: 267. Type species: *Ipideurytoma spessivtsevi* Boucek & Novicky, original designation and monotypy [Synonimised by Delvare *et al*., 2014]

Diagnosis: Head without raised preorbital carinae; genotemporal margin strongly carinate; back of head with postgenal groove descending obliquely to near genal carina (often with a tooth or ridge in lateral view); antennal funicle usually 5- segmented (rarely six segmented); club 3 segmented (rarely 2- segmented); front ocellus situated outside scrobe; face with or without radiating carinae from clypeal margin; mesosternal shelf distinct; propodeum with or without median furrow; forewing veins not thickened; gaster sessile or petiolate (but petiole never longer than hind coxa in Indian species); T4 occupy less than 0.5 dorsal length; gaster compressed or sub compressed.

Distribution: Cosmopolitan in distribution.

Host: The members of this genus has a wide range of host associations with the members of Order Araneae, Coleoptera, Diptera, Hemiptera, Hymenoptera, Lepidoptera, Orthoptera.

Remarks: There are 37 species reported from Kerala under this genus. The dichotomous key for identification of all species is provided. The new species

present in the collection was already published (*Eurytoma chinnarensis* Narendran and Sureshan) and the descriptions of the existing species are enough for identification, so the detailed descriptions were not given to avoid repetition and to make the thesis practically handy.

Key to Species of *Eurytoma* Illiger of Kerala

(Modified from Narendran, 1994)

1. Hind tibia with two or more strong bristles or spines on dorsal margin along with normal short bristles; face without radiating carinae from mouth margin…..2

- Hind tibia without such strong bristles or spines, dorsal margin with a row of normal or weak row of bristles; face with or without radiating carinae from mouth margin 15

2. MV length subequal or equal to that of STV… 3

- MV distinctly longer than STV 5

3. T5 more than half length of T4; T6 slightly or hardly visible; ovipositor sheath tilted upwards ..... *Eurytoma risa* Narendran

- T5 less than half length of T4; T6 distinctly visible; ovipositor sheath not tilted upwards 4

4. Hind tibia with 3 strong bristles on dorsal margin; gaster longer than combined length of head and thorax; PMV longer than STV; anterior width of head more than 1.5x distance between front ocellus and clypeal margin ..... *Eurytoma setitibia* Gahan

- Hind tibia with two strong bristles on dorsal margin; gaster shorter than combined length of head and thorax; PMV shorter than or as long as STV; anterior width of head less than 1.5x distance between front ocellus and clypeal margin ..... .*Eurytoma anupama* Narendran

5. Length of gastral petiole subequal or longer than half length of hind coxa in dorsal aspect; hind tibia with more than three strong bristles or spines on dorsal side..... 6

- Length of gastral petiole shorter than half length of hind coxa in dorsal aspect; hind tibia with three or less than three strong bristles or spines on dorsal side..... 8

6. Hind tibia with 15 strong bristles or spines on dorsal side; interstices of pronotum spiny ..... *Eurytoma chinnarensis* Narendran & Sureshan

- Hind tibia with 4 or 5 strong bristles or spines on dorsal side; interstices of pronotum not spiny..... 7

7. Length of MV 2.27x length of PMV; maximum eye diameter in profile 1.23x malar space; hind tibia with four dorsal bristles or spines ....*Eurytoma quadrispina* Narendran

- Length of MV 1.3x length of PMV; eye diameter in profile 1.55x malar space; hind tibia with five dorsal bristles or spines...…..... .... *Eurytoma pentaspina* Narendran

8. Antenna of female plumose; funicular segments submoniliform; hind tibia with two strong dorsal spines…….. .... *Eurytoma similis* Narendran

- Antenna of female not plumose; funicular segments not submoniliform…9

9. PMV length equal to STV; length of scape 2.5x length of F1; dorsal length of T4 2.6x dorsal length of T3; length of gaster in profile 1.83x length of T4; antennal club two segmented……..... ....*Eurytoma kasaragodensis* Mukerjee

- PMV length not equal to STV; length of scape less than 2.5x length of F1; dorsal length of T4 less than 2.6x dorsal length ofT3; length of gaster in profile less than 1.83x length of T4; antennal club three segmented..... 10

10. Scape reaching or exceeding front ocellus…..... 11

- Scape not reaching front ocellus…..... 13

11. Gaster including ovipositor sheath shorter than combined length of head and thorax; propodeum with distinct rugae; MV 1.35x PMV; STV distinctly shorter than PMV ..... *Eurytoma keralensis* Ozdikmen

- Gaster including ovipositor sheath longer than combined length of head and thorax; propodeum without distinct rugae; MV greater than 1.35x PMV; STV longer than PMV..... 12

12. Propodeum with a distinct median groove; hind tibia with three dorsal bristles or spines; funicular segments distinctly longer than its width; T4 smooth; MV longer than 1.8x STV ....*Eurytoma porensis* Mukerjee

- Propodeum without distinct median groove; hind tibia with two dorsal bristles or spines; funicular segments sub equal to its width; T4 with fine reticulations; MV shorter than 1.8x STV ....*Eurytoma caudata* Narendran

13. Ovipositor sheath tilted upwards; MV greater than 2x length of PMV; anterior width of head less than 1.5x distance between front ocellus and clypeal margin… ..... *Eurytoma camposa* Narendran

- Ovipositor sheath not tilted upwards; MV shorter than or sub equal to 2x length of PMV; anterior width of head greater than 1.5x distance between front ocellus and clypeal margin 14

14. T5 distinctly visible; T4 deeply emarginate posteriorly; STV subequal to PMV.. .....*Eurytoma emarginata* Narendran

- T5 not distinctly visible; T4 not emarginate posteriorly; STV shorter than PMV ..... *Eurytoma gastra* Narendran

15. Fore coxa with a distinct tooth in side view; face without several radiating carinae from mouth margin..... 16

- Fore coxa without a tooth in side view; face with or without radiating carinae 19

16. Antennal funicular segments pedicellate and fairly plumose: F1 length 2x length of pedicel; MV 1.45x PMV; STV shorter than PMV; anterior width of head 1.5x distance between median ocellus & mouth margin..... ..... *Eurytoma chaitra* Narendran

- Antennal funicular segments not pedicellate: F1 length less than 2x length of pedicel; MV less than 1.45x PMV; STV sub equal or longer than PMV; anterior width of head greater than 1.5x distance between median ocellus & mouth margin..... 17

17. STV length sub equal to PMV; eye height in profile 1.1x malar space; propodeum with a median furrow having transverse carinae; T4 densely microsculptured on sides.....*Eurytoma puctigastra* Narendran

- STV length distinctly longer than PMV; eye height in profile greater than 1.1x malar space; propodeum without median carina; T4 smooth on sides..... 18

18. MV sub equal to PMV; length of PMV 1.2x length of STV; scape approximately 2.75x length of F1; anterior width of head 1.4x distance between front ocellus and clypeal margin; propodeum with a median furrow containing transverse pits… ..... *Eurytoma nalanda* Narendran

- PMV distinctly longer than MV; scape shorter than 2.5x F1; anterior width of head 1.2x distance between front ocellus and clypeal margin; median furrow of propodeum with irregular rugae, not forming transverse pits .. .. *Eurytoma punctifronta* Narendran

19. Face without radiating carinae from mouth margin... 20

- Face with distinct several radiating carinae from mouth margin..... 21

20. PMV equal to STV; scape 3x length of F1; pedicel as long as F1..... .....*Eurytoma raoi* Narendran

- PMV 1.5x to STV; scape 1.8x length of F1; pedicel 0.3x length of F1 .... *Eurytoma albotibialis* Ashmead

21. Scape not reaching level of vertex…..... 22

- Scape reaching level of vertex or exceeding level of vertex 24

22. Propodeum with a concave area with pits; PMV equal to MV..... 23

- Propodeum without any concave area; PMV 1.5x MV..... ..... *Eurytoma shyamagatra* Narendran

23. Scape length 2.5x F1; T4 distinctly longer than T3; parasitic on *Melanagromyza* sp. ……..... *Eurytoma melanagromyzae* Narendran

- Scape length less than 2x F1; T4 sub equal to T3; parasitic on *Apanteles* sp. ... . *Eurytoma apantelesi* Narendran

24. PMV shorter than or equal to MV.... 25

- PMV longer than MV... 33

25. Scape length more than 2.4x F1... 26

- Scape length less than 2.4x F1... 27

26. PMV shorter than MV; POL 2x OOL; hind tibia with a median black band.. ..... *Eurytoma amaranthusha* Narendran

- PMV longer than MV; POL 3x OOL; hind tibia without any bands.. .... *Eurytoma pigra* Burks

27. Gaster sessile or subsessile 28

- Gaster petiolate 30

28. MV shorter than PMV; scape shorter than 2x F1;F1 greater than or equal to 2x length of pedicel 29

- MV longer than PMV; scape longer than 2x F1; F1 shorter than or equal to 2x length of pedicel .....*Eurytoma manilensis* Ashmead

29. Pubescence on head and body golden yellow; each funicular segment with a neck at base; MV 1.8x as long as STV; gaster subsessile ... . *Eurytoma chrysothrix* Waterst

- Pubescence not golden yellow; funicular segments without neck at base; MV 1.3x as long as STV; gaster sessile .... *Eurytoma kulamensis* Narendran

30. PMV longer than or equal to MV; F1 1.5x length of pedicel.....
.....*Eurytoma ranjithi* Narendran

- PMV shorter than MV; F1 2x or more than length of pedicel..... 31

31. F2 to F5 strongly wider than long; scape 2x F1.....
..... *Eurytoma apara* Narendran

- F2 to F5 longer than wide; scape shorter than 2x F1 32

32. Petiole length sub equal to dorsal length of hind coxa; propodeum without a median furrow..... *Eurytoma sheelae* Narendran

- Petiole length 0.3x dorsal length of hind coxa; propodeum with median furrow ..... *Eurytoma breviscaposa* Narendran

33. PMV greater than or equal to 2x MV 34

- PMV shorter than 2x MV 35

34. Propodeum with median fovea .....*Eurytoma rajeevi* Narendran

- Propodeum without median fovea ..... *Eurytoma peethapada* Narendran

35. Gaster sessile; scape 3x length of F1 .....*Eurytoma agalica* Narendran

- Gaster petiolate; scape 1.8x length of F1 ..... *Eurytoma udara* Narendran

4. Genus: *Eurytomocharis* Ashmead

(Plate. 6. Fig. 5)

Eurytomocharis Ashmead, 1888: 42-43. Type species: *Eurytomocharis minuta* Ashmead, by subsequent monotypy.

Diagnosis: Genotemporal margin weakly carinate; front ocellus situated outside scrobe; postgenal groove without accompanying ridge or tooth; antenna moniliform with formula 11153;) propodeum vertical almost flat, median area shagreened; petiole usually hidden in undissected specimens; T4 usually occupying more than half dorsal length of gaster.

Distribution: India (Kerala and Tamil Nadu).

Host: Unknown.

Remarks: Only one species is reported from Kerala under this genus viz. *Eurytomocharis keralensis* and the original description of this species are enough for identification, so the detailed description was not given to avoid repetition.

5. Genus: *Fronsoma* Narendran

(Plate. 6. Fig. 4)

Fronsoma Narendran, 1994: 105-106. Type species *Fronsoma caudata* Narendran, original designation by monotypy.
Neoeurytomaria Narendran, 1994: Type species: *Neoeurytomaria subbaraoi* Narendran, original designation by monotypy [Synonimised by Lotfalizadeh *et al*., 2007]

Diagnosis: MV distinctly longer than PMV; ventral half of frons with golden pubescence; STV distinctly shorter than MV; Anterior ocellus located inside

scrobe and usually separated by a weak carina; genotemporal margin carinate; petiole extremely short hardly visible in dorsal view; Gaster compressed from sides, T4 longest in dorsal view; preorbital carina prominent; propodeum with median furrow; funicles 5 or 6 segmented; numerous carinae present on face.

Distribution: India, Nepal, Malaysia, Gabon.

Host: Unknown.

Remarks: Only one species is reported from Kerala under this genus viz. *Fronsoma subbaraoi* Narendran. The description of existing species is enough for identification.

6. Genus: *Neobephrata* Narendran & Padmasenan

Neobephrata Narendran & Padmasenan, 1989: 1-2. Type species: *Neobephrata petiolata* Narendran & Padmasenan, original designation and monotypy.

Diagnosis: Gastral petiole 1.34x as long as hind coxa; PMV shorter than MV but longer than STV; front ocellus located outside scrobe; T3 largest and longest and sometimes 2x dorsal length of T4; propodeum somewhat narrowly concave at middle but without a distinct median furrow; gaster compressed from sides; genotemporal margin carinate; face with radiating carinae from clypeal margin; funicular segments longer than broad.

Distribution: India.

Host: Unknown.

Key to species of *Neobephrata* Narendran and Padmasenan of Kerala

1. Scape not reaching or reaching level of vertex; gaster shorter than or subequal to head plus mesosoma combined 2

- Scape exceeding level of vertex; gaster distinctly longer than head plus mesosoma combined.....Neobephrata *idukkiensis* sp. nov.

2. T1 subequal to T2; antennal funicle six segmented .....
.....*Neobephrata aiswaryae* sp. nov.

- T1 not equal to T2; antennal funicle five segmented 3

3. SMV 3.6x MV; gaster dorsal length 3x its width; propodeum median length 0.35x its maximum width .....
.....*Neobephrata petiolata* Narendran and Padmasenan

- SMV less than 3.1x MV; gaster dorsal length more than 3.5x its width; propodeum median length 0.6x its maximum width.. 4

4. Clava length 2.4x its width; propodeal spiracle separated by metanotum by 0.6x its diameter; F1 and F2 different in length .. ..
..... *Neobephrata neopetiolata* sp. nov.

- Clava length 3.4x its width; propodeal spiracle separated by metanotum by 0.2x its diameter; F1 and F2 equal in length .....
..... *Neobephrata keralensis* sp. nov.

Species descriptions

6.1. *Neobephrata aiswaryae* sp. nov.

(Plate. 7. Fig. 1-9)

Holotype: Female: Length 2.97 mm. Body black in colour except the following, gaster brownish black; all femora except dorsal part of fore femur, all tibia, scape and basal part of ovipositor sheath golden yellow; dorsal part

of fore femur, pedicel, funicles and clava brown; tarsi pale yellow; eyes grey; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 7. Fig. 2, 3 & 8) Width 1.4x (74:52) its height in front view; face with several radiating rugae which extends up to pre orbital carina; two radiating weak carina extending up to scrobe, area between two carina smooth; scrobal margin carinate; preorbital carina present starting from the base of eye; frons with silvery pubescence; inter antennal projection hook like; malar area swollen with dense and umblicate punctures; postorbital carina absent; upper frons and vertex with distinct piliferous pits, interstices carinate; front ocellus located in a smooth area, scrobal margin and front ocellus connected by a median carina; mandible tridentate; eyes bare; toruli situated 0.42x (22:52) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 45:14:7; dorsally width 1.9x (73:39) its maximum height; POL 1.4x (13:9) OOL; POL 2.2x (13:6) AOL; OOL equal to (6:6) OD; laterally eye height 1.2x (36:31) its maximum width and 2.3x malar space; post genal carina well defined; malar sulcus not present; antennal formula 11162; scape length 3.1x (25:8) its width, reaching level of vertex; pedicel length 0.9x (6:7) its width; ring segment length 0.2x (1:5) its width; funicle and clava with setae; relative measurements of length and width of F1 to F6 are F1= 19:7; F2= 15:7; F3= 14:8, F4= 13:8, F5= 13:8 and F6= 11:7; clava length 2.4x (17:7) its width.

Mesosoma: (Plate. 7. Fig. 6) length 1.4x (101:74) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; anterior margin of pronotum ecarinate, carinate laterally, maximum length 0.7x (40:57) width and median length 0.6x (35:57) its maximum width; mesoscutum median length 0.4x (29:74) its maximum width, notuali present and distinct; scutellum median length 0.8x

(30:37) its maximum width; propodeum with weak median concave area bordered by two irregular lateral carina, whole area with distinct piliferous pits with interstices carinate, lateral upper part of the concave area having a smooth area, median length 0.5x (30:56) its maximum width, spiracle separated from metanotum by 0.4x its diameter; relative length and width of hind leg, coxa = 34:23, trochanter = 10:7, femur = 57:14, tibia = 61:12, tarsals 1 to 5 = 21:13:10:7:6; fore wing length 2.8x (196:70) its maximum width; relative length of SMV= 81, MV= 22, PMV= 20, STV= 17, CC= 80.

Metasoma: (Plate. 7. Fig. 5) Smooth and shining, lateral part of T3 onwards with micro sculptures on lateral side, length subequal to (154:143) head plus mesosoma combined (in profile) and 3.4x (174:51) to its maximum width dorsally; petiolate, dorsal length 3.4x its width, length 1.35x length of hind coxa; relative median length and maximum width of tergites are T1= 27:32, T2= 26:50, T3= 31:51, T4= 7:36, T5= 8:24, T6= 9:13, T7= 13:6, ovipositor sheath length dorsally 19.

Host: Unknown.

Male: Unknown.

Material examined: Holotype: Female: INDIA: Kerala, Kollam, Rosemala, 25.xi.2011, Col. Bijoy, Reg. No. E.IR. 11.

Paratype: One female: INDIA: Kerala, Kollam, Rosemala, 25.xi.2011, Col. Bijoy**,** Reg. No. E.IR. 12.

Etymology: The species derives its name after my wife Aiswarya.

Remarks: *Neobephrata aiswaryae* sp. nov. shows similarity with *Neobephrata idukkiensis* sp. nov. in proportions of SMV and MV; proportions of MV and PMV; proportions of gaster length and width, but strongly differs by the following characters, scape reaching level of vertex and not exceeding

(in *N. idukkiensis* sp. nov. scape exceeding level of vertex); T1 subequal to T2 (in *N. idukkiensis* sp. nov. T1 not equal to T2); antennal formula 11162 (in *N. idukkiensis* sp. nov. antennal formula 11153).

Neobephrata aiswaryae sp. nov. shows similarity with *Neobephrata keralensis* sp. nov. in scape reaching level of vertex; proportions of MV and PMV, but strongly differs by the following characters, SMV 3.7x MV (in *N. keralensis* sp. nov. SMV 3x MV); clava length 2.4x its maximum width (in *N. keralensis* sp. nov. clava length 3.4x its maximum width); antennal formula 11162 (in *N. keralensis* sp. nov. antennal formula 11153).

6.2. *Neobephrata idukkiensis* sp. nov.

(Plate. 8. Fig. 1-8)

Holotype: Female: Length 3.24 mm. Body black in colour except the following, base and apices of fore and mid femur, hind femur, all tibia except base and apex and scape except apex golden yellow; fore and mid femur except base and apices, pedicel, funicles and clava brown; base and apices of tibia, tarsi pale yellow; eyes grey; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 8. Fig. 2, 3 & 5) Width 1.5x (84:57) its height in front view; face with several radiating rugae which extends up to pre orbital carina and toruli; two radiating carina extending up to scrobe, area between two carina smooth and pubescent; scrobal margin carinate; preorbital carina present but weak, starting from the base of eye; frons densely pubescent with silvery pubescence; inter antennal projection hook like; malar area swollen with dense and umblicate punctures; postorbital carina absent; upper frons with distinct piliferous pits, interstices carinate; vertex with micro sculptured area; front ocellus located in a smooth area, scrobal margin and front ocellus

connected by a median carina; mandible bidentate; eyes bare; toruli situated 0.4x (23:57) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 53:15:9; dorsally width 1.9x (84:45) its maximum height; POL 1.5x (15:10) OOL; POL 1.9x (15:8) AOL; OOL equal to (8:8) OD; laterally eye height 1.2x (38:33) its maximum width and 1.8x malar space; post genal carina well defined and extending up to temple; malar sulcus not present; antennal formula 11153; scape length 3x (24:8) its width, exceeding level of vertex; pedicel length equal to (7:7) its width; ring segment length 0.2x (1:5) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1= 21:8; F2= 16:7; F3= 16:9, F4= 13:8 and F5= 14:8; clava length 2.9x (26:9) its width.

Mesosoma: (Plate. 8. Fig. 7) length 1.5x (124:85) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; anterior margin of pronotum ecarinate, maximum length 0.7x (43:63) width and median length 0.4x (28:63) its maximum width; mesoscutum median length 0.4x (35:85) its maximum width, notuali present, not distinct; scutellum median length 1.2x (43:37) its maximum width; propodeum with weak median concave area bordered by irregular carina and having two lateral carina adjacent to it, median area of concavity with a raw of large sized cell while comparing with the other cell in the concavity, callus densely setose, median length 0.5x (36:67) its maximum width, spiracle separated from metanotum by 0.2x its diameter; relative length and width of hind leg, coxa = 39:18, trochanter = 9:7, femur = 70:15, tibia = 70:12, tarsals 1 to 5 = 25:10:10:8:12; fore wing length 2.9x (218:86) its maximum width; relative length of SMV= 89, MV= 25, PMV= 22, STV= 19, CC= 85.

Metasoma: (Plate. 8. Fig. 6) Smooth and shining, lateral part of T4 onwards with micro sculptures on lateral side, length 1.2x (167:145) head plus mesosoma combined (in profile) and 3.3x (158:47) to its maximum width dorsally; petiolate, dorsal length 3.3x its width, length 1.3x length of hind coxa; relative median length and maximum width of tergites are T1= 10:28, T2= 21:42, T3= 58:47, T4= 15:20, T5= 5:11, T6= 8:7, T7= 6:6, ovipositor sheath length dorsally 11.

Host: Unknown.

Male: Unknown.

Material examined: Holotype: Female: INDIA: Kerala, Idukki, Pampadum Shola, 26.v.2014, Col. P. M. Sureshan, Reg. No. E.IR. 15.

Etymology: The species derives its name from the district of the type locality, Idukki (Kerala).

Remarks: *Neobephrata idukkiensis* sp. nov. shows similarity with *Neobephrata aiswaryae* sp. nov. in proportions of SMV and MV; proportions of MV and PMV; proportions of gaster length and width, but strongly differs by the following characters, scape exceeding level of vertex (in *N. aiswaryae* sp. nov. scape reaching level of vertex and not exceeding); T1 not equal to T2 (in *N. aiswaryae* sp. nov. T1 subequal to T2); antennal formula 11153 (in *N. aiswaryae* sp. nov. antennal formula 11162).

Neobephrata idukkiensis sp. nov. shows similarity with *Neobephrata keralensis* sp. nov. in proportions of POL and OOL; proportions of MV and PMV, but strongly differs by the following characters, scape exceeding level of vertex (in *N.* sp. 5 scape reaching level of vertex and not exceeding); SMV 3.6x MV (in *N.* sp. 5 SMV 3x MV); length of head plus mesosoma longer

than length of gaster in profile (in *N.* sp. 5 length of head plus mesosoma shorter than length of gaster in profile).

6.3. *Neobephrata keralensis* sp. nov.

(Plate. 9. Fig. 1-8)

Holotype: Female: Length 3.26 mm. Body black in colour except the following, base and apices of fore and mid femur, hind femur, all tibia except base and apex and scape golden yellow; fore and mid femur except base and apices, pedicel, funicles and clava brown; base and apices of tibia, tarsi pale yellow; eyes grey; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 9. Fig. 2, 3 & 5) Width 1.5x (81:55) its height in front view; face with several radiating rugae which extends up to pre orbital carina and toruli; two radiating carina extending up to scrobe, area between two carina smooth and pubescent; scrobal margin carinate; preorbital carina present but weak, starting from the base of eye; frons densely pubescent with silvery pubescence; malar area swollen with dense and umblicate punctures; postorbital carina absent; upper frons and vertex with distinct piliferous pits, interstices carinate; front ocellus located in a smooth area, scrobal margin and front ocellus connected by a median carina; mandible tridentate; eyes bare; toruli situated 0.5x (25:55) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 51:16:8; dorsally width 1.9x (83:43) its maximum height; POL 1.6x (16:10) OOL; POL 2x (16:8) AOL; OOL 1.3x (8:6) OD; laterally eye height 1.2x (38:31) its maximum width and 1.9x malar space; post genal carina well defined and extending up to temple; malar sulcus not present; antennal formula 11153; scape length 3.3x (26:8) its width, reaching level of vertex; pedicel length

equal to (7:7) its width; ring segment length 0.2x (1:5) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1= 15:8; F2= 15:8; F3= 13:8, F4= 14:8 and F5= 13:8; clava length 3.4x (27:8) its width.

Mesosoma: (Plate. 9. Fig. 7) length 1.8x (136:76) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; anterior margin of pronotum ecarinate, maximum length 0.7x (43:60) width and median length 0.6x (34:60) its maximum width; mesoscutum median length 0.4x (30:76) its maximum width, notuali present, not distinct; scutellum median length 1.2x (44:38) its maximum width; propodeum with median concave area bordered by irregular carina, median part of concave area having irregular rectangle cell with interstices carinate, callus setose, median length 0.6x (38:65) its maximum width, spiracle separated from metanotum by 0.2x its diameter; relative length and width of hind leg, coxa = 36:22, trochanter = 8:6, femur = 67:19, tibia = 67:13, tarsals 1 to 5 = 29:11:10:9:9; fore wing length 2.3x (208:91) its maximum width; relative length of SMV= 79, MV= 26, PMV= 25, STV= 20, CC= 77.

Metasoma: (Plate. 9. Fig. 6) Smooth and shining, lateral part of T4 onwards with micro sculptures on lateral side, length 0.9x (158:171) head plus mesosoma combined (in profile) and 3.6x (150:42) to its maximum width dorsally; petiolate, dorsal length 3.4x its width, length 1.36x length of hind coxa; relative median length and maximum width of tergites are T1= 14:25, T2= 23:42, T3= 42:34, T4= 7:17, T5= 7:14, T6= 11:8, T7= 11:8, ovipositor sheath length dorsally 15.

Host: Unknown.

Male: Unknown.

Materials examined: Holotype: Female: INDIA: Kerala, Kollam, Pandimotta, 25.xi.2011, Col. P. M. Sureshan, Reg. No. E.IR. 16.

Paratype: Five female: INDIA: Kerala, Kollam, Pandimotta, 25.xi.2011, Col. P. M. Sureshan**,** Reg. No. E.IR. 17.

Other materials examined: One female: INDIA: Kerala, Kollam, Idalimotta, 25.xi.2011, Col. P. M. Sureshan**,** Reg. No. E.IR. 18. Four female: INDIA: Kerala, Palakkad, Silentvalley NP, Sirendri, 15.i.2013, Col. K. Nikhil**,** Reg. No. E.IR. 19.

Etymology: The species derives its name from the name of State of the type locality, Kerala.

Remarks: *Neobephrata keralensis* sp. nov. shows similarity with *Neobephrata aiswaryae* sp. nov. in scape reaching level of vertex; proportions of MV and PMV, but strongly differs by the following characters, SMV 3x MV (in *N. aiswaryae* sp. nov. SMV 3.7x MV); clava length 3.4x its maximum width (in *N. aiswaryae* sp. nov. clava length 2.4x its maximum width); antennal formula 11153 (in *N. aiswaryae* sp. nov. antennal formula 11162).

Neobephrata keralensis sp. nov. shows similarity with *Neobephrata neopetiolata* sp. nov. in scape reaching level of vertex; proportions of SMV and MV, but differs strongly by the following characters, length of head plus mesosoma shorter than length of gaster (in *N. neopetiolata* sp. nov. length of head plus mesosoma longer than length of gaster); clava length 3.4x its maximum width (in *N. neopetiolata* sp. nov. clava length 2.4x its maximum width); eye height in profile 1.9x malar space in profile (in *N. neopetiolata* sp. nov. eye height in profile 2.3x malar space in profile).

6.4. *Neobephrata neopetiolata* sp. nov.

(Plate. 10. Fig. 1-8)

Holotype: Female: Length 3.04 mm. Body black in colour except the following, scape except apex, all trochanters, hind femur except middle area, base and apices of fore and mid femur, all tibia except base and apices, golden yellow; middle portion of hind femur, fore and mid femur except base and apices brown, apex of scape, pedicel, funicles, clava and ovipositor sheath blackish brown; base and apices of tibia, tarsi pale yellow; eyes grey; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 10. Fig. 2, 3 & 8) Width 1.46x (76:52) its height in front view; face with several radiating rugae which extends up to pre orbital carina and toruli; two radiating weak carina extending up to scrobe, area between two carina smooth; scrobal margin carinate; preorbital carina present starting from the base of eye; frons with silvery pubescence; inter antennal projection hook like; malar area swollen with dense and umblicate punctures; postorbital carina absent; upper frons and vertex with distinct piliferous pits, interstices carinate; front ocellus located in a smooth area, scrobal margin and front ocellus connected by a median carina; adjacent areas of ocelli with smooth and fine reticulations; mandible bidentate; eyes bare; toruli situated 0.36x (19:52) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 49:15:8; dorsally width 2x (81:41) its maximum height; POL 1.3x (14:11) OOL; POL 2.3x (14:6) AOL; OOL 0.6x (6:10) OD; laterally eye height 1.2x (37:32) its maximum width and 2.3x malar space; post genal carina well defined; malar sulcus not present; antennal formula 11153; scape length 3.3x (26:8) its width, reaching level of vertex; pedicel length equal to (7:7) its width; ring segment length 0.2x (1:5) its width; funicle and clava with setae; relative measurements of

length and width of F1 to F5 are F1= 20:7; F2= 16:8; F3= 15:8, F4= 15:9 and F5= 13:9; clava length 2.4x (27:8) its width.

Mesosoma: (Plate. 10. Fig. 6) length 1.5x (111:74) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; anterior margin of pronotum ecarinate, maximum length 0.6x (40:62) width and median length 0.5x (31:62) its maximum width; mesoscutum median length 0.6x (41:74) its maximum width, notuali present, not distinct; scutellum median length equal to (35:35) its maximum width; propodeum with weak median concave area, concave area with distinct piliferous pits with interstices carinate, lateral upper part of the concave area having a smooth area, callus highly setose, median length 0.5x (33:62) its maximum width, spiracle separated from metanotum by 0.6x its diameter; relative length and width of hind leg, coxa = 37:26, trochanter = 9:8, femur = 63:16, tibia = 70:11, tarsals 1 to 5 = 24:11:9:10:8; fore wing length 2.9x (203:70) its maximum width; relative length of SMV= 76, MV= 25, PMV= 22, STV= 17, CC= 68.

Metasoma: (Plate. 10. Fig. 5) Smooth and shining, lateral part of T6 onwards with micro sculptures on lateral side, length 1.1x (155:145) head plus mesosoma combined (in profile) and 4x (151:37) to its maximum width dorsally; petiolate, dorsal length 3.5x its width, length 1.45x length of hind coxa; relative median length and maximum width of tergites are T1= 14:30, T2= 24:37, T3= 50:37, T4= 13:16, T5= 6:6, T6= 5:6, T7= 4:6, ovipositor sheath length dorsally 11.

Host: Unknown.

Male: Unknown.

Material examined: Holotype: Female: INDIA: Kerala, Thrissur, Vazhani, 23.x.2013, Col. K. Nikhil, Reg. No. E.IR. 13.

Paratype: One female: INDIA: Kerala, Thrissur, Vazhani, 23.x.2013, Col. K. Nikhil**,** Reg. No. E.IR. 14.

Etymology: The species derives its name from the species name *Neobephrata petiolata*. Neo means new.

Remarks: *Neobephrata neopetiolata* sp. nov. shows similarity with *Neobephrata petiolata* Narendran & Padmasenan in proportions of MV and PMV; scape reaching level of vertex, but differs strongly by the following characters, SMV 3x MV (in *N. petiolata* SMV 3.6x MV); length of head plus mesosoma longer than length of gaster (in *N. petiolata* length of head plus mesosoma shorter than length of gaster); gaster length 3.5x its maximum width (in *N petiolata* gaster length 3x its maximum width).

Neobephrata neopetiolata sp. nov. shows similarity with *Neobephrata keralensis* sp. nov. in scape reaching level of vertex; proportions of SMV and MV, but differs strongly by the following characters, length of head plus mesosoma longer than length of gaster (in *N. keralensis* sp. nov. length of head plus mesosoma shorter than length of gaster); clava length 2.4x its maximum width (in *N. keralensis* sp. nov. clava length 3.4x its maximum width); eye height in profile 2.3x malar space in profile (in *N. keralensis* sp. nov. eye height in profile 1.9x malar space in profile).

6.5. *Neobephrata petiolata* Narendran & Padmasenan

(Plate. 11. Fig. 1-7)

Neobephrata petiolata Narendran & Padmasenan, 1989: 1-2. female. India, Kerala, Thekkady (QMB).

Diagnosis: Female: Length 2.8- 3.1 mm. Body black except the following, scape, tibiae, tarsi, bases and apices of femora, yellow; middle portion of femora brown; ovipositor sheath at apex brown; funicle and club blackish brown; head dorsally 2x as broad as long, anterior width 1.43x distance between front ocellus and clypeal margin; densely and umbilicately punctured including malar space; face below antennal toruli with radiating carinae from clypeal margin, two submedian carinae are stronger than others; scrobe deep, margins carinate; preorbital carina very distinct; lower edge of toruli situated at half distance between front ocellus; malar groove absent; relative measurements of POL 1.3x OOL; antennal formula 11153; scape reaching front ocellus; thorax densely punctate on dorsum; pronotum anteriorly ecarinate; propodeum vertical to dorsal margin of scutellum, median area somewhat narrowly concave; forewing minutely pubescent; PMV longer than STV, shorter than MV, a distinct break present at apical region of SMV; gaster compressed from sides; T4 smooth on dorsal side, ventral side minutely punctured; T3 largest; ovipositor sheath distinctly projecting.

Distribution: India (Kerala, Tamil Nadu).

Host: Unknown.

Male: Length 2.5- 2.9 mm. Resembles to female in all aspects except in having plumose antenna and shorter gaster.

Materials examined: Two female: INDIA: Kerala, Kollam, Rosemala, 18.x.2012, Col. Bijoy, Reg. No. E.IR. 1. Two female: INDIA: Kerala, Idukki, Mannavan Shola, Methop, 07.iv.2012, Col. Rajmohana, Reg. No. E.IR. 2. One female: INDIA: Kerala, Kozhikode, Kakkayam, 12.v. 2013, Col. K. Nikhil, Reg. No. E.IR. 3. One female: INDIA: Kerala, Kasargode, Manjeshwaram, 24.viii.2013, Col. Abhilash, Reg. No. E.IR. 4. One female:

INDIA: Kerala, Wayanad, Manathavady, 26.ix. 2012, Col. K. Nikhil, Reg. No. E.IR. 5. One female: INDIA: Kerala, Palakkad, Silentvalley NP, Sirendri, 15.i.2013, Col. K. Nikhil, Reg. No. E.IR. 6. One female: INDIA: Kerala, Thrissur, Peechi, 22.x.2013, Col. K. Nikhil, Reg. No. E.IR. 7. Two female: INDIA: Kerala, Idukki, Periyar Tiger Reserve, Cheriyamkunnu, 05.iv.2013, Col. Abhilash, Reg. No. E.IR. 8. One female: INDIA: Kerala, Idukki, Mannavan Shola, Methop, 24.v.2014, Col. Rajmohana, Reg. No. E.IR. 9. One female: INDIA: Kerala, Wayanad, Puzhamudi, 23.ii.1988, Col. Narendran and Party, Reg. No. E.IR. 10.

Remarks: *Neobephrata petiolata* Narendran & Padmasenan shows similarity with *Neobephrata neopetiolata* sp. nov. in proportions of MV and PMV; scape reaching level of vertex, but differs strongly by the following characters, SMV 3.6x MV (in *N. neopetiolata* sp. nov. SMV 3x MV); length of head plus mesosoma shorter than length of gaster (in *N. neopetiolata* sp. nov. length of head plus mesosoma longer than length of gaster); gaster length 3x its maximum width (in *N. neopetiolata* sp. nov. gaster length 3.5x its maximum width).

7. Genus: *Philolema* Cameron

Philolema Cameron, 1908: 560. Type species: *Philolema carinigena* Cameron, by monotypy.

Acantheurytoma Cameron, 1911: 23. Type species: *Acantheurytoma spinifera* Cameron, by monotypy. [Synonimised by Lotfalizadeh *et al*., 2007]

Desantisca Burks, 1971: 37-38. Type species: *Eurytoma latrodecti* Fullaway, original designation. [Synonimised by Lotfalizadeh *et al*., 2007]

Odonteurytoma Mukerjee, 1981: 44. Type species: *Odonteurytoma tanjorensis* Mukerjee, original designation and monotypy. [Synonimised by Farooqi and Subba Rao, 1986]

Subbaella Narendran, 1994: 97. Type species: *Subbaella negriensis* Narendran, original designation and monotypy. [Synonimised by Lotfalizadeh *et al*., 2007]

Diagnosis: Sublateral prepectus as a deep pit; mesopleuron with long but sloping ventral shelf; median part of ventral shelf strongly projecting anteriorly in to a shoulder - like process when seen in lateral view; subalar pit present and deep, but mostly hidden by tegula; procoxae with raised oblique carina delimiting ventrally an oblique groove; procoxae with a small areola on side of carina.

Distribution: Members of this genus made their representation throughout the world, apart from this a major portion occurs in the Oriental Region.

Host: Primary host: Scotylidae (Coleoptera), also association with Sphecoid wasps and Spider eggs.

Key to species of *Philolema* Cameron of Kerala

(Modified from Narendran, 1994)

1. Scutellum with spine..... .2

- Scutellum without spine..... 3

2. T5 longest; T1, T2 and T3 subequal in length; PMV 1.4x STV; POL 2x OOL .....*Philolema albitarsis* Motschulsky

- T4 longest; T1 and T2 subequal in length; PMV equal to STV; POL 1.5x OOL .....*Philolema spinifera* (Cameron)

3. Gaster dorsal length less than 2.7x its width…..... 4

- Gaster dorsal length more than 2.7x its width…..... .8

4. T4 longest; T2 subequal to T3; scape 2.83x its width…… .... *Philolema lankana* (Narendran)

- T3 longest; T2 not equal to T3; scape length more than 3x its width..... 5

5. Gaster dorsal length 1.75x its width; T3 subequal to T4; mesosoma length 1.3x its maximum width…..... *Philolema palanichami* (Narendran)

- Gaster dorsal length more than 2x its width; T3 not equal to T4; mesosoma length greater than 1.5x its maximum width……..... 6

6. Length of head plus mesosoma combined in profile 0.64x length of gaster; MV 1.2x PMV; SMV 2.9x MV; Propodeum median length 0.83x its maximum width…… ..... .*Philolema maleena* Narendran

- Length of head plus mesosoma combined in profile more than 0.8x length of gaster; MV shorter than PMV; SMV more than 3.2x MV; Propodeum median length less than or equal to 5x its maximum width…..... 7

7. Clava length 2.4x its width; SMV 3.5x MV; PMV 1.38x STV…..... ..... *Philolema kozhikodensis* sp. nov.

- Clava length 3.1x its width; SMV 3.2x MV; PMV 1.6x STV .... *Philolema neomaleena* sp. nov.

8. T4 longest; clava length 3.3x its width..... .... *Philolema narendrani* sp. nov.

- T4 not longest; clava less than 2.6x its width 9

9. T3 longest; SMV 4.3x MV; scutellum length less than its width..... .... *Philolema fronta* Narendran

- T1 longest; SMV less than 3.8x MV; scutellum length more than its width..... 10

10. T1 equal to T3; PMV 1.63x STV; SMV 3x MV; scape length 3.4x its width…..... *Philolema braconidis* (Ferrière)

- T1, T2 and T3 equal in length; PMV 1.14x STV; SMV 3.7x MV; scape length 4.2x its width..... *Philolema campoletisa* Narendran

Species descriptions

7.1. *Philolema albitarsis* Motschulsky

(Plate. 12. Fig. 1-9)

Eurytoma albitarsis Motschulsky, 1863: 41. female. Sri Lanka.
Acantheurytoma albicornis (Motschulsky), New combination for *Eurytoma albitarsis* Motschulsky by Boucek 1988: 117.
Acantheurytoma albitarsis (Motschulsky), Printing error for the name *Acantheurytoma albitarsis* (Motschulsky) by Boucek 1989: 85.
Philolema albitarsis (Motschulsky), New combination for *Acantheurytoma* (Motschulsky) by Lotfalizadeh *et al*., 2007: 491.

Redescription:

Female: Length 3.52 mm. Body black in colour except the following, eyes coppery brown; gaster coffee brown; forecaxa, mesocoxa, flagellum, all femora except apices, mid tibia and hind tibia except base and apices, apex of scape and madible brownish; scape except apex, apices of all femur, for tibia, base and apices of meso and meta tibia and tarsus pale yellow; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 12. Fig. 2, 3 & 7) Width 1.56x (87:56) its height in front view; face with several radiating carina originating from clypeal margin, two central

carina extending up to scrobal margin and continue as carina on scrobal margin; frons with close piliferous close pits; scrobe carinate; preorbital carina well defined starting from malar area and extending up to lateral ocellus; head dorsally with numerous piliferous close pits interstices carinate; mandible tridentate; eyes bare; toruli situated 0.54x (30:56) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 54:20:7; dorsally width 1.9x (89:47) its maximum height; POL 2x (18:9) OOL; POL 2.6x (18:7) AOL; OOL 1.13x (9:8) OD; laterally eye height 1.23x (43:35) its maximum width; post genal carina well defined; malar sulcus not present; antennal formula 11153; scape length 3.6x (25:7) its width, reaching level of vertex; pedicel length 1.67x (10:6) its width; ring segment length 0.4x (2:5) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1 and F2= 15:8; F3= 14:8, F4= 13:8 and F5= 11:8; clava length 3.3x (23:7) its width.

Mesosoma: (Plate. 12. Fig. 8) length 1.65x (129:78) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; pronotum maximum length 0.64x (47:73) width and median length 0.4x (28:73) its maximum width, collar carinate; mesoscutum median length 0.53x (40:75) its maximum width, notuali complete but not distinct; scutellum convex with a spine at base (fig.) median length 1.33x (48:36) its maximum width; propodeum with median fovea, foveal margin carinate, a less strong lateral carinae present on each side of foveal carina, inside the fovea 6 small parallel carina perpendicular to foveal carina present and among this the basal one strong, whole area except callus without hairs, median length 0.6x (38:64) its maximum width, spiracle separated from metanotum by 2.5x its own diameter; relative length and width of hind leg, coxa = 31:23, trochanter = 7:7, femur = 68:17, tibia =

63:11, tarsals 1 to 5 = 16:14:6:7:10; fore wing length 2.24x (204:91) its maximum width; relative length of SMV= 91, MV= 20, PMV= 21, STV= 15, CC= 87.

Metasoma: (Plate. 12. Fig. 9) Smooth and shining, length 0.97x (168:173) head plus mesosoma combined (in profile) and 4.1x (160:39) to its maximum width dorsally; petiolate, petiole with a projection on both sides laterally, length 0.69x its width; relative median length and maximum width of tergites are T1= 24:29, T2= 23:38, T3= 26:39, T4= 13:26, T5= 30:23, T6= 11:12, T7= 12:8, ovipositor sheath length 13.

Distribution: India (Kerala, Karnataka), Sri Lanka.

Host: Unknown.

Male: Unknown.

Materials examined: One female: INDIA: Kerala, Malappuram, Nilambur, 25.xi.2014, Col. K. Nikhil**,** Reg. No. E.IR. 20. One female: INDIA: Kerala, Thiruvananthapuram, Peppara, 12.viii.2012, Col. Bijoy**,** Reg. No. E.IR. 21. One female: INDIA: Kerala, Thiruvananthapuram, Neyyar, 25.iv.2012, Col. Bijoy**,** Reg. No. E.IR. 22. One female: INDIA: Kerala, Kannur, Palchuram, 20.iv.2012, Col. K. Nikhil**,** Reg. No. E.IR. 23. One female: INDIA, Kerala, Malappuram, Calicut University Campus, 1982, Col. M. Das**,** Reg. No. E.IR. 24. One female: INDIA, Kerala, Palakkad, Malampuzha, 10.viii.1988, Col. Narendran and Party**,** Reg. No. E.IR. 25. One female: INDIA, Kerala, Kozhikode, Feroke, 27.xi.1985 Col. Narendran and Party**,** Reg. No. E.IR. 26.

Remarks: *Philolema albitarsis* Motschulsky shows similarity with *Philolema spinifera* (Cameron) having scutellum with one spine; proportions of mesosoma and clava, but strongly differs by the following characters, scape reaching level of vertex (in *P. spinifera* scape not reaching level of vertex);

MV shorter than PMV (in *P. spinifera* MV longer than PMV); T5 longest (in *P. spinifera* T4 longest).

7.2. *Philolema braconidis* (Ferrière)

(Plate. 13. Fig. 1-8)

Eurytoma braconidis Ferrière, 1929: 256. female. Uganda, Kampala. (BMNH).
Philolema braconidis (Ferrière), New combination for *Eurytoma braconidis* Ferrière by Lotfalizadeh *et al*., 2007: 509.

Redescription:

Female: Length 2.34 mm. Body black in colour except the following, gaster coffee brown; eyes grey; fore and mid tibia, apices and base of hind tibia golden yellow; all femora, scape and flagellum brownish; tarsals pale yellow; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 13. Fig. 2, 3 & 5) Width 1.48x (65:44) its height in front view; face with several radiating carina originating from clypeal margin, scrobe extending up to clypeal margin; scrobal margin carinate; frons with close piliferous close pits; preorbital carina present but weak, starting from base of eye and extending up to lateral ocellus; head dorsally with numerous piliferous close pits interstices carinate; mandible tridentate; eyes bare; toruli situated 0.36x (16:44) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 40:14:5; dorsally width 1.9x (66:35) its maximum height; POL 2x (14:7) OOL; POL 2x (14:7) AOL; OOL 1.17x (7:6) OD; laterally eye height 1.22x (33:27) its maximum width; post genal carina well defined and extending up to temple;

malar sulcus not present; antennal formula 11153; scape length 4.2x (21:5) its width, not reaching level of vertex; pedicel length 0.83x (5:6) its width; ring segment length 0.2x (1:5) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1 = 9:6; F2= 9:7; F3= 8:7, F4 and F5 = 7:7; clava length 1.88x (15:5) its width.

Mesosoma: (Plate. 13. Fig. 7) length 1.35x (84:62) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; pronotum maximum length 0.54x (30:56) width and median length 0.38x (21:56) its maximum width, collar carinate; mesoscutum median length 0.47x (27:57) its maximum width, notuali not distinct; scutellum convex without spine, median length 1.16x (29:25) its maximum width; propodeum with median fovea, foveal margin weakly carinate, no lateral carinae present side of foveal carina, fovea reticulate, whole area except callus without hairs, median length 0.5x (24:49) its maximum width, spiracle separated from metanotum by its own diameter; relative length and width of hind leg, coxa = 23:14, trochanter = 5:6, femur = 50:13, tibia = 38:6, tarsals 1 to 5 = 9:6:4:3:2; fore wing length 2.13x (126:63) its maximum width; relative length of SMV= 52, MV= 14, PMV= 16, STV= 14, CC= 49.

Metasoma: (Plate. 13. Fig. 6) Smooth and shining, length 0.92x (108:118) head plus mesosoma combined (in profile) and 3.3x (109:33) to its maximum width dorsally; petiolate, petiole with a lateral carina projecting outwards on both sides, length 0.5x its width; relative median length and maximum width of tergites are T1= 20:24, T2 and T3 = 20:33, T4= 18:25, T5= 4:11, T6= 5:8, T7= 6:6, ovipositor sheath length 11.

Distribution: India (Kerala, Karnataka, Tamil Nadu), Benin, Cameroon, Chad, Congo, Kenya, Malawi, Niger, North Africa, Philippines, South Africa, Sudan, Tanzania, Togo and Uganda.

Host: Primary Host: Gelechiidae (Lepidoptera)., *Busseola fusca, Diparopsis castanea, Sesamia* sp., *Sesamia cretica* (Noctuidae: Lepidoptera)., *Opisina arenosella* (Oecophoridae: Lepidoptera)., *Chilo ignefusalis, Chilo orichalcociliellus, Chilo partellus, Diaphania indica, Haritalodes derogate, Sylepta derogate* (Pyralidae: Lepidoptera).

Parasitoid Host: *Aleodies* sp., *Apanteles sagax, Apanteles syleptae, Apanteles taragamae, Bracon* sp., *Bracon hancocki, Bracon sesamiae, Habrobracon brevicornis, Euviopio* sp., *Microbracon hancocki* (Braconidae: Hymenoptera).

Male: Length 1.76mm. Similar to female except in having gaster with petiole longer than hind coxa; gaster shorter; funicular segments pedicellate; propodeum with median area narrower and concave with median carina and horizontal carinae more prominent (Narendran, 1994).

Materials examined: One female: INDIA: Kerala, Idukki, Kumily, 13.i.2013, Col. Bijoy, Reg. No. E.IR. 27. One female: INDIA: Kerala, Malappuram, Nilambur, 25.xi.2014, Col. K. Nikhil, Reg. No. E.IR. 28. One female: INDIA: Kerala, Idukki, Cheruthoni, 12.i.2013, Col. Bijoy, Reg. No. E.IR. 29. One female: INDIA: Kerala, Kottayam, Chirakkadavu, 18.xi.2012, Col. Minu, Reg. No. E.IR. 30. One female: INDIA: Kerala, Kozhikode, Sarovaram, 12.ii. 2015, Col. K. Nikhil, Reg. No. E.IR. 31. One female: INDIA: Kerala, Kasargode, Manjeshwaram, 24.viii.2013, Col. Abhilash, Reg. No. E.IR. 32. One female: INDIA: Kerala, Kozhikode, Nanminda, 29.vii.2014, Col. K. Nikhil, Reg. No. E.IR. 33. One female: INDIA: Kerala, Pathanamthitta, Chittar, 21.xi.2012, Col. Bijoy, Reg. No. E.IR. 34. One female: INDIA: Kerala, Kottayam, Pala, 17.xi.2012, Col. Minu, Reg. No. E.IR. 35. One female: INDIA: Kerala, Kozhikode, Payyoli, Kizoor, 01.ii. 2014, Col. K. Nikhil, Reg. No. E.IR. 36. One female: INDIA: Kerala, Malappuram, Thenhipalam, vi.1983, Col. T. C. Narendran, Reg. No. E.IR. 37.

One female INDIA: Kerala, Malappuram, Nilambur, 1995, Col. Mohandas, Reg. No. E.IR. 38.

Remarks: *Philolema braconidis* Ferrière shows similarity with *Philolema campoletisa* Narendran in scutellum without spine; proportions of MV and PMV, but strongly differs by the following characters, scape not reaching level of vertex (in *P. campoletisa* scape reaching level of vertex); scape length 4.2x its maximum width (in *P. campoletisa* scape length 3.4x its maximum width); T1, T2 and T3 equal in length (in *P. campoletisa* T1 and T3 equal in length).

7.3. *Philolema campoletisa* Narendran

(Plate. 14. Fig. 1-9)

Philolema campoletisa Narendran, 1994: 188-189. female. India, Kerala, Calicut University Campus. (QMB).

Redescription:

Female: Length 2.92 mm. Body black in colour except the following, eyes coppery brown; ventral side of T1 to T4 coffee brown; apices of all femora, fore tibia, base and apices of mid and hind tibia yellowish brown; flagellum brown; tarsals pale yellow; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 14. Fig. 2, 3 & 5) Width 1.57x (99:63) its height in front view; face with several radiating carina originating from clypeal margin, two weak central carina extending up to scrobal margin and continue as a strong carina on scrobal margin; frons with close piliferous close pits; scrobal margin strongly carinate; preorbital carina well defined starting from base of eye and extending up to lateral ocellus; head dorsally with numerous piliferous close

pits interstices carinate; mandible tridentate; eyes bare; toruli situated 0.44x (28:63) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 63:22:8; dorsally width 2x (100:50) its maximum height; POL 1.9x (19:10) OOL; POL 2.7x (19:7) AOL; OOL 1.1x (10:9) OD; laterally eye height 1.13x (36:32) its maximum width; post genal carina well defined and extending up to temple; malar sulcus not present; antennal formula 11153; scape length 3.44x (31:9) its width, reaching level of vertex; pedicel length 0.86x (6:7) its width; ring segment length 0.33x (2:6) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1 = 16:8; F2= 13:9; F3= 14:8, F4= 12:8 and F5= 11:9; clava length 2.55x (23:9) its width.

Mesosoma: (Plate. 14. Fig. 8) length 1.5x (146:97) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; pronotum maximum length 0.63x (55:88) width and median length 0.38x (33:88) its maximum width, collar carinate; mesoscutum median length 0.55x (51:92) its maximum width, notuali complete but not distinct; scutellum convex without spine, median length 1.1x (51:48) its maximum width; propodeum with median fovea, foveal margin carinate, a less strong lateral carinae present on each side of foveal carina, inside the fovea numerous curved carina present which connects the foveal carina, whole area except callus without hairs, median length 0.55x (44:81) its maximum width, spiracle separated from metanotum by 0.5x its own diameter; relative length and width of hind leg, coxa = 34:23, trochanter = 8:6, femur = 56:16, tibia = 60:10, tarsals 1 to 5 = 21:11:9:7:6; fore wing length 2.13x (162:76) its maximum width; relative length of SMV= 70, MV= 23, PMV= 26, STV= 16, CC= 69.

Metasoma: (Plate. 14. Fig. 7) Smooth and shining, length 0.97x (137:141) head plus mesosoma combined (in profile) and 3.5x (179:51) to its maximum width dorsally; petiolate, petiole with a lateral carina projecting outwards on both sides, length 0.44x its width; relative median length and maximum width of tergites are T1= 35:40, T2= 30:51, T3= 35:50, T4= 34:38, T5= 10:22, T6= 11:12, T7= 7:6, ovipositor sheath length 12.

Distribution: India (Kerala, Karnataka, Madhya Pradesh, Andhra Pradesh, West Bengal).

Host: Primary Host: *Heliothis armigera* (Noctuidae: Lepidoptera).

Parasitoid Host: *Campoletis* sp., *Campoletis chlorideae., Campoletis perdistinctus* (Ichenumonidae: Hymenoptera).

Male: Essentially similar to female except shorter gaster, longer petiole and petiolate funicular segments (Narendran, 1994).

Materials examined: One female: INDIA: Kerala, Kasargode, Chowki, 23.ii.2012, Col. Bijoy, Reg. No. E.IR. 39. One female: INDIA: Kerala, Pathanamthitta, Thiruvalla, 14.xii.2013, Col. K. Nikhil, Reg. No. E.IR. 40. One female: INDIA: Kerala, Wayanad, Pokkod, 04.iv.2012, Col. Nikhil, Reg. No. E.IR. 41. One female: INDIA: Kerala, Alappuzha, Mavelikkara, 19.x.2013, Col. K. Nikhil, Reg. No. E.IR. 42. One female: INDIA: Kerala, Kozhikode, Nanminda, 29.vii.2014, Col. K. Nikhil, Reg. No. E.IR. 43. Two female: INDIA: Kerala, Palakkad, Malampuzha, i.1986, Col. Narendran and Party, Reg. No. E.IR. 44.

Remarks: *Philolema campoletisa* Narendran shows similarity with *Philolema braconidis* Ferrière in scutellum without spine; proportions of MV and PMV, but strongly differs by the following characters, scape reaching level of vertex (in *P. braconidis* scape not reaching level of vertex); scape

length 3.4x its maximum width (in *P. braconidis* scape length 4.2x its maximum width); T1 and T3 equal in length (in *P. braconidis* T1, T2 and T3 equal in length).

7.4. *Philolema fronta* Narendran

(Plate. 15. Fig. 1-7)

Philolema fronta Narendran, 1994: 188. female. India, Kerala, Malampuzha. (ZSIK, examined).

Redescription:

Female: Length 3.44 mm. Body black in colour except the following, antennae including scape dark brown; apices of all femora, fore tibia, mid tibia except middle area, base and apices of hind tibia golden yellow; tarsals pale yellow; eyes grey; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 15. Fig. 2, 3 & 5) Width 1.56x (98:63) its height in front view; face with several radiating carina originating from clypeal margin, two central weak carina extending up to scrobal margin and between this a carina present and extending up to toruli; scrobal margin carinate; frons with close piliferous pits; preorbital carina distinct, starting from base of eye and extending up to lateral ocellus; head dorsally with numerous piliferous close pits interstices carinate; mandible tridentate; eyes bare; toruli situated 0.35x (22:63) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 64:22:7; dorsally width 1.94x (99:51) its maximum height; POL 2.2x (20:9) OOL; POL 2.2x (20:9) AOL; OOL 1.13x (9:8) OD; laterally eye height 1.16x (43:37) its maximum width; post genal carina well defined and extending up to temple; malar sulcus not present; antennal formula 11153; scape length 4.57x (32:7) its width,

exceeding level of vertex; pedicel length 0.88x (7:8) its width; ring segment length 0.17x (1:6) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1 = 15:9; F2= 13:9; F3= 12:9, F4 = 13:9 and F5 = 12:9; clava length 1.88x (23:10) its width.

Mesosoma: (Plate. 15. Fig. 7) length 1.5x (141:94) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; pronotum maximum length 0.64x (55:86) width and median length 0.47x (40:86) its maximum width, collar smooth and carinate; mesoscutum median length 0.58x (51:88) its maximum width, notuali weak but complete; scutellum convex without spine, median length 0.95x (42:44) its maximum width; propodeum with median fovea, foveal margin weakly carinate, weak lateral carinae present side of foveal carina, fovea with irregular weak carinae joining foveal carinae perpendicularly, whole area except callus without hairs, median length 0.59x (38:64) its maximum width, spiracle separated from metanotum by its own diameter; relative length and width of hind leg, coxa = 39:26, trochanter = 11:9, femur = 76:21, tibia = 77:13, tarsals 1 to 5 = 25:16:12:8:9; fore wing length 2.1x (210:100) its maximum width; relative length of SMV= 103, MV= 24, PMV= 25, STV= 20, CC= 103.

Metasoma: (Plate. 15. Fig. 6) Smooth and shining, length 0.94x (162:173) head plus mesosoma combined (in profile) and 3.4x (166:49) to its maximum width dorsally; petiolate, petiole with a lateral carina projecting outwards on both sides, length 0.5x its width; relative median length and maximum width of tergites are T1= 36:38, T2 = 39:44, T3 = 46:38, T4= 9:17, T5= 7:10, T6= 8:8, T7= 7:7, ovipositor sheath length 12.

Distribution: India (Kerala, Karnataka.

Host: Primary Host: *Apion* sp. (Apionidae: Coleoptera)

Male: Unknown

Material examined: One female: INDIA: Kerala, Kasargode, Chowki, 23.ii.2012, Col. Bijoy, Reg. No. E.IR. 45.

Remarks: *Philolema fronta* Narendran shows similarity with *Philolema campoletisa* Narendran in proportions of MV and PMV; POL 1.9x OOL but strongly differs by the following characters, scape exceeding level of vertex (in *P. campoletisa* scape reaching level of vertex); T1 not equal to T3 (in *P. campoletisa* T1 equal to T3); SMV 4.3x MV (in *P. campoletisa* SMV 3x MV).

7.5. *Philolema kozhikodensis* sp. nov.

(Plate. 16. Fig. 1-7)

Female: Length 2.92 mm. Body black in colour except the following, base and apices of all femora, base and apices of mid and hind tibia, fore tibia and scape except apex golden yellow; apex of scape, pedicel, funicles and clava blackish brown; tarsi pale yellow; eyes grey; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 16. Fig. 2-4) Width 1.4x (60:43) its height in front view; face with several radiating carina originating from clypeal margin, two weak central carina extending up to scrobal margin the area between carna is smooth and having a median carina; scrobal margin carinate, scrobe deep and smooth; frons with close piliferous pits; preorbital carina strongly indicated and well raised in frons, starting from gena and extending up to lateral ocellus; the area between eye and pre orbital carina with microsculptures; head dorsally with numerous piliferous close pits interstices carinate; mandible tridentate; eyes bare; toruli situated 0.4x (18:43) of maximum

height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 40:12:6; dorsally width 1.7x (61:35) its maximum height; POL 1.5x (12:8) OOL; POL 1.7x (12:7) AOL; OOL 1.4x (7:5) OD; laterally eye height 1.1x (27:24) its maximum width; post genal carina present and extending up to temple; malar sulcus not present; antennal formula 11153; scape length 3.6x (18:5) its width, not reaching level of vertex; pedicel length 1.2x (6:5) its width; ring segment length 0.3x (1:4) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1= 12:6; F2= 12:6; F3= 12:6; F4= 10:6 and F5 = 10:9; clava length 2.4x (24:10) its width.

Mesosoma: (Plate. 16. Fig. 5) length 1.7x (116:68) its maximum width (including tegula), convex in shape; pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate, pits of scutellum comparatively large and the interstices thickly carinate; pronotum maximum length 0.7x (39:57) width and median length 0.5x (27:57) its maximum width, collar smooth and ecarinate; mesoscutum median length 0.5x (31:68) its maximum width, notuali present and distinct; scutellum convex without any spine, median length subequal to (38:36) its maximum width; propodeum with fovea bordered by lateral carina and a basal carina, having five cross carina at centre, other areas with irregular shaped cell with interstices carinate, fovea without any seatae, median length 0.5x (33:62) its maximum width, spiracle separated from metanotum by its own diameter; relative length and width of hind leg, coxa = 33:18, trochanter = 9:9, femur = 56:21, tibia = 57:10, tarsals 1 to 5 = 21:10:8:6:11; fore wing length 2.3x (148:64) its maximum width; relative length of SMV= 60, MV= 17, PMV= 18, STV= 13, CC= 57.

Metasoma: (Plate. 16. Fig. 7) Smooth and shining, length subequal to (148:145) head plus mesosoma combined (in profile) and 2.6x (109:42) to its maximum width dorsally; petiolate, petiole length 0.9x its width; relative median length and maximum width of tergites are T1= 11:20, T2 = 18:33, T3 = 42:42, T4= 25:28, T5= 7:14, T6= 5:9, T7= 4:5, ovipositor sheath length 5.

Host: Unknown.

Male: Unknown.

Materials examined: Holotype: Female: INDIA: Kerala, Kozhikode, Kakkayam, 12.v. 2013, Col. K. Nikhil, Reg. No. E.IR. 66.

Paratype: Six female: INDIA: Kerala, Kozhikode, Kakkayam, 12.v. 2013, Col. K. Nikhil , Reg. No. E.IR. 67.

Other Materials examined: Two female: INDIA: Kerala, Wayanad, Tholpetty, 27.ix. 2012, Col. K. Nikhil , Reg. No. E.IR. 184.

Etymology: The species derives its name from the district of the type locality, Kozhikode (Kerala).

Remarks: *Philolema kozhikodensis* sp. nov. shows similarity with *Philolema maleena* Narendran in proportions of POL and OOL; scape not reaching level of vertex; proportions of PMV and STV, but strongly differs by the following characters, clava 2.4x its maximum width (in *P. maleena* clava 3.4x its maximum width); propodeum median length 05x its maximum width (in *P. maleena* propodeum median length 0.83x its maximum width); length of head plus mesosoma subequal to length of gaster (in *P. maleena* length of head plus mesosoma 0.64x length of gaster).

Philolema kozhikodensis sp. nov. shows similarity with *Philolema neomaleena* sp. nov. in scape not reaching level of vertex; proportions of

length and width of scape; T3 longest, but strongly differs by the following characters, clava length 2.4x its maximum width (in *P. neomaleena* sp. nov. clava length 3.1x its maximum width); fovea of propodeum having eight cross carina (in *P. neomaleena* sp. nov. fovea of propodeum having five cross carina); SMV 3.5x MV (in *P. neomaleena* sp. nov. SMV 3.2x MV).

7.6. *Philolema lankana* (Narendran)

(Plate. 17. Fig. 1-7)

Desantisca lankana Narendran, 1994: 206-207. female. Sri Lanka, Nugegoda. (BMNH).
Philolema lankana (Narendran), New combination for *Desantisca* by Lotfalizadeh *et al*., 2007: 508.

Redescription:

Female: Length 1.88 mm. Body black in colour except the following, gaster and all coxae coffee brown; scape, fore and mid tibia, apices and bases of hind tibia, apices and base of fore and mid femur, tarsi pale yellow; funicles including clava, hind femur, hind tibia except apices brown; eyes grey; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 17. Fig. 2, 3 & 5) Width 1.41x (55:39) its height in front view; face with several radiating carina originating from clypeal margin extending up to lower eye margin, scrobal margin weakly carinate; frons with close piliferous pits; preorbital carina present but not distinct, starting from base of eye and extending up to lateral ocellus; head dorsally with numerous piliferous close pits interstices carinate; mandible bidentate; eyes bare; toruli situated 0.44x (17:39) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at

the level of toruli, between eyes and toruli and between toruli are 40:15:4; dorsally width 2x (56:28) its maximum height; POL 1.9x (15:8) OOL; POL 1.9x (15:8) AOL; OOL 1.6x (8:5) OD; laterally eye height 1.2x (23:19) its maximum width; post genal carina well defined and extending up to temple; malar sulcus not present; antennal formula 11153; scape length 2.83x (17:6) its width, not reaching level of vertex; pedicel length 1.17x (7:6) its width; ring segment length 0.5x (2:4) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1 = 8:5; F2= 8:6; F3= 6:6, F4 and F5 = 6:5; clava length 2.33x (14:6) its width.

Mesosoma: (Plate. 17. Fig. 7) length 1.5x (75:50) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits(size of pit on scutellum comparatively large than pronotum and mesoscutum), interstices carinate; pronotum maximum length 0.66x (29:44) width and median length 0.52x (23:44) its maximum width, collar smooth and carinate; mesoscutum median length 0.44x (22:50) its maximum width, notuali present but not distinct; scutellum convex without spine, median length 1.1x (25:23) its maximum width; propodeum with median fovea, foveal margin carinate but not distinct, lateral carinae absent on sides of foveal carina, fovea without carinae, fovea with numerous pits interstices carinate, whole area except callus without hairs, median length 0.46x (19:41) its maximum width, spiracle separated from metanotum by its own diameter; relative length and width of hind leg, coxa = 27:17, trochanter = 6:5, femur = 49:11, tibia = 48:8, tarsals 1 to 5 = 13:8:7:5:5; fore wing length 2.2x (220:100) its maximum width; relative length of SMV= 96, MV= 21, PMV= 18, STV= 16, CC= 93.

Metasoma: (Plate. 17. Fig. 6) Smooth and shining, length 0.83x (85:103) head plus mesosoma combined (in profile) and 2.3x (96:38) to its maximum width dorsally; petiolate, petiole with a lateral carina projecting outwards on

both sides, length 1.1x its width; relative median length and maximum width of tergites are T1= 20:28, T2 = 14:37, T3 = 14:38, T4= 21:30, T5= 5:18, T6= 3:10, T7= 7:8, ovipositor sheath length 4.

Distribution: India (Kerala), Sri Lanka.

Host: Primary Host: *Cyrtophora* sp.. (Araneidae: Araneae)

Male: Length 1.5mm; antennal formula 11152; funicular segments bead like, gaster shorter than female, petiole longer than female other charecters are similar to that of female (Narendran, 1994).

Materials examined: One female: INDIA, Kerala, Kazargod, Pamdi, 09.xi.2013, Col. P. M. Sureshan, Reg. No. E.IR. 46. One female: INDIA: Kerala, Kozhikode, Kakkayam, 16.ix. 2013, Col. K. Nikhil, Reg. No. E.IR. 47.

Remarks: *Philolema lankana* (Narendran) shows similarity with *Philolema narendrani* sp. nov. in proportions of POL and OOL; scape not reaching level of vertex but strongly differs by the following characters, scape length 2.8x its maximum width (in *P. narendrani* sp. nov. scape length 3.9x its maximum width); propodeum median length 0.46x its maximum width (in *P. narendrani* sp. nov. propodeum median length 073x its maximum width); T2 equal to T3 (in *P. narendrani* sp. nov. T2 not equal to T3).

7.7. *Philolema maleena* Narendran

(Plate. 18. Fig. 1-8)

Philolema maleena Narendran, 1994: 187-188. female. India, Kerala, Kollam, Neendakara. (ZSIK, examined).

Redescription:

Female: Length 3 mm. Body black in colour except the following, fore femur except apices, mid and hind femur except base and apices, mid and hind tibia except base and apices dark brown; apices of fore femur, base and apices of mid and hind femur, base and apices of mid and hind tibia, fore tibia, scape golden yellow; funicle including clava and pedicel brownish; tarsi pale yellow; eyes grey; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 18. Fig. 2, 3 & 5) Width 1.38x (76:55) its height in front view; face with several radiating carina originating from clypeal margin, two central carina extending up to scrobal margin and between this a smooth area having a carina extending up to toruli; scrobal margin carinate; frons with close piliferous pits; preorbital carina well defined, starting from gena and extending up to lateral ocellus, in both ends the carina becoming weak; head dorsally with numerous piliferous close pits interstices carinate; mandible tridentate; eyes bare; toruli situated 0.38x (21:55) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 49:16:6; dorsally width 1.7x (84:50) its maximum height; POL 1.5x (15:10) OOL; POL 1.9x (15:8) AOL; OOL 1.43x (10:7) OD; laterally eye height 1.1x (36:33) its maximum width; post genal carina well defined and extending up to temple; malar sulcus not present; antennal formula 11153; scape length 3.14x (22:7) its width, not reaching level of vertex; pedicel length 1.2x (6:5) its width; ring segment length 0.5x (2:4) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1 = 16:8; F2= 12:7; F3= 13:7, F4= 11:7 and F5 = 12:7; clava length 3.43x (24:7) its width.

Mesosoma: (Plate. 18. Fig. 8) length 1.65x (114:69) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous

piliferous pits, interstices carinate; pronotum maximum length 0.65x (41:63) width and median length 0.48x (30:63) its maximum width, collar smooth and carinate; mesoscutum median length 0.57x (39:69) its maximum width, notuali present; scutellum convex without spine, median length 1.1x (37:35) its maximum width; propodeum with median fovea with a longitudinal area of seven pits and numerous pis nearby, foveal margin carinate, lateral carinae present both on sides of foveal carina, except the middle region fovea and callus with silver hairs, median length 0.83x (34:41) its maximum width, spiracle separated from metanotum by its own diameter; relative length and width of hind leg, coxa = 39:22, trochanter = 10:9, femur = 59:17, tibia = 62:11, tarsals 1 to 5 = 21:16:8:8:7; fore wing length 2.24x (186:83) its maximum width; relative length of SMV= 76, MV= 26, PMV= 22, STV= 16, CC= 74.

Metasoma: (Plate. 18. Fig. 6) Smooth and shining, length 0.64x (118:184) head plus mesosoma combined (in profile) and 2.63x (121:46) to its maximum width dorsally; petiolate, petiole with a lateral carina projecting outwards on both sides, length equal to its width; T6, T7 with numerous hairs; relative median length and maximum width of tergites are T1= 28:26, T2 = 20:36, T3 = 39:46, T4= 26:27, T5= 15:16, T6= 10:13, T7= 9:8, ovipositor sheath length 12.

Distribution: India (Kerala, Karnataka, Tamil Nadu, West Bengal).

Host: Plant associate: *Oryza sativa*. (Poaceae)

Male: Unknown

Materials examined: One female: INDIA, Kerala, Idukki, Mannavan Shola National Park, Methop, 07.iv.2012, Col. Rajmohana, Reg. No. E.IR. 48. One female: INDIA: Kerala, Pathanamthitta, Ranni, 23.i.2014, Col. Rajmohana, Reg. No. E.IR. 49. One female: INDIA: Kerala, Alappuzha, Kayamkulam,

16.ix.2013, Col. K. Nikhil, Reg. No. E.IR. 50. One female: INDIA: Kerala, Kasargode, Manjeshwaram, 24.viii.2013, Col. Abhilash, Reg. No. E.IR. 51. One female: INDIA: Kerala, Malappuram, Kadalundi, 10.v. 2013, Col. K. Nikhil, Reg. No. E.IR. 52.

Remarks: *Philolema maleena* Narendran shows similarity with *Philolema kozhikodensis* sp. nov. in proportions of POL and OOL; scape not reaching level of vertex; proportions of PMV and STV, but strongly differs by the following characters, clava 3.4x its maximum width (in *P. kozhikodensis* sp. nov. clava 2.4x its maximum width); propodeum median length 0.83x its maximum width (in *P. kozhikodensis* sp. nov. propodeum median length 05x its maximum width); length of head plus mesosoma 0.64x length of gaster (in *P. kozhikodensis* sp. nov. length of head plus mesosoma subequal to length of gaster).

7.8. *Philolema narendrani* sp. nov.

(Plate. 19. Fig. 1-7)

Female: Length 3.1 mm. Body black in colour except the following, base and apices of fore and mid femur, apex of hind femur, base and apex of mid and hind tibia, fore femur, funicles and clava golden yellow; tarsi pale yellow; eyes grey; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 19. Fig. 2-4) Width 1.44x (81:56) its height in front view; face with several radiating carina originating from clypeal margin, two weak central carina extending up to scrobal margin and between this a groove with smooth area and bordered by carina; scrobal margin carinate; frons with close piliferous pits; preorbital carina strongly indicated, starting from gena and extending up to lateral ocellus; head dorsally with numerous piliferous close

pits interstices carinate; mandible tridentate; eyes bare; toruli situated 0.5x (27:56) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 52:17:7; dorsally width 2x (88:44) its maximum height; POL 2x (18:9) OOL; POL 2.3x (18:8) AOL; OOL equal to (8:8) OD; laterally eye height 1.2x (42:35) its maximum width; post genal carina present and extending up to temple; malar sulcus not present; antennal formula 11153; scape length 3.9x (27:7) its width, not reaching level of vertex; pedicel length equal to (6:6) its width; ring segment length 0.2x (1:5) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1= 14:9; F2= 12:9; F3= 11:9; F4= 9:9 and F5 = 8:9; clava length 3.33x (18:9) its width.

Mesosoma: (Plate. 19. Fig. 7) length 1.3x (109:83) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate, pits of scutellum comparatively large and the interstices thickly carinate; pronotum maximum length 0.6x (38:67) width and median length 0.4x (25:67) its maximum width, collar smooth and weakly carinate; mesoscutum median length 0.5x (40:83) its maximum width, notuali present; scutellum convex without any spine, median length equal to (41:41) its maximum width; propodeum with median concave area with lateral sides carinate, concavity with irregular weak cross carinas and fine reticulations, whole area except callus without hairs, median length 0.73x (35:48) its maximum width, spiracle separated from metanotum by its own diameter; relative length and width of hind leg, coxa = 36:22, trochanter = 7:10, femur = 65:17, tibia = 66:12, tarsals 1 to 5 = 24:13:7:8:6; fore wing length 2.1x (169:81) its maximum width; relative length of SMV= 75, MV= 20, PMV= 24, STV= 17, CC= 72.

Metasoma: (Plate. 19. Fig. 6) Smooth and shining, length 0.84x (203:243) head plus mesosoma combined (in profile) and 3.3x (146:44) to its maximum width dorsally; petiolate, petiole length 0.7x its width; relative median length and maximum width of tergites are T1= 9:28, T2 = 20:38, T3 = 33:44, T4= 39:38, T5= 12:17, T6= 7:12, T7= 9:8, ovipositor sheath length 16.

Host: Unknown.

Male: Unknown.

Materials examined: Holotype: Female: INDIA, Kerala, Idukki, Chinnar, Vyasan Para, 05.iv.2012, Col. Bijoy, Reg. No. E.IR. 61.

Other Materials examined: Two female: INDIA: Kerala, Idukki, Chinnar, 13.viii.2013, Col. P. M. Sureshan, Reg. No. E.IR. 62. One female: INDIA: Kerala, Idukki, Mannavan Shola, 06.iv.2012, Col. P. M. Sureshan, Reg. No. E.IR. 63.

Etymology: The species derives its name after Dr. T. C. Narendran for his great contributions to the taxonomy of Hymenoptera.

Remarks: *Philolema narendrani* sp. nov. shows similarity with *Philolema lankana* (Narendran) in proportions of POL and OOL; scape not reaching level of vertex but strongly differs by the following characters, scape length 3.9x its maximum width (in *P. narendrani* sp. nov. scape length 2.8x its maximum width); propodeum median length 073x its maximum width (in *P. narendrani* sp. nov. propodeum median length 0.46x its maximum width); T2 not equal to T3 (in *P. narendrani* sp. nov. T2 equal to T3).

Philolema narendrani sp. nov. shows similarity with *Philolema fronta* Narendran in proportions of length and width of scutellum; proportions of fore wing and gaster, but strongly differs by the following characters, scape not reaching level of vertex (in *P. fronta* scape exceeding level of vertex);

clava length 3.3x its maximum width (in *P. fronta* clava length 1.88x its maximum width); T4 longest (in *P. fronta* T3 longest).

7.9. *Philolema neomaleena* sp. nov.

(Plate. 20. Fig. 1-8)

Female: Length 2.62 mm. Body black in colour except the following, apices of all femora, base and apices of mid and hind tibia and fore tibia golden yellow; scape pedicel, funicles and clava yellowish brown; tarsi pale yellow; eyes grey; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 20. Fig. 2-4) Width 1.5x (68:46) its height in front view; face with several radiating carina originating from clypeal margin, two weak central carina extending up to scrobal margin and between this a groove with smooth area and bordered by carina; scrobal margin carinate; frons with close piliferous pits; preorbital carina strongly indicated, starting from gena and extending up to lateral ocellus; the area between eye and pre orbital carina smooth; head dorsally with numerous piliferous close pits interstices carinate; mandible tridentate; eyes bare; toruli situated 0.4x (19:46) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 44:14:7; dorsally width 1.7x (69:40) its maximum height; POL 1.8x (14:8) OOL; POL 2x (14:7) AOL; OOL 1.2x (7:6) OD; laterally eye height 1.1x (32:28) its maximum width; post genal carina present and extending up to temple; malar sulcus not present; antennal formula 11153; scape length 3.5x (21:6) its width, not reaching level of vertex; pedicel length equal to (6:6) its width; ring segment length 0.2x (1:5) its width; funicle and clava with setae; relative measurements of length and

width of F1 to F5 are F1= 13:7; F2= 13:7; F3= 11:7; F4= 11:7 and F5 = 10:7; clava length 3.1x (22:7) its width.

Mesosoma: (Plate. 20. Fig. 8) length 1.6x (105:66) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate, pits of scutellum comparatively large and the interstices thickly carinate; pronotum maximum length 0.6x (32:51) width and median length 0.4x (20:51) its maximum width, collar smooth and weakly carinate; mesoscutum median length 0.4x (27:66) its maximum width, notuali present; scutellum convex without any spine, median length subequal to (32:30) its maximum width; propodeum with fovea having eight cross carina at centre, other areas with irregular shaped cell with interstices carinate, borders of fovea setose, median length 0.4x (29:67) its maximum width, spiracle separated from metanotum by its own diameter; relative length and width of hind leg, coxa = 30:19, trochanter = 9:8, femur = 57:16, tibia = 50:9, tarsals 1 to 5 = 15:10:9:8:5; fore wing length 2.2x (168:78) its maximum width; relative length of SMV= 65, MV= 20, PMV= 23, STV= 14, CC= 60.

Metasoma: (Plate. 20. Fig. 7) Smooth and shining, length 0.9x (127:139) head plus mesosoma combined (in profile) and 2.6x (110:42) to its maximum width dorsally; petiolate, petiole length 2x its width; relative median length and maximum width of tergites are T1= 7:19, T2 = 9:30, T3 = 33:42, T4= 28:29, T5= 8:13, T6= 5:10, T7= 5:5, ovipositor sheath length 10.

Host: Unknown.

Male: Unknown.

Materials examined: Holotype: Female: INDIA: Kerala, Palakkad, Dhoni, 24.ii.2013, Col. K. Nikhil, Reg. No. E.IR. 64.

Paratype: Four female: Female: INDIA: Kerala, Palakkad, Dhoni, 24.ii.2013, Col. K. Nikhil, Reg. No. E.IR. 65.

Etymology: The species derives its name from the species name *Philolema maleena*. Neo means new.

Remarks: *Philolema neomaleena* sp. nov. shows similarity with *Philolema maleena* Narendran in scape not reaching level of vertex; proportions of length and width of mesosoma and fore wing, but strongly differs by the following characters, MV shorter than PMV (in *P. maleena* MV longer than PMV); length of head plus mesosoma combined 0.9x length of gaster (in *P. maleena* length of head plus mesosoma combined 0.64x length of gaster); propodeum median length 0.4x its maximum width (in *P. maleena* propodeum median length 0.83x its maximum width).

Philolema neomaleena sp. nov. shows similarity with *Philolema kozhikodensis* sp. nov. in scape not reaching level of vertex; proportions of length and width of scape; T3 longest, but strongly differs by the following characters, clava length 3.1x its maximum width (in *P. kozhikodensis* sp. nov. clava length 2.4x its maximum width); fovea of propodeum having five cross carina (in *P. kozhikodensis* sp. nov. fovea of propodeum having eight cross carina); SMV 3.2x MV (in *P. kozhikodensis* sp. nov. SMV 3.5x MV).

7.10. *Philolema palanichamyi* (Narendran)

(Plate. 21. Fig. 1-7)

Desantisca palanichamyi Narendran, 1984: 4. female. India, Tamil Nadu. (BMNH). [Synonimised by Lotfalizadeh *et al.,* 2007].

Eurytoma palanichamyi (Narendran), 1987: 437. New combination for *Desantisca palanichamyi* Narendran by Subba Rao [Wrong combination for *Desantisca palanichamyi* Narendran, Narendran, 1994: 207-208].

Philolema palanichamyi (Narendran), New combination for *Desantisca* by Lotfalizadeh *et al*., 2007: 508.

Redescription:

Female: Length 2.36 mm. Body black in colour except the following, gaster coffee brown; hind femur, hind tibia except apices, tegula and epipygium brown; tarsi, fore and mid femur and tibia, antennae golden yellow; eyes light brown; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 21. Fig. 2, 3 & 5) Width 1.56x (67:43) its height in front view; face with several radiating carina originating from clypeal margin, some are extending up to scrobal margin; scrobal margin faintly carinate; frons with close piliferous pits; preorbital carina weakly indicated, starting from lower margin of eye and extending up to upper margin of eye; head dorsally with numerous close pits (not piliferous) interstices carinate; mandible bidentate; eyes bare; toruli situated 0.3x (13:43) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 47:18:6; dorsally width 2.1x (69:33) its maximum height; POL 2x (18:9) OOL; POL 2.25x (18:8) AOL; OOL 1.6x (8:5) OD; laterally eye height 1.25x (30:24) its maximum width; post genal carina present and extending up to eye base; malar sulcus not present; antennal formula 11153; scape length 3.17x (19:6) its width, not reaching level of vertex; pedicel length equal to its own width; ring segment length 0.2x (1:5) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1 and F2= 9:8; F3 and F4= 8:8 and F5 = 7:8; clava length 2.13x (17:8) its width.

Mesosoma: (Plate. 21. Fig. 7) length 1.27x (94:74) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous pits, interstices carinate; pronotum maximum length 0.65x (29:62) width and

median length 0.26x (16:62) its maximum width, collar smooth and carinate; mesoscutum median length 0.4x (29:74) its maximum width, notuali present but not distinct; scutellum convex without spine, median length 1.12x (38:34) its maximum width; propodeum with median fovea with minute reticulations, foveal margin weakly carinate, lateral carinae present both on sides of foveal carina, whole area except callus without hairs, median length 0.54x (28:52) its maximum width, spiracle separated from metanotum by its own diameter; relative length and width of hind leg, coxa = 28:18, trochanter = 5:7, femur = 55:15, tibia = 57:9, tarsals 1 to 5 = 17:10:8:5:5; fore wing length 2.18x (146:67) its maximum width; relative length of SMV= 60, MV= 17, PMV= 19, STV= 15, CC= 56.

Metasoma: (Plate. 21. Fig. 6) Smooth and shining, length 0.77x (102:133) head plus mesosoma combined (in profile) and 1.75x (100:57) to its maximum width dorsally; petiolate, petiole with a lateral carina projecting outwards on both sides, length 0.63x its width; relative median length and maximum width of tergites are T1= 14:35, T2 = 18:51, T3 = 22:57, T4= 21:53, T5= 9:32, T6= 3:10, T7= 3:6, ovipositor sheath length 12.

Distribution: India (**Kerala**, Tamil Nadu).

Host: Primary Host: *Cyrtophora* sp. (Araneidae: Araneae)

Male: Length 1.42 to 1.76mm. Similar to female except in having denser pubescence on frons, longer pubescence on antennae and gaster more or less blunt (Narendran, 1994).

Material examined: One female: INDIA: Kerala, Wayanad, Pokkod, 04.iv.2012, Col. Nikhil, Reg. No. E.IR. 53.

Remarks: *Philolema palanichamyi* (Narendran) shows similarity with *Philolema braconidis* (Ferrière) in scape not reaching level of vertex;

proportions of median length and maximum width of propodeum, but strongly differs with the following characters, scape length 3.17x its maximum width (in *P. braconidis* scape length 4.2x its maximum width); gaster length 1.75x its maximum width (in *P. braconidis* gaster length 3.3x its maximum width); T3 and T4 subequal in length (in *P. braconidis* T1, T2 and T3 equal in length).

7.11. *Philolema spinifera* (Cameron)

(Plate. 22. Fig. 1-8)

Acantheurytoma spinifera Cameron, 1911: 22-23. female. Malaysia, Sarawak. (BMNH). *Odonteurytoma tanjorensis* Mukerjee, 1981: 47. Synonym of *Acantheurytoma spinifera* Cameron by Farooqi & Subba Rao, 1986.
Philolema spinifera (Cameron), New combination for *Acantheurytoma* by Lotfalizadeh *et al*., 2007: 508.

Redescription:

Female: Length 4.45 mm. Body black in colour except the following, apices of mid and hind femur, fore tibia, base and apices of mid tibia, apices of hind tibia golden yellow; scape yellowish brown; funicles and clava dark brown; tarsi pale yellow; eyes grey; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 22. Fig. 2, 3 & 5) Width 1.55x (113:73) its height in front view; face with several radiating carina originating from clypeal margin, two central carina extending up to scrobal margin and between this a smooth area having a carina extending up to toruli; scrobal margin distinctly carinate; frons with close piliferous pits; preorbital carina strongly indicated, starting from gena and extending up to lateral ocellus; head dorsally with numerous piliferous close pits interstices carinate; mandible tridentate; eyes bare; toruli situated 0.41x (30:73) of maximum height between anterior ocellus and clypeal

margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 68:23:9; dorsally width 1.9x (117:62) its maximum height; POL 1.5x (21:14) OOL; POL 2.1x (21:10) AOL; OOL 1.3x (14:11) OD; laterally eye height 1.13x (52:46) its maximum width; post genal carina present and extending up to temple; malar sulcus not present; antennal formula 11153; scape length 3.18x (35:11) its width, not reaching level of vertex; pedicel length 0.8x its width; ring segment length 0.13x (1:8) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1= 18:13; F2= 18:15; F3= 18:13; F4= 17:11 and F5 = 15:11; clava length 3.33x (30:9) its width.

Mesosoma: (Plate. 22. Fig. 8) length 1.68x (188:112) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate, pits of scutellum comparatively large and the interstices thickly carinate; pronotum maximum length 0.68x (63:93) width and median length 0.49x (46:93) its maximum width, collar smooth and carinate; mesoscutum median length 0.53x (54:102) its maximum width, notuali present; scutellum convex with a spine at base, median length 1.2x (64:54) its maximum width; propodeum with median fovea, foveal margin carinate, lateral carinae present both on sides of foveal carina, foveal carina and lateral carina joined by a lateral carina at apex, fovea with seven cross carina at centre; whole area except callus without hairs, median length 0.53x (40:76) its maximum width, spiracle separated from metanotum by its own diameter; relative length and width of hind leg, coxa = 46:34, trochanter = 9:12, femur = 90:21, tibia = 86:15, tarsals 1 to 5 = 30:13:13:12:10; fore wing length 2.56x (233:91) its maximum width; relative length of SMV= 108, MV= 22, PMV= 18, STV= 17, CC= 103.

Metasoma: (Plate. 22. Fig. 7) Smooth and shining, length 0.84x (203:243) head plus mesosoma combined (in profile) and 3.71x (215:58) to its

maximum width dorsally; petiolate, petiole length 0.66x its width; relative median length and maximum width of tergites are T1= 27:38, T2 = 28:42, T3 = 31:51, T4= 51:43, T5= 13:28, T6= 13:25, T7= 20:12, ovipositor sheath length 14.

Distribution: India (Kerala, Tamil Nadu, Karnataka), Indonesia, Malaysia, People's Republic of China.

Host: Primary Host: *Eumeninae* sp. (Vespidae: Hymenoptera)

Plant Associates: *Ricinus* sp. (Euphorbiaceae)

Male: Similar to female but differs in plumose antennae and petiolate funicles and longer petiole (Narendran, 1994).

Materials examined: One female: INDIA: Kerala, Kottayam, Chirakkadavu, 18.xi.2012, Col. Minu, Reg. No. E.IR. 54. Two female: INDIA: Kerala, Malappuram, Tirur, Kegippady, 18.ix.2013, Col. K. Nikhil, Reg. No. E.IR. 55. One female: INDIA: Kerala, Malappuram, Kadalundi, 10.v. 2013, Col. K. Nikhil, Reg. No. E.IR. 56. Two female: INDIA: Kerala, Kozhikode, Nanminda, 29.vii.2014, Col. K. Nikhil, Reg. No. E.IR. 57. One female: INDIA: Kerala, Ernakulam, Palarivattom, 12.i.2014, Col. K. Nikhil, Reg. No. E.IR. 58. One female: INDIA: Kerala, Malappuram, Thalappara, 31.viii.1987, Col. Narendran and Party, Reg. No. E.IR. 59. One female: INDIA: Kerala, Malappuram, Calicut University Campus, vii.1986, Col. Narendran and Party, Reg. No. E.IR. 60.

Remarks: *Philolema spinifera* (Cameron) shows similarity with *Philolema albitarsis* Motschulsky in scutellum with one spine; proportions of mesosoma and clava, but strongly differs by the following characters, scape not reaching level of vertex (in *P. albitarsis* scape reaching level of vertex); MV longer

than PMV (in *P. albitarsis* MV shorter than PMV); T4 longest (in *P. albitarsis* T5 longest).

8. Genus: *Plutarchia* Girault

(Plate.6. Fig. 3)

Plutarchia Girault, 1925: 3. Type species: *Plutarchia bicarinativentris* Girault, by monotypy.

Diagnosis: T1 anteriorly with strong sublateral keels; T1 and T2 fused in females (in female of *neepalica* the line separating the two tergites is distinct); T3 and T4 fused in female; strong genal carina (malar ridge) dorsally weak but joining preorbital carina.

Distribution: India, Malaysia, Papua New Guinea, Thailand.

Remarks: Only five species are reported from Kerala under this genus. The dichotomous key for identification of all species is provided. Since the examined collections does not contain any new species and the descriptions of the existing species are enough for identification, the detailed descriptions were not given to avoid repetition.

Host: Primary hosts: *Melanagromyza* sp., *Ophiomyia* sp. (Agromyzidae: Diptera).

Plant associates: *Cajanus* sp., *Phaseolus* sp. (Fabaceae).

Key to Species *Plutarchia* Girault of Kerala

(Modified from Narendran, 1994)

1. Propodeum with a distinct median carina..... .2

- Propodeum without a distinct median carina… 4

2. Dorsal length of T3 more than 2.25x combined length of fused Tl and T2; T1 + T2 small and fused to T3..... .... *Plutarchia marginata* Narendran & Padmasenan.

- Dorsal length of T3 less than 2.25x combined length of fused Tl and T2; T1 & T2 not fused with T3 3

3. Gaster length subequal to thorax; MV sub equal to STV..... ....*Plutarchia Keralensis* Narendran & Padmasenan.

- Gaster longer than thorax; MV distinctly shorter than STV..... ....*Plutarchia gastris* Narendran.

4. Lower face with radiating striae; median strip on lower face bordered by carinae; eye length in profile 1.1x malar space..... .... *Plutarchia malabarica* Narendran & Padmasenan.

- Lower face without radiating striae; median strip on lower face not bordered by carinae; eye length in profile 2.2x malar space ....*Plutarchia fronta* Narendran.

9. Genus: *Prodecatoma* Ashmead

Prodecatoma Ashmead, 1904: 261. Type species: *Prodecatoma flavescens* Ashmead, original designation.

Diagnosis: Front ocellus clearly situated inside scrobe, sometimes set off by a transverse carina; antennal formula 11153 or 11152; genotemporal margin ecarinate well beyond level of ventral margin of eye; anterior margin of pronotum never carinate on median dorsal part; propodeum with lateral areas irregularly or regularly alveolate, usually with median longitudinal furrow; gastral petiole varying in length, rarely extremely short; gaster compressed from sides.

Distribution: Members of this genus found in Nearctic, Neotropical, Ethiopean and Oriental Regions. Many species have been reared from plant galls and seeds

Host: Plant host: *Psidium* sp. (Myrtaceae).

Key to species of *Prodecatoma* Ashmead of Kerala

(Modified from Narendran, 1994)

1. Lower frons with several weak or strong radiating carinae..... 2

- Lower frons without any radiating carinae. ....*Prodecatoma. Neoglobosa* sp. nov.

2. POL less than or equal to 2x OOL 3

- POL greater than 2x OOL..... 6

3. T1 subequal to T2; length of eye less than 2x malar space in profile..... .....*Prodecatoma bijoyi* sp. nov.

- T1 not equal to T2; length of eye greater than 2x malar space in profile 4

4. Clava length 2x its width; POL 2x OOL; scape length less than or equal to 3.75x its width… ..... *Prodecatoma confusa* Narendran

- Clava length more than 2.9x its width; POL 1.5x OOL; scape length less than or equal to 3.3x its width… 5

5. T1 and T4 equal in length; MV 1.1x PMV; scape not reaching level of vertex; PMV 1.3x STV… .....*Prodecatoma ponmudiensis* sp. nov.

- T1 and T4 not equal in length; MV 0.8x PMV; scape reaching level of vertex; PMV 1.6x STV ..... *Prodecatoma chinnarensis* sp. nov.

6. Gaster dorsal length less than or equal to 3x its width 7

- Gaster dorsal length greater than to 3x its width..... 11

7. T1 equal to or sub equal to T2..... .8

- T1 not equal to T2..... 9

8. T4 longest; scape length 4.8x its width; MV subequal to STV; MV 0.7x PMV..... *Prodecatoma modesta* Narendran

- T3 longest; scape length 3.8x its width; MV 1.3x STV; MV equal to PMV……. ..... *Prodecatoma sureshani* sp. nov.

9. T1 longest; clava length 3.25x its width ....*Prodecatoma globosa* Narendran

- T 4 longest; clava length less than 2.5x its width..... 10

10. Scape length 5x its width; frons with golden pubescence..... ....*Prodecatoma cheriyani* Narendran

- Scape length 3.3x its width; frons without golden pubescence… ....*Prodecatoma nilamburensis* Mukerjee

11. T4 longest; scape length 2.9x its width; POL 2.1x OOL .... *Prodecatoma idukkiensis* sp. nov.

- T3 longest; scape length more than 3.4x its width; POL 2.8x OOL 12

12. T1 equal to T2; scape 3.5x its width; gaster length 4.3x its width; scape not reaching level of vertex ....*Prodecatoma neojosephi* sp. nov.

- T1 not equal to T2; scape 5x its width; gaster length 3.4x its width; scape exceeding level of vertex ... .*Prodecatoma josephi* Narendran

Species descriptions

9.1. *Prodecatoma bijoyi* sp. nov.

(Plate. 23. Fig. 1-7)

Holotype: Female: Length 2.44 mm. Body black in colour except the following, gaster brownish black; scape base and apices of all femora, fore tibia, base and apices of mid and hind tibia golden yellow; all femora except base and apices, mid and hind tibia except base and apices, pedicel, funicles and clava brown; tarsi pale yellow; eyes grey; wings hyaline, veins pale yellow; body hairs silvery, ovipositor sheath brown, ovipositor golden yellow.

Head: (Plate. 23. Fig. 2-4) Width 1.5x (66:43) its height in front view; face with several radiating rugae from clypeal margin, with two radiating carina from clypeal margin extending up to scrobe, area between two carina smooth; scrobal margin carinate; preorbital carina present starting from malar space and slightly extending to lateral ocellus; frons without golden pubescence;

inter antennal projection hook like; malar area swollen without a strip of microsculpture; postorbital carina present, lower part of the carina extending up malar space; preorbital carina and postorbital carina weakly joining each other; upper frons and vertex with distinct piliferous pits, interstices carinate; mandible tridentate; eyes bare; toruli situated 0.5x (20:43) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 42:13:8; dorsally width 1.9x (68:35) its maximum height; POL 1.8x (14:8) OOL; POL 2x (14:7) AOL; OOL equal to (7:6) OD; laterally eye height 1.2x (29:25) its maximum width and 1.9x malar space; post genal carina well defined and extending up to temple; the area between genal carina and post orbital carina with two raw of piliferous pits; malar sulcus not present; antennal formula 11153; scape length 3.5x (21:6) its width, reaching level of vertex; pedicel length equal to (6:6) its width; ring segment length 0.5x (1:2) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1= 12:7; F2= 11:7; F3= 11:7, F4= 11:9 and F5= 7:9; clava length 2.7x (18:9) its width.

Mesosoma: (Plate. 23. Fig. 7) length 1.7x (92:53) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; pronotum with anterior margin carinate except at on median part, carinate laterally, maximum length 0.6x (30:50) width and median length 0.4x (20:50) its maximum width; mesoscutum median length 0.53x (28:53) its maximum width, notuali present; scutellum median length subequal to (33:31) its maximum width; propodeum with median groove having six cross carina each of them form a rectangle cell, other areas with irregular shapes cells with interstices carinate, whole area except callus without hairs, median length 0.62x (29:47) its maximum width, spiracle separated from metanotum by 0.4x its diameter; relative length and width of hind leg, coxa = 27:19, trochanter = 7:5, femur = 55:13, tibia = 55:8,

tarsals 1 to 5 = 16:11:9:5:5; fore wing length 2.1x (158:76) its maximum width; relative length of SMV= 61, MV= 20, PMV= 21, STV= 15, CC= 58.

Metasoma: (Plate. 23. Fig. 6) Smooth and shining, lateral part of T3 onwards with micro sculptures on lateral side, length 0.9x (110:126) head plus mesosoma combined (in profile) and 3.1x (91:29) to its maximum width dorsally; petiolate, petiole with a projection on both sides laterally, length 0.5x its width; relative median length and maximum width of tergites are T1= 13:17, T2= 14:20, T3= 27:29, T4= 29:22, T5= 6:11, T6= 5:7, T7= 10:6, ovipositor sheath length dorsally 9, ovipositor length dorsally 8.

Host: Unknown.

Male: Unknown.

Materials examined: Holotype: Female: INDIA: Kerala, Pathanamthitta, Ranni, Pekkavu, 23.i.2014, Col. Bijoy. C, Reg. No. E.IR. 115.

Paratype: One female: INDIA: Kerala, Pathanamthitta, Ranni, Pekkavu, 23.i.2014, Col. Bijoy. C, Reg. No. E.IR. 116.

Etymology: The species derives its name after Mr. Bijoy. C who has collected the specimen.

Remarks: *Prodecatoma bijoyi* sp. nov. shows similarity with *Prodecatoma idukkiensis* sp. nov. in T4 longest; length of head plus mesosoma combined 0.9x length of gaster; scape reaching level of vertex, but strongly differs with the following characters, median groove of propodeum having six cross carina (in *P. idukkiensis* sp. nov. propodeum without any cross carina); scape length 3.5x its maximum width (in *P. idukkiensis* sp. nov. scape length 2.9x its maximum width); F2 and F3 equal in length (in *P. idukkiensis* sp. nov. F2 to F5 equal in length).

Prodecatoma bijoyi sp. nov. shows similarity with *Prodecatoma neoglobosa* sp. nov. in scape reaching level of vertex; scutellum length 1.2x length of mesoscutum; length of head plus mesosoma 0.9x length of gaster, but strongly differs with the following characters, face with several radiating carina (in *P. neoglobosa* sp. nov. face without any radiating carina); T1 and T2 subequal in length (in *P. neoglobosa* sp. nov. T2 and T3 subequal in length); length of eye in profile 1.9x malar space (in *P. neoglobosa* sp. nov. length of eye in profile 2.3x malar space).

9.2. *Prodecatoma cheriani* Narendran

(Plate. 24. Fig. 1-7)

Prodecatoma cheriani Narendran, 1994: 173-174. female. India, Kerala, Parambikulam. (ZSIK, examined).

Redescription:

Female: Length 3.1 mm. Body black in colour except the following, femur except hind femur, tibia except hind tibia, scape and apices of hind tibia golden yellow; hind femur except apices dark brown; hind tibia except apices, funicles and clava yellowish brown; eyes grey; tarsus pale yellow; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 24. Fig. 2-4) Width 1.6x (106:66) its height in front view; face with two weak radiating carina extending up to scrobe; scrobe carinate; preorbital carina well defined but not extending to lateral ocellus; frons with moderate golden pubescence and the pubescence denser bellow toruli; inter antennal projection hook like; malar area swollen with microsculpture; post orbital carina present; upper frons and vertex with distinct piliferous pits,

interstices carinate; mandible tridentate; eyes bare; toruli situated 0.45x (30:66) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 62:25:10; dorsally width 1.9x (99:52) its maximum height; POL 2.6x (21:8) OOL; POL 2.3x (21:9) AOL; OOL equal to (8:8) OD; laterally eye height 1.3x (45:34) its maximum width and 2x malar space; post genal carina well defined and extending up to temple; malar sulcus not present; antennal formula 11153; scape length 5x (35:7) its width, exceeding level of vertex; pedicel length 1.1x (8:7) its width; ring segment length 0.2x (1:5) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1= 15:9; F2= 13:9; F3= 14:9, F4= 12:9 and F5= 11:9; clava length 2.3x (21:9) its width.

Mesosoma: (Plate. 24. Fig. 7) length 1.3x (126:98) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; pronotum maximum length 0.58x (51:88) width and median length 0.34x (30:88) its maximum width, collar ecarinate; mesoscutum median length 0.46x (45:98) its maximum width, notuali complete; scutellum median length 0.9x (49:54) its maximum width; propodeum surface shallowly concave with distinct rugae in median portion, irregularly punctuate on sides, whole area except rugae in median portion having hairs, median length 0.4x (30:77) its maximum width, spiracle separated from metanotum by its own diameter; relative length and width of hind leg, coxa = 34:18, trochanter = 6:6, femur = 66:18, tibia = 66:12, tarsals 1 to 5 = 19:9:8:6:9; fore wing length 2.14x (210:98) its maximum width; relative length of SMV= 103, MV= 20, PMV= 25, STV= 17, CC= 97.

Metasoma: (Plate. 24. Fig. 6) Smooth and shining, lateral part of T4 onwards with micro sculptures, length 0.8x (134:166) head plus mesosoma combined (in profile) and 2.3x (127:56) to its maximum width dorsally; petiolate,

petiole with a projection on both sides laterally, length 1.2x its width; relative median length and maximum width of tergites are T1= 21:39, T2= 15:50, T3= 26:56, T4= 32:51, T5= 12:22, T6= 3:14, T7= 5:10, ovipositor sheath length 9.

Distribution: India (Kerala), Taiwan.

Host: Unknown.

Male: Unknown.

Materials examined: One female: INDIA: Kerala, Malappuram, C.U. Campus, 05.iii.2013, Col. K. Nikhil, Reg. No. E.IR. 68. One female: INDIA: Kerala, Wayanad, Muthanga, 17.x.2011, Col. P. M Sureshan, Reg. No. E.IR. 69. One female: INDIA: Kerala, Palakkad, Dhoni, 24.ii.2013, Col. K. Nikhil, Reg. No. E.IR. 70. One female: INDIA: Kerala, Alappuzha, Harippad, 17.ix.2013, Col. K. Nikhil, Reg. No. E.IR. 71. One female: INDIA: Kerala, Thrissur, Peechi, 22.x.2013, Col. K. Nikhil, Reg. No. E.IR. 72. One female: INDIA: Kerala, Thrissur, Vazhani, 23.x.2013, Col. K. Nikhil, Reg. No. E.IR. 73. One female: INDIA: Kerala, Pathanamthitta, Chittar, 21.xi.2012, Col. Bijoy, Reg. No. E.IR. 185. One female: INDIA: Kerala, Idukki, Thekkady, v. 1986, Col. Narendran and party, Reg. No. E.IR. 74. One female: INDIA: Kerala, Wayanad, Mananthavady, 22.ii.1988, Col. Narendran and party, Reg. No. E.IR. 75. One female: INDIA: Kerala, Kazargod, Manjeswaram, 27.ii.1988, Col. Narendran and party, Reg. No. E.IR. 76.

Remarks: *Prodecatoma ceriyani* Narendran shows similarity with *Prodecatoma nilamburensis* Mukerjee in scutellum length sub equal to mesoscutum length; frons with several radiating carinae, but strongly differs with the following characters, scape length 5x its maximum width (in *P. nilamburensis* scape length 3.3x its maximum width); length of head plus mesosoma combined in profile 0.8x length of gaster (in *P. nilamburensis* length of head plus mesosoma combined in profile 1.1x length of gaster).

9.3. *Prodecatoma chinnarensis* sp. nov.

(Plate. 25. Fig. 1-7)

Holotype: Female: Length 2.45 mm. Body black in colour except the following, base and apex of fore femur, apex of mid femur, apex of mid and hind tibia and scape golden yellow; fore femur except base and apex, mid femur except apex, hind femur, base of mid and hind tibia, brownish yellow; pedicel, funicle, clava and ovipositor sheath brown; tarsi pale yellow; eyes grey; wings hyaline, veins pale yellow; body hairs silvery, ovipositor sheath brown, ovipositor golden yellow.

Head: (Plate. 25. Fig. 2-4) Width 1.5x (75:50) its height in front view; face with several short radiating rugae from clypeal margin, not reaching preorbital carina or toruli, with two radiating carina from clypeal margin extending up to scrobe, area between two carina smooth; scrobal margin carinate; preorbital carina present starting from malar space and slightly extending to lateral ocellus; frons without golden pubescence; inter antennal projection hook like; malar area swollen with a strip of microsculpture which extends up to temple the area between post orbital carina and post genal carina; postorbital carina present, lower part of the carina extending up to malar space; pre orbital carina and postorbital carina not joining each other; upper frons and vertex with distinct piliferous pits, interstices carinate; mandible tridentate; eyes bare; toruli situated 0.4x (20:50) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 47:13:9; dorsally width 1.9x (74:39) its maximum height; POL 1.55x (16:8) OOL; POL 2x (16:8) AOL; OOL 1.1x (8:7) OD; laterally eye height 1.2x (34:29) its maximum width and 2.4x malar space; post genal carina well defined and extending up to temple; malar sulcus not present; antennal formula 11153; scape length 3.3x (26:8) its

width, reaching level of vertex; pedicel length 1.2x (7:6) its width; ring segment length 0.3x (1:4) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1= 10:7; F2= 10:7; F3= 12:6, F4= 10:5 and F5= 8:5; clava length 3.2x (19:6) its width.

Mesosoma: (Plate. 25. Fig. 7) length 1.65x (99:60) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; pronotum with anterior margin carinate except at on median part, carinate laterally, maximum length 0.7x (37:53) width and median length 0.5x (27:53) its maximum width; mesoscutum median length 0.4x (25:60) its maximum width, notuali present; scutellum median length equal to (34:34) its maximum width; propodeum with median fovea with five irregular cross carina, foveal area smooth, fovea bordered with two raw of piliferous pits, other areas of the concavity with sculptures, median length 0.7x (30:41) its maximum width, spiracle separated from metanotum by its own diameter; relative length and width of hind leg, coxa = 25:13, trochanter = 7:8, femur = 50:13, tibia = 54:8, tarsals 1 to 5 = 15:12:6:5:5; fore wing length 2.1x (158:75) its maximum width; relative length of SMV= 66, MV= 19, PMV= 25, STV= 16, CC= 64.

Metasoma: (Plate. 25. Fig. 6) Smooth and shining, lateral part of T5 onwards with micro sculptures on laterally and dorsally, length 0.85x (112:131) head plus mesosoma combined (in profile) and 3.6x (113:31) to its maximum width dorsally; petiolate, petiole with a projection on both sides laterally, length 0.8x its width; relative median length and maximum width of tergites are T1= 14:20, T2= 12:28, T3= 15:31, T4= 42:30, T5= 10:10, T6= 4:6, T7= 10:4, ovipositor sheath length dorsally 10.

Host: Unknown.

Male: Unknown.

Materials examined: Holotype: Female: INDIA: Kerala, Idukki, Chinnar, Vyasan para, 05.iv.2012, Col. Bijoy, Reg. No. E.IR. 119.

Other Materials Examined: Two female: INDIA: Kerala, Wayanad, Muthanga, 02.iv.2012, Col. Nikhil, Reg. No. E.IR. 120. One female: INDIA: Kerala, Idukki, Chinnar, 04.iv.2012, Col. P. M. Sureshan, Reg. No. E.IR. 121. One female: INDIA: Kerala, Idukki, Mannavan Shola, 06.iv.2012, Col. P. M. Sureshan, Reg. No. E.IR. 122. One female: INDIA: Kerala, Wayanad, Muthanga, Maragada, 17.x.2011, Col. P. M. Sureshan, Reg. No. E.IR. 123.

Etymology: The species derives its name from the type locality, Chinnar, Idukki (Kerala).

Remarks: *Prodecatoma chinnarensis* sp. nov. shows similarity with *Prodecatoma confusa* Narendran in proportions of MV and PMV; scape reaching level of vertex; T4 longest, but strongly differs by the following characters, gaster length 3.6x its maximum width (in *P. confusa* gaster length 2.75x its maximum width); mesosoma length 1.65x its maximum width (in *P. confusa* mesosoma length 1.2x its maximum width); clava length 3.2x its maximum width (in *P. confusa* clava length 2x its maximum width).

Prodecatoma chinnarensis sp. nov. shows similarity with *Prodecatoma ponmudiensis* sp. nov. in proportions of POL and OOL; length of head plus mesosoma combined in profile 0.85x length of gaster; proportions of fore wing, but strongly differs by the following characters, MV shorter than PMV (in *P. ponmudiensis* sp. nov. MV longer than PMV); scape reaching level of vertex (in *P. ponmudiensis* sp. nov. scape not reaching level of vertex); T1 not equal to T4 (in *P. ponmudiensis* sp. nov. T1 equal to T4); gaster length 3.6x its maximum width (in *P. ponmudiensis* sp. nov. gaster length 3x its maximum width).

9.4. *Prodecatoma confusa* Narendran

(Plate. 26. Fig. 1-7)

Prodecatoma confusa Narendran, 1944: 176-177. female. India, Kerala, Kozhikode. (ZSIK, examined).

Redescription:

Female: Length 3.56 mm. Body black in colour except the following, all femora, fore tibia, mid tibia except apices, ovipositor sheath, pedicel, funicles, clava yellowish brown; scape brownish yellow; hind tibia, tarsi pale yellow; eyes grey; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 26. Fig. 2-4) Width 1.55x (93:60) its height in front view; face densely and umbilicately punctured, with two weak radiating carina extending up to scrobe; scrobe carinate; preorbital carina present but not extending to lateral ocellus; frons without golden pubescence; inter antennal projection hook like; malar area swollen with a strip of microsculpture; post orbital carina present; upper frons and vertex with distinct piliferous pits, interstices carinate; mandible tridentate; eyes bare; toruli situated 0.35x (21:60) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 61:20:8; dorsally width 1.9x (93:49) its maximum height; POL 2x (20:10) OOL; POL 2.5x (20:8) AOL; OOL 1.4x (10:7) OD; laterally eye height 1.2x (43:36) its maximum width and 2.26x malar space; post genal carina well defined and extending up to temple; malar sulcus not present; antennal formula 11153; scape length 3.75x (30:8) its width, reaching level of vertex; pedicel length 1.7x (10:6) its width; ring segment length 0.4x (2:5) its width; funicle and clava with setae; relative

measurements of length and width of F1 to F5 are F1= 14:9; F2= 12:9; F3= 12:8, F4= 12:8 and F5= 10:10; clava length 2x (20:10) its width.

Mesosoma: (Plate. 26. Fig. 7) length 1.23x (129:105) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; pronotum maximum length 0.6x (49:81) width and median length 0.5x (38:81) its maximum width, collar ecarinate; mesoscutum median length 0.37x (39:105) its maximum width, notuali complete; scutellum median length 0.85x (45:53) its maximum width; propodeum posteriorly with a short neck, median area broadly concave with sides weakly carinate, the median concave area shagreened, rest of the area umblicately punctured, whole area except middle region of concave area having hairs, median length 0.5x (37:71) its maximum width, spiracle separated from metanotum by its own diameter; relative length and width of hind leg, coxa = 32:25, trochanter = 9:8, femur = 67:17, tibia = 69:12, tarsals 1 to 5 = 24:14:11:8:6; fore wing length 2.14x (194:80) its maximum width; relative length of SMV= 93, MV= 18, PMV= 25, STV= 17, CC= 89.

Metasoma: (Plate. 26. Fig. 6) Smooth and shining, lateral part of T2 onwards with micro sculptures, length equal to head plus mesosoma combined (in profile) and 2.75x (151:55) to its maximum width dorsally; petiolate, petiole with a projection on both sides laterally, length 1.1x its width; relative median length and maximum width of tergites are T1= 36:33, T2= 25:48, T3= 40:55, T4= 51:45, T5= 8:22, T6= 8:11, T7= 11:5, ovipositor sheath length 23.

Distribution: India (Kerala).

Host: Unknown.

Male: Unknown.

Materials examined: One female: INDIA: Kerala, Idukki, Cheruthoni, 12.i.2013, Col. Bijoy, Reg. No. E.IR. 77. One female: INDIA: Kerala, Kollam, Thenmala, 23.xi.2011, Col. Bijoy, Reg. No. E.IR. 78. One female: INDIA: Kerala, Kottayam, Irattupetta, 25.xi.2012, Col. Minu, Reg. No. E.IR. 79. One female: INDIA: Kerala, Kozhikode, Kallai, 25.v.1987, Col. Narendran and Party, Reg. No. E.IR. 80. One female: INDIA: Kerala, Thiruvanandapuram, Sreekaryam, 25.ii.1989, Col. Narendran and Party, Reg. No. E.IR. 81.

Remarks: *Prodecatoma confusa* Narendran shows similarity with *Prodecatoma ponmudiensis* sp. nov. in proportions of fore wing length and width; length of head plus mesosoma combined in profile 0.85x length of gaster, but strongly differs with the following characters, MV 0.7x PMV (in *Prodecatoma ponmudiensis* sp. nov. MV 1.1x PMV); POL 2x OOL (*Prodecatoma ponmudiensis* sp. nov. POL 1.5x OOL); scape reaching level of vertex (*Prodecatoma ponmudiensis* sp. nov. scape not reaching level of vertex); T4 longest (*Prodecatoma ponmudiensis* sp. nov. T1 length equal to T4).

9.5. *Prodecatoma globosa* Narendran

(Plate. 27. Fig. 1-7)

Prodecatoma globosa Narendran, 1994: 175-176. female. India, Kerala, Calicut University Campus (QMB).

Redescription:

Female: Length 4.21 mm. Body black in colour except the following, all tibia, apices of femur, scape and pedicel golden yellow; funicles and clava

brownish; ventral side of gaster yellowish brown; ovipositor sheath golden yellowish at centre and brownish at base and apices; tarsi pale yellow; eyes grey; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 27. Fig. 2-4) Width 1.46x (118:80) its height in front view; face densely and umbilicately punctured, with three weak radiating carina extending up to scrobe; scrobal margin distinctly carinate; preorbital carina distinct but not extending to lateral ocellus; frons without golden pubescence; inter antennal projection hook like; malar area swollen with a strip of microsculpture; post orbital carina present, lower part of the carina extending to the microsculptured area of malar space; upper frons and vertex with distinct piliferous pits, interstices carinate; mandible tridentate; eyes bare; toruli situated 0.43x (34:80) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 77:27:11; dorsally width 1.9x (118:62) its maximum height; POL 2.5x (25:10) OOL; POL 2.3x (25:11) AOL; OOL 1.1x (10:9) OD; laterally eye height 1.3x (57:44) its maximum width and 2x malar space; post genal carina well defined and extending up to temple; the area between genal carina and post orbital carina with one raw of piliferous pits; malar sulcus not present; antennal formula 11153; scape length 4.1x (33:8) its width, exceeding level of vertex; pedicel length 0.88x (7:8) its width; ring segment length 0.4x (2:5) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1= 15:9; F2= 14:8; F3= 15:8, F4= 14:8 and F5= 13:8; clava length 3.25x (26:8) its width.

Mesosoma: (Plate. 27. Fig. 7) length 1.23x (174:110) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; pronotum with anterior margin carinate except at on median part, carina represent weakly on submedian part but

distinct on sides, maximum length 0.65x (64:99) width and median length 0.4x (40:99) its maximum width; mesoscutum median length 0.53x (58:110) its maximum width, notuali complete and distinct; scutellum median length subequal to (62:60) its maximum width; propodeum surface broadly concave with scattered irregular pits and microsculptures, sides of concave area with carina and lateral carina also present on both sides, whole area except middle region of concave area having hairs, median length 0.44x (36:82) its maximum width, spiracle separated from metanotum by its own diameter; relative length and width of hind leg, coxa = 44:35, trochanter = 8:7, femur = 81:21, tibia = 82:14, tarsals 1 to 5 = 27:17:12:8:9; fore wing length 2.21x (243:110) its maximum width; relative length of SMV= 116, MV= 24, PMV= 26, STV= 21, CC= 115.

Metasoma: (Plate. 27. Fig. 6) Smooth and shining, lateral part of T2 onwards with micro sculptures on lateral side, length 0.82x (193:235) head plus mesosoma combined (in profile) and 2.73x (194:71) to its maximum width dorsally; petiolate, petiole with a projection on both sides laterally, length 0.81x its width; relative median length and maximum width of tergites are T1= 46:63, T2= 41:71, T3= 41:58, T4= 17:36, T5= 6:26, T6= 5:18, T7= 7:6, ovipositor sheath length dorsally 17 and in profile 123.

Distribution: India (Kerala).

Host: Unknown.

Male: Unknown.

Materials examined: One female: INDIA: Kerala, Palakkad, Sirendri, 15.i.2013, Col. K. Nikhil, Reg. No. E.IR. 82. One female: INDIA: Kerala, Idukki, Marayoor, Nattachivayal, 04.ix.203, Col. P. M. Sureshan, Reg. No. E.IR. 83.

Remarks: *Prodecatoma globosa* Narendran shows similarity with *Prodecatoma josephi* Narendran in proportions of MV and PMV; scape exceeding level of vertex, but strongly differs with the following characters, T1 longest (in *P. josephi* T3 longest); clava length 3.25x its width (in *P. josephi* clava length 2.4x its width).

9.6. *Prodecatoma idukkiensis* sp. nov.

(Plate. 28. Fig. 1-7)

Holotype: Female: Length 2.28 mm. Body black in colour except the following, scape, pedicel, funicle and clava brown; all femora except apices, fore tibia, mid and hind tibia except base and apices blackish brown; base and apices of mid and hind tibia, apices of all femora golden yellow; tarsi pale yellow; eyes grey; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 28. Fig. 2-4) Width 1.4x (62:43) its height in front view; face with several radiating rugae from clypeal margin, with two weak radiating carina extending up to scrobe, area between two carina smooth; scrobal margin carinate; preorbital carina present starting from malar area and slightly extending to lateral ocellus; frons without golden pubescence; inter antennal projection hook like; malar area swollen without a strip of microsculpture; postorbital carina present, lower part of the carina extending up malar space; preorbital carina and postorbital carina joining each other at malar space; upper frons and vertex with distinct piliferous pits, interstices carinate; mandible tridentate; eyes bare; toruli situated 0.4x (17:43) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 41:14:5; dorsally width 2x (63:31) its maximum height; POL 2.1x (15:7) OOL; POL 1.9x (15:8) AOL; OOL 1.6x

(8:5) OD; laterally eye height 1.1x (27:24) its maximum width and 2x malar space; post genal carina well defined and extending up to temple; the area between genal carina and post orbital carina with two raw of piliferous pits; malar sulcus not present; antennal formula 11153; scape length 2.9x (20:7) its width, reaching level of vertex; pedicel length equal to (6:6) its width; ring segment length 0.3x (1:4) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1= 10:7; F2= 8:6; F3= 8:6, F4= 8:6 and F5= 8:6; clava length 2.4x (17:7) its width.

Mesosoma: (Plate. 28. Fig. 7) length 1.6x (86:53) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; pronotum with anterior margin carinate except at on median part, carinate laterally, maximum length 0.6x (28:47) width and median length 0.34x (16:47) its maximum width; mesoscutum median length 0.5x (26:53) its maximum width, notuali present but not distinct; scutellum median length 1.2x (31:25) its maximum width; propodeum with median concave area having a median irregular carina, both sides of median carina having three cell arranged in two raw, other area of concavity with irregular shapes cells with interstices carinate, median basal part of propodeum have a neck like projection towards petiole, whole area except callus without hairs, median length 0.5x (24:49) its maximum width, spiracle separated from metanotum by its own diameter; relative length and width of hind leg, coxa = 28:17, trochanter = 5:7, femur = 46:14, tibia = 44:8, tarsals 1 to 5 = 16:9:8:7:6; fore wing length 1.9x (140:74) its maximum width; relative length of SMV= 54, MV= 20, PMV= 19, STV= 14, CC= 53.

Metasoma: (Plate. 28. Fig. 6) Smooth and shining, lateral part of T3 onwards with micro sculptures on lateral side, length 0.9x (116:125) head plus mesosoma combined (in profile) and 3.24x (107:33) to its maximum width dorsally; petiolate, petiole with a projection on both sides laterally, length

0.5x its width; relative median length and maximum width of tergites are T1= 17:21, T2= 18:30, T3= 19:33, T4= 23:26, T5= 5:9, T6= 8:7, T7= 8:5, ovipositor sheath length dorsally 11.

Host: Unknown.

Male: Unknown.

Material examined: Holotype: Female: INDIA: Kerala, Idukki, Pampadum shola, 08.iv.2012, Col. P. M. Sureshan, Reg. No. E.IR. 111.

Paratype: One female: INDIA: Kerala, Idukki, Pampadum shola, 08.iv.2012, Col. Bijoy**,** Reg. No. E.IR. 112.

Etymology: The species derives from its name from the district of the type locality, Idukki (Kerala).

Remarks: *Prodecatoma idukkiensis* sp. nov. shows similarity with *Prodecatoma sureshani* sp. nov. in MV equal to PMV; POL 2.1x OOL; mesosoma length 1.6x its maximum width, but strongly differs by the following characters, scape reaching level of vertex (in *P. sureshani* sp. nov. scape exceeding level of vertex); gaster length 3.2x its maximum width (in *P. sureshani* sp. nov. gaster length 2.6x its maximum width); T4 longest (in *P. sureshani* sp. nov. T3 longest); scape length 2.9x its maximum width (in *P. sureshani* sp. nov. scape length 3.8x its maximum width).

Prodecatoma idukkiensis sp. nov. shows similarity with *Prodecatoma neojosephi* sp. nov. in proportions of PMV and STV; dorsal width of head 2x its maximum length; scutellum length 1.2x length of mesoscutum, but strongly differs with the following characters, scape reaching level of vertex (in *P. neojosephi* sp. nov. scape not reaching level of vertex); gaster length 2.6x its maximum width (in *P. neojosephi* sp. nov. gaster length 4.3x its maximum width); POL 2.1x OOL (in *P. neojosephi* sp. nov. POL 2.8x OOL).

9.7. *Prodecatoma josephi* Narendran

(Plate. 29. Fig. 1-7)

Prodecatoma josephi Narendran, 1994: 177. female. India, Kerala, Thekkady. (ZSIK, examined).

Redescription:

Female: Length 3.5 mm. Body black in colour except the following, fore tibia, base and apices of mid and hind tibia, base and apices of fore and mid femur, apices of hind femur golden yellow; fore and mid femur except apices and base, hind femur except apices, dark brown; mid and hind tibia except base and apices golden yellow; scape brownish yellow; flagellum and clava brown; tarsi pale yellow; eyes grey; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 29. Fig. 2-4) Width 1.6x (116:73) its height in front view; face densely and umbilicately punctured, with two weak radiating carina extending up to scrobe, area between two carina smooth; scrobal margin distinctly carinate; preorbital carina present but not extending to lateral ocellus; frons without golden pubescence; inter antennal projection hook like; malar area swollen with a strip of microsculpture; postorbital carina present, lower part of the carina extending to the microsculptured area of malar space; upper frons and vertex with distinct piliferous pits, interstices carinate; mandible tridentate; eyes bare; toruli situated 0.44x (32:73) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 75:26:9; dorsally width 1.9x (117:62) its maximum height; POL 2.8x (25:9) OOL; POL 2.5x (25:10) AOL; OOL equal to (9:9) OD; laterally eye height 1.2x (49:42) its maximum width and 2.2x malar space; post genal carina well defined and extending up to temple; the area between genal carina and post orbital carina with two raw of piliferous

pits; malar sulcus not present; antennal formula 11153; scape length 5x (35:7) its width, exceeding level of vertex; pedicel length 1.3x (9:7) its width; ring segment length 0.4x (2:5) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1= 15:8; F2= 16:8; F3= 15:8, F4= 15:9 and F5= 13:9; clava length 2.4x (24:10) its width.

Mesosoma: (Plate. 29. Fig. 7) length 1.6x (166:105) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; pronotum with anterior margin carinate except at on median part, carina represent weakly on submedian part but distinct on sides, maximum length 0.63x (62:98) width and median length 0.41x (41:99) its maximum width; mesoscutum median length 0.52x (55:105) its maximum width, notuali complete; scutellum median length subequal to (60:59) its maximum width; propodeum surface broadly concave with sides closer and a median irregular weak carna, sides of concave area with carina and lateral carina also present on both sides, whole area except middle region of concave area having hairs, median length 0.6x (46:76) its maximum width, spiracle separated from metanotum 1.3x its diameter; relative length and width of hind leg, coxa = 41:35, trochanter = 11:12, femur = 81:22, tibia = 81:12, tarsals 1 to 5 = 28:18:12:8:7; fore wing length 2.15x (228:106) its maximum width; relative length of SMV= 107, MV= 22, PMV= 23, STV= 17, CC= 108.

Metasoma: (Plate. 29. Fig. 6) Smooth and shining, lateral part of T2 onwards with micro sculptures on lateral side, length 0.78x (155:198) head plus mesosoma combined (in profile) and 3.4x (176:52) to its maximum width dorsally; petiolate, petiole with a projection on both sides laterally, length 0.83x its width; relative median length and maximum width of tergites are T1= 25:36, T2= 29:49, T3= 45:52, T4= 38:34, T5= 10:8, T6= 5:6, T7= 4:5, ovipositor sheath length dorsally 7.

Distribution: India (Kerala, Andhra Pradesh), Sri Lanka.

Host: Unknown.

Male: Unknown.

Materials examined: One female: INDIA: Kerala, Pathanamthitta, Konni, 18.xi.2012, Col. Bijoy, Reg. No. E.IR. 84. One female: INDIA: Kerala, Malappuram, Vazhikkadavu, 14.xi.2014, Col. K. Nikhil, Reg. No. E.IR. 85. Three female: INDIA: Kerala, Kozhikode, Kakkayam, 12.v. 2013, Col. K. Nikhil, Reg. No. E.IR. 86. Two female: INDIA: Kerala, Thrissur, KFRI Campus, 21.x.2013, Col. K. Nikhil, Reg. No. E.IR. 87. Two female: INDIA: Kerala, Alappuzha, Harippad, 17.ix.2013, Col. K. Nikhil , Reg. No. E.IR.89. One female: INDIA: Kerala, Idukki, Kumuli, 13.i.2013, Col. Bijoy, Reg. No. E.IR. 88. One female: INDIA: Kerala, Wayanad, Tholpetty, 27.ix. 2012, Col. K. Nikhil, Reg. No. E.IR. 90. One female: INDIA: Kerala, Kasargode, Manjeshwaram, 24.viii.2013, Col. Abhilash, Reg. No. E.IR. 91. Two female: INDIA: Kerala, Alappuzha, Ambalappuzha, 17.ix.2013, Col. K. Nikhil, Reg. No. E.IR. 92. Two female: INDIA: Kerala, Kottayam, Chirakkadavu, 18.xi.2012, Col. Minu, Reg. No. E.IR. 93. One female: INDIA: Kerala, Idukki, Thekkadi, v. 1986, Col. Narendran and Party, Reg. No. E.IR. 94. Three female: INDIA: Kerala, Kozhikode, Chaliyam, 23. ix. 1985, Col. Narendran and Party, Reg. No. E.IR. 95.

Remarks: *Prodecatoma josephi* Narendran shows similarity with *Prodecatoma neojosephi* sp. nov. in proportions of MV and PMV; POL 2.8x OOL, but strongly differs by the following characters, scape exceeding level of vertex (in *Prodecatoma neojosephi* sp. nov. scape not reaching level of vertex); gaster 3.4x its maximum width (in *Prodecatoma neojosephi* sp. nov. gaster 4.3x its maximum width).

9.8. *Prodecatoma modesta* Narendran

(Plate. 30. Fig. 1-7)

Prodecatoma modesta Narendran, 1994: 181-182. female. India, Kerala, Calicut University Campus. (ZSIK, examined).

Redescription:

Female: Length 3.47 mm. Body black in colour except the following, all femora, fore and mid tibia, F1, F2 brownish; hind tibia yellowish brown; pedicel F3 to F5, clava, dark brown; scape golden yellow; tarsi pale yellow; eyes grey; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 30. Fig. 2-4) Width 1.66x (106:64) its height in front view; face densely and umbilicately punctured, with two weak radiating carina extending up to scrobe, area between two carina smooth; scrobal margin distinctly carinate; preorbital carina present but not extending to lateral ocellus; frons without golden pubescence; inter antennal projection hook like; malar area swollen with a strip of microsculpture; postorbital carina present, lower part of the carina extending to the microsculptured area of malar space and joining with pre orbital carina; upper frons and vertex with distinct piliferous pits, interstices carinate; mandible tridentate; eyes bare; toruli situated 0.31x (20:64) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 65:23:8; dorsally width 1.9x (103:54) its maximum height; POL 2.3x (21:9) OOL; POL 2.6x (21:8) AOL; OOL equal to (9:9) OD; laterally eye height 1.2x (51:43) its maximum width and 2.1x malar space; post genal carina well defined and extending up to temple; the area between genal carina and post orbital carina with one raw of piliferous pits; malar sulcus not present;

antennal formula 11153; scape length 4.8x (38:8) its width, reaching level of vertex; pedicel length 1.1x (9:8) its width; ring segment length 0.2x (1:5) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1= 16:10; F2= 15:10; F3= 15:10, F4= 16:10 and F5= 12:11; clava length 1.85x (24:13) its width.

Mesosoma: (Plate. 30. Fig. 7) length 1.6x (149:95) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; pronotum with anterior margin carinate except at on median part, carina represent weakly on submedian part but distinct on sides, carinate laterally, maximum length 0.65x (51:79) width and median length 0.44x (35:79) its maximum width; mesoscutum median length 0.42x (40:95) its maximum width, notuali distinct; scutellum median length 1.1x (52:46) its maximum width; propodeum with median fovea having eight cross carina, fovea smooth, sides with numerous piliferous pits, whole area except fovea having hairs, median length 0.6x (46:77) its maximum width, spiracle separated from metanotum 2.7x its diameter; relative length and width of hind leg, coxa = 38:28, trochanter = 6:9, femur = 66:23, tibia = 74:16, tarsals 1 to 5 = 31:12:9:7:9; fore wing length 2.4x (239:101) its maximum width; relative length of SMV= 109, MV= 20, PMV= 27, STV= 19, CC= 101.

Metasoma: (Plate. 30. Fig. 6) Smooth and shining, lateral part of T2 onwards with micro sculptures on lateral side, length 0.88x (161:184) head plus mesosoma combined (in profile) and 3x (164:55) to its maximum width dorsally; petiolate, petiole with a projection on both sides laterally, length 0.82x its width; relative median length and maximum width of tergites are T1= 21:36, T2= 21:50, T3= 25:54, T4= 55:55, T5= 14:24, T6= 6:11, T7= 4:9, ovipositor sheath length dorsally 7.

Distribution: India (Kerala), Malaysia.

Host: Unknown.

Male: Unknown.

Materials examined: One female: INDIA: Kerala, Ernakulam, Kalady, 04.iv.2013, Col. K. Nikhil, Reg. No. E.IR. 96. One female: INDIA: Kerala, Idukki, Eravikulam NP, 05.iv.2013, Col. K. Nikhil, Reg. No. E.IR. 97. One female: INDIA: Kerala, Malappuram, C.U. Campus, 05.iii.2013, Col. K. Nikhil, Reg. No. E.IR. 98. One female: INDIA: Kerala, Idukki, Periyar Tiger Reserve, 04.iv.2013, Col. Abhilash, Reg. No. E.IR. 99. One female: INDIA: Kerala, Pathanamthitta, Konni, 18.xi.2012, Col. Bijoy, Reg. No. E.IR. 100. Two female: INDIA: Kerala, Kottayam, Chirakkadavu, 18.xi.2012, Col. Minu, Reg. No. E.IR. 101. One female: INDIA: Kerala, Kottayam, Kidangoor, 10.xi.2012, Col. K. Nikhil, Reg. No. E.IR. 102. One female: INDIA: Kerala, Wayanad, Muthanga, 17.x.2011, Col. P. M Sureshan, Reg. No. E.IR. 103. One female: INDIA: Kerala, Malappuram, Nilambur, 1985, Col. Mohandas, Reg. No. E.IR. 104. One female: INDIA: Kerala, Malappuram, Calicut University Campus, 06.viii.1988, Col. Narendran and Party, Reg. No. E.IR. 105.

Remarks: *Prodecatoma modesta* Narendran shows similarity with *Prodecatoma sureshani* sp. nov. in T1 subequal to T2; propodeum median length 0.6x its maximum width, but strongly differs with the following characters, scape reaching level of vertex (in *P. sureshani* sp. nov. scape exceeding level of vertex); T4 longest (in *P. sureshani* sp. nov. T3 longest); MV 0.7x PMV (in *P. sureshani* sp. nov. MV greater than PMV).

9.9. *Prodecatoma neoglobosa* sp. nov.

(Plate. 31. Fig. 1-7)

Holotype: Female: Length 2.42 mm. Body black in colour except the following, scape base and apices of all femora, fore tibia, base and apices of mid and hind tibia golden yellow; all femora except base and apices, mid and hind tibia except base and apices blackish brown; pedicel, funicles and clava brownish yellow; tarsi pale yellow; eyes grey; wings hyaline, veins pale yellow; body hairs silvery, ovipositor sheath brown, ovipositor golden yellow.

Head: (Plate. 31. Fig. 2-4) Width 1.5x (74:50) its height in front view; face densely and umbilicately punctured without any radiating rugae from clypeal margin; scrobal margin carinate; preorbital carina present starting from lower part of eye and slightly extending to lateral ocellus; frons without golden pubescence; inter antennal projection hook like; malar area swollen with a strip of microsculpture; postorbital carina present, lower part of the carina extending up malar space; preorbital carina and postorbital carina not joining each other; upper frons and vertex with distinct piliferous pits, interstices carinate; mandible tridentate; eyes bare; toruli situated 0.4x (20:50) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 49:18:7; dorsally width 1.9x (73:38) its maximum height; POL 2.8x (17:6) OOL; POL 2.1x (17:8) AOL; OOL 1.3x (8:6) OD; laterally eye height 1.2x (32:26) its maximum width and 2.3x malar space; post genal carina well defined and extending up to temple; the area between genal carina and post orbital carina with two raw of piliferous pits; malar sulcus not present; antennal formula 11153; scape length 3.4x (24:7) its width, reaching level of vertex; pedicel length equal to (6:6) its width; ring segment length 0.3x (1:3) its width; funicle and clava with setae; relative

measurements of length and width of F1 to F5 are F1= 9:6; F2= 9:6; F3= 10:6, F4= 10:6 and F5= 8:6; clava length 2.7x (16:6) its width.

Mesosoma: (Plate. 31. Fig. 7) length 1.5x (102:68) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; pronotum with anterior margin carinate except at on median part, carinate laterally, maximum length 0.58x (34:59) width and median length 0.3x (18:59) its maximum width; mesoscutum median length 0.4x (30:68) its maximum width, notuali present but not distinct; scutellum median length 1.2x (37:32) its maximum width; propodeum with median fovea, foveal margin carinate, fovea having seven cross carina, other areas with irregular shapes cells with interstices carinate, whole area except callus without hairs, median length 0.6x (27:45) its maximum width, spiracle separated from metanotum by its own diameter; relative length and width of hind leg, coxa = 31:18, trochanter = 6:7, femur = 49:13, tibia = 54:9, tarsals 1 to 5 = 9:6:11:10:9; fore wing length 2.1x (191:91) its maximum width; relative length of SMV= 72, MV= 25, PMV= 23, STV= 18, CC= 70.

Metasoma: (Plate. 31. Fig. 6) Smooth and shining, lateral part of T3 onwards with micro sculptures on lateral side, length 0.9x (118:125) head plus mesosoma combined (in profile) and 3x (119:40) to its maximum width dorsally; petiolate, petiole with a projection on both sides laterally, length 0.5x its width; relative median length and maximum width of tergites are T1= 9:23, T2= 17:31, T3= 19:40, T4= 36:34, T5= 5:12, T6= 7:8, T7= 9:8, ovipositor sheath length dorsally 20, ovipositor length dorsally 41.

Host: Unknown.

Male: Unknown.

Material examined: Holotype: Female: INDIA: Kerala, Wayanad, Tholpetty, 27.ix. 2012, Col. K. Nikhil, Reg. No. E.IR. 113.

Paratype: One female: INDIA: Kerala, Wayanad, Tholpetty, 27.ix. 2012, Col. K. Nikhil**,** Reg. No. E.IR. 114.

Etymology: The species derives its name from the species name *Prodecatoma globosa* Narendran. Neo means "New".

Remarks: *Prodecatoma neoglobosa* sp. nov. shows similarity with *Prodecatoma idukkiensis* sp. nov. in proportions of POL and OOL; scutellum length 1.2x length of mesoscutum; MV 1.4x STV, but strongly differs by the following characters, face without any radiating carinae (in *P. idukkiensis* sp. nov. face with several radiating carinae); T2 and T3 subequal in length (in *P. idukkiensis* sp. nov. T1 and T2 subequal in length); scape length 3.4x its maximum width (in *P. idukkiensis* sp. nov. scape length 2.9x its maximum width).

Prodecatoma neoglobosa sp. nov. shows similarity with *Prodecatoma globosa* Narendran in dorsal width of head 1.9x its maximum length; fore wing length 2.1x its width; length of head plus mesosoma combined in profile 0.8x length of gaster, but strongly differs with the following characters, face without any radiating carinae (in *P. globosa* face with several radiating carinae); T4 longest (in *P. globosa* T1 longest); T2 subequal to T3 (in *P. globosa* T2 not equal to T3); POL 2.1x OOL (in *P. globosa* POL 2.8x OOL).

9.10. *Prodecatoma neojosephi* sp. nov.

(Plate. 32. Fig. 1-7)

Holotype: Female: Length 2.41 mm. Body black in colour except the following, base and apex of all tibia golden yellow; tarsi pale yellow; eyes grey; wings hyaline, veins pale yellow; body hairs silvery, ovipositor sheath brown, ovipositor golden yellow.

Head: (Plate. 32. Fig. 2-4) Width 1.45x (67:46) its height in front view; face with several radiating rugae from clypeal margin, with two radiating weak carina from clypeal margin extending up to scrobe, area between two carina smooth; scrobal margin carinate; preorbital carina present starting from malar space and not extending to lateral ocellus; frons without golden pubescence; inter antennal projection hook like; malar area swollen with a strip of microsculpture; postorbital carina present, lower part of the carina extending up to microsculptured area of malar space; pre orbital carina and postorbital carina weakly joining each other; upper frons and vertex with distinct piliferous pits, interstices carinate; mandible tridentate; eyes bare; toruli situated 0.4x (18:46) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 45:17:6; dorsally width 2x (65:33) its maximum height; POL 2.8x (17:6) OOL; POL 2.8x (17:6) AOL; OOL equal to (6:6) OD; laterally eye height 1.2x (30:25) its maximum width and 2.1x malar space; post genal carina well defined and extending up to temple; the area between genal carina and post orbital carina with one raw of piliferous pits; malar sulcus not present; antennal formula 11153; scape length 3.5x (21:6) its width, not reaching level of vertex; pedicel length equal to (5:5) its width; ring segment length 0.3x (1:4) its width; funicle and clava with setae; relative measurements of length and width of F1

to F5 are F1= 8:7; F2= 8:7; F3= 8:7, F4= 7:7 and F5= 7:7; clava length 2.1x (15:7) its width.

Mesosoma: (Plate. 32. Fig. 7) length 1.5x (87:57) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; pronotum with anterior margin carinate except at on median part, carinate laterally, maximum length 0.55x (29:52) width and median length 0.35x (18:52) its maximum width; mesoscutum median length 0.46x (26:57) its maximum width, notuali present, but not distinct; scutellum median length subequal to (31:29) its maximum width; propodeum with median concave area with two weak median carina, concave area with reticulations other areas with irregular shapes cells with interstices carinate, median length 0.5x (23:50) its maximum width, spiracle separated from metanotum by its own diameter; relative length and width of hind leg, coxa = 23:14, trochanter = 6:6, femur = 52:15, tibia = 51:9, tarsals 1 to 5 = 16:11:8:6:4; fore wing length 2.2x (124:57) its maximum width; relative length of SMV= 52, MV= 14, PMV= 15, STV= 11, CC= 51.

Metasoma: (Plate. 32. Fig. 6) Smooth and shining, lateral part of T2 onwards with micro sculptures on lateral side, length 0.9x (118:128) head plus mesosoma combined (in profile) and 4.3x (113:26) to its maximum width dorsally; petiolate, petiole with a projection on both sides laterally, length 0.9x its width; relative median length and maximum width of tergites are T1= 16:19, T2= 16:24, T3= 25:26, T4= 15:18, T5= 8:8, T6= 7:5, T7= 12:6, ovipositor sheath length dorsally 12.

Host: Unknown.

Male: Unknown.

Material examined: Holotype: Female: INDIA: Kerala, Kollam, Thenmala, 23.xi.2011, Col. Bijoy, Reg. No. E.IR. 124.

Etymology: The species derives its name from the species *Prodecatoma josephi*. Neo means new.

Remarks: *Prodecatoma neojosephi* sp. nov. shows similarity with *Prodecatoma josephi* Narendran in proportions of MV and PMV; POL 2.8x OOL, but strongly differs by the following characters, scape not reaching level of vertex (in *P. josephi* scape exceeding level of vertex*)*; gaster 4.3x its maximum width (in *P. josephi* gaster 3.4x its maximum width); scape length 3.5x its maximum width (in *P. josephi* scape length 5x its maximum width); T1 and T2 equal in length (in *P. josephi* T1 and T2 not equal in length).

Prodecatoma neojosephi sp. nov. shows similarity with *Prodecatoma globosa* Narendran in proportions of MV and PMV; face with several radiating carinae; proportions of eye length and malar space in profile, but strongly differs by the following characters, scape not reaching level of vertex (in *P. globosa* scape exceeding level of vertex); T3 longest (in *P. globosa* T1 longest); T1 length equal to T2 (in *P. globosa* T1 length not equal to T2).

9.11. *Prodecatoma nilamburensis* Mukerjee

(Plate. 33. Fig. 1-7)

Prodecatoma nilamburensis Mukerjee, 1981: 73. female. India, Kerala, Nilambur. (ZSIC).

Diagnosis: Female: Length 3.28mm. Black; eyes and ocelli brownish black; antennal funicle brownish black; scape and pedicel black; club dark brown; legs brown with apices of femora paler; wings hyaline, veins brown; head anterior width 1.66x distance between front ocellus and clypeal margin and

width 1.6x length between anterion ocelli and clypeal margin; gena and face longitudinally striate; POL 2.8x OOL; mesosoma 1.3x its maximum width, thoracic dorsum with close umbilicate pits; pronotum shorter than mesoscutum; scutellum as long as mesoscutum; MV as long as PMV; STV 0.75x MV; propodeum with a faint longitudinal carina on either side of median longitudinal line; gaster subsessile; petiole short and transverse; T4 longest. (Modified from Narendran, 1994).

Distribution: India (Kerala).

Host: Unknown.

Male: Unknown.

Materials examined: One female: INDIA: Kerala, Idukki, Mannavan Shola, Methop, 07.iv.2012, Col. Rajmohana, Reg. No. E.IR. 106. One female: INDIA: Kerala, Plakkad, Mukkali, 04.i.2012, Col. Sheeba, Reg. No. E.IR. 107. One female: INDIA: Kerala, Kozhikode, Koyilandy, Nandi, 10.viii. 2013, Col. K. Nikhil, Reg. No. E.IR. 108.

Remarks: *Prodecatoma nilamburensis* Mukerjee shows similarity with *Prodecatoma cheriyani* Narendran in scutellum length sub equal to mesoscutum length; frons with several radiating carinae, but strongly differs with the following characters, scape length 3.3x its maximum width (in *P. cheriyani* scape length 5x its maximum width); length of head plus mesosoma combined in profile 1.1x length of gaster (in *P. cheriyani* length of head plus mesosoma combined in profile 0.8x length of gaster).

9.12. *Prodecatoma ponmudiensis* sp. nov.

(Plate. 34. Fig. 1-7)

Holotype: Female: Length 2.64 mm. Body black in colour except the following, gaster coffee brown; scape, pedicel, funicles, clava, tegula, all tibia and all femora golden yellow; fore coxa brownish yellow; hind coxa concolorous to gaster; tarsi pale yellow; eyes grey; wings hyaline, veins pale yellow; body hairs silvery, ovipositor sheath brown, ovipositor golden yellow.

Head: (Plate. 34. Fig. 2-4) Width 1.5x (73:48) its height in front view; face with several radiating rugae from clypeal margin, with two radiating carina from clypeal margin extending up to scrobe, area between two carina smooth; scrobal margin carinate; preorbital carina present starting from lower margin of eye and not extending to lateral ocellus; frons without golden pubescence, but densely pubescent with silvery hairs; inter antennal projection hook like; malar area swollen with a strip of microsculpture; postorbital carina present, lower part of the carina extending up microsculptured area malar space; preorbital carina and postorbital carina not joining each other; upper frons and vertex with distinct piliferous pits, interstices carinate; mandible tridentate; eyes bare; toruli situated 0.46x (22:48) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 47:17:6; dorsally width 1.9x (75:39) its maximum height; POL 1.55x (14:9) OOL; POL 2.3x (14:6) AOL; OOL 1.3x (9:7) OD; laterally eye height 1.2x (34:29) its maximum width and 2.1x malar space; post genal carina well defined and extending up to temple; the area between genal carina and post orbital carina with one raw of piliferous pits; malar sulcus not present; antennal formula 11153; scape length 3.3x (23:7) its width, not reaching level of vertex; pedicel length equal to (6:6) its width; ring segment length 0.2x (1:5) its width; funicle and clava with setae; relative measurements of length

and width of F1 to F5 are F1= 8:9; F2= 8:9; F3= 9:9, F4= 9:8 and F5= 10:8; clava length 2.9x (23:8) its width.

Mesosoma: (Plate. 34. Fig. 7) length 1.4x (102:71) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; pronotum with anterior margin carinate except at on median part, carinate laterally, maximum length 0.5x (33:63) width and median length 0.4x (23:63) its maximum width; mesoscutum median length 0.5x (34:71) its maximum width, notuali present but not distinct; scutellum median length subequal to (38:36) its maximum width; propodeum with median concave area, borders of concave area carinate, centre of concave area having to median carina with six cross carina forming square shaped cells, other areas of the concavity with sculptures, whole area except callus without hairs, median length 0.53x (28:53) its maximum width, spiracle separated from metanotum by its own diameter; relative length and width of hind leg, coxa = 35:23, trochanter = 10:11, femur = 62:19, tibia = 63:9, tarsals 1 to 5 = 23:7:10:7:5; fore wing length 2.1x (170:81) its maximum width; relative length of SMV= 71, MV= 23, PMV= 21, STV= 16, CC= 70.

Metasoma: (Plate. 34. Fig. 6) Smooth and shining, lateral part of T5 onwards with micro sculptures on laterally and dorsally, length 0.85x (121:142) head plus mesosoma combined (in profile) and 3x (125:42) to its maximum width dorsally; petiolate, petiole with a projection on both sides laterally, length 1.2x its width; relative median length and maximum width of tergites are T1= 28:27, T2= 19:39, T3= 15:42, T4= 28:26, T5= 5:14, T6= 5:12, T7= 4:7, ovipositor sheath length dorsally 11.

Host: Unknown.

Male: Unknown.

Materials examined: Holotype: Female: INDIA: Kerala, Thiruvananthapuram, Ponmudi, 15.x.2012, Col. Bijoy, Reg. No. E.IR. 117.

Paratype: Two female: INDIA: Kerala, Thiruvananthapuram, Ponmudi, 15.x.2012, Col. Bijoy, Reg. No. E.IR. 118.

Etymology: The species derives its name from the type locality, Ponmudi, Thiruvananthapuram (Kerala).

Remarks: *Prodecatoma ponmudiensis* sp. nov. shows similarity with *Prodecatoma confusa* Narendran in proportions of fore wing length and width; length of head plus mesosoma combined in profile 0.85x length of gaster, but strongly differs with the following characters, MV 1.1x PMV (in *P. confusa* MV 0.7x PMV); POL 1.5x OOL (in *P. confusa* POL 2x OOL); scape not reaching level of vertex (in *P. confusa* scape reaching level of vertex); T1 length equal to T4 (in *P. confusa* T4 longest).

Prodecatoma ponmudiensis sp. nov. shows similarity with *Prodecatoma chinnarensis* sp. nov. in proportions of POL and OOL; length of head plus mesosoma combined in profile 0.85x length of gaster; proportions of eye length and malar space in profile, but strongly differs by the following characters, scape not reaching level of vertex (in *P. chinnarensis* sp. nov. scape exceeding level of vertex); T1 and T4 equal in length (in *P. chinnarensis* sp. nov. T1 and T4 not equal in length); MV 1.1x PMV (in *P. chinnarensis* sp. nov. MV 0.75x PMV); gaster length 3x its maximum width (in *P. chinnarensis* sp. nov. gaster length 3.6x its maximum width).

9.13. *Prodecatoma sureshani* sp. nov.

(Plate. 35. Fig. 1-7)

Holotype: Female: Length 2.27 mm. Body black in colour except the following, gaster, mid and hind coxa, all femora except bases and apices, coffee brown; scape except base, funicles and clava, brown; base of scape, base and apices of all femora, all tibia golden yellow; tarsi pale yellow; eyes grey; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 35. Fig. 2-4) Width 1.5x (60:40) its height in front view; face densely and umbilicately punctured, with two radiating carina extending up to scrobe, area between two carina smooth; scrobal margin carinate; preorbital carina present starting from the base of eye and not extending to lateral ocellus; frons without golden pubescence, but densely pubescent with silvery hairs; inter antennal projection hook like; malar area swollen without a strip of microsculpture; postorbital carina present, lower part of the carina extending up malar space; preorbital carina and postorbital carina not joining each other; upper frons and vertex with distinct piliferous pits, interstices carinate; mandible tridentate; eyes bare; toruli situated 0.36x (15:40) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 38:13:5; dorsally width 1.9x (60:32) its maximum height; POL 2.1x (15:7) OOL; POL 2.1x (15:7) AOL; OOL 1.4x (7:5) OD; laterally eye height 1.2x (26:22) its maximum width and 2x malar space; post genal carina well defined and extending up to temple; the area between genal carina and post orbital carina with two raw of piliferous pits; malar sulcus not present; antennal formula 11153; scape length 3.8x (19:5) its width, exceeding level of vertex; pedicel length 0.8x (5:6) its width; ring segment length 0.3x (1:4) its width; funicle and clava with setae; relative

measurements of length and width of F1 to F5 are F1= 10:7; F2= 9:7; F3= 10:7, F4= 8:7 and F5= 9:6; clava length 3x (18:6) its width.

Mesosoma: (Plate. 35. Fig. 7) length 1.6x (83:52) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; pronotum with anterior margin carinate except at on median part, carinate laterally, maximum length 0.6x (26:45) width and median length 0.4x (17:45) its maximum width; mesoscutum median length 0.52x (27:52) its maximum width, notuali present but not distinct; scutellum median length equal to (27:27) its maximum width; propodeum with median fovea having a median carina with half the median length of fovea, fovea with deep reticulations, median basal part of propodeum have a neck like projection towards petiole, whole area except fovea having hairs, median length 0.6x (25:41) its maximum width, spiracle separated from metanotum by its own diameter; relative length and width of hind leg, coxa = 24:17, trochanter = 4:6, femur = 47:14, tibia = 51:8, tarsals 1 to 5 = 13:10:9:8:3; fore wing length 2.2x (156:71) its maximum width; relative length of SMV= 61, MV= 21, PMV= 20, STV= 16, CC= 60.

Metasoma: (Plate. 35. Fig. 6) Smooth and shining, lateral part of T3 onwards with micro sculptures on lateral side, length subequal to (116:120) head plus mesosoma combined (in profile) and 2.6x (95:36) to its maximum width dorsally; petiolate, petiole with a projection on both sides laterally, length 0.77x its width; relative median length and maximum width of tergites are T1= 13:20, T2= 14:26, T3= 29:36, T4= 27:31, T5= 4:9, T6= 3:7, T7= 5:5, ovipositor sheath length dorsally 9.

Host: Unknown.

Male: Unknown.

Materials examined: Holotype: Female: INDIA: Kerala, Kannur, Kottiyoor forest, 19.iv.2012, Col. K. Nikhil, Reg. No. E.IR. 109.

Paratype: One female: INDIA: Kerala, Kannur, Kottiyoor forest, 19.iv.2012, Col. K. Nikhil**,** Reg. No. E.IR. 110.

Etymology: The species derives its name after Dr. P. M. Sureshan for his contributions to Chalcidoidea.

Remarks: *Prodecatoma sureshani* sp. nov. shows similarity with *Prodecatoma modesta* Narendran in T1 subequal to T2; propodeum median length 0.6x its maximum width; MV subequal to PMV, but strongly differs with the following characters, scape exceeding level of vertex (in *P. modesta* scape reaching level of vertex); T3 longest (in *P. modesta* T4 longest); MV greater than PMV (in *P. modesta* MV 0.7x PMV); scutellum length equal to mesoscutum length (in *P. modesta* scutellum length 1.3x length of mesoscutum).

Prodecatoma sureshani sp. nov. shows similarity with *Prodecatoma idukkiensis* sp. nov. in MV equal to PMV; POL 2.1x OOL; mesosoma length 1.6x its maximum width, but strongly differs by the following characters, scape exceeding level of vertex (in *P. idukkiensis* sp. nov. scape reaching level of vertex); gaster length 2.6x its maximum width (in *P. idukkiensis* sp. nov. gaster length 3.2x its maximum width); T3 longest (in *P. idukkiensis* sp. nov. T4 longest); scape length 3.8x its maximum width (in *P. idukkiensis* sp. nov. scape length 2.9x its maximum width).

10. Genus: *Ramdasoma* Narendran

(Plate. 6. Fig. 6)

Ramdasoma Narendran, 1994: 102. Type species: *Ramdasoma peethodaris* Narendran, original designation.

Diagnosis: Head broader than long; malar groove weak; genotemporal margin carinate; antennae inserted at or a trifle above level of ventral margin of eyes; anterior ocellus located outside scrobe; antennal formula 11163; scape slightly exceeding level of vertex; anterior margin of pronotum ecarinate; face below antennal toruli without radiating carinae; thoracic dorsum with close pits with dense short pubescence; length of mesoscutum subequal to that of scutellum; propodeum with a distinct short apical median neck; petiole distinct; gaster distinctly longer than combined length of head and thorax; T4 longest.

Distribution: India.

Host: Unknown.

Remarks: Only three species are reported from Kerala under this genus. The dichotomous key for identification of all species is provided. Since the examined collection does not contain any new species and the descriptions of the existing species are enough for identification, the detailed descriptions were not given to avoid repetition.

Key to Species of *Ramdasoma* Narendran of Kerala

(Modified from Narendran, 1994)

1. Pronotum longer than mesoscutum in length; flagellum with long setae …….....*Ramdasoma peethodaris* Narendran

- Pronotum shorter than mesoscutum in length; flagellum with short setae…… 2

2. Petiole more 0.5x length of hind coxa; gaster not compressed; PMV 1.6x STV .....*Ramdasoma simplexus* Narendran

- Petiole 0.25x length of hind coxa; gaster compressed; PMV 1.2x STV ..... *Ramdasoma zandanus* Narendran

11. *Risbecoma* Subba Rao

(Plate. 6. Fig. 7)

Risbecoma Subba Rao, 1978: 300. Type species: *Eurytoma brucosida* Risbec, original designation and monotypy.

Diagnosis: Face with strong or weak radiating carinae from clypeus; genotemporal margin ecarinate (in Indian species); front ocellus located outside scrobe; antennal formula of female 11153; MV longer than STV; PMV subequal to STV; propodeum without median furrow; thoracic notum with weak punctures; gaster distinctly petiolate, not compressed laterally; T1 longest; T2 about half or more than half of T1.

Distribution: India, Australia, Senegal, South Africa.

Host: Unknown.

Remarks: Only one species is reported from Kerala under this genus viz. *Risbecoma mohandasi* Narendran. The original description of the existing species is enough for identification.

12. Genus: *Sycophila* Walker

Sycophila Walker, 1871: 63. Type species: *Sycophila decatomoides* Walker, by subsequent designation of, Ashmead, W.H. (1904)

Tineomyza Rondani, 1872: 205. Type species: *Tineomyza pistacina* Rondani, by monotypy [Synonymised by Boucek, Z., 1974].

Pseudisa Walker, 1875: 15. Type species: *Pseudisa smicroides* Walker, by monotypy [Synonymised by Dalla Torre, K.W. von, 1898]

Isanisa Walker, 1875: 15. Type species: *Sycophila decatomoides* Walker, by monotypy [Synonymised by Dalla Torre, K.W. von, 1898]

Eudecatoma Ashmead, 1888: 42-43. Type species: *Decatoma batatoides* Ashmead, by subsequent monotypy of, Ashmead, W.H, 1894 [Synonymised by Boucek, Z, 1974]

Decatomidea Ashmead, 1888: 42-43. Type species: *Decatomidea xanthochroa* Ashmead, by subsequent designation of, Ashmead, W.H, 1894]

Diagnosis: Most species are with yellowish or brownish colouration or markings; front ocellus located outside scrobe; genotemporal margin ecarinate or with very short carinae near base of mandible; antennal formula 11153; antennae located slightly above ventral margin of compound eyes; anterior margin of pronotum ecarinate; thoracic notum smooth or rugulose or with distinct umbilicate close punctures; anterior depression of fore coxa indistinct; MV enlarged, stigmated, most species with dark brown shading below MV; PMV short or obscure in most species; propodeum surface with a median broad or narrow fovea or depression; petiole length varying from longer than wide to as long as or a trifle longer than hind coxa; gaster in several species compressed.

Distribution: Benin, Brazil, Bulgaria, French Guiana, Gabon, Hawaii, India, Ivory Cost, Japan, People's Republic of China, Spain, Sweden, Turkey, United Kingdom, United States of America.

Remarks: Many of the species are associated with Plant galls.

Host: Primary hosts: Cecidomyiid sp. (Cecidomyiidae: Diptera)., *Acraspis* sp., *Andricus* sp., *Aulacidea* sp., *Barbotina* sp., *Callirhytis* sp., *Disholcaspis* sp., *Dryocosmus* sp. (Cynipidae: Hymenoptera).

Plant hosts: *Pistacia* sp. (Anacardiaceae)., *Philodendron* sp. (Araceae)., *Quercus* sp. (Fagaceae).

Parasitoid hosts: *Exurus* sp. (Eulophidae: Hymenoptera)., *Tetramesa* sp. (Eurytomidae).

Parasitoids: *Eurytoma* sp. (Eurytomidae)., *Ormyrus* sp. (Ormyridae)., *Gugolzia* sp. (Pteromaildae).

Associates: *Ceratosolen* sp. (Agonidae)., *Eurytoma* sp. (Eurytomidae)., *Formica* sp. (Formicidae)., *Megastigmus* sp. (Torymidae).

Plant associates: *Pistacia* sp. (Anacardiaceae)., *Ilex* sp. (Aquifoliaceae)., *Quercus* sp. (Fagaceae)., *Ficus* sp. (Moraceae)., *Jasminum* sp. (Oleaceae)., *Papaver* sp. (Papaveraceae)., *Ammophila* sp., *Elymus* sp., *Festuca* sp., *Phyllostaxhys* sp. (Poaceae).

Key to species of *Sycophila* Walker of Kerala

(Modified from Narendran, 1994)

1. F1 length equal to longer than pedicel..... 2

- F1 length shorter than pedicel 3

2. Pterostigma width equal to height; T4 longest..... ..... *Sycophila dharwarensis* Joseph & Abdurahiman

- Pterostigma width 0.75x its height; T1 longest..... .....*Sycophila Neodharwarensis* sp. nov.

3. POL less than 3.6x OOL..... 4

- POL greater than 3.6x OOL..... 7

4. T3 and T4 sub equal in length..... 5

- T3 and T4 not equal in length 6

5. Body golden yellow in colour; POL 2.8x OOL; Stigma width 1.6x its height……. ..... *Sycophila rosae* sp. nov.

- Body black in colour; POL 3.5x OOL; Stigma width 2.4x its height..……..... *Sycophila* w*ayanadensis* sp. nov.

6. T1 and T2 subequal in length; MV and STV subequal in length; POL 3.25x OOL…….....… .....*Sycophila floribundae* Narendran

- T1 and T2 not equal in length; STV distinctly shorter than MV; POL 2.1x OOL……..... *Sycophila kokila* Narendran

7. MV greater than or equal to STV; T4 longest; Scutellum length sorter than or sub equal to pronotum……..... 8

- MV shorter than STV; T3 longest; Scutellum length longer than pronotum……..… ..... *Sycophila mukerjeei* Narendran

8. MV equal to STV; scutellum length subequal to pronotum..... .... *Sycophila petersani* Narendran

- MV longer than STV; scutellum length distinctly shorter than pronotum……..... *Sycophila chaliyarensis* Narendran

Species desciptions

12.1. *Sycophila chaliyarensis* Narendran

(Plate. 36. Fig. 1-7)

Sycophila chaliyarensis Narendran, 1994: 160-161. female. India, Kerala, Chaliyar. (ZSIK, examined).

Diagnosis: Modified from Narendran, 1994.

Female: Length 3.05mm. Body yellowish brown, femora yellow, eye grey, tarsi pale yellow, MV conspicuous and swollen, with fuscous spot; head width 1.46x distance between front ocellus and clypeal margin; clypeal margin weakly but distinctly bilobed; vertex and frons rugulose; scrobe deep, margins ecarinate, not reaching front ocellus; malar groove distinct. POL 4.75x OOL; antennal formula 11153; scape not reaching front ocellus; F1 distinctly shorter than pedicel; maximum diameter of eye in profile 1.8x malar space; thorax with umbilicate fairly dense punctures on notum; pronotum length subequal to length of mesoscutum; scutellum distinctly shorter than pronotum, a trifle wider than long; base of scutellum narrower than each axilla; propodeum lying perpendicular to longitudinal axis of thorax, surface with a median fovea containing irregular pits, sides with irregular pits, posterior part narrow forming a neck; hind coxa without distinct bristles on dorsal side; hind femur with a row of 10 bristles on ventral margin; forewing with basal third bare; MV longer than STV, its lower margin not concave; prepectus without pubescence; gastral petiole longer than hind coxa; gaster (excluding petiole) as long as thorax, smooth, T4 a trifle longer than T3.

Distribution: India (Kerala).

Host: Unknown.

Male: Unknown.

Materials examined: One female: INDIA: Kerala, Malappuram, C.U. Campus, 05.iii.2013, Col. K. Nikhil, Reg. No. E.IR. 125. One female: INDIA: Kerala, Palakkad, Silentvalley NP, Sirendri, 20.ii.2013, Col. P. M. Sureshan, Reg. No. E.IR. 126.

Remarks: *Sycophila chaliyarensis* Narendran resembles to *Sycophila peterseni* Narendran in scape not reaching level of vertex; T4 longest, but differs strongly by the following characters, MV longer than STV (in *S. peterseni* MV equal to STV); scutellum shorter than pronotum (in *S. peterseni* scutellum subequal to pronotum).

12.2. *Sycophila dharwarensis* (Joseph & Abdurahiman)

(Plate. 37. Fig. 1-6)

Decatoma dharwarensis Joseph & Abdurahiman, 1968: 83. female. India, Karnataka, Dharwar. (PCAB).

Eurytoma dharwarensis (Joseph & Abdurahiman), New combination for *Decatoma dharwarensis* Joseph & Abdurahiman by Farooqi and Subba Rao, 1986: 250.

Sycophila dharwarensis (Joseph & Abdurahiman), New combination for *Decatoma dharwarensis* Joseph & Abdurahiman by Narendran, 1994: 167.

Diagnosis: Modified from Narendran, 1994.

Female: Length 3.03mm. Head and thorax testaceous in colour; gaster brownish black; pronotum brownish yellow; tibiae black; wings hyaline, pterostigma brown; head width 1.35x distance between front ocellus and clypeal margin; scrobe not reaching front ocellus; clypeal margin bilobed; malar groove complete; maximum eye diameter about 2x malar space; POL 1.6x OOL. Antennal formula 11153; scape not reaching front ocellus; pedicel as long as F1; mesosoma with dorsum minutely rugulose or with leathery

texture; median length of pronotum distinctly less than median length of scutellum: mesoscutum length subequal to length or scutellum; scutellum a trifle longer than its width; propodeum surface with a broad median depression which narrows towards anterior and posterior ends, this depression bounded laterally by carinae; posterior part of propodeum narrowed and neck-like; SMV as long as MV; pterostigmal area about 2x as wide as long; gastral petiole length a trifle over half length of hind coxa; gaster longer than thorax; T4 longer than T3; T4 longest.

Distribution: India (**Kerala**, Karnataka).

Host: Plant associates: *Ficus* sp. (Moraceae).

Male: Length 3mm. Differs from female mainly in having four segmented funicle, longer petiole (longer than hind coxa) and T3 longest (Narendran, 1994).

Material examined: One female: INDIA: Kerala, Malappuram, C.U. Campus, viii. 2011, Col. K. Razak, Reg. No. E.IR. 127.

Remarks: *Sycophila dharwarensis* (Joseph & Abdurahiman) resembles to *Sycophila neodharwarensis* sp. nov. in scutellum sub equal to pronotum; scape not reaching level of vertex, but differs strongly by the following characters, F1 length equal to pedicel (in *S. neodharwarensis* sp. nov. F1 length longer than pedicel); T4 longest (in *S. neodharwarensis* sp. nov. T1 longest).

12.3. *Sycophila floribundae* Narendran

(Plate. 38. Fig. 1-7)

Sycophila floribundae Narendran, 1994: 159. female. India, Kerala, Calicut University Campus. (ZSIK, examined).

Redescription:

Female: Length 1.68 mm. Body orange yellow in colour except the following, scape, all tibia, all tibia, lateral sides of pronotum golden yellow; eyes coffee brown; tarsus pale yellow; wings hyaline, veins pale yellow, MV with brownish spot; body hairs silvery.

Head: (Plate. 38. Fig. 2-4) Width 1.4x (46:32) its height in front view; head with sparse shallow piliferous punctures; pre orbital carina and post orbital carina absent; scrobe margin weakly carinate, scrobe smooth and shining; upper part of scrobe with a brown marking which extend towards front ocelli; mandible bidentate; eyes bare; toruli situated 0.38x (12:32) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 30:9:5; dorsally width 1.74x (47:27) its maximum height; POL 3.25x (13:4) OOL; POL 2.2x (13:6) AOL; OOL equal to (4:4) OD; laterally eye height 1.1x (21:19) its maximum width and 2.6x malar space; post genal carina not distinct; malar sulcus present but not distinct; antennal formula 11153; scape length 4.6x (19:4) its width, not reaching level of vertex; pedicel length 2x (8:4) its width; ring segment length 0.3x (1:3) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1= 5:4; F2= 5:4; F3= 5:4, F4= 6:5 and F5= 5:5; clava length 1.7x (10:6) its width.

Mesosoma: (Plate. 38. Fig. 7) length 1.55x (63:41) its maximum width (including tegula); pronotum, mesoscutum and scutellum with shallow

umblicate punctures, interstices small and carinate; pronotum maximum length 0.65x (24:37) width and median length 0.43x (16:37) its maximum width, collar ecarinate; mesoscutum median length 0.5x (20:41) its maximum width, notuali complete and distinct; scutellum median length equal to (24:24) its maximum width; propodeum with a median fovea, fovea having five cross carina, foveal margin carinate, posterior part of propodeum narrow and neck like, sides of fovea rugos punctuate, whole area except callus without hairs, median length 0.46x (16:35) its maximum width, spiracle separated from metanotum 0.5x its diameter; relative length and width of hind leg, coxa = 21:13, trochanter = 4:3, femur = 35:10, tibia = 34:6, tarsals 1 to 5 = 8:5:5:4:5; fore wing length 2.4x (129:53) its maximum width; relative length of SMV= 58, MV= 13, PMV= 5, STV= 14, CC= 59; stigma width 1.9x its height.

Metasoma: (Plate. 38. Fig. 6) Smooth and shining, lateral part of tergites minutely reticulate, length subqual to (83:84) head plus mesosoma combined (in profile) and 3.1x (80:26) to its maximum width dorsally; petiolate, ventral part of petiole black in colour basally, length 0.63x its width; relative median length and maximum width of tergites are T1= 12:16, T2= 10:22, T3= 18:26, T4= 8:24, T5= 9:18, T6= 8:12, T7= 6:5, ovipositor sheath dorsal length 9.

Distribution: India (Kerala).

Host: Plant associates: *Calycopteris* sp. (Combretaceae)

Male: Length 1.6- 2mm. Similar to female except in having antennal funicles four segmented; petiole longer than hind coxa; gaster not compressed.

Materials examined: One female: INDIA: Kerala, Malappuram, C.U. Campus, 05.iii.2013, Col. Minu, Reg. No. E.IR. 128. One female: INDIA: Kerala, Malappuram, C.U. Campus, 05.iii.2013, Col. K. Nikhil, Reg. No. E.IR. 129. Two female: INDIA: Kerala, Idukki, Marayoor, 12.Viii.2013, Col. P. M. Sureshan, Reg. No. E.IR. 130. Two female: INDIA: Kerala, Kozhikode,

Sarovaram, 04.vii. 2013, Col. K. Nikhil, Reg. No. E.IR. 131. One female: INDIA: Kerala, Kannur, Kannavam, 21.iv.2012, Col. K. Nikhil, Reg. No. E.IR. 132. Two female: INDIA: Kerala, Alappuzha, Ambalappuzha, 17.ix.2013, Col. K. Nikhil, Reg. No. E.IR. 133. Four female: INDIA: Kerala, Malappuram, Vazhikkadavu, 14.xi.2014, Col. K. Nikhil, Reg. No. E.IR. 134. Three female: INDIA: Kerala, Malappuram, C.U. Campus, 23.iv.1988, Col. Narendran and Party, Reg. No. E.IR. 135. One female: INDIA: Kerala, Kozhikode, Malaparambu, 03.x.2009, Col. Mercy Ignatius, Reg. No. E.IR. 136.

Remarks: *Sycophila floribundae* Narendran resembles to *Sycophila kokila* Narendran in F1 shorter than pedicel; T3 longest, but strongly differs by the following characters, scutellum length longer than pronotum (in *S. kokila* scutellum length subequal to pronotum); MV subequal to STV (in *S. kokila* MV longer than STV); T1 subequal to T2 (in *S. kokila* T1 not equal to T2).

12.4. *Sycophila kokila* Narendran

(Plate. 39. Fig. 1-7)

Sycophila kokila Narendran, 1994: 161. female. India, Kerala, Manjeri.
(ZSIK, examined).

Redescription:

Female: Length 1.7 mm. Body dark brown in colour except the following, gaster coffee brown; scape, pedicel, funicles, clava, lateral part of pronotum, lobe of mesopleuron near propodeum, ventral part of fore coxa, mid and hind coxa, all femora and tibia and clypeus golden yellow; eyes grey; tarsus pale

yellow; wings hyaline, veins pale yellow, MV with brownish spot; body hairs silvery.

Head: (Plate. 39. Fig. 2-4) Width 1.5x (54:35) its height in front view; lower face with sparse shallow piliferous punctures, upper face smooth reticulate; pre orbital carina and post orbital carina absent; scrobe margin weakly carinate, scrobe smooth and shining; mandible bidentate; eyes bare; toruli situated 0.2x (6:35) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 36:11:5; dorsally width 1.7x (51:30) its maximum height; POL 3.75x (15:4) OOL; POL 2.1x (15:7) AOL; OOL equal to (4:4) OD; laterally eye height 1.2x (27:23) its maximum width and 2.5x malar space; post genal carina not distinct; malar sulcus present and distinct; antennal formula 11153; scape length 7.7x (23:3) its width, not reaching level of vertex; pedicel length 2x (10:5) its width; ring segment length 0.3x (1:3) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1= 5:5; F2= 3:5; F3= 5:5, F4= 4:5 and F5= 4:5; clava length 2.8x (14:5) its width.

Mesosoma: (Plate. 39. Fig. 7) length 1.55x (70:45) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; pronotum maximum length 0.65x (28:43) width and median length 0.42x (18:43) its maximum width, collar weakly carinate; mesoscutum median length 0.62x (28:45) its maximum width, notuali complete and distinct; scutellum carinate basally, median length 0.7x (21:30) its maximum width; propodeum with a median fovea, fovea smooth and having an irregular cross carina, foveal margin carinate, posterior part of propodeum narrow and neck like, sides of fovea having irregular reticulations having edges carinate, whole area except callus without hairs, median length 0.53x (20:38) its maximum width, spiracle separated from metanotum 0.5x its

diameter; relative length and width of hind leg, coxa = 21:14, trochanter = 3:4; femur = 34:12, tibia = 37:7, tarsals 1 to 5 = 10:6:5:4:4; fore wing length 2.2x (111:50) its maximum width; relative length of SMV= 50, MV= 14, PMV= 5, STV= 11, CC= 52; stigma width 1.6x its height.

Metasoma: (Plate. 39. Fig. 6) Smooth and shining, lateral part of tergites minutely reticulate, length 0.72x (73:101) head plus mesosoma combined (in profile) and 2.1x (70:33) to its maximum width dorsally; petiolate, basal ridge of petiole carinate, two weak carina present parallel to body, length 1.3x its width; relative median length and maximum width of tergites are T1= 12:19, T2= 9:24, T3= 19:33, T4= 14:23, T5= 9:14.

Distribution: India (Kerala).

Host: Unknown.

Male: Unknown.

Materials examined: One female: INDIA: Kerala, Idukki, Periyar Tiger Reserve, 04.iv.2013, Col. Abhilash, Reg. No. E.IR. 137. One female: INDIA: Kerala, Kollam, Rosemala, 25.xi.2011, Col. Bijoy, Reg. No. E.IR. 138. One female: INDIA: Kerala, Wayanad, Thirunelli, 25.ix. 2012, Col. K. Nikhil, Reg. No. E.IR. 139. INDIA: Kerala, Malappuram, C.U. Campus, 1982, Mohandas, Reg. No. E.IR. 140.

Remarks: *Sycophila kokila* Narendran resembles to *Sycophila floribundae* Narendran in F1 shorter than pedicel; T3 longest, but strongly differs by the following characters, scutellum length subequal to pronotum (in *S. floribundae* scutellum length longer than pronotum); MV longer than STV (in *S. floribundae* MV subequal to STV); T1 not equal to T2 (in *S. floribundae* T1 subequal to T2).

12.5. *Sycophila mukerjeei* Narendran

(Plate. 40. Fig. 1-7)

Decatoma karnatakensis Mukerjee, 1981: 79. female. India, Karnataka. (ZSIC).

Sycophila mukerjeei Narendran, 1994: 168. Replacement name for *Decatoma karnatakensis* Mukerjee.

Diagnosis: Modified from Narendran, 1994.

Female: Length 1.79mm. Black; face below antennal toruli brown; eyes brownish grey; antenna blackish brown with scape and pedicel yellowish brown; gaster brownish black; head anterior width 1.48x distance between front ocellus and clypeal margin, closely umbilicately punctate; interstices wider than puncture especially on lower half of frons; vertex pilose; eyes sparsely pubescent; antennal toruli a little below middle of frons; scrobe not reaching front ocellus, margins ecarinate; dorsal length of head about 1.3x its median dorsal length; POL 4x OOL; antennal formula 11151; pedicel 2x length of F1; thorax closely and umbilicately punctate; pronotum shorter than scutellum; mesoscutum longer than scutellum; forewing 2.2x as long as wide; PMV a little more than half length of MV, distinctly shorter than STV; costal cell moderately pilose; propodeum reticulo-punctate; petiole 2.2x as long as its width; gaster smooth, not compressed; T4 longest.

Distribution: India (Kerala, Karnataka).

Host: Unknown.

Male: Unknown.

Material examined: One female: INDIA: Kerala, Kollam, Thenmala, 23.xi.2011, Col. Bijoy, Reg. No. E.IR.141 .

Remarks: *Sycophila mukerjeei* Narendran resembles to *Sycophila kokila* Narendran in F1 shorter than pedicel; T3 longest, but strongly differs by the following characters, pronotum shorter than scutellum (in *S. kokila* pronotum subequal to scutellum); MV shorter than STV (in *S. kokila* MV longer than STV).

12.6. *Sycophila neodharwarensis* sp. nov.

(Plate. 41. Fig. 1-7)

Female: Length 3.38 mm. Body brownish yellow in colour except the following, pronotum, mesoscutum, scutellum and vertex with black patches; all basal part of tergites coffee brown; head, scape, hind femur and tarsi pale yellow; clava brownish; eyes reddish gray; wings hyaline, veins pale yellow, MV with brownish spot; body hairs silvery.

Head: (Plate. 41. Fig. 2-4) Width 1.5x (85:56) its height in front view; face with fine umblicate punctures, without any radiating rugae, upper face and vertex with smooth reticulations; pre orbital carina and post orbital carina absent; scrobe margin carinate, scrobe smooth and shining; mandible tridentate; eyes bare; toruli situated 0.3x (18:56) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 57:21:7; dorsally width 1.9x (87:45) its maximum height; POL 4x (24:6) OOL; POL 2.4x (24:10) AOL; OOL equal to (6:6) OD; ocelli enclosed in blackish patch on head; laterally eye height 1.3x (41:32) its maximum width and 2.2x malar space; post genal carina not distinct; malar sulcus present and distinct; antennal formula 11153; scape length 4.9x (34:7) its width, not reaching level of vertex; pedicel length 1.3x (9:7) its width; ring segment length 0.2x (1:5) its width; funicle and clava with setae; relative

measurements of length and width of F1 to F5 are F1= 18:9; F2= 13:8; F3= 13:8, F4= 13:9 and F5= 10:9; clava length 1.9x (21:11) its width.

Mesosoma: (Plate. 41. Fig. 7) length 1.6x (132:83) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; pronotum with black patch at dorsal part, maximum length 0.74x (53:72) width and median length 0.63x (45:72) its maximum width, collar ecarinate; mesoscutum with tree black patch, median length 0.4x (33:83) its maximum width, notuali present and notolar groove having brown patch; scutellum convex, black in colour, median length 0.9x (43:47) its maximum width; propodeum with a median black groove having seven cross carina, other area are concolorous to body and having piliferous punctures, median length 0.5x (36:74) its maximum width, spiracle separated from metanotum its own diameter; dorsal apical part of hind coxa with black patch, relative length and width of hind leg, coxa = 44:23, trochanter = 10:9; femur = 65:25, tibia = 80:13, tarsals 1 to 5 = 30:7:7:5:4; fore wing length 2.3x (204:89) its maximum width; relative length of SMV= 103, MV= 20, PMV= 9, STV= 20, CC= 101; stigma width 0.75x its height.

Metasoma: (Plate. 41. Fig. 6) Smooth and shining, lateral part of tergites minutely reticulate, length subequal to (175:170) head plus mesosoma combined (in profile) and 3.5x (176:50) to its maximum width dorsally; petiolate, length 3.6x its width; relative median length and maximum width of tergites are T1= 41:35, T2= 21:47, T3= 17:50, T4= 33:42, T5= 8:14, T6= 6:6, T7= 5:4, ovipositor sheath length 16.

Host: Unknown.

Male: Unknown.

Material examined: Holotype: Female: INDIA: Kerala, Idukki, Chinnar, Churalipetti 06.ix.2013, Col. P. M. Sureshan, Reg. No. E.IR. 144.

Etymology: The species derives its name from the species name *Sycophila dharwarensis*. Neo means new.

Remarks: *Sycophila neodharwarensis* sp. nov. resembles to *Sycophila dharwarensis* (Joseph & Abdurahiman) in scutellum sub equal to pronotum; scape not reaching level of vertex, but differs strongly by the following characters, F1 length longer than pedicel (in *S. dharwarensis* F1 length equal to pedicel); T1 longest (in *S. dharwarensis* T4 longest).

Sycophila neodharwarensis sp. nov. resembles to *Sycophila rosae* sp. nov. in scutellum length sub equal to pronotum; MV subequal to STV, but strongly differs by the following characters, F1 longer than pedicel (in *S. rosae* sp. nov. F1 shorter than pedicel); T1 longest (in *S. rosae* sp. nov. T3 longest); T3 subequal to T4 (in *S. rosae* sp. nov. T3 not equal to T4).

12.7. *Sycophila peterseni* Narendran

(Plate. 42. Fig. 1-7)

Sycophila peterseni Narendran, 1994: 163: female. India, Kerala, Calicut University Campus. (ZSIK, examined).

Diagnosis: Modified from Narendran, 1994.

Female: Length 1.86- 2.05mm. Black; lower half of frons, gena, shoulders, propleura and mesopleura, legs, antennae and ventral side of gaster golden yellow; head with distinct close umbilicate punctures, interstices narrow and rugulose; clypeal margin bilobed; scrobe deep, not reaching front ocellus, margins ecarinate; malar groove weakly distinct; maximum diameter of eye in

profile 2.7x malar space; POL 5x OOL; dorsal maximum width of head 3.25x its minimum median length; anterior width of head 1.47x distance between front ocellus and clypeal margin; scape not at all reaching front ocellus; F1 shorter than pedicel; thorax with umbilicate, shallow, dense close punctures; interstices carinate, rugulose; median length of pronotum subequal to median length of mesoscutum; scutellum length subequal to that of pronotum; scutellum a little wider than its length; propodeum with a median fovea, sides of fovea distinctly punctuate; fore wing 2.4x its maximum width; MV equal to STV; fore femur a little swollen; gastral petiole length subequal to that of hind coxa; gaster not compressed from sides; length of gaster including petiole a little longer than thorax; T4 longest; T6 almost concealed by T5.

Distribution: India (Kerala).

Host: Unknown.

Male: Unknown.

Materials examined: One female: INDIA: Kerala, Malappuram, C.U. Campus, 05.iii.2013, Col. K. Nikhil, Reg. No. E.IR. 142. One female: INDIA: Kerala, Malappuram, Vazhikkadavu, 14.xi.2014, Col. K. Nikhil, Reg. No. E.IR. 143.

Remarks: *Sycophila peterseni* Narendran resembles to *Sycophila chaliyarensis* Narendran in scape not reaching level of vertex; T4 longest, but differs strongly by the following characters, MV equal to STV (in *S. chaliyarensis* MV longer than STV); scutellum subequal to pronotum (in *S. chaliyarensis* scutellum shorter than pronotum).

12.8. *Sycophila rosae* sp. nov.

(Plate. 43. Fig. 1-7)

Female: Length 1.85 mm. Body golden yellow in colour except the following, apex of petiole with a black patch; all coxa, trochanter, femur and tibia yellow; tarsi pale yellow; eyes grey; tarsus pale yellow; wings hyaline, veins pale yellow, MV with brownish spot; body hairs silvery.

Head: (Plate. 43. Fig. 2-4) Width 1.4x (52:36) its height in front view; lower face with sparse shallow piliferous punctures, upper face smooth reticulate; pre orbital carina and post orbital carina absent; scrobe margin carinate, scrobe smooth and shining; mandible bidentate; eyes bare; toruli situated 0.3x (12:36) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 34:11:4; dorsally width 1.9x (53:28) its maximum height; POL 2.8x (14:5) OOL; POL 2.3x (14:6) AOL; OOL equal to (5:5) OD; laterally eye height 1.3x (25:20) its maximum width and 2.3x malar space; post genal carina not distinct; malar sulcus present; antennal formula 11153; scape length 4.2x (21:5) its width, not reaching level of vertex; pedicel length 1.8x (7:4) its width; ring segment length 0.3x (1:3) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1= 6:4; F2= 5:5; F3= 5:5, F4= 5:5 and F5= 5:5; clava length 2x (14:7) its width.

Mesosoma: (Plate. 43. Fig. 7) length 1.5x (71:48) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; pronotum maximum length 0.7x (28:41) width and median length 0.6x (23:41) its maximum width, collar weakly carinate; mesoscutum median length 0.5x (22:48) its maximum width, notuali complete and distinct; scutellum carinate basally, median length 0.9x (21:24)

its maximum width; propodeum with four carina from apex to base, each carina joined in base and apex by two cross carina, whole area except callus without hairs, median length 0.35x (17:48) its maximum width, spiracle separated from metanotum 0.5x its diameter; relative length and width of hind leg, coxa = 26:16, trochanter = 4:7; femur = 36:13, tibia = 40:7, tarsals 1 to 5 = 10:9:4:5:3; fore wing length 2.4x (131:56) its maximum width; relative length of SMV= 60, MV= 12, PMV= 4, STV= 13, CC= 60; stigma width 1.6x its height.

Metasoma: (Plate. 43. Fig. 6) Smooth and shining, lateral part of tergites minutely reticulate, length subequal to (94:92) head plus mesosoma combined (in profile) and 3.5x (91:26) to its maximum width dorsally; petiolate, length equal to its width; relative median length and maximum width of tergites are T1= 8:18, T2= 7:23, T3= 28:26, T4= 27:24, T5= 4:8, T6= 4:4, T7= 4:3, ovipositor sheath length 6.

Host: Unknown.

Male: Unknown.

Materials examined: Holotype: Female: INDIA: Kerala, Kollam, Rosemala, 25.xi.2011, Col. Bijoy, Reg. No. E.IR. 145.

Paratype: Four female: INDIA: Kerala, Kollam, Rosemala, 25.xi.2011, Col. Bijoy, Reg. No. E.IR. 146.

Other Materials examined: Two female: INDIA: Kerala, Idukki, Chinnar, 13.viii.2013, Col. P. M. Sureshan, Reg. No. E.IR. 147. Two female: INDIA: Kerala, Thiruvananthapuram, Peppara, 12.viii.2012, Col. Bijoy, Reg. No. E.IR. 148. INDIA: Kerala, Idukki, Marayoor, 12.viii.2013, Col. P. M. Sureshan, Reg. No. E.IR. 149.

Etymology: The species derives its name from an arbitrary combination of letters ‘rosae’ which does not have a specific meaning.

Remarks: *Sycophila rosae* sp. nov. resembles to *Sycophila kokila* Narendran in F1 shorter than pedicel;scutellum length subequal to pronotum, but strongly differs by the following characters, MV subequal to STV (in *S. kokila* MV longer than STV); T3 sub equal to T4 (in *S. kokila* T3 not equal to T4); T3 not equal to T4 (in *S. neodharwarensis* sp. nov. T3 subequal to T4).

Sycophila rosae sp. nov. resembles to *Sycophila wayanadensis* sp. nov. in F1 shorter than pedicel; MV subequal to STV, but strongly differs by the following characters, scutellum length longer than pronotum (in *S. wayanadensis* sp. nov. scutellum length subequal to pronotum); POL 2.3x OOL (in *S. wayanadensis* sp. nov. POL 3.5x OOL).

12.9. *Sycophila wayanadensis* sp. nov.

(Plate. 44. Fig. 1-7)

Female: Length 1.88 mm. Body black in colour except the following, gaster and coxa coffee brown, base and apices of mid and hind femora, apex of fore femur, base and apices of all tibia, clypeus and scape golden yellow; mid and hind femur except base and apices, fore femur except apex, all tibia except base and apices, funicles and clava brown; tarsi pale yellow; eyes grey; tarsus pale yellow; wings hyaline, veins pale yellow, MV with brownish spot; body hairs silvery.

Head: (Plate. 44. Fig. 2-4) Width 1.6x (47:30) its height in front view; face with piliferous punctures interstices carinate; pre orbital carina and post orbital carina absent; scrobe margin carinate, scrobe smooth; mandible tridentate; clypeus tridentate; malar space with smooth reticulations; eyes

bare; toruli situated below the level of eye and 0.1x (4:30) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes, between eyes and toruli and between toruli are 33:13:4; dorsally width 1.7x (48:29) its maximum height; POL 3.5x (14:4) OOL; POL 2x (14:7) AOL; OOL equal to (4:4) OD; laterally eye height 1.3x (24:19) its maximum width and 2x malar space; post genal carina not distinct; malar sulcus present; antennal formula 11153; scape length 4x (20:5) its width, not reaching level of vertex; pedicel length 1.8x (7:4) its width; ring segment length 0.3x (1:3) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1= 5:5; F2= 4:5; F3= 5:6, F4= 5:6 and F5= 6:6; clava length 2.1x (15:7) its width.

Mesosoma: (Plate. 44. Fig. 7) length 1.6x (81:51) its maximum width (including tegula); pronotum, mesoscutum and scutellum with numerous piliferous pits, interstices carinate; pronotum maximum length 0.7x (30:41) width and median length 0.6x (23:41) its maximum width, collar weakly carinate; mesoscutum median length 0.4x (22:51) its maximum width, notuali present but not distinct; scutellum weakly carinate basally, basal part extending as neck like projection towards petiole, median length subequal to (28:29) its maximum width; propodeum convex with several irregular cross carina, surface smooth, whole area except callus without hairs, median length 0.4x (16:37) its maximum width, spiracle separated from metanotum 0.5x its diameter; relative length and width of hind leg, coxa = 26:11, trochanter = 4:5; femur = 33:11, tibia = 38:6, tarsals 1 to 5 = 12:5:5:5:4; fore wing length 2.1x (151:71) its maximum width; relative length of SMV= 67, MV= 17, PMV= 6, STV= 15, CC= 66; stigma width 2.4x its height.

Metasoma: (Plate. 44. Fig. 6) Smooth and shining, lateral part of tergites minutely reticulate, length 0.8x (83:107) head plus mesosoma combined (in profile) and 2.7x (83:31) to its maximum width dorsally; petiolate, length 2.3x

its width; relative median length and maximum width of tergites are T1= 17:19, T2= 12:29, T3= 20:31, T4= 18:26, T5= 5:7, T6= 4:6, T7= 4:5, ovipositor sheath length 6.

Host: Unknown.

Male: Unknown.

Materials examined: Holotype: Female: INDIA: Kerala, Wayanad, Sulthan Bathery, Manichira, 03.iv.2012, Col. Nikhil, Reg. No. E.IR. 150.

Etymology: The species derives its name from the district of the type locality, Wayanad (Kerala).

Remarks: *Sycophila wayanadensis* sp. nov. resembles to *Sycophila rosae* sp. nov. in F1 shorter than pedicel; MV subequal to STV, but strongly differs by the following characters, scutellum length subequal to pronotum (in *S. rosae* sp. nov. scutellum length longer than pronotum); POL 3.5x OOL (in *S. rosae* sp. nov. POL 2.3x OOL).

Sycophila wayanadensis sp. nov. resembles to *Sycophila kokila* Narendran in F1 shorter than pedicel; T3 longest, but strongly differs by the following characters, T3 subequal to T4 (in *S. kokila* T3 not equal to T4); MV subequal to STV (in *S. kokila* MV longer than STV); POL 3.5x OOL (in *S. kokila* POL 2.1x OOL).

13. Genus: *Systole* Walker

Systole Walker, 1832: 13, 22. Type species: S*ystole albipennis* Walker, by monotypy.
Pseudosystole Kalina, 1969: 181. Type species: *Pseudosystole hofferi* Kalina, by monotypy [Synonimised by Lotfalizadeh *et al,* 2007]

Diagnosis: This genus comes very close to *Bruchophagus* but differs from that genus in having, genotemporal margin not at all carinate but rounded; dorsal surface of thorax with sculpturing less pronounced than those of *Bruchophagus*; F1 in female usually elongate, slightly subconical with its surface nearly bare.

Distribution: Bulgaria, Canary Islands, France, India, Italy, Morocco, Senegal, Spain, West Africa.

Remarks: Many species have been reared from plant galls and seeds.

Host: Primary hosts: *Lixus* sp. (Curculionidae: Coleoptera)., *Celama* sp., *Eublemma* sp. (Noctuidae: Lepidoptera).

Plant host: *Coriandrum* sp. (Apiaceae).

Parasitoid host: *Chelonus* sp. (Braconidae: Hymenoptera).

Key to species of *Systole* Walker of Kerala

(Modified from Narendran, 1994)

1. Pronotum with yellow spot on lateral side; T1, T2 and T3 subequal in length; scape 5.7x its width..... *Systole calycopterae* Narendran

- Pronotum without yellow spot on lateral side; T1, T2 and T3 different in length; scape less than 3.5x its width 2

2. T1 longest; SMV 5.2x MV; pronotum width 3x its median length..... .....*Systole albipennis* Walker

- T4 longest; SMV 2.7x MV; pronotum width 2x its median length …… .....*Systole mohanae* sp. nov.

Species descriptions

13.1. *Systole albipennis* Walker

(Plate. 45. Fig. 1-7)

Systole albipennis Walker, 1832: 22. female, Lectotype. (BMNH).
Eurytoma nitida Walker, 1832: 25. Synonym of *Systole albipennis* Walker. Dalla Torre, K.W. von, 1898: 330.
Eurytoma brevicornis Boheman, 1836: 245. Synonym of *Systole albipennis* Walker. Dalla Torre, K.W. von, 1898: 330.

Diagnosis: Modified from Narendran, 1994.

Length 1.8 - 2.2 mm. Black; pronotum without yellow spots, tibiae blackish in colour; wings hyaline; head width about 1.55x length between front ocellus and anterior margin of clypeus; antennal scape about 2.5x length of pedicel; frons almost non-pubescent; sculpture on head and thorax finely alveolate; pronotum approximately 3x wider than long; posterior margin straight; propodeum rugose and reticulate; PMV slightly shorter than STV; gaster ovate, T2 to T4 subequal in length in dorsal aspect; ovipositor hardly protrudes.

Distribution: India **(Kerala,** Delhi, Gujarat, Haryana**)**, Bulgaria, Canada, Caucasus, Chili, Croatia, Czech Republic, Czechoslovakia, Europe, France, Germany, Hungary, Iran, Italy, Moldova, Montenegro, Netherlands, Romania, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, Russia.

Host: Plant associates: *Anethum* sp., *Bupleurum* sp., *Carum* sp., *Conium* sp., *Coriandrum* sp., *Cuminum* sp., *Daucus* sp., *Ferula* sp., *Foeniculum* sp., *Pastinaca* sp., *Petroselinum* sp., *Pimpinella* sp., *Torilis* sp. (Apiaceae).

Male: Length 1.6-2.2mm. Similar to female except following: antennal formula 11143; plumose, gaster petiolate.

Materials examined: One female: INDIA: Kerala, Kottayam, Manimala, 25.xi.2012, Col. Minu, Reg. No. E.IR. 154. One female: INDIA: Kerala, Thrissur, Peechi, 22.x.2013, Col. K. Nikhil, Reg. No. E.IR. 155. One female: INDIA: Kerala, Palakkad, Dhoni, 24.ii.2013, Col. K. Nikhil, Reg. No. E.IR. 156.

Remarks: *Systole albipennis* Walker shows resemblance to *Systole mohanae* sp. nov.. in pronotum without any yellow spot on lateral side of pronotum; T1, T2 and T3 different in length, but strongly differs by the following characters, T1 longest (in *S. mohanae* sp. nov.. T4 longest); SMV 5.2x MV (in *S. mohanae* sp. nov.. SMV 2.7x MV).

13.2. *Systole calycopterae* Narendran

(Plate. 46. Fig. 1-7)

Systole calycopterae Narendran, 1994: 120. female. India, Kerala, Calicut University Campus (ZSIK, examined).

Redescription:

Female: Length 1.51 mm. Body black in colour except the following, ventral side of gaster, mid and hind coxa light brown; pronotum with yellow sport on dorsolareral part; all femor, tibia and tarus, scape, pedicel, funicle and clava pale yellow; eyes grey; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 46. Fig. 2-4) Width 1.4x (46:34) its height in front view; reticulae; without any radiating carina on face; scrobe weakly carinate; preorbital carina absent; inter antennal projection hook like; malar area with a strip of microsculpture; post orbital carina absent; temple reticulate; mandible bidentate; eyes bare; toruli situated 0.5x (16:34) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 33:13:4; dorsally width 2x (46:23) its maximum height; POL 2.2x (13:6) OOL; POL 2.6x (13:5) AOL; OOL 1.5x (6:4) OD; laterally eye height 1.2x (22:18) its maximum width and 3.1x malar space; post genal carina not defined; malar sulcus present; antennal formula 11153; scape length 5.7x (17:3) its width, reaching level of vertex; pedicel length 2x (6:3) its width; ring segment length 0.3x (1:3) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1= 6:5; F2= 5:5; F3= 6:5, F4= 5:5 and F5= 5:5; clava length 2.5x (15:6) its width.

Mesosoma: (Plate. 46. Fig. 7) length 1.4x (57:40) its maximum width (including tegula); pronotum reticulate, mesoscutum anteriorly reticulate and numerous pits posteriorly, scutellum with numerous pits; pronotum maximum length 0.7x (24:35) width and median length 0.6x (21:35) its maximum width, collar ecarinate; mesoscutum median length 0.45x (18:40) its maximum width, notuali complete; scutellum median length equal to (23:23) its maximum width; propodeum surface minutely punctured, with a weak median carina, without hairs, median length 0.4x (12:30) its maximum width, spiracle separated from metanotum by its own diameter; relative length and width of hind leg, coxa = 16:9, trochanter = 4:4, femur = 31:9, tibia = 34:5, tarsals 1 to 5 = 9:6:6:3:3; fore wing length 2.13x (100:47) its maximum width; relative length of SMV= 44, MV= 9, PMV= 8, STV= 10, CC= 19.

Metasoma: (Plate. 46. Fig. 6) Smooth and shining, T1 anteriorly with a projection, length 0.83x (69:83) head plus mesosoma combined (in profile) and 2.4x (68:28) to its maximum width dorsally; sessile; relative median length and maximum width of tergites are T1= 10:18, T2= 11:26, T3= 11:28, T4= 24:26, T5= 3:11, ovipositor sheath dorsal length 7.

Distribution: India (Kerala).

Host: Plant associates: *Calycopteris* sp. (Combretaceae).

Male: Length 1- 1.6mm. Similar to female except in the following, antennal funicle four segmented, plumose; gaster petiolate, petiole subequal in length to hind coxa.

Materials examined: One female: INDIA, Kerala, Idukki, Mannavan Shola, 07.iv.2012, Col. Rajmohana, Reg. No. E.IR. 157. One female: INDIA: Kerala, Ernakulam, Kalady, 04.iv.2013, Col. K. Nikhil, Reg. No. E.IR. 158. One female: INDIA: Kerala, Thrissur, Peechi, 22.x.2013, Col. K. Nikhil, Reg. No. E.IR. 159. One female: INDIA: Kerala, Kozhikode, Sarovaram, 12.ii.2015, Col. K. Nikhil, Reg. No. E.IR. 160. One female: INDIA: Kerala, Malappuram, Calicut University Campus, 05.iii.2013, Col. K. Nikhil, Reg. No. E.IR. 161. One female: INDIA: Kerala, Kasargode, Central University campus, 23.viii.2013, Col. Abhilash, Reg. No. E.IR. 162. One female: INDIA: Kerala, Idukki, Chinnar, 13.viii.2013, Col. P. M. Sureshan, Reg. No. E.IR. 163. One female: INDIA: Kerala, Kannur, Muzhuppilangad, 15.xii.2015, Col. K. Nikhil, Reg. No. E.IR. 164. One female: INDIA: Kerala, Kottayam, Kidangoor, 10.xi.2012, Col. K. Nikhil, Reg. No. E.IR. 165. Two female: INDIA: Kerala, Kannur, Aralam WLS, 22.iv.2012, Col. K. Nikhil, Reg. No. E.IR. 166. One female: INDIA: Kerala, Kannur, Panniyoor, 11.x.2012, Col. Minu, Reg. No. E.IR. 167. One female: INDIA: Kerala, Idukki, Chinnar, 04.iv.2012, Col. Rajmohana, Reg. No. E.IR. 168. Four

female: INDIA: Kerala, Malappuram, Nilambur, Chaliyamukku, 17.xi.2005, Col. M. Shibu, Reg. No. E.IR. 169.

Remarks: *Systole calycopterae* Narendran shows resemblance to *Systole mohanae* sp. nov.. in proportions of length and width of head in profile; proportions of length and width of mesosoma, but strongly differs by the following characters, pronotum with yellow spot on lateral side of pronotum (in *S. mohanae* sp. nov.. pronotum without any yellow spot on lateral side of pronotum); T1, T2 and T3 sub equal in length (in *S. mohanae* sp. nov.. T1, T2 and T3 different in length).

13.3. *Systole mohanae* sp. nov.

(Plate. 47. Fig. 1-7)

Female: Length 1.6 mm. Body black in colour except the following, base and apices of all femora and tibia, all femora and tibia except base and apices and coxa blackish brown; ovipositor sheath brownish yellow; scape, pedicel, funicles and clava brown; tarsi pale yellow; eyes grey; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 47. Fig. 2-4) Width 1.5x (45:31) its height in front view; reticulae; face convex, with several radiating weak rugae which extends up to upper part of scrobe and lower part of eye, scrobe weakly carinate; preorbital carina absent; inter antennal projection hook like; malar area smooth with microsculpture; post orbital carina absent; temple reticulate; mandible bidentate; eyes bare; toruli situated 0.5x (14:31) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 35:12:5; dorsally width 1.7x (46:27) its maximum height;

POL 2.8x (14:5) OOL; POL 2.3x (14:6) AOL; OOL 1.3x (5:4) OD; laterally eye height 1.2x (21:18) its maximum width and 2.1x malar space; post genal carina not defined; malar sulcus present; antennal formula 11153; scape length 3.4x (17:5) its width, exceeding level of vertex; pedicel length 1.8x (7:4) its width; ring segment length 0.3x (1:3) its width; funicle and clava with setae; relative measurements of length and width of F1 to F5 are F1= 6:5; F2= 6:5; F3= 6:5, F4= 5:5 and F5= 6:5; clava length 2.5x (16:6) its width.

Mesosoma: (Plate. 47. Fig. 7) length 1.4x (61:44) its maximum width (including tegula); pronotum reticulate, mesoscutum anteriorly reticulate and numerous pits posteriorly, scutellum with numerous pits; pronotum without any marking on lateral sides, maximum length 0.6x (22:35) width and median length 0.5x (18:35) its maximum width, collar ecarinate; mesoscutum median length 0.5x (22:44) its maximum width, notuali present but not distinct; scutellum median length 0.8x (18:23) its maximum width; propodeum surface with several cross carina forms different shaped cells, irregularly setose, basal part extending as neck towards petiole, median length 0.6x (18:32) its maximum width, spiracle separated from metanotum by its own diameter; relative length and width of hind leg, coxa = 18:9, trochanter = 5:4, femur = 38:10, tibia = 38:5, tarsals 1 to 5 = 8:6:5:4:3; fore wing length 1.8x (144:78) its maximum width; relative length of SMV= 51, MV= 19, PMV= 16, STV= 15, CC= 48.

Metasoma: (Plate. 47. Fig. 6) Smooth and shining, T1 without any projection, length 0.8x (72:87) head plus mesosoma combined (in profile) and 2.8x (73:26) to its maximum width dorsally; petiolate, petiole length 2.5x its width; relative median length and maximum width of tergites are T1= 12:15, T2= 9:21, T3= 10:26, T4= 28:25 ovipositor sheath dorsal length 10.

Host: Unknown.

Male: Unknown.

Materials examined: Holotype: Female: INDIA, Kerala, Idukki, Mannavan Shola, 07.iv.2012, Col. Rajmohana, Reg. No. E.IR. 151.

Paratype: One female: INDIA, Kerala, Idukki, Mannavan Shola, 07.iv.2012, Col. Rajmohana, Reg. No. E.IR. 152.

Other Materials examined: One female: INDIA, Kerala, Kazargod, Pamdi, 09.xi.2013, Col. P. M. Sureshan, Reg. No. E.IR. 153.

Etymology: The species derives its name after Dr. Rajmohana, who has collected the specimen.

Remarks: *Systole mohanae* sp. nov. shows resemblance to *Systole calycopterae* Narendran in proportions of length and width of head in profile; proportions of length and width of mesosoma, but strongly differs by the following characters, pronotum without any yellow spot on lateral side of pronotum (in *S. calycopterae* pronotum with yellow spot on lateral side of pronotum); T1, T2 and T3 different in length (in *S. calycopterae* T1, T2 and T3 sub equal in length).

Systole mohanae sp. nov. shows resemblance to *Systole albipennis* Walker in pronotum without any yellow spot on lateral side of pronotum; T1, T2 and T3 different in length, but strongly differs by the following characters, T4 longest (in *S. albipennis* T1 longest); SMV 2.7x MV (in *S. albipennis* SMV 5.2x MV).

14. Genus *Tetramesa* Walker

Isosoma Walker, 1832: 13-14. Type species *Eurytoma longula* Dalman; designated by Westwood, 1839. Preoccupied by *Isosoma* Billberg, 1820.

Tetramesa Walker, 1848: 104, 154. Type species *Tetramesa iarbas* Walker; by monotypy.

Harmolita Motschulsky, 1863: 58. Type species *Harmolita longicornis* Motschulsky; by monotypy [Synonymised by Claridge 1961]

Philachyra Walker, 1871: 7. Type species *Philachyra ips* Walker, by monotypy [Synonymised by Peck 1963]

Xanthosoma Ashmead, 1888: 42. Type species: *Xanthosoma nigricornis* Ashmead, by subsequent monotypy [Synonymised by Peck 1963]

Isosomorpha Ashmead, 1888: 42. Type species *Xanthosoma nigricornis* Ashmead, by subsequent monotypy [Synonymised by Peck 1963]

Isosomocharis Ashmead, 1888 : 42. Type species *Isosomocharis sulcata* Ashmead, by subsequent monotypy [Synonymised by Peck 1963]

Urios Girault, 1911: 175. Type species *Urios vestali Girault,* by monotypy [Synonymised by Peck 1963]

Xanthosomodes Brèthes, 1913 : 107. Type species *Xanthosomodes albiangulatus* Brèthes, by monotypy [Synonymised by Gates, M.W. 2014]

Exanthosoma Girault, 1915 : 265. Type species *Exanthosoma funeralis* Girault, by monotypy [Synonymised by Boucek, Z. 1988]

Isthmosoma Hedicke, 1921: 165. [Replacement name for *Isosoma* Walker, 1832 nec Billberg, 1820] [Synonymised by Peck 1963]

Gahaniola Erdös, 1952: 117. Type species *Harmolita phyllostachitis* Gahan, original designation [Synonymised by Zerova, M.D. 1976]

Diagnosis: Body slender, long, with gaster sessile in female with at least 1.6 times as long as broad; thorax long; pronotum usually slightly expanding forward; notaular grooves deep in anterior halves; antennal funicles with 5-6 segments; ring segment in some case elongate; propodeum slopping posteriorly; marginal vein always distinctly longer than stigmal vein; flagellum with sparse linear sensilla.

Distribution

Members of this genus are distributed throughout the World, a major portion occurs in the temperate zones of Northern Hemisphere.

Host: Primary host: *Orseolia* sp. (Family: Cecidomyiidae, Order: Diptera).

Plant hosts: *Agropyron* sp., *Agrostis* sp., *Muhlenbergia* sp., *Phragmites* sp. (Family: Poaceae).

Parasitoid host: *Notanisus* sp. (Family: Pteromalidae, Order: Hymenoptera).

Parasitoids: *Calosota* sp. and *Eupelmus* sp. (Family: Eupelmidae)., *Sycophila* sp., *Sycophila* sp., *Eurytoma* sp., *Eurytoma* sp. and *Sycophila* sp. (Family: Eurytomidae)., *Thrybius* sp. (Family: Ichneumonidae)., *Homoporus* sp., *Homoporus* sp., *Homoporus* sp., *Homoporus* sp., *Merisus* sp., *Notanisus* sp. and *Notanisus* sp. (Family: Pteromalidae)., *Eridontomerus* sp., *Eridontomerus* sp., *Pseudotorymus* sp. and *Torymus* sp. (Family: Torymidae). All these members are from Order Hymenoptera.

Associates: *Leperesinus* sp. and *Leperesinus* sp. (Family: Scolytidae, Order: Coleoptera)., *Aprostocetus* sp. and *Aprostocetus* sp. (Family: Eulophidae, Order: Hymenoptera).

Key to Species of *Tetramesa* Walker of Kerala

(Modified from Nikhil and Sureshan, 2015)

1. Antennal funicle five segmented..... 2

- Antennal funicle six segmented ..... *Tetramesa gibsoni* Narendran

2. Pronotum maximum length (including collum) distinctly longer than mesoscutum.... 3

- Pronotum maximum length shorter than or equal to (rarely sub equal to) median length of mesoscutum…..... ..8

3. Propodeum without median fovea; T4 longer than or sub equal to T3..... 4

- Propodeum with median fovea; T4 always longer than T3…..... 6

4. T4 longer than T3; MV 1.65x PMV; head width in anterior aspect 1.75x distance between anterior ocellus and lower margin of clypeus .... *Tetramesa distincta* Narendran

- T4 sub equal to T3; MV less than 1.3x PMV; anterior width of head l.3x to 1.5x distance between anterior ocellus and lower margin of clypeus 5

5. General colour of head and body brownish yellow; POL 1.45x OOL; STV sub equal to PMV; pronotum without distinct yellow spots at shoulders..... ..... *Tetramesa peethavarna* Narendran

- General colour of head and body black; POL 1.2x OOL; STV 0.6x longer than PMV; pronotum with distinct yellow spots at shoulders …….....*Tetramesa neyyarensis* sp.nov.

6. POL 1.3x OOL; F1 longer than pedicel; MV 1.6x PMV; gaster 1.3x as long as head plus mesosoma combined;..... ....*Tetramesa narendrani* Sureshan

- POL greater than 2x OOL; F1 equal to or shorter than pedicel; MV more than 1.9x PMV; gaster length sub equal to head plus mesosoma combined …….....7

7. STV sub equal to PMV; scape not reaching level of vertex; POL 2.4x OOL; forewing 2.9x its width; SMV 4.4x STV; F1 to F3 equal in length..…… .....*Tetramesa palakkadensis* sp. nov.

- STV 0.6x PMV; scape reaching level of vertex; POL 2x OOL; fore wing 2.1x its width; SMV 8.2x STV; F2 to F5 equal in length…..... .... *Tetramesa calicutensis* Sureshan

8. MV 2.1x PMV; POL 1.6x OOL; pronotum median length equal to mesoscutum… .....*Tetramesa zerovae* Narendran

- MV 2.5x PMV; POL 1.36x OOL; pronotum median length shorter than mesoscutum ..... *Tetramesa vadana* Narendran

14.1. *Tetramesa calicutensis* Sureshan

Tetramesa calicutensis Sureshan, 2005: 137-139. female. India, Kerala, Kozhikode, Kolavipalam. (ZSIK, examined).

Diagnosis: Female: Length 2.6 mm. General body colour black; pronotum with a broad yellowish white patch on antero lateral corners; head uniformly and finely reticulate, meshes very small, with long white hairs; gena almost shiny, malar grooves weakly indicated; clypeal area slightly raised, anterior margin angularly produced; head in dorsal view 1.6x as wide as long; POL 2x OOL; in front view head width 1.2x height; eye length 1.23x width in profile; malar space 0.46x eye length; antennae inserted above lower margin of eyes; scape hardly reaching median ocellus, length 0.7x eye length; pedicel plus flagellum length as long as head width; antennal formula 11153; pedicel as long as F1 and as wide as F5; F2-F5 equal in length, shorter than F1; funicular segments longer than wide, except F5 almost subquadrate, club as long as 3 preceding segments combined; thorax 2.3x as long as wide, pronotum almost as long as wide, collar ecarinate, finely reticulate; mesoscutum medially shorter than pronotum and 1.6x as wide as long, scutellum similarly reticuate as on mesoscutum and pronotum, medially

little longer than mesoscutum; propodeum uniformly reticulate punctate, meshes small, medially 0.7x as long as scutellum, medially with a shallow fovea, basal part with few short carinulae separated by deep foveae, only upper part of callus covered with white hairs; prepectus finely reticulate; mesopleuron with mesepistemum moderately reticulate, mesepimeron transversely striated; metapleuron similarly reticulate as on propodeum. Forewing length 2.1x width, basal part with less pubescence, speculum open below, PMV short, stigma slightly enlarged; relative lengths of SMV = 33, MV = 12, PMV = 6, STV = 4; gaster sessile, long and ovate, as long as head plus thorax combined, dorsally collapsing; T1 dorsally as long as T2 and T3 combined; T4 little longer than T3; T5 1.2x longer than T4.

Distribution: India - Kerala.

Host: Unknown.

Material examined: Holotype only.

14.2. *Tetramesa distincta* Narendran

(Plate. 48. Fig. 1-7)

Tetramesa distincta Narendran, 1994: 148, 150-151. female. India, Kerala, Calicut University Campus. (ZSIK, examined).

Diagnosis: Female: Length 2.8-3.1mm. General body colour black; pronotum with a blackish yellow spot on anterolateral part on each side. Head faintly but clearly reticulate, not distinctly punctate, moderately pubescent; scrobe with margins ecarinate, reaching front ocellus. POL l.46x OOL; head width 1.75x distance between front ocellus and anterior margin of clypeus; antennal formula 11153; scape reaching front ocellus; malar groove distinct; malar area

distinctly striate; posterior margin of gena ecarinate; thoracic notum reticulate, without distinct puntures, moderately pubescent, median length of pronotum including collum a little longer than median length of mesoscutum; median length of scutellum a little shorter than median length of mesoscutum: propodeum surface distinctly punctate and reticulate, without a median groove; MV 1.65x PMV; STV a little shorter than PMV. Gaster sessile faintly rugulose.

Distribution: India - Kerala.

Host: Unknown.

Materials examined: Holotype and one paratype.

Other Materials Examined: One female: INDIA: Kerala, Kozhikode, Kakkayam, Orakkuzhi, 22.x.2012, Col. K. Nikhil, Reg. No. E.IR. 176.

14.3. *Tetramesa gibsoni* Narendran

(Plate. 49. Fig. 1-7)

Tetramesa gibsoni Narendran, 1994: 148, 149. female. India, Tamil Nadu, Kodaikanal Hills. (CNC).

Diagnosis: Female: Length 7.1mm. General body colour black; pronotal collar bears a yellow marking on anteriolateral corners; wing pubescence light brown; body covered with long silvery hairs. Head with sparse, shallow, umbilicate punctures; interstices broad, flat and microsculptured; dorsal width 1.9x is height; anterior width 1.14x its height; lateral width 1.67x its height; frons convex and slightly bulging; lower face with numerous striations radiating from lateral margins of clypeus; median strip on lower face extend from toruli to half way between toruli and anterior margin of clypeus; anterior

margin of clypeus medially pointed; inner surface of scrobe reticulated, margins ecarinate; toruli situated well above half distance between front ocellus and anterior clypeal margin; eye length 1.5x its width in profile; POL 1.1x OOL; a short carina runs from corner of mouth to one-third length of malar space; gena posteriorly ecarinate. Antennal formula 11162(with flagellum not distinctly demarcated into funicle and club). Thorax densely and umbilicately punctured on dorsum, interstices narrow, carinate and shagreened on pronotum, middle lobe of mesoscutum and scutellum; on scapula interstices broad, flat and shagreened dorsally; relative measurements of dorsal length of thorax: width: pronotum ecarinate anteriorly; pronotum median length (including collum) subequal to median length of middle lobe of mesoscutum; scutellum a little shorter than mesoscutum; mesopleuron with epicnemial area slightly sloping; notauli complete, deeply grooved, these grooves obstructed by cross carinae; scutellum broadly convex dorsally, laminated posteriorly, lamina bears cross carinae on its dorsal surface; mesepimeron and mesepisternum horizontally striated; propodeum convex medially with a fovea; propodeal surface (except median fovea) covered with long hairs. Forewing length 3x its width; MV 1.6x PMV; STV 1.1x PMV; MV broad. Gaster sessile, longer than head and thorax combined, gradually pointed towards apex.

Distribution: India - Tamil Nadu, **Kerala (Present record)**.

Host: Unknown.

Material examined: One female: INDIA: Kerala, Idukki, Manalar, 17.iv.2013, Col. Rajmohana, Reg. No. E.IR. 180.

14.4. *Tetramesa narendrani* Sureshan

(Plate. 50. Fig. 1-8)

Tetramesa narendrani Sureshan, 2004: 504-506. female. India, Kerala, Parambikulam. (ZSIK, examined).

Diagnosis: Female: Length 3.7-4 mm. General body colour black; pronotum with a pale brownish yellow spot on anterior corner of the collar on either side; head distinctly and minutely reticulate with long white pubescence, denser on lower face; in dorsal view head width 1.8x length and in front view width 1.2x height; genae ecarinate, with longitudinal striae; malar groove distinct; eye length l.2x width (in profile); malar space length 0.7x eye length; POL 1.3x OOL. Antennal formula 11153, slender with scape hardly reaching vertex level; F1 longer than pedicel; pedicel plus flagellum length 1.3x head width; mesosoma uniformly with broad meshed reticulation, area inside of which minutely reticulate, pubescence long and white; pronotum width 1.3x median length, medially little longer than mesoscutum, collar ecarinate; scutellum medially longer than mesoscutum; propodeum medially with a fovea, uniformly reticulate punctate with meshes broad, interior of which minutely reticulate, whole surface except median fovea with long white hairs; forewing length 3.1x width, speculum closed below, basal cell hairy, marginal fringe long; relative lengths of SMV = 39, MV = 12.5, PMV = 8, STV = 7.5; gaster sessile, long and ovate, 1.3x as long as head plus mesosoma combined, T4 distinctly longer than T3.

Distribution: India - Kerala.

Host: Unknown.

Materials examined: Holotype.

Other Materials Examined: One female: INDIA: Kerala, Wayanad, Muthanga, Maragad, 17.x.2011, Co. P. M. Sureshan, Reg. No. E.IR. 178. One female: INDIA: Kerala, Wayanad, Banasura Hills, 12.v.2005, Co. Rajmohana, Reg. No. E.IR. 179.

14.5. *Tetramesa neyyarensis* Nikhil & Sureshan

(Plate. 51. Fig. 1-7)

Tetramesa neyyarensis Nikhil & Sureshan, 2015: 379-380. female. India, Kerala, Neyyar, Puralimala. (ZSIK, examined).

Holotype: Female: Length 3.43 mm. Body slender, elongate and blackish in colour except the following, eyes silvery; clypeus, scape, apices of mid and hind femur, more than half of apical fore femur, fore, mid and hind tibia, tarsals, ovipositor sheath pale yellow; Pronotal collar bears yellow marking on lateral side; pedicel and funicles brownish; mandible brownish; clypeal area (up to malarsulcus) yellowish brown; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 51. Fig. 2-4) Width 1.33x (69:52) its height in lateral view; face rugose (fig. 2), clypeal margin with radiating rugae, malar space faintly rugose, eyes bare, funicles and clava with long hairs; toruli situated 0.37x (19:52) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 51:19:5; mandible bidentate; dorsally width 1.92x (71:37) its maximum height; POL 1.23x (16:13) OOL; POL 2.67x (16:6) AOL; OOL 2.6x (13:5) OD; laterally eye height 1.33x (28:21) its maximum width; gena slightly curved and posteriorly ecarinate; malar sulcus distinct, 0.71x (20:28) eye height laterally; antennal formula

11153; scape length 4.4x (22:5) its width, not reaching level of vertex; pedicel length 1.67x (10:6) its width; ring segment length 0.5x (2:4) its width; funicles and clava has long silvery hairs; relative measurements of length and width of F1 to F5 are F1= 11:4; F2= 9:5; F3= 8:6, F4 and F5= 7:7; clava length 2.36x (19:8) its width.

Mesosoma: (Plate. 51. Fig. 5) length 1.94x (136:70) its maximum width; pronotal collar finely reticulate punctate and remaining rugose, mesonotum and scutellum distinctly rugose (fig. 6); pronotum maximum length 0.79x (49:62) width and median length 1.72x (62:36) its maximum width, collar ecarinate; mesocutem length 0.6x (42:70) its maximum width, notauli complete and distinct; scutellum convex, length 1.24x (42:34) its maximum width; propodeum reticulate without median fovea, two lateral carina starting from spiracle and extending up to tip of propodeum, whole area except callus without hairs, median length 0.66x (36:54) its maximum width, spiracle separated from metanotum by its own diameter; relative length and width of hind leg, coxa = 34:18, trochanter = 11:10, femur = 62:16, tibia = 71:10, tarsals 1 to 5 = 23:6:6:7:13; fore wing length 2.64x (235:89) its maximum width; relative length of SMV= 96, MV= 31, PMV= 27, STV= 16, CC= 92.

Metasoma: (Plate. 51. Fig. 7) Sessile; smooth and shining; length 1.1x (180:167) head plus mesosoma combined (in profile) and 2.9x to its maximum width dorsally; relative median length and maximum width of tergites are T1= 43:54, T2= 8:56, T3= 17:54, T4= 20:52, T5= 22:48, T6= 22:38, T7= 17:19, ovipositor sheath length 18.

Type Locality: India (Kerala).

Host: Unknown.

Male: Unknown.

Materials examined: Holotype: Female: INDIA: Kerala, Thiruvananthapuram, Neyyar, Puralimala, 11.x.2012 Col. P. M. Sureshan, Reg. No. E.IR. 170.

Paratype: One female: INDIA: Kerala, Thiruvananthapuram, Neyyar, Puralimala, 11.x.2012 Col. P. M. Sureshan, Reg. No. E.IR. 171. One female: INDIA: Kerala, Kazargod, Pamdi, 09.xi.2013 Col. P. M. Sureshan, Reg. No. E.IR. 172.

Etymology: the species derives its name from the type locality, Neyyar, Thiruvananthapuram (Kerala).

Remarks: This species shows similarity to *Tetramesa narendrani* Sureshan in Head length and width in front and dorsal aspects, propotions of malar space and eye length in profile but differs strongly by these characters, pedicel plus flagellum length equal to head width (in *Tetramesa narendrani* pedicel plus flagellum length 1.3x head width), pronotum median length 1.72x its maximum width (in *Tetramesa narendrani* width 1.3x its median length), mesoscutum medially equal to scutellum (in *Tetramesa narendrani* Scutellum medially longer than mesoscutum), propodeum without a fovea (in *Tetramesa narendrani* propodeum with a fovea).

The new species also show resemblance to *Tetramesa calicutensis* Sureshan in length and width measurements in anterior and profile view, pronotum 1.6x times as wide as long, fore wing length 2.7x its width but differs strongly by these characters, Malar groove distinct (in *Tetramesa calicutensis* malar groove weekly indicated), POL 1.23x OOL (in *Tetramesa calicutensis* POL 2x OOL), F2-F5 different in length (in *Tetramesa calicutensis* F2-F5 equal in length), Propodeum without a fovea (in *Tetramesa calicutensis* propodeum with a shallow fovea), dorsally T1 length greater than T2 plus T3 length (in *Tetramesa calicutensis* T1 dorsally as long as T2 Plus T3 length).

The species also show resemblance to *Tetramesa peethavarna* Narendran in length and width measurements of head in anterior and profile view, MV longer than PMV, proportions of malar sulcus and eye height but differs strongly by these characters, general body colour black (in *Tetramesa peethavarna* body colour brownish yellow), pronotum with distinct yellow spot laterally (in *Tetramesa peethavarna* yellow spot absent or not distinguishable with body colour), T4 longer than T3 (in *Tetramesa peethavarna* T3 and T4 sub equal in length).

14.6. *Tetramesa palakkadensis* Nikhil & Sureshan

(Plate. 52. Fig. 1-7)

Tetramesa palakkadensis Nikhil & Sureshan, 2015: 380-381. female. India, Kerala, Palakkad, Silent Valley National Park, Parathodu. (ZSIK, examined).

Holotype: Female: Length 2.65 mm. Body slender, elongate and brownish black in colour except the following, eyes pinkish red; apices of femur, base and apices of mid and hind tibia, ventral part of fore tibia, tarsals, ovipositor sheath pale yellow; Pronotal collar bears yellow marking on lateral side; antennae brownish; wings hyaline, veins pale yellow; body hairs silvery.

Head: (Plate. 52. Fig. 2-4) Width 1.38x (54:39) its height in lateral view; face rugose with silvery hairs (fig. 10), gena and temple faintly rugose, eyes bare, funicles and clava with long brown hairs; toruli situated 0.4x (16:39) of maximum height between anterior ocellus and clypeal margin; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 39:13:2; mandible tridentate; dorsally width 1.6x (56:35) its maximum height; POL 2.4x (17:7) OOL; POL 2.1x (17:8) AOL; OOL 1.4x (7:5) OD; laterally eye height 1.24x (26:21) its maximum

width; gena slightly curved and posteriorly ecarinate; malar sulcus faintly present; malar sulcus 0.46x (12:26) eye height laterally; antennal formula 11153; scape length 2.83x (17:6) its width, not reaching level of vertex; pedicel length 1.5x (9:6) its width; ring segment length 0.66x its width; funicles and clava has long brown hairs; relative measurements of length and width of F1 to F5 are F1 to F3 7:5, F4 7:6, F5 6:6; clava length 3.1x (19:6) its width.

Mesosoma: (Plate. 52. Fig. 5) faintly rugose; length 2.23x (105:47) its maximum width; pronotum maximum length 1.25x (40:32) its maximum width and median length 0.53x (21:40) its maximum width, collar ecarinate; mesocutem convex, length 0.66x (31:47) its maximum width, notauli complete (fig. 14); scutellum convex, length 1.32x (29:22) its maximum width; propodeum reticulate punctate with median fovea, whole area except callus without hairs, median length 0.63x (22:35) its maximum width, spiracle separated from metanotum by 1.5x its diameter; relative length and width of hind leg, coxa = 22:13, trochanter = 7:8, femur = 39:13, tibia = 50:6, tarsals 1 to 5 = 18:7:7:5:7; fore wing length 2.9x its maximum width; relative length of SMV = 71, MV = 28, PMV = 15, STV = 16, CC = 68.

Metasoma: (Plate. 52. Fig. 7) Sessile; faintly rugose; length sub equal to head plus mesosoma combined (in profile) and 3.33x (130:39) to its maximum width (in dorsal); relative maximum length and maximum width of tergites are T1 = 33:36, T2 = 12:39, T3 = 16:41, T4 = 21:39, T5 = 20:34, T6 = 14:21, T7 = 6:9, ovipositor sheath length 9.

Type Locality: India (Kerala).

Host: Unknown.

Male: Unknown.

Material examined: Holotype: Female: INDIA: Kerala, Palakkad, Silent Valley National Park, Parathodu, 15.i.2013 Col. Nikhil. K, Reg. No. E.IR. 173.

Etymology: the species derives its name from the district of type locality, Palakkad (Kerala).

Remarks: This species shows similarity to *Tetramesa ventricosa* (Motschulsky) in POL OOL ratio, malar groove distinct, STV distinctly shorter than MV but differs strongly by these characters, scape not reaching level of vertex (in *Tetramesa ventricosa* scape reaching level of vertex), malar sulcus in profile 0.46x eye height (in *Tetramesa ventricosa* height of eye a little more than half length of malar groove in profile), head dorsally width 1.63x its maximum height (in *Tetramesa ventricosa* head dorsal width a trifle over 2.8 its median length).

This new species also shows resemblance to *Tetramesa zerovae* Narendran in general body colour, proportions of length and width of head front view, malar groove distinct but differs strongly by these characters, POL 2.4x OOL (in *Tetramesa zerovae* POL 1.6x OOL), scape not reaching level of vertex (in *Tetramesa zerovae* scape reaching level of vertex), median length of pronotum 0.68x mesoscutum (in *Tetramesa zerovae* median length of pronotum equal to mesoscutum, Propodeum with median fovea (in *Tetramesa zerovae* propodeum without median fovea).

This new species also show resemblance to *Tetramesa calicutensis* Sureshan in proportions of length and width of head front view and dorsal view, proportions between malar space and eye length in profile but differs strongly by these characters, fore wing width 2.9x its width (in *Tetramesa calicutensis* fore wing width 2.1x its width), scape not reaching level of vertex (in *Tetramesa calicutensis* scape reaching level of vertex), POL 2.4x OOL (in *Tetramesa calicutensis* POL 2x OOL), T5 and T4 sub equal in length (in *Tetramesa calicutensis* T5 1.2x longer than T4).

14.7. *Tetramesa peethavarna* Narendran

(Plate. 53. Fig. 1-7)

Tetramesa peethavarna Narendran, 1994: 148, 151-152. female. India, Uttar Pradesh, Aligarh. (ZSIK, examined).

Diagnosis: Female: Length 2.5–2.9 mm. Brownish yellow; flagellum brownish black wings hyaline; veins pale brown. Head with shallow faint pits; scrobe margins ecarinate, its upper margin indistinct; POL 1.45x OOL. Head width in front view 1.45x length between front ocellus and anterior margin of clypeus. Malar groove indistinct, posterior margin of gena ecarinate; length of malar groove 0.64x length of eye in profile. Antenna with scape slightly exceeding vertex; funicle five segmented; club three segmented. Thorax with pronotum large, a little longer than mesoscutum; scutellum a little shorter than median length of mesoscutum; thoracic notum not distinctly punctate, faintly rugulose; propodeum surface with distinct punctures, without a median groove; prepectus triangular; MV longer than PMV; STV subequal to PMV. Gaster sessile, smooth with sparse pubescence on T6 and on epipygium; T3 and T4 subequal in length.

Distribution: India – Uttar Pradesh, **Kerala (Present record)**.

Host: Unknown.

Materials examined: Holotype and one paratype.

Other Materials Examined: One female: INDIA: Kerala, Pathanamthitta, Gavi, 10.v.2013, Col. P. M. Sureshan, Reg. No. E.IR. 181. One female: INDIA: Kerala, Malappuram, Kadalundi, 12.viii.2013, Col. K. Nikhil, Reg. No. E.IR. 182. One female: INDIA: Kerala, Kozhikode, Sarovaram, 05.vii.2013, Col. K. Nikhil, Reg. No. E.IR. 183.

14.8. *Tetramesa vadana* Narendran

(Plate. 54. Fig. 1-7)

Tetramesa vadana Narendran, 1994: 148, 153. female. India, Kerala, Ernakulam. (ZSIK, examined).

Diagnosis: Female: Length 2.9-3.1mm. General body colour black; pronotum with a pale blackish yellow patch on shoulders. Eyes and ocelli pale blackish brown; frons with pale brownish yellow patches on either side of clypeal region. Head with rugose sculptures, without distinct pits; width of head in anterior aspect 1.25x distance between front ocellus and anterior margin of clypeus. POL 1.36x OOL; scrobe margins ecarinate; front ocellus outside scrobe; face with a median smooth area below interantennal projection; malar groove distinct, posterior part of malar groove with distinct striations; genotemporal margin ecarinate; antennal formula 11153; scape reaching front ocellus but not distinctly exceeding level of vertex; thoracic dorsum not distinctly punctate, rugose; median length of pronotum shorter than that of mesoscutum; scutellum shorter than mesoscutum; propodeum without distinct pits, reticulate on sides, reticulation sparse on median part, without a distinct groove; MV 2.5x PMV; STV a little shorter than PMV; gaster sessile; ovipositor sheath exerted.

Distribution: India – Kerala; Nepal; Taiwan.

Host: Unknown.

Materials examined: Holotype.

Other Materials Examined: One female: INDIA: Kerala, Malappuram, Calicut University campus, 07.ii.2013, Col. K. Nikhil, Reg. No. E.IR. 177.

14.9. *Tetramesa zerovae* Narendran

(Plate. 55. Fig. 1-7)

Tetramesa zerovae Narendran, 1994: 152-153. female. India, Uttar Pradesh, Aligarh. (ZSIK, examined).

Diagnosis: Female: Length 2.5-3.7mm. Head and body in general liver brown or brownish black in colour; pronotum with a yellow patch at shoulders; wings pale brownish yellow. Head without distinct punctures, rugose, moderately pubescent on frons; width 1.27x distance between front ocellus and anterior margin of clypeus; scrobe smooth, margins ecarinate, reaching front ocellus. POL 1.6x OOL. Malar groove faint but distinct; posterior region to malar groove faintly rugos; posterior margin of gena ecarinate. Antenna with scape reaching front ocellus, not exceeding vertex, funicle five segmented, club 3 segmented. Thoracic dorsum rugulose, not punctate; median length of pronotum equal to median length of mesoscutum; median length of scutellum equal to median length of mesoscutum. Propodeum slanting with full of distinct uniform microsculptures, without distinct large pits or rugae; propodeum without median fovea, MV 2.1 x PMV, STV shorter than MV. Gaster sessile, distinctly longer than thorax.

Distribution: India - Kerala, Uttar Pradesh and West Bengal.

Host: Unknown.

Materials examined: Holotype and one paratype.

Other Materials Examined: One female: INDIA: Kerala, Kannur, Aralam, 12.ix.2012, Col. K. Nikhil, Reg. No. E.IR. 174. One female: INDIA: Kerala, Thrissur, Peechi, 24.vii. 2012, Col. K. Nikhi, Reg. No. E.IR. 175.

CHAPTER 5

CHECK LIST OF EURYTOMIDAE OF KERALA

***Aximopsis* Ashmead, 1904**

[=*Aximogastroma* Narendran, 1994

= *Conoaxima* Brues, 1922

= *Eurytomaria* Masi, 1943

= *Mesoeurytoma* Cameron, 1911

= *Stireurytoma* Cameron, 1911]

1. *caudata* (Narendran & Padmasenan, 1991) (*Mesoeurytoma*) — India (Kerala)
2. *nigriscaposa* (Narendran & Padmasenan, 1991) (*Mesoeurytoma*) — India (Kerala)
3. *raoi* (Narendran & Padmasenan, 1991) (*Mesoeurytoma*) — India (Kerala)
4. *sapana* (Narendran, 1994) (*Mesoeurytoma*) — India (Kerala)

***Bruchophagus* Ashmead, 1888**

[= *Ahtola* Claridge, 1961

= *Birolajosia* Erdös, 1955

= *Biro-lajosia* Erdös, 1955

= *Eurysystole* Girault, 1913

= *Eurytoma* (*Ahtola*) Claridge, 1961

= *Eurytoma* (*Bruchophagus*) Ashmead, 1888

= *Nikanoria* Nikol'skaya, 1955

= *Phylloxeroxenoides* Girault, 1913

= *Systolodes* Ashmead, 1888]

1. *apoorvus* Narendran, 1994	India (Kerala)
2. *grassius* Narendran, 1994	India (Kerala, Tamil Nadu)
3. *grewiae* Narendran, 1994	India (Kerala)
4. *lyubai* Narendran, 1994	India (Kerala)
5. *mandelai* Narendran, 1994	India (Kerala, Tamil Nadu)
6. *manii* Narendran, 1994	India (Kerala, Tamil Nadu, Andhra Pradesh)
7. *noyesi* Narendran, 1994	India (Kerala)
8. *peethavarnus* Narendran, 1994	India (Kerala)
9. *prathiaegus* Narendran, 1994	India (Kerala)
10. *rexus* Narendran, 1994	India (Kerala)
11. *shonagatrus* Narendran, 1994	India (Kerala)
12. *shonanethrus* Narendran, 1994	India (Kerala)
13. *tagorei* Narendran, 1994	India (Kerala, Tamil Nadu, Uttar Pradesh)

***Eurytoma* Illiger, 1807**

[=*Bephratella* Girault, 1913

= *Decatoma* Spinola, 1811

= *Entedon* (*Ennetoma*) Dahlbom, 1857

= *Eurytoma* (*Dieurytoma*) Erdös, 1957

= *Eurytoma* (*Hydateurytoma*) Erdös, 1957

= *Eurytoma* (*Moneurytoma*) Erdös, 1957

= *Eurytomidia* Masi, 1917

= *Ipideurytoma* Boucek & Novicky, 1954]

1. *albotibialis* Ashmead, 1905 [= *pallidiscapus* Cameron, 1913]	India (**Kerala**, Karnataka, Bihar, Uttar Pradesh), Indonesia, Malaysia, Papua New Guinea, Philippines, Sri Lanka.
2. *agalica* Narendran, 1994	India (Kerala, Tamil Nadu)
3. *amaranthusa* Narendran, 1994	India (Kerala)
4. *anupama* Narendran, 1994	India (Kerala)
5. *apara* Narendran, 1994	India (Kerala, Andhra Pradesh)
6. *breviscaposa* Narendran, 1994	India (Kerala)
7. *camposa* Narendran, 1994	India (Kerala)
8. *caudata* Narendran, 1994	India (Kerala)
9. *chaitra* Narendran, 1994	India (Kerala, Karnataka)
10. *Chinnarensis* Narendran & Sureshan, 2013.	India (Kerala)
11. *chrysothrix* Waterston, 1924	India (Kerala)
12. *emarginata* Narendran, 1994	India (Kerala)
13. *gastra* Narendran, 1994	India (Kerala, Uttar Pradesh, Goa)
14. *indiana* Özdikmen, 2011 [*apantelesi* Narendran, 1994]	India (Kerala, Assam, Bihar, Gujarat, Karnataka, Maharashtra, Tamil Nadu), China.
15. *kasaragodensis* Mukerjee, 1981	India (Kerala)
16. *keralensis* Özdikmen, 2011 [*scaposa* Narendran, 1994]	India (Kerala), Bulgaria.
17. *kulamensis* Narendran, 1994	India (Kerala)
18. *manilensis* Ashmead, 1904	India (Kerala), China, Philippines.

19. *melanagromyzae* Narendran, 1994	India (Kerala, Karnataka, Tamil Nadu, Uttar Pradesh)
20. *nalanda* Narendran, 1994	India (Kerala), Nepal.
21. *peethapada* Narendran, 1994	India (Kerala, Tamil Nadu)
22. *pentaspina* Narendran, 1994	India (Kerala)
23. *pigra* Burks, 1958	India (**Kerala**, Delhi, Tamil Nadu)
24. *poroensis* Mukerjee, 1981	India (Kerala, Karnataka, Tamil Nadu, West Bengal)
25. *punctifronta* Narendran, 1994	India (Kerala, Andhra Pradesh)
26. *punctigastra* Narendran, 1994	India (Kerala)
27. *quadrispina* Narendran, 1994	India (Kerala, Karnataka)
28. *rajeevi* Narendran, 1994	India (Kerala, Karnataka, Uttar Pradesh), Thailand.
29. *ranjithi* Narendran, 1994	India (Kerala)
30. *raoi* Narendran, 1994	India (Kerala)
31. *risa* Narendran, 1994	India (Kerala)
32. *setitibia* Gahan, 1919	India (**Kerala**, Andhra Pradesh, Bihar, Tamil Nadu, West Bengal), Indonesia.
33. *sheelae* Narendran, 1994	India (Kerala, Andhra Pradesh)
34. *shyamagatra* Narendran, 1994	India (Kerala)
35. *similis* Narendran, 1994	India (Kerala)
36. *udara* Narendran, 1994	India (Kerala)

***Eurytomocharis* Ashmead, 1888**

1. *keralensis* Mukerjee, 1981 India (Kerala)

***Fronsoma* Narendran, 1994**

[= *Neoeurytomaria* Narendran, 1994]

1. *subbaraoi* (Narendran, 1994) India (Kerala), Malaysia, Nepal.

   (*Neoeurytomaria*)

***Neobephrata* Narendran & Padmasenan, 1989**

1. *petiolata* Narendran & Padmasenan, 1989 India (Kerala, Tamil Nadu)
2. *aiswaryae* sp. nov. India (Kerala)
3. *neopetiolata* sp. nov. India (Kerala)
4. *idukkiensis* sp. nov. India (Kerala)
5. *keralensis* sp. nov. India (Kerala)

***Philolema* Cameron, 1908**

[=*Acantheurytoma* Cameron, 1911

= *Desantisca* Burks, 1971

= *Odonteurytoma* Mukerjee, 1981

= *Subbaella* Narendran, 1994]

1. *albitarsis* (Motschulsky, 1863)

   [=*Acantheurytoma*] **India (Kerala)**, Sri Lanka.
2. *braconidis* (Ferrière), 1929

   [=*Eurytoma*] India (Kerala, Karnataka, Tamil Nadu), Benin, Cameroon, Chad, Congo, Kenya, Malawi, Niger, North Africa, Philippines, South Africa, Sudan, Tanzania, Togo, Uganda.

3. *campoletisa* Narendran, 1994	India (Kerala, Andhra Pradesh, Karnataka, Madhya Pradesh, West Bengal)
4. *fronta* Narendran, 1994	India (Kerala, Karnataka)
5. *lankana* (Narendran, 1994) [*Desantisca*]	**India (Kerala)**, Sri Lanka.
6. *maleena* Narendran, 1994	India (Kerala, Karnataka, Tamil Nadu, West Bengal)
7. *palanichamyi* (Narendran, 1984) (*Desantisca* *Eurytoma*)	India (**Kerala**, Tamil Nadu)
8. *spinifera* (Cameron, 1911) [=*Acantheurytoma* = *Odonteurytoma*]	India (Kerala, Karnataka, Tamil Nadu), Indonesia, Malaysia, China.
9. *narendrani* sp. nov.	India (Kerala)
10. *neomaleena* sp. nov.	India (Kerala)
11. *kozhikodensis* sp. nov.	India (Kerala)

***Plutarchia* Girault, 1925**

1. *fronta* Narendran, 1994	India (Kerala)
2. *gastris* Narendran, 1994	India (Kerala)
3. *keralensis* Narendran & Padmasenan, 1990	India (Kerala)
4. *malabarica* Narendran & Padmasenan, 1990	India (Kerala)
5. *marginata* Narendran & Padmasenan, 1990	India (Kerala)

***Prodecatoma* Ashmead, 1904**

1. *cheriani* Narendran, 1994 — India (Kerala), Taiwan.
2. *confusa* Narendran, 1994 — India (Kerala)
3. *globosa* Narendran, 1994 — India (Kerala)
4. *josephi* Narendran, 1994 — India (Kerala, Andhra Pradesh), Sri Lanka.
5. *modesta* Narendran, 1994 — India (Kerala), Malaysia.
6. *nilamburensis* Mukerjee, 1981 — India (Kerala)
7. *sureshani* sp. nov. — India (Kerala)
8. *idukkiensis* sp. nov. — India (Kerala)
9. *neoglobosa* sp. nov. — India (Kerala)
10. *bijoyi* sp. nov. — India (Kerala)
11. *ponmudiensis* sp. nov. — India (Kerala)
12. *chinnarensis* sp. nov. — India (Kerala)
13. *neojosephi* sp. nov. — India (Kerala)

***Ramdasoma* Narendran, 1994**

1. *peethodaris* Narendran, 1994 — India (Kerala)
2. *simplexus* Narendran, 1994 — India (Kerala), China.
3. *zandanus* Narendran, 1994 — India (Kerala)

***Risbecoma* Subba Rao, 1978**

1. *mohandasi* Narendran, 1994 — India (Kerala)

***Sycophila* Walker, 1871**

[=*Decatomidea* Ashmead, 1888

= *Eudecatoma* Ashmead, 1888

= *Isanisa* Walker, 1875

= *Pseudisa* Walker, 1875

= *Tineomyza* Rondani, 1872]

1. *chaliyarensis* Narendran, 1994	India (Kerala)
2. *dharwarensis* (Joseph and Abdurahiman, 1968) (*Decatoma* *Eurytoma*)	India (**Kerala,** Karnataka)
3. *floribundae* Narendran, 1994	India (Kerala)
4. *kokila* Narendran, 1994	India (Kerala)
5. *mukerjeei* Narendran, 1994 (*Decatoma)* [= *karnatakensis* Mukerjee, 1981]	India (Kerala, Karnataka)
6. *peterseni* Narendran, 1984	India (Kerala)
7. *neodharwarensis* sp. nov.	India (Kerala)
8. *rosae* sp. nov.	India (Kerala)
9. *wayanadensis* sp. nov.	India (Kerala)

***Systole* Walker, 1832**

[=*Pseudosystole* Kalina, 1969

= *Systole* (*Trichosystole*) Zerova, 1978 (a)]

1. *albipennis* Walker, 1832 (*Eurytoma*) [=*brevicornis* Boheman, 1836 = *nitida* Walker, 1832]	India **(Kerala,** Delhi, Gujarat, Haryana**)**, Bulgaria, Canada, Caucasus, Chili, Croatia, Czech Republic, Czechoslovakia, Europe, France, Germany, Hungary, Iran, Italy, Moldova, Montenegro, Netherlands, Romania, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, Russia.
2. *calycopterae* Narendran, 1994	India (Kerala)
3. *mohanae* sp. nov.	India (Kerala)

***Tetramesa* Walker, 1848**

[=*Exanthosoma* Girault, 1915

= *Gahaniola* Erdös, 1952

= *Harmolita* Motschulsky, 1863

= *Harmolyta* Dalla Torre, 1898

= *Isosoma* Walker, 1832

= *Isosomocharis* Ashmead, 1888

= *Isosomorpha* Ashmead, 1888

= *Isthmosoma* Hedicke, 1921

= *Philachyra* Walker, 1871

= *Urios* Girault, 1911

= *Xanthosoma* Ashmead, 1888

= *Xanthosomodes* Brèthes, 1913]

1. *calicutensis* Sureshan, 2005	India (Kerala)
2. *distincta* Narendran, 1994	India (Kerala)
3. *gibsoni* Narendran, 1994	India (**Kerala**, Tamil Nadu)
4. *narendrani* Sureshan, 2004	India (Kerala)
5. *neyyarensis* sp.nov	India (Kerala)
6. palakkadensis sp. nov.	India (Kerala)
7. *peethavarna* Narendran, 1994	India (**Kerala**, Uttar Pradesh)
8. *vadana* Narendran, 1994	India (Kerala), Nepal, Taiwan.
9. *zerovae* Narendran, 1994	India (Kerala, Uttar Pradesh, West Bengal)

CHAPTER 6

HOST PARASITE INDEX

Species	Host
Aximopsis caudata (Narendran & Padmasenan)	Nil
Aximopsis nigriscaposa (Narendran & Padmasenan)	Nil
Aximopsis raoi (Narendran & Padmasenan)	Nil
Aximopsis sapana (Narendran)	Nil
Bruchophagus apoorvus Narendran	Nil
Bruchophagus grassius Narendran	Nil
Bruchophagus grewiae Narendran	Plant Associate: TILIACEAE: MALVALES *Grewia tilaefolia*
Bruchophagus lyubai Narendran	Nil
Bruchophagus mandelai Narendran	Nil
Bruchophagus manii Narendran	Nil
Bruchophagus noyesi Narendran	Nil
Bruchophagus peethavarnus Narendran	Nil
Bruchophagus prathiaegus Narendran	Nil
Bruchophagus rexus Narendran	Plant Associate:

	MORACEAE: ROSALES *Ficus benghalensis*
Bruchophagus shonagatrus Narendran	Nil
Bruchophagus shonanethrus Narendran	Nil
Bruchophagus tagorei Narendran	Nil
Eurytoma agalica Narendran	Nil
Eurytoma albotibialis Ashmead	Primary host: KERRIIDAE: HEMIPTERA *Laccifer lacca* ICHNEUMONIDAE: HYMENOPTERA *Angitia* sp. BLASTOBASIDAE: LEPIDOPTERA *Holcocera pulverea* NOCTUIDAE: LEPIDOPTERA *Eublemma amabilis* OECOPHORIDAE: LEPIDOPTERA *Nephantis serinopa* *Opisina arenosella* PYRALIDAE: LEPIDOPTERA *Corcyra cephalonica* ZYGAENIDAE: LEPIDOPTERA *Artona* sp. *Artona catoxantha*

	Parasitoid hosts: BETHYLIDAE: HYMENOPTERA *Perisierola nephantidis* BRACONIDAE: HYMENOPTERA *Apanteles* sp. *Apanteles artonae* *Apanteles tachardiae* *Microbracon greeni* *Microbracon hebetor* CHALCIDIDAE: HYMENOPTERA *Brachymeria tachardiae* TACHINIDAE: DIPTERA *Stomatomyia bezziana* Plant associates: ARECACEAE: ARECALES *Borassus flabellifer* *Cocos nucifera* STERCULIACEAE: MALVALES *Theobroma cacao*
Eurytoma amaranthusa Narendran	Nil
Eurytoma anupama Narendran	Nil
Eurytoma apara Narendran	Nil
Eurytoma breviscaposa Narendran	Nil

Eurytoma camposa Narendran	Nil
Eurytoma caudata Narendran	Nil
Eurytoma chaitra Narendran	Plat Associate: SOLANACEAE: SOLANALES *Capsicum annuum*
Eurytoma chinnarensis Narendran & Sureshan	Associates: CERAMBYCIDAE: COLEOPTERA *Clytocera chinospila*
Eurytoma chrysothrix Waterston	Nil
Eurytoma emarginata Narendran	Nil
Eurytoma gastra Narendran	Nil
Eurytoma indiana Özdikmen	Primary hosts: HESPERIIDAE: LEPIDOPTERA *Parnara mathias* NOCTUIDAE: LEPIDOPTERA *Trichoplusia ni* NYMPHALIDAE: LEPIDOPTERA *Orsotriaena medus* PIERIDAE: LEPIDOPTERA *Pieris brassicae* Parasitoid hosts: BRACONIDAE: HYMENOPTERA *Apanteles* sp.

	Apanteles plutellae *Miscogaster* sp. Plant associates: POACEAE: POALES *Oryza sativa*
Eurytoma kasaragodensis Mukerjee	Nil
Eurytoma keralensis Özdikmen	Nil
Eurytoma kulamensis Narendran	Nil
Eurytoma manilensis Ashmead	Primary hosts: HESPERIIDAE: LEPIDOPTERA *Borbo cinnara* *Pelopidas mathias* Plant associates: POACEAE: POALES *Setaria barbata*
Eurytoma melanagromyzae Narendran	Primary hosts: AGROMYZIDAE: DIPTERA *Melanagromyza hibisci* *Melanagromyza obtuse* *Melanagromyza sojae* Plant associates: FABACEAE: FABALES *Glycine max* *Phaseolus mungo*

Eurytoma nalanda Narendran	Nil
Eurytoma peethapada Narendran	Nil
Eurytoma pentaspina Narendran	Nil
Eurytoma pigra Burks	Primary hosts: CURCULIONIDAE: COLEOPTERA *Alcidodes bubo* *Microlarinus* sp. Plant associates: ZYGOPHYLLACEAE: ZYGOPHYLLALES *Tribulus* sp. *Tribulus terrestris*
Eurytoma poroensis Mukerjee	Nil
Eurytoma punctifronta Narendran	Nil
Eurytoma punctigastra Narendran	Nil
Eurytoma quadrispina Narendran	Nil
Eurytoma rajeevi Narendran	Parasitoid hosts: BRACONIDAE: HYMENOPTERA *Apanteles* sp. *Microgaster* sp. *Stenobracon nicevillei*
Eurytoma ranjithi Narendran	Nil
Eurytoma raoi Narendran	Nil

Eurytoma risa Narendran	Nil
Eurytoma setitibia Gahan	Primary hosts: CECIDOMYIIDAE: DIPTERA *Orseolia oryzae* TRIOZIDAE: HEMIPTERA *Trioza fletcheri* Plant associates: BORAGINACEAE: BORAGINALES *Cordia myxa* EUPHORBIACEAE: MALPIGHIALES *Trewia nudiflora* POACEAE: POALES *Oryza sativa*
Eurytoma sheelae Narendran	Nil
Eurytoma shyamagatra Narendran	Nil
Eurytoma similis Narendran	Nil
Eurytoma udara Narendran	Nil
Eurytomocharis keralensis Mukerjee	Primary hosts: AGROMYZIDAE: DIPTERA *Melanagromyza hibisci* MALVACEAE: MALVALES *Hibiscus esculentus*
Fronsoma subbaraoi (Narendran)	Nil

Neobephrata aiswaryae sp. nov.	Nil
Neobephrata idukkiensis sp. nov.	Nil
Neobephrata keralensis sp. nov.	Nil
Neobephrata neopetiolata sp. nov.	Nil
Neobephrata petiolata Narendran & Padmasenan	Nil
Philolema albitarsis (Motschulsky)	Nil
Philolema braconidis (Ferrière)	Primary hosts: NOCTUIDAE: LEPIDOPTERA *Busseola fusca* *Diparopsis castanea* *Sesamia cretica* OECOPHORIDAE: LEPIDOPTERA *Opisina arenosella* PYRALIDAE: LEPIDOPTERA *Chilo ignefusalis* *Chilo orichalcociliellus* *Chilo partellus* *Diaphania indica* *Haritalodes derogata* *Sylepta derogata* Parasitoid host: BRACONIDAE: HYMENOPTERA

	Aleiodes sp. *Apanteles sagax* *Apanteles syleptae* *Apanteles taragamae* *Bracon brevicornis* *Bracon hancocki* *Bracon sesamiae* *Microbracon hancocki* Plant associates: ARECACEAE: ARECALES *Borassus flabellifer* POACEAE: POALES *Oryza sativa* *Zea mays*
Philolema campoletisa Narendran	Primary hosts: NOCTUIDAE: LEPIDOPTERA *Heliothis armigera* Parasitoid host: ICHNEUMONIDAE: HYMENOPTERA *Campoletis chlorideae* *Campoletis perdistinctus*
Philolema fronta Narendran	Primary hosts: APIONIDAE: COLEOPTERA *Apion* sp.

Philolema kozhikodensis sp. nov.	Nil
Philolema lankana (Narendran)	Primary hosts: ARANEIDAE: ARANEAE *Cyrtophora cicatrosa*
Philolema maleena Narendran	Plant associates: POACEAE: POALES *Oryza sativa*
Philolema narendrani sp. nov.	Nil
Philolema neomaleena sp. nov.	Nil
Philolema palanichamyi (Narendran)	Primary hosts: ARANEIDAE: ARANEAE *Cyrtophora cicatrosa*
Philolema spinifera (Cameron)	Primary hosts: VESPIDAE: HYMENOPTERA *Eumeninae* sp. Plant associates: EUPHORBIACEAE: MALPIGHIALES *Ricinus communis*
Plutarchia fronta Narendran	Nil
Plutarchia gastris Narendran	Nil
Plutarchia keralensis Narendran & Padmasenan	Nil
Plutarchia malabarica Narendran & Padmasenan	Nil

Plutarchia marginata Narendran & Padmasenan	Nil
Prodecatoma bijoyi sp. nov.	Nil
Prodecatoma cheriani Narendran	Nil
Prodecatoma chinnarensis sp. nov.	Nil
Prodecatoma confusa Narendran	Nil
Prodecatoma globosa Narendran	Nil
Prodecatoma idukkiensis sp. nov.	Nil
Prodecatoma josephi Narendran	Nil
Prodecatoma modesta Narendran	Nil
Prodecatoma neoglobosa sp. nov.	Nil
Prodecatoma neojosephi sp. nov.	Nil
Prodecatoma nilamburensis Mukerjee	Nil
Prodecatoma ponmudiensis sp. nov.	Nil
Prodecatoma sureshani sp. nov.	Nil
Ramdasoma peethodaris Narendran	Nil
Ramdasoma simplexus Narendran	Nil
Ramdasoma zandanus Narendran	Nil
Risbecoma mohandasi Narendran	Nil
Sycophila chaliyarensis Narendran	Nil
Sycophila dharwarensis (Joseph and Abdurahiman)	Plant associates: MORACEAE: ROSALES

	Ficus benghalensis
Sycophila floribundae Narendran	Plant associates: COMBRETACEAE: MYRTALES *Calycopteris floribunda*
Sycophila kokila Narendran	Nil
Sycophila mukerjeei Narendran	Nil
Sycophila neodharwarensis sp. nov.	Nil
Sycophila peterseni Narendran	Nil
Sycophila rosae sp. nov.	Nil
Sycophila wayanadensis sp. nov.	Nil
Systole albipennis Walker	Plant associates: APIACEAE: APIALES *Anethum graveolens* *Bupleurum fruticosum* *Bupleurum rotundifolium* *Carum carvi* *Conium maculatum* *Coriandrum sativum* *Cuminum cyminum* *Daucus carota* *Ferula orientalis* *Foeniculum vulgare* *Petroselinum sativum* *Pimpinella anisum* *Torilis japonica* *Daucus carota*

	Foeniculum vulgare *Petroselinum crispum*
Systole calycopterae Narendran	Plant associates: COMBRETACEAE: MYRTALES *Calycopteris floribunda*
Systole mohanae sp. nov.	Nil
Tetramesa calicutensis Sureshan	Nil
Tetramesa distincta Narendran	Nil
Tetramesa gibsoni Narendran	Nil
Tetramesa narendrani Sureshan	Nil
Tetramesa neyyarensis Nikhil & Sureshan	Nil
Tetramesa palakkadensis Nikhil & Sureshan	Nil
Tetramesa peethavarna Narendran	Nil
Tetramesa vadana Narendran	Nil
Tetramesa zerovae Narendran	Nil

CHAPTER 7

SUMMARY

This study covers the taxonomic revision of six genera of the family Eurytomidae viz. *Neobephrata* Narendran and Padmasenan, *Philolema* Cameron, *Prodecatoma* Ashmead, *Sycophila* Walker, *Systole* Walker and *Tetramesa* Walker. The diagnosis and key to species of remaining genera of Eurytomidae of Kerala are also provided.

- In the present investigation 20 Species have been described as new to science.
- Two species viz. *Philolema albitarsis* (Motschulsky) and *Philolema lankana* (Narendran) are reported in India for the first time.
- The species like *Philolema palanichamyi* (Narendran), *Sycophila dharwarensis* (Joseph and Abdurahiman), *Systole albipennis* Walker, *Tetramesa gibsoni* Narendran and *Tetramesa peethavarna* Narendran are reported for the first time in Kerala.

The list of species are follows

1.	***Neobephrata petiolata* Narendran & Padmasenan**	Redescription
2.	***Neobephrata aiswaryae* sp. nov.**	New species
3.	***Neobephrata neopetiolata* sp. nov.**	
4.	***Neobephrata idukkiensis* sp. nov.**	
5.	***Neobephrata keralensis* sp. nov.**	

6.	***Philolema albitarsis* (Motschulsky) –** First Repot from India	Redescription
7.	***Philolema braconidis* (Ferrière)**	
8.	***Philolema campoletisa* Narendran**	
9.	***Philolema fronta* Narendran**	
10.	***Philolema lankana* (Narendran)**	
11.	***Philolema maleena* Narendran**	
12.	***Philolema palanichamyi* (Narendran)**	
13.	***Philolema spinifera* (Cameron)**	
14.	***Philolema narendrani* sp. nov.**	New species
15.	***Philolema neomaleena* sp. nov.**	
16.	***Philolema kozhikodensis* sp. nov.**	
17.	***Prodecatoma cheriani* Narendran**	Redescription
18.	***Prodecatoma confusa* Narendran**	
19.	***Prodecatoma globosa* Narendran**	
20.	***Prodecatoma josephi* Narendran**	
21.	***Prodecatoma modesta* Narendran**	
22.	***Prodecatoma nilamburensis* Mukerjee**	Diagnosis
23.	***Prodecatoma sureshani* sp. nov.**	New Species
24.	***Prodecatoma idukkiensis* sp. nov.**	
25.	***Prodecatoma neoglobosa* sp. nov.**	
26.	***Prodecatoma bijoyi* sp. nov.**	
27.	***Prodecatoma ponmudiensis* sp. nov.**	
28.	***Prodecatoma chinnarensis* sp. nov.**	
29.	***Prodecatoma neojosephi* sp. nov.**	
30.	***Sycophila chaliyarensis* Narendran**	Diagnosis
31.	***Sycophila dharwarensis* (Joseph and Abdurahiman)**	

32.	***Sycophila floribundae* Narendran**	Redescription
33.	***Sycophila kokila* Narendran**	
34.	***Sycophila mukerjeei* Narendran**	Diagnosis
35.	***Sycophila peterseni* Narendran**	
36.	***Sycophila neodharwarensis* sp. nov.**	New Species
37.	***Sycophila rosae* sp. nov.**	
38.	***Sycophila wayanadensis* sp. nov.**	
39.	***Systole albipennis* Walker –** First Repot from Kerala	Diagnosis
40.	***Systole calycopterae* Narendran**	Redescription
41.	***Systole mohanae* sp. nov.**	New Species
42.	***Tetramesa calicutensis* Sureshan**	Diagnosis
43.	***Tetramesa distincta* Narendran**	
44.	***Tetramesa gibsoni* Narendran –** First Repot from Kerala	
45.	***Tetramesa narendrani* Sureshan**	
46.	***Tetramesa neyyarensis* Nikhil & Sureshan**	New Species
47.	***Tetramesa palakkadensis* Nikhil & Sureshan**	
48.	***Tetramesa peethavarna* Narendran –** First Repot from Kerala	Diagnosis
49.	***Tetramesa vadana* Narendran**	
50.	***Tetramesa zerovae* Narendran**	
51.	***Aximopsis caudata* (Narendran & Padmasenan)**	Diagnosis to genera
52.	***Aximopsis nigriscaposa* (Narendran & Padmasenan)**	
53.	***Aximopsis raoi* (Narendran & Padmasenan)**	
54.	***Aximopsis sapana* (Narendran)**	
55.	***Bruchophagus apoorvus* Narendran**	
56.	***Bruchophagus grassius* Narendran**	

57.	***Bruchophagus grewiae* Narendran**	Diagnosis to genera
58.	***Bruchophagus lyubai* Narendran**	
59.	***Bruchophagus mandelai* Narendran**	
60.	***Bruchophagus manii* Narendran**	
61.	***Bruchophagus noyesi* Narendran**	
62.	***Bruchophagus peethavarnus* Narendran**	
63.	***Bruchophagus prathiaegus* Narendran**	
64.	***Bruchophagus rexus* Narendran**	
65.	***Bruchophagus shonagatrus* Narendran**	
66.	***Bruchophagus shonanethrus* Narendran**	
67.	***Bruchophagus tagorei* Narendran**	
68.	***Eurytoma albotibialis* Ashmead**	
69.	***Eurytoma agalica* Narendran**	
70.	***Eurytoma amaranthusa* Narendran**	
71.	***Eurytoma anupama* Narendran**	
72.	***Eurytoma apara* Narendran**	
73.	***Eurytoma breviscaposa* Narendran**	
74.	***Eurytoma camposa* Narendran**	
75.	***Eurytoma caudata* Narendran**	
76.	***Eurytoma chaitra* Narendran**	
77.	***Eurytoma chinnarensis* Narendran & Sureshan**	
78.	***Eurytoma chrysothrix* Waterston**	
79.	***Eurytoma emarginata* Narendran**	
80.	***Eurytoma gastra* Narendran**	
81.	***Eurytoma indiana* Özdikmen**	
82.	***Eurytoma kasaragodensis* Mukerjee**	
83.	***Eurytoma keralensis* Özdikmen**	
84.	***Eurytoma kulamensis* Narendran**	
85.	***Eurytoma manilensis* Ashmead**	

86.	***Eurytoma melanagromyzae* Narendran**	Diagnosis to genera
87.	***Eurytoma nalanda* Narendran**	
88.	***Eurytoma peethapada* Narendran**	
89.	***Eurytoma pentaspina* Narendran**	
90.	***Eurytoma pigra* Burks**	
91.	***Eurytoma poroensis* Mukerjee**	
92.	***Eurytoma punctifronta* Narendran**	
93.	***Eurytoma punctigastra* Narendran**	
94.	***Eurytoma quadrispina* Narendran**	
95.	***Eurytoma rajeevi* Narendran**	
96.	***Eurytoma ranjithi* Narendran**	
97.	***Eurytoma raoi* Narendran**	
98.	***Eurytoma risa* Narendran**	
99.	***Eurytoma setitibia* Gahan**	
100.	***Eurytoma sheelae* Narendran**	
101.	***Eurytoma shyamagatra* Narendran**	
102.	***Eurytoma similis* Narendran**	
103.	***Eurytoma udara* Narendran**	
104.	***Eurytomocharis keralensis* Mukerjee**	
105.	***Fronsoma subbaraoi* (Narendran)**	
106.	***Plutarchia fronta* Narendran**	
107.	***Plutarchia gastris* Narendran**	
108.	***Plutarchia keralensis* Narendran & Padmasenan**	
109.	***Plutarchia malabarica* Narendran & Padmasenan**	
110.	***Plutarchia marginata* Narendran & Padmasenan**	
111.	***Ramdasoma peethodaris* Narendran**	
112.	***Ramdasoma simplexus* Narendran**	
113.	***Ramdasoma zandanus* Narendran**	
114.	***Risbecoma mohandasi* Narendran**	

Apart from these the checklist of family Eurytomidae and host parasite index are provided. Maps showing complete generic and species distribution of Kerala are also provided. All the type materials including holotypes are deposited in National Zoological Collections, Zoological Survey of India, Western Ghat Regional Centre, Kozhikode.

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APPENDIX

GEO-COORDINATES OF COLLECTION LOCALITIES

KERALA STATE			
DISTRICTS	**LOCALITIES**	**LATITUDE (˚N)**	**LONGITUDE (˚E)**
Kazargod	C. U. Campus	12.39107	75.09744
	Manjeswaram	12.69982	74.90614
	Chowki	12.54193	75.01279
	Pamdi	12.55966	75.23135
Kannur	Palchuram	11.87799	75.85315
	Kottiyur	11.872500	75.852500
	Kannavam	11.83817	75.66743
	Muzhuppilangad Beach	11.79946	75.44421
	Aralam	11.967600	75.772000
	Panniyoor	12.07893	75.40362
Kozhikode	Kakkayam	11.554500	75.919300
	Feroke	11.17909	75.83526
	Sarovaram	11.26938	75.79239
	Nanminda	11.42491	75.83714
	Kizhur	11.52449	75.63191
	Kallai	11.23302	75.79102
	Chaliyam	11.15773	75.81011
	Nandi	11.47352	75.64681
	Malaparambu	11.29196	75.80819
Wayanad	Sulthan Bathery (Manichira)	11.65491	76.24737
	Thirunelli	11.908100	75.997100
	Muthanga	11.67116	76.36874
	Tholpetty	11.926300	76.106700
	Puzhamudi	11.6117	76.05627
	Pookode	11.54193	76.02601
	Banasura Hills	11.69902	75.92252
	Manathavady	11.80759	76.00792

Malappuram	K. G. Padi	10.90596	75.92162
	Kadalundi	11.13191	75.82799
	Nilambur	11.279400	76.239700
	Calicut University campus	11.138200	75.889300
	Kadalundi	11.13191	75.82799
	Thalappara	11.07329	75.9077
	Vazhikkadavu	11.38495	76.34757
	Kadalundi	11.13191	75.82799
Palakkad	Sairandri	11.094900	76.448900
	Dhoni forest	10.873500	76.621600
	Mukkali	11.05307	76.54009
	Silent Valley NP (Parathodu)	11.09491	76.43631
	Malampuzha	10.83665	76.73276
Thrissur	Vazhani	10.54837	76.58762
	Peechi	10.53369	76.34721
	KFRI	10.52929	76.35238
Ernakulam	Palarivattom	10.00275	76.31165
	Kalady	10.17097	76.43614
Idukki	Mannavan shola (Metap)	10.208300	77.083300
	Cheriyamkunnu (PTR)	9.50433	77.17655
	Pampadum shola	9.984600	77.246200
	Kumuli	9.60818	77.16029
	Vyasapara (Chinnar)	12.642300	78.060200
	Chinnar	9.66125	76.99483
	Thekkady	9.60263	77.16085
	Marayoor	10.27447	77.15704
	Eravikulam	10.136900	77.059400
	Periyar Tiger Resrve	9.54064	77.13158
	Manalar	9.622930	77.346080
	Cheruthoni	9.85502	76.96351
Kottayam	Pala	9.71948	76.68291
	Chirakkavu	9.54135	76.77258
	Irattupetta	9.68673	76.7717
	Kidangoor	9.68779	76.60668
	Manimala	9.49983	76.74554

Alappuzha	Kayamkulam	9.19257	76.51474
	Mavelikkara	9.25362	76.53947
	Harippad	9.28281	76.45282
	Ambalapuzha	9.38409	76.36109
Pathanamthitta	Thiruvalla	9.38673	76.56935
	Konni	9.226700	76.849700
	Chittar	9.3326	76.92165
	Ranni	9.386500	76.785500
	Gavi	9.435800	77.165700
Kollam	Rosemala	8.91389	77.17112
	Pandimotta	8.84752	77.2144
	Idalimotta	8.86934	77.14788
	Thenmala	8.963200	77.065000
Thiruvananthapuram	Peppara	8.61961	77.13893
	Neyyar	8.53088	77.19535
	Sreekaryam	8.54789	76.91227
	Ponmudi	8.759900	77.116800

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Description of two new species of *Tetramesa* walker (Eurytomidae: Chalcidoidea) from Kerala, India with a key to Indian species

K. Nikhil* and P.M. Sureshan

Zoological Survey of India, Western Ghat Regional Centre (The Centre is affiliated to University of Calicut), Kozhikode - 673 006, Kerala, India

ABSTRACT

Two new species of *Tetramesa* Walker, 1848 (Hymenoptera: Chalcidoidea: Eurytomidae) are described *viz*. *Tetramesa neyyarensis* sp. nov. and *Tetramesa palakkadensis* sp. nov. and materials pertaining to two known species from Kerala, India are recorded, the diagnosis of all Indian species are also provided in addition to a revised key to Indian species of *Tetramesa* Walker.

Key words : Hymenoptera, Eurytomidae, *Tetramesa*, new species, Kerala, India.

INTRODUCTION

The genus *Tetramesa* Walker belongs to the family Eurytomidae (Hymenoptera: Chalcidoidea). It is comparatively a large genus in Eurytomidae and currently includes 200 valid species worldwide, with 19 species from Oriental region and 9 from India (Noyes, 2015). During the study of Eurytomid wasps, two interesting species of the genus *Tetramesa* Walker which on closer study were found to be undescribed. This provided an opportunity to update the genus *Tetramesa* Walker occurring in India by providing descriptions of two new species and a key to Indian species and diagnosis to Indian species. The larval stages of some *Tetramesa* feed stem of grasses and cereals, and some of these produce galls. Majority of species of this genus are associated with agricultural crops, but the two newly described species are collected from the forested tracts of Kerala.

MATERIALS AND METHODS

The specimens were collected from different parts of Kerala, India, by different methods namely insect triangle sweeping net, malaise trap and yellow pan trap, in different cases. The specimens were card mounted and studied under a stereoscopic binocular microscope (Leica M 205C and Leica S8 APO) and photographs were taken with a digital camera attached with microscope (DFC 450).

*Corresponding author's E-mail: kizhakayilnikhil@gmail.com

The terminology used in this paper generally follows Gibson (1997). **The type specimens are deposited in the National Zoological collections of Zoological Survey of India, Western Ghat Regional Centre, Calicut (ZSIK).**

Abbreviations Used

AOL = distance between anterior ocellus and posterior ocellus; CC = costal cell; F1 to F5 = funicular segments 1 to 5; MS = malar sulcus; MV = marginal vein; OD = ocellar diameter; OOL = distance between eye and posterior ocellus; PMV = post marginal vein; POL = distance between posterior ocelli; SMV = submarginal vein; STV = stigmal vein; T1 to T7 = Tergites 1 to 7; ZSIK = Zoological Survey of India, Western Ghat Regional Centre, Kozhikode - 06.

RESULTS AND DISCUSSION

Genus *Tetramesa* Walker, 1848

Isosoma Walker, 1832: 13-14. Type species *Eurytoma longula* Dalman; designated by Westwood, 1839. Preoccupied by *Isosoma* Billberg, 1820.

Tetramesa Walker, 1848: 104, 154. Type species *Tetramesa iarbas* Walker; by monotypy.

Harmolita Motschulsky, 1863: 58. Type species *Harmolita longicornis* Motschulsky; by monotypy [Synonymised by Claridge 1961]

Philachyra Walker, 1871: 7. Type species *Philachyra ips* Walker, by monotypy [Synonymised by Peck 1963]

Xanthosoma Ashmead, 1888: 42. Type species: *Xanthosoma nigricornis* Ashmead, by subsequent monotypy [Synonymised by Peck 1963]

Isosomorpha Ashmead, 1888: 42. Type species *Xanthosoma nigricornis* Ashmead, by subsequent monotypy [Synonymised by Peck 1963]

Isosomocharis Ashmead, 1888 : 42. Type species *Isosomocharis sulcata* Ashmead, by subsequent monotypy [Synonymised by Peck 1963]

Urios Girault, 1911: 175. Type species *Urios vestali Girault,* by monotypy [Synonymised by Peck 1963]

Xanthosomodes Brèthes, 1913 : 107. Type species *Xanthosomodes albiangulatus* Brèthes, by monotypy [Synonymised by Gates, M.W. 2014]

Exanthosoma Girault, 1915 : 265. Type species *Exanthosoma funeralis* Girault, by monotypy [Synonymised by Boucek, Z. 1988]

Isthmosoma Hedicke, 1921: 165. [Replacement name for *Isosoma* Walker, 1832 nec Billberg, 1820] [Synonymised by Peck 1963]

Gahaniola Erdös, 1952: 117. Type species *Harmolita phyllostachitis* Gahan, original designation [Synonymised by Zerova, M.D. 1976]

***Tetramesa* Walker**

Diagnosis : Body slender, long, with gaster sessile in female with at least 1.6 times as long as broad; thorax long; pronotum usually slightly expanding forward; notaular grooves deep in anterior halves; antennal funicles with 5-6 segments; ring segment in some case elongate; propodeum slopping posteriorly; marginal vein always distinctly longer than stigmal vein; flagellum with sparse linear sensilla.

Distribution : Members of this genus are distributed throughout the World, a major portion occurs in the temperate zones of Northern Hemisphere.

Key to Indian Species of *Tetramesa* Walker

1. Antennal funicle five segmented……2
– Antennal funicle six segmented……..…10
2. Pronotum maximum length (including collum) distinctly longer than mesoscutum……3
– Pronotum maximum length shorter than or equal to (rarely sub equal to) median length of mesoscutum…….....……..…8
3. Propodeum without median fovea; T4 longer than or sub equal to T3……..….4
– Propodeum with median fovea; T4 always longer than T3……....6
4. T4 longer than T3; MV 1.65x PMV; head width in anterior aspect 1.75x distance between anterior ocellus and lower margin of clypeus ……..*Tetramesa distincta Narendran*
– T4 sub equal to T3; MV less than 1.3x PMV; anterior width of head l.3x to 1.5x distance between anterior ocellus and lower margin of clypeus……...…….…5
5. General colour of head and body brownish yellow; POL 1.45x OOL; STV sub equal to PMV; pronotum without distinct yellow spots at shoulders.....… Tetramesa peethavarna Narendran
– General colour of head and body black; POL 1.2x OOL; STV 0.6x longer than PMV; pronotum with distinct yellow spots at shoulders…….…. Tetramesa neyyarensis sp. nov.
6. POL 1.3x OOL; F1 longer than pedicel; MV 1.6x PMV; gaster 1.3x as long as head plus mesosoma combined…… Tetramesa narendrani Sureshan
– POL greater than 2x OOL; F1 equal to or shorter than pedicel; MV more than 1.9x PMV; gaster length sub equal to head plus mesosoma combined……...…..7
7. STV sub equal to PMV; scape not reaching level of vertex; POL 2.4x OOL; forewing 2.9x its width; SMV 4.4x STV; F1 to F3 equal in length..…… …….. Tetramesa palakkadensis sp. nov.
– STV 0.6x PMV; scape reaching level of vertex; POL 2x OOL; fore wing 2.1x its width; SMV 8.2x STV; F2 to F5 equal in length…… Tetramesa calicutensis Sureshan
8. Pronotum length (including collum) equal or sub equal to median length of mesoscutum; POL 1.6x OOL..……...….. Tetramesa zerovae Narendran
– Pronotum length (including collum) shorter than median length of mesoscutum; POL less than 1.35x OOL……...……...…….....9
9. General colour of head and body yellowish brown; POL sub equal to OOL; STV longer than PMV; anterior width of head l.35x distance between front ocellus and lower clypeal margin; eyes finely and sparsely pubescent……Tetramesa deccanensis (Mukerjee)

– General colour of head and body black with brownish yellow patch on either side of frons above clypeus; POL 1.36x OOL; STV distinctly shorter than PMV; anterior width of head 1.25x length between front ocellus and lower margin of clypeus; eyes bare…….. Tetramesa vadana Narendran

10. Club segmented; eyes bare; POL 1.1x OOL; median length of scutellum shorter than median length of mesoscutum; STV longer than PMV……. *Tetramesa gibsoni* Narendran

– Club unsegmented; eyes finely and sparsely pubescent; POL 1.6x OOL; median length of mesoscutum equal to that of scutellum; STV shorter than PMV…….…… *Tetramesa delhousiae* (Mukerjee).

Species descriptions

1. *Tetramesa neyyarensis* sp. nov. (Figs. 1-8)

Holotype : Female: Length 3.43 mm. Body slender, elongate and blackish in colour except the following, eyes silvery; clypeus, scape, apices of mid and hind femur, more than half of apical fore femur, fore, mid and hind tibia, tarsals, ovipositor sheath pale yellow; Pronotal collar bears yellow marking on lateral side; pedicel and funicles brownish; mandible brownish; clypeal area (up to malarsulcus) yellowish brown; wings hyaline, veins pale yellow; body hairs silvery.

Head : Width 1.33x (69:52) its height in lateral view; face rugose (Fig. 2), clypeal margin with radiating rugae, malar space faintly rugose, eyes bare, funicles and clava with long hairs; toruli situated 0.37x (19:52) of maximum height between anterior ocellus and clypeal margin from base; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 51:19:5; mandible bidentate; dorsally width 1.92x (71:37) its maximum height; POL 1.23x (16:13) OOL; POL 2.67x (16:6) AOL; OOL 2.6x (13:5) OD; laterally eye height 1.33x (28:21) its maximum width; gena slightly curved and posteriorly ecarinate; malar sulcus distinct, 0.71x (20:28) eye height laterally; antennal formula 11153; scape length 4.4x (22:5) its width, not reaching level of vertex; pedicel length 1.67x (10:6) its width; ring segment length 0.5x (2:4) its width; funicles and clava has long silvery hairs; relative measurements of length and width of F1 to F5 are F1 = 11:4; F2 = 9:5; F3 = 8:6, F4 and F5 = 7:7; clava length 2.36x (19:8) its width.

Mesosoma : length 1.94x (136:70) its maximum width; pronotal collar finely reticulate punctate and remaining rugose, mesonotum and scutellum distinctly rugose (Fig. 6); pronotum maximum length 0.79x (49:62) width and median length 1.72x (62:36) its maximum width, collar ecarinate; mesocutem length 0.6x (42:70) its maximum width, notauli complete and distinct; scutellum convex, length 1.24x (42:34) its maximum width; propodeum reticulate without median fovea, two lateral carina starting from spiracle and extending up to tip of propodeum, whole area except callus without hairs, median length 0.66x (36:54) its maximum width, spiracle separated from metanotum

Figs. 1-8. *Tetramesa neyyarensis* sp. nov.: 1. Profile, 2. Head front view, 3. Head dorsal view, 4. Head side view with antenna, 5. Propodeum, 6. Mesosoma, 7. Gaster, 8. Fore wing

by its own diameter; relative length and width of hind leg, coxa = 34:18, trochanter = 11:10, femur = 62:16, tibia = 71:10, tarsals 1 to 5 = 23:6:6:7:13; fore wing length 2.64x (235:89) its maximum width; relative length of SMV = 96, MV = 31, PMV = 27, STV = 16, CC = 92.

Metasoma : Sessile; smooth and shining; length 1.1x (180:167) head plus mesosoma combined (in profile) and 2.9x to its maximum width dorsally; relative median length and maximum width of tergites are T1 = 43:54, T2 = 8:56, T3 = 17:54, T4 = 20:52, T5 = 22:48, T6 = 22:38, T7 = 17:19, ovipositor sheath length 18.

Type Locality : India (Kerala).

Host : Unknown.

Male : Unknown.

Materials examined : Holotype: Female: INDIA: Kerala, Thiruvananthapuram, Neyyar, Puralimala **(**11°04'27.9"N 76°25'28.4"E), 11.x.2012 Col. P. M. Sureshan (ZSIK Reg. No. ZSI/WGRC/IR/INV/4409).

Paratype : 1 female: INDIA: Kerala, Thiruvananthapuram, Neyyar, Puralimala (11°04'27.9"N 76°25'28.4"E), 11.x.2012 Col. P. M. Sureshan (ZSIK Reg. No. ZSI/WGRC/IR/INV/4410). 1 female: INDIA: Kerala, Kazargod, Pamdi, 09.xi.2013 Col. P. M. Sureshan (ZSIK Reg. No. ZSI/WGRC/IR/INV/4411).

Etymology : the species derives its name from the type locality, Neyyar, Thiruvananthapuram (Kerala).

Remarks : This species shows similarity to *Tetramesa narendrani Sureshan* in Head length and width in front and dorsal aspects, propotions of malar space and eye length in profile but differs strongly by these characters, pedicel plus flagellum length equal to head width (in *Tetramesa narendrani* pedicel plus flagellum length 1.3x head width), pronotum median length 1.72x its maximum width (in *Tetramesa narendrani* width 1.3x its median length), mesoscutum medially equal to scutellum (in *Tetramesa narendrani* Scutellum medially longer than mesoscutum), propodeum without a fovea (in *Tetramesa narendrani* propodeum with a fovea).

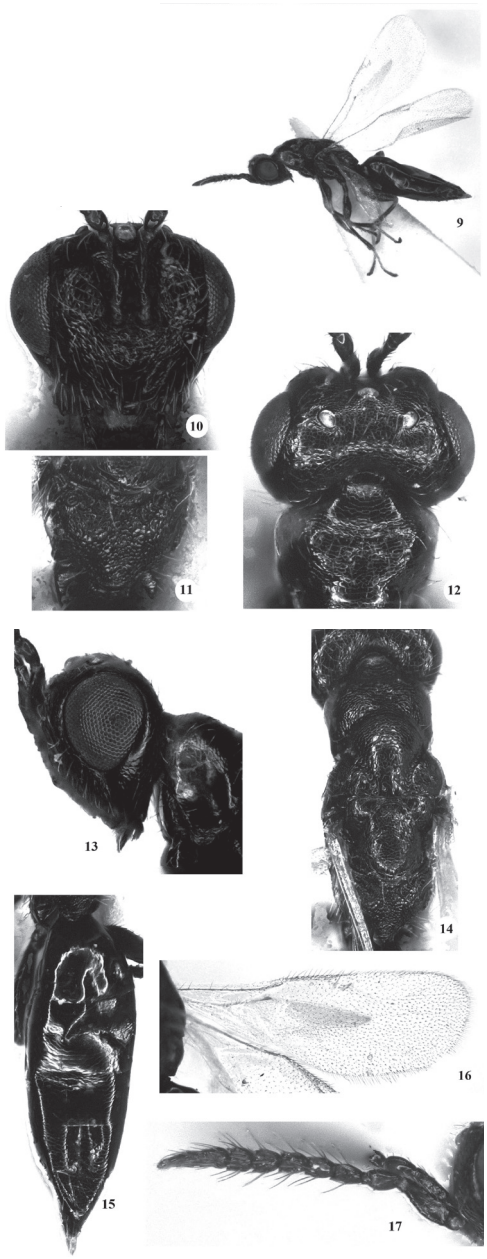
The new species also show resemblance to *Tetramesa calicutensis* Sureshan in length and width measurements in anterior and profile view, pronotum 1.6x times as wide as long, fore wing length 2.7x its width but differs strongly by these characters, Malar groove distinct (in *Tetramesa calicutensis* malar groove weekly indicated), POL 1.23x OOL (in *Tetramesa calicutensis* POL 2x OOL), F2-F5 different in length (in *Tetramesa calicutensis* F2-F5 equal in length), Propodeum without a fovea (in *Tetramesa calicutensis* propodeum with a shallow fovea), dorsally T1 length greater than T2 plus T3 length (in *Tetramesa calicutensis* T1 dorsally as long as T2 Plus T3 length).

The species also show resemblance to *Tetramesa peethavarna* Narendran in length and width measurements of head in anterior and profile view, MV longer than PMV, proportions of malar sulcus and eye height but differs strongly by these characters, general body colour black (in *Tetramesa peethavarna* body colour brownish yellow), pronotum with distinct yellow spot laterally (in *Tetramesa peethavarna* yellow spot absent or not distinguishable with body colour), T4 longer than T3 (in *Tetramesa peethavarna* T3 and T4 sub equal in length).

2. *Tetramesa palakkadensis* sp. nov. (Fig. 9-17)

Holotype : Female: Length 2.65 mm. Body slender, elongate and brownish black in colour except the following, eyes pinkish red; apices of femur, base and apices of mid and hind tibia, ventral part of fore tibia, tarsals, ovipositor sheath pale yellow; Pronotal collar bears yellow marking on lateral side; antennae brownish; wings hyaline, veins pale yellow; body hairs silvery.

Head : Width 1.38x (54:39) its height in lateral view; face rugose with silvery hairs (Fig. 10), gena and temple faintly rugose, eyes bare, funicles and clava with long brown hairs; toruli situated 0.4x (16:39) of maximum height between anterior ocellus and clypeal margin; relative measurements of distance between eyes at the level of toruli, between eyes and toruli and between toruli are 39:13:2; mandible tridentate; dorsally width 1.6x (56:35) its maximum height; POL 2.4x (17:7) OOL; POL 2.1x (17:8) AOL; OOL 1.4x (7:5) OD; laterally eye height 1.24x (26:21) its maximum width; gena slightly curved and posteriorly ecarinate; malar sulcus faintly present; malar sulcus 0.46x (12:26) eye height laterally; antennal formula 11153; scape length 2.83x (17:6) its width, not reaching level of vertex; pedicel length 1.5x (9:6) its width; ring segment length 0.66x its width; funicles and clava has long brown hairs; relative measurements of length and width of F1 to F5 are F1 to F3 7:5, F4 7:6, F5 6:6; clava length 3.1x (19:6) its width.



Figs. 9-17. *Tetramesa palakkadensis* Nikhil & Sureshan sp. nov.: 9. Profile, 10. Head front view, 11. Propodeum, 12. Head dorsal view, 13. Head side view, 14. Mesosoma, 15. Gaster, 16. Fore wing, 17. Antenna

Mesosoma : faintly rugose; length 2.23x (105:47) its maximum width; pronotum maximum length 1.25x (40:32) its maximum width and median length 0.53x (21:40) its maximum width, collar ecarinate; mesocutem convex, length 0.66x (31:47) its maximum width, notauli complete (Fig. 14); scutellum convex, length 1.32x (29:22) its maximum width; propodeum reticulate punctate with median fovea, whole area except callus without hairs, median length 0.63x (22:35) its maximum width, spiracle separated from metanotum by 1.5x its diameter; relative length and width of hind leg, coxa = 22:13, trochanter = 7:8, femur = 39:13, tibia = 50:6, tarsals 1 to 5 = 18:7:7:5:7; fore wing length 2.9x its maximum width; relative length of SMV = 71, MV = 28, PMV = 15, STV = 16, CC = 68.

Metasoma : Sessile; faintly rugose; length sub equal to head plus mesosoma combined (in profile) and 3.33x (130:39) to its maximum width (in dorsal); relative maximum length and maximum width of tergites are T1 = 33:36, T2 = 12:39, T3 = 16:41, T4 = 21:39, T5 = 20:34, T6 = 14:21, T7 = 6:9, ovipositor sheath length 9.

Type Locality : India (Kerala).

Host : Unknown.

Male : Unknown.

Materials examined : Holotype: Female: INDIA: Kerala, Palakkad, Silent Valley National Park, Parathodu (11°04'27.9"N 76°25'28.4"E), 15.i.2013 Col. Nikhil. K (ZSIK Reg. No. ZSI/WGRC/IR/INV/4412).

Etymology : the species derives its name from the district of type locality, Palakkad (Kerala).

Remarks : This species shows similarity to *Tetramesa ventricosa* (Motschulsky) in POL OOL ratio, malar groove distinct, STV distinctly shorter than MV but differs strongly by these characters, scape not reaching level of vertex (in *Tetramesa ventricosa* scape reaching level of vertex), malar sulcus in profile 0.46x eye height (in *Tetramesa ventricosa* height of eye a little more than half length of malar groove in profile), head dorsally width 1.63x its maximum height (in *Tetramesa ventricosa* head dorsal width a trifle over 2.8 its median length).

This new species also shows resemblance to *Tetramesa zerovae* Narendran in general body colour, proportions of length and width of head front view, malar groove distinct but differs strongly by these characters, POL 2.4x OOL (in *Tetramesa zerovae* POL 1.6x OOL), scape not reaching level of vertex (in *Tetramesa zerovae* scape reaching level of vertex), median length of pronotum 0.68x mesoscutum (in *Tetramesa zerovae* median length of pronotum equal to mesoscutum, Propodeum with median fovea (in *Tetramesa zerovae* propodeum without median fovea).

This new species also show resemblance to *Tetramesa calicutensis* Sureshan in proportions of length and width of head front view and dorsal view, proportions between malar space and eye length in profile but differs strongly by these characters, fore wing width 2.9x its width (in *Tetramesa calicutensis* fore wing width 2.1x its width), scape not reaching level of vertex (in *Tetramesa calicutensis* scape reaching level of vertex), POL 2.4x OOL (in *Tetramesa calicutensis* POL 2x OOL), T5 and T4 sub equal in length (in *Tetramesa calicutensis* T5 1.2x longer than T4).

3. *Tetramesa zerovae* Narendran

Tetramesa zerovae Narendran, 1994: 152-153. Type species *Tetramesa zerovae* by monotypy, Original designation.

Diagnosis : Female: Length 2.5-3.7 mm. Head and body in general liver brown or brownish black in colour; pronotum with a yellow patch at shoulders; wings pale brownish yellow. Head without distinct punctures, rugose, moderately pubescent on frons; width 1.27x distance between front ocellus and anterior margin of clypeus; scrobe smooth, margins ecarinate, reaching front ocellus. POL 1.6x OOL. Malar groove faint but distinct; posterior region to malar groove faintly rugos; posterior margin of gena ecarinate. Antenna with scape reaching front ocellus, not exceeding vertex, funicle five segmented, club 3 segmented. Thoracic dorsum rugulose, not punctate; median length of pronotum equal to median length of mesoscutum; median length of scutellum equal to median length of mesoscutum. Propodeum slanting with full of distinct uniform microsculptures, without distinct large pits or rugae; propodeum without median fovea, MV 2.1 x PMV*, STV* shorter than MV*.* Gaster sessile, distinctly longer than thorax.

Distribution : India - Kerala, Uttar Pradesh and West Bengal.

Materials examined : Holotype and one paratype.

Other Materials Examined : One female: INDIA: Kerala, Kannur, Aralam, 12.ix.2012, Col. K. Nikhil (ZSIK Reg. No. ZSI/WGRC/IR/INV/4413); one female: INDIA: Kerala, Thrissur, Peechi, 24.vii. 2012, Col. K. Nikhil (ZSIK Reg. No. ZSI/WGRC/IR/INV/4414).

4. *Tetramesa distincta* Narendran

Tetramesa distincta Narendran, 1994: 148, 150-151. Type species *Tetramesa distincta* by monotypy, Original designation.

Diagnosis : Female: Length 2.8-3.1 mm. General body colour black; pronotum with a blackish yellow spot on anterolateral part on each side. Head faintly but clearly reticulate, not distinctly punctate, moderately pubescent; scrobe with margins ecarinate, reaching front ocellus. POL l.46x OOL; head width 1.75x distance between front ocellus and anterior margin of clypeus; antennal formula 11153; scape reaching front ocellus; malar groove distinct; malar area distinctly striate; posterior margin of gena ecarinate; thoracic notum reticulate, without distinct puntures, moderately pubescent, median length of pronotum including collum a little longer than median length of mesoscutum; median length of scutellum a little shorter than median length of mesoscutum: propodeum surface distinctly punctate and reticulate, without a median groove; MV 1.65x PMV; *STV* a little shorter than PMV. Gaster sessile faintly rugulose.

Distribution : India - Kerala.

Materials examined : Holotype and one paratype.

Other Materials Examined : One female: INDIA: Kerala, Kozhikode, Kakkayam, Orakkuzhi, 22.x.2012, Col. K. Nikhil (ZSIK Reg. No. ZSI/WGRC/IR/INV/4415).

5. *Tetramesa vadana* Narendran

Tetramesa vadana Narendran, 1994: 148, 153. Type species *Tetramesa vadana* by monotypy, Original designation.

Diagnosis : Female: Length 2.9-3.1 mm. General body colour black; pronotum with a pale blackish yellow patch on shoulders. Eyes and ocelli pale blackish brown; frons with pale brownish yellow patches on either side of clypeal region. Head with rugose sculptures, without distinct pits; width of head in anterior aspect 1.25x distance between front ocellus and anterior margin of clypeus. POL 1.36x OOL; scrobe margins ecarinate; front ocellus outside scrobe; face with a median smooth area below interantennal projection; malar groove distinct, posterior part of malar groove with distinct striations; genotemporal margin ecarinate; antennal formula 11153; scape reaching front ocellus but not distinctly exceeding level of vertex; thoracic dorsum not distinctly punctate, rugose; median length of pronotum shorter than that of mesoscutum; scutellum shorter than mesoscutum; propodeum without distinct pits, reticulate on sides, reticulation sparse on median part, without a distinct groove; MV 2.5x PMV; STV a little shorter than PMV*;* gaster sessile; ovipositor sheath exerted.

Distribution : India - Kerala; Nepal; Taiwan.

Materials examined : Holotype.

Other Materials Examined : One female: INDIA: Kerala, Malappuram, Calicut University campus, 07.ii.2013, Col. K. Nikhil (ZSIK Reg. No. ZSI/WGRC/IR/INV/4416).

6. *Tetramesa narendrani* Sureshan

Tetramesa narendrani Sureshan, 2004: 504-506. Type species *Tetramesa narendrani* by monotypy, Original designation.

Diagnosis : Female: Length 3.7-4 mm. General body colour black; pronotum with a pale brownish yellow spot on anterior corner of the collar on either side; head distinctly and minutely reticulate with long white pubescence, denser on lower face; in dorsal view head width 1.8x length and in front view width 1.2x height; genae ecarinate, with longitudinal striae; malar groove distinct; eye length l.2x width (in profile); malar space length 0.7x eye length; POL 1.3x OOL. Antennal formula 11153, slender with scape hardly reaching vertex level; F1 longer than pedicel; pedicel plus flagellum length 1.3x head width; *mesosoma u*niformly with broad meshed reticulation, area inside of which minutely reticulate, pubescence long and white; pronotum width 1.3x median length, medially little longer than mesoscutum, collar ecarinate; scutellum medially longer than mesoscutum; propodeum medially with a fovea, uniformly reticulate punctate with meshes broad, interior of which minutely reticulate, whole surface except median fovea with long white hairs; forewing length 3.1x width, speculum closed below, basal cell hairy, marginal fringe long; relative lengths of SMV = 39, MV = 12.5, PMV = 8, STV = 7.5; g*aster* sessile, long and ovate, 1.3x as long as head plus mesosoma combined, T4 distinctly longer than T3.

Distribution : India - Kerala.

Materials examined : Holotype.

Other Materials Examined : One female: INDIA: Kerala, Wayanad, Muthanga, Maragad, 17.x.2011, Co. P. M. Sureshan (ZSIK Reg. No. ZSI/WGRC/IR/INV/4417); one female: INDIA: Kerala, Wayanad, Banasura Hills, 12.v.2005, Co. Rajmohana (ZSIK Reg. No. ZSI/WGRC/IR/INV/4418).

7. *Tetramesa calicutensis* Sureshan

Tetramesa calicutensis Sureshan, 2005: 137-139. Type species *Tetramesa calicutensis* by monotypy, Original designation.

Diagnosis : Female: Length 2.6 mm. General body colour black; pronotum with a broad yellowish white patch on antero lateral corners; h*ead u*niformly and finely reticulate, meshes very small, with long white hairs; gena almost shiny, malar grooves weakly indicated; clypeal area slightly raised, anterior margin angularly produced; head in dorsal view 1.6x as wide as long; POL 2x OOL; in front view head width 1.2x height; eye length 1.23x width in profile; malar space 0.46x eye length; antennae inserted above lower margin of eyes; scape hardly reaching median ocellus, length 0.7x eye length; pedicel plus flagellum length as long as head width; antennal formula 11153; pedicel as long as F1 and as wide as F5; F2-F5 equal in length, shorter than F1; funicular segments longer than wide, except F5 almost subquadrate, club as long as 3 preceding segments combined; *thorax* 2.3x as long as wide, pronotum almost as long as wide, collar ecarinate, finely reticulate; mesoscutum medially shorter than pronotum and 1.6x as wide as long, scutellum similarly reticuate as on mesoscutum and pronotum, medially little longer than mesoscutum; propodeum uniformly reticulate punctate, meshes small, medially 0.7x as long as scutellum, medially with a shallow fovea, basal part with few short carinulae separated by deep foveae, only upper part of callus covered with white hairs; prepectus finely reticulate; mesopleuron with mesepistemum moderately reticulate, mesepimeron transversely striated; metapleuron similarly reticulate as on propodeum. Forewing length *2.1x* width, basal part with less pubescence, speculum open below, PMV short, stigma slightly enlarged; relative lengths of SMV = 33, MV = 12, PMV = 6, STV = 4; *gaster* sessile, long and ovate, as long as head plus thorax combined, dorsally collapsing; T1 dorsally as long as T2 and T3 combined; T4 little longer than T3; T5 1.2x longer than T4.

Distribution : India - Kerala.

Materials examined : Holotype only.

7. *Tetramesa gibsoni* Narendran

Tetramesa gibsoni Narendran, 1994: 148, 149. Type species *Tetramesa gibsoni* by monotypy, Original designation.

Diagnosis : Female: Length 7.1 mm. General body colour black; pronotal collar bears a yellow marking on anteriolateral corners; wing pubescence light brown; body covered with long silvery hairs. Head

with sparse, shallow, umbilicate punctures; interstices broad, flat and microsculptured; dorsal width 1.9x is height; anterior width 1.14x its height; lateral width 1.67x its height; frons convex and slightly bulging; lower face with numerous striations radiating from lateral margins of clypeus; median strip on lower face extend from toruli to half way between toruli and anterior margin of clypeus; anterior margin of clypeus medially pointed; inner surface of scrobe reticulated, margins ecarinate; toruli situated well above half distance between front ocellus and anterior clypeal margin; eye length 1.5x its width in profile; POL 1.1x OOL; a short carina runs from corner of mouth to one-third length of malar space; gena posteriorly ecarinate. Antennal formula 11162 (with flagellum not distinctly demarcated into funicle and club). Thorax densely and umbilicately punctured on dorsum, interstices narrow, carinate and shagreened on pronotum, middle lobe of mesoscutum and scutellum; on scapula interstices broad, flat and shagreened dorsally; relative measurements of dorsal length of thorax: width: pronotum ecarinate anteriorly; pronotum median length (including collum) subequal to median length of middle lobe of mesoscutum; scutellum a little shorter than mesoscutum; mesopleuron with epicnemial area slightly sloping; notauli complete, deeply grooved, these grooves obstructed by cross carinae; scutellum broadly convex dorsally, laminated posteriorly, lamina bears cross carinae on its dorsal surface; mesepimeron and mesepisternum horizontally striated; propodeum convex medially with a fovea; propodeal surface (except median fovea) covered with long hairs. Forewing length 3x its width; MV 1.6x PMV; STV 1.1x PMV; MV broad. Gaster sessile, longer than head and thorax combined, gradually pointed towards apex.

Distribution : India - Tamil Nadu, Kerala (Present record).

Materials examined : One female: INDIA: Kerala, Idukki, Manalar, 17.iv.2013, Col. Rajmohana (ZSIK Reg. No. ZSI/WGRC/IR/INV/4419).

8. *Tetramesa peethavarna* Narendran

Tetramesa peethavarna Narendran, 1994: 148, 151-152. Type species *Tetramesa peethavarna* by monotypy, Original designation.

Diagnosis : Female: Length 2.5-2.9 mm. Brownish yellow; flagellum brownish black wings hyaline; veins pale brown. Head with shallow faint pits; scrobe margins ecarinate, its upper margin indistinct; POL 1.45x OOL. Head width in front view 1.45x length between front ocellus and anterior margin of clypeus. Malar groove indistinct, posterior margin of gena ecarinate; length of malar groove 0.64x length of eye in profile. Antenna with scape slightly exceeding vertex; funicle five segmented; club three segmented. Thorax with pronotum large, a little longer than mesoscutum; scutellum a little shorter than median length of mesoscutum; thoracic notum not distinctly punctate, faintly rugulose; propodeum surface with distinct punctures, without a median groove; prepectus triangular; MV longer than PMV; STV subequal to PMV. Gaster sessile, smooth with sparse pubescence on T6 and on epipygium; T3 and T4 subequal in length.

Distribution : India - Uttar Pradesh, Kerala (Present record).

Materials examined : Holotype and one paratype.

Other Materials Examined : One female: INDIA: Kerala, Pathanamthitta, Gavi, 10.v.2013, Col. P. M. Sureshan (ZSIK Reg. No. ZSI/WGRC/IR/INV/4420); one female: INDIA: Kerala, Malappuram, Kadalundi, 12.viii.2013, Col. K. Nikhil (ZSIK Reg. No. ZSI/WGRC/IR/INV/4421); one female: INDIA: Kerala, Kozhikode, Sarovaram, 05.vii.2013, Col. K. Nikhil (ZSIK Reg. No. ZSI/WGRC/IR/INV/4422).

10. *Tetramesa deccanensis* (Mukerjee)

Harmolita deccanensis Mukerjee, 1981: 6. Type species *Harmolita deccanensis* by monotypy.

Tetramesa deccanensis (Mukerjee), Farooqi & Subba Rao, 1986: 257. Synonym of *Harmolita deccanensis* Mukerjee.

Diagnosis : Female: Length 2.86 mm. yellowish brown; flagellum brownish black; pedicel, anellus and scape brown; legs brown, thorax yellowish brown with notaulices irregularly dark brown; sides of scapula, anterior part of pronotum (faintly) and middle of scutellum dark brown; gaster brown. Head width 1.35x length between front ocellus and lower margin of clypeus; vertex with long hairs; eyes finely and sparsely pubescent; scrobe smooth; POL subequal to OOL; antennal formula 11153; thorax with length of pronotum shorter than mesoscutum. length of scutellum equal to length of mesoscutum; propodeum umbilicately punctate; MV 2x PMV; STV distinctly longer than PMV. Gaster sessile (Narendran, 1994).

Distribution : India - Maharashtra.

11. *Tetramesa dalhousiae* (Mukerjee)

Harmolita dalhousiae Mukerjee, 1981: 1. Type species *Harmolita dalhousiae* by monotypy.

Tetramesa dalhousiae (Mukerjee), Farooqi & Subba Rao, 1986: 257. Synonym of *Harmolita dalhousiae* Mukerjee.

Diagnosis : Female: General body colour black; head black; eyes and ocelli brown; antenna black with scape brownish black on basal side; sides of pronotum and tegula with yellow markings; fore leg reddish brown except for black coxa and black half of femur. Middle leg dark brown except for black coxa, brownish black basal part of femur and median part of tibia. Hind leg brownish black except for black coxa and dark brown tarsus. Head with shallow punctures, eyes finely and sparsely pubescent; width 1.32x distance between front ocellus and lower margin of clypeus; scrobe sculptured like that of parascrobal space; POL 1.6x OOL. Antenna with club unsegmented. Thoracic dorsum densely and umbilicately punctate with pubescence moderately dense; length of pronotum shorter than mesoscutum; length of scutellum equal to length of mesoscutum; *MV* 1.56x length of *PMV; STV* shorter thanPMV. Gaster sessile, smooth, shiny with T4 slightly longer than T3 (Narendran, 1994).

Distribution : India - Himachal Pradesh.

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Parasitoids (Hymenoptera) of xylophagous beetles (Coleoptera) attacking dead wood in southern Western Ghats, Kerala, India, with descriptions of two new species

P.M. Sureshan [1], T.C. Narendran [2] & K. Nikhil [3]

[1,2,3] Zoological Survey of India, Western Ghats Regional Centre, Jafferkhan Colony, Eranhipalam P.O., Kozhikode, Kerala 673006, India
[1] pmsuresh43@yahoo.com (corresponding author), [2] drtcnarendran@yahoo.com, [3] kizhakayilnikhil@gmail.com

Abstract: An account is given of four species of Hymenoptera parasitoids probably of the wood boring beetle *Clytocera chinospila* Gahan (Coleoptera: Cerambycidae) from Chinnar Wildlife Sanctuary, southern Western Ghats, Kerala. Two new hymenopteran species, *Eurytoma chinnarensis* (Eurytomidae) and *Foenatopus idukkiensis* (Stephanidae) are described. *Solenura ania* Walker (Pteromalidae) is reported for the first time from Kerala and Western Ghats with a new host record, and *Doryctus* sp. (Braconidae) is reported here.

Keywords: *Eurytoma chinnarensis* sp. nov., Eurytomidae , *Foenatopus idukkiensis* sp. nov., Hymenoptera, new species, parasitoids, Stephanidae, xylophagous beetles.

Abbreviations: AOL - Distance between a posterior ocellus and the anterior ocellus; CC - Costal cell; F1-F5 - Funicular segments 1 to 5; L - Length; m-cu - Transverse medio-cubital vein; MV - Marginal vein; OOL - Ocellocular distance; PGA - Pterostigma; PMV - Postmarginal vein; POL - Post-ocellar distance; r - Transverse radial cell; SMV - Submarginal vein; 1-SR+M - Marginal cell sectio radii Media; 2SR - Submarginal cell Sectio radii; 3-SR - Discal cell Sectio radii; SR1 - Sectio radii Marginal cell; STV - Stigmal vein; T1-T7 - Gastral tergites 1-7; W - Width; ZSIK: Zoological Survey of India, Western Ghat Regional Centre, Kozhikode, Kerala, India.

The coleopteran (Insecta) families Cerambycidae, Buprestidae, Scolytidae, Anobiidae, Passalidae, Lucanidae and Elateridae mainly include wood boring beetles. Insect parasitoids exert natural control of the populations of wood boring beetles by attacking their immature stages. Major insect parastoids attacking the wood boring beetles belong to Hymenoptera (Chalcidoidea, Stephanoidae, Ichneumonoidea, Proctotrupoidea, Megalyroidea, Evanoidea, Chrysidoidea and Vespoidea). During the faunal exploration surveys conducted in the forest tracts of Chinnar Wildlife Sanctuary, Kerala ($10^0$30'N & $77^0$17'E; altitude 450m), a piece of dead wood of an unidentified forest tree heavily infested with xylophagous beetles was collected. The infestation of beetles in the wood was indicated by closely arranged holes and saw dust (Image 18). One hymenopteran parasitoid, *Solenura ania* (Walker) (Hymenoptera: Pteromalidae)

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Competing Interest: None.

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(Image. 17) was collected from the surface of the wood by aspiration. The wood was then cut into small pieces and kept in wide-mouthed glass bottles covered with mulmul cloth. The hymenopteran parasiotids emerged from the wood along with an adult beetle *Clytocera chinospila* Gahan (Coleoptera: Cerambycidae), that were subsequently identified as *Eurytoma chinnarensis* sp. nov. (Eurytomidae), *Foenatopus idukkiensis* sp. nov. (Stephanidae) and *Doryctus* sp. (Braconidae). Among the individual parasitoids that emerged, the number of *Solenura ania* was at a maximum. The beetle *Clytocera chinospila* Gahan (Cerambycidae) was identified as a new host for *Solenura ania* which is reported for the first time from the southern Western Ghats. The specimens of the present study are deposited in Zoological Survey of India, Western Ghat Regional Centre, Kozhikode (ZSIK). The terminology used in the paper follows that of Bouček (1988) for Chalcidoidea, Achterberg (2002) for Stephanoidea and Belokobylskij et al. (2004) for Braconidae.

Descriptions of Parasitoids

Order: Hymenoptera
Superfamily: Chalcidoidea
Family: Eurytomidae
Subfamily: Eurytominae

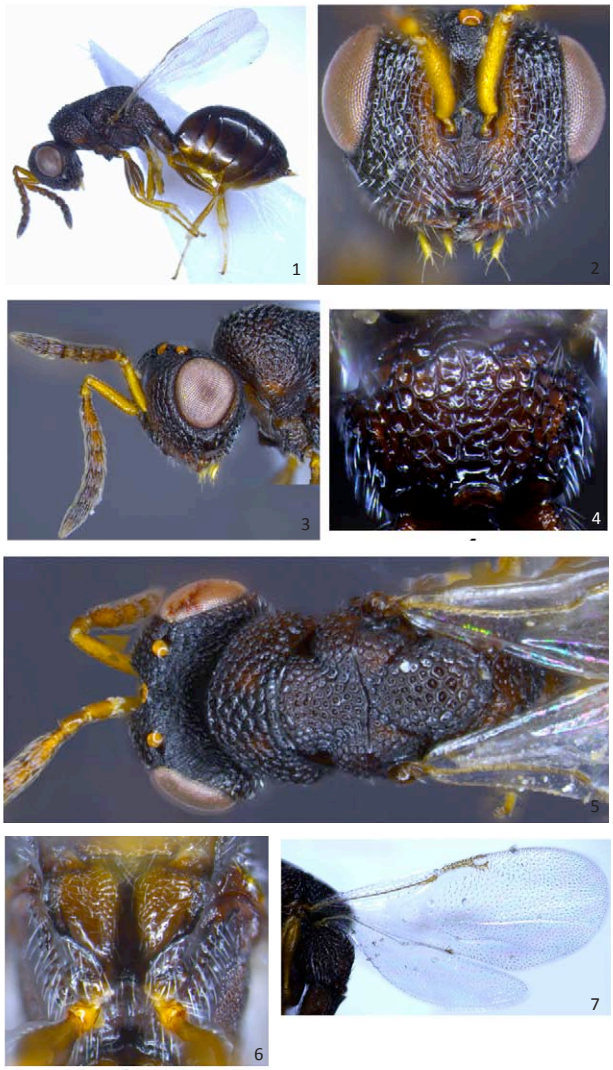
***Eurytoma chinnarensis* Narendran & Sureshan sp. nov. (Images 1–7)**

urn:lsid:zoobank.org:act:1A0D5DCB-6617-4CF4-A4EC-35B3DE9ABB06

Material examined: Holotype: Reg.No. ZSI/WGRC/IR/INV/2349, 04.iv.2012, female, Kuttar, Chinnar Wildlife Sanctuary, Idukki District, Kerala, India, 10^{0}30'N–77^{0}20'E, altitude 450m, emerged from dead wood infested with beetles, coll. P.M. Sureshan.

Paratypes: ZSI/WGRC/IR/INV/2350 (i-ix), 9 females, data same as that of holotype; ZSI/WGRC/IR/INV 2351, 1 female, data same as that of holotype except coll. K. Rajmohana.

Female: (Holotype). Length: 2.75mm. Body black except scape, pedicel, maxillary and labial palps, trochanters, bases and apices of femora, tibiae completely, tarsi and ovipositor yellow; F1, F2, F3 and ventral part of gaster brownish-yellow; F4, F5 and clava brownish-black; ventral surface of cervix pale brownish-yellow; frons and mesosoma with reddish-brown marks (Images.2,4); fore coxae black with sides partially brown; mid and hind coxae pale reddish-brown; femora dark brown medially (Image 1); eyes grey; wings hyaline, veins pale brown; pubescence on body silvery.



Images 1–7. *Eurytoma chinnarensis* Narendran & Sureshan sp. nov. Female: 1 - Body in profile; 2, Head in dorsal view; 3 - Head and antenna in profile; 4 - Head and mesosoma in dorsal view; 5 - Propodeum in dorsal view; 6 - Fore coxae in ventral view; 7 - Wings. © WGRC, ZSI, Calicut

Head: (Image 2–4) width in anterior view 1.43x its height (77:54); width in dorsal view 1.97x its length (75:38); POL: OOL:AOL=24:6:10; anterior ocellus situated outside scrobe; scrobe with raised reticulation; frons with close pits, interstices carinate; scrobal margin carinate laterally; area below toruli with a 'V' shaped carina (Image 2); clypeus smooth and shiny, apex entire; mandibles bidentate; genal carina well developed; postorbital carina faintly indicated; malar sulcus distinct with a patch of faintly reticulated shiny area just below ventral margin of eye. Antennae inserted a little above the level of ventral margin of eyes; antennal formula (excluding radicula) 11153; scape reaching just above anterior ocellus; ratio of L:W of antennal segments: Radicula 2:3; scape 30:7;

pedicel 8:6; F1 14:6; F2 11:7; F3 11:7; F4 8:8; F5 10:7; clava 20:9. F1 slightly narrowed basally with a single row of longitudinal sensillae.

Mesosoma: (Images 4,5) Relative L: W of mesosoma 118:135; mesoscutum 30:60; scutellum 38:36; propodeum 37:45. Pronotum with interstices of pits spiny (Image 3) (clearly visible in side view); propleuron subtriangular; prosternum triangular, posterior margin slightly biconcave with slight median projection, concavity with a row of 5–6 weak setae along anterior margin, procoxa two-thirds from base to apex depressed ventrally (Image 6) for reception of lower head (postgenal carina), depression strongly carinate along outer edge (Image 3) forming a sharp tooth in side view; mesopleuron and mesepisternum in ventral view with semicircular carinae meeting medially and protruding forwards between forecoxae; mesosternal shelf flat, wider than mesocoxal diameter; prepectus subtriangular with posterior margin arcuate, surface reticulate punctuate. Propodeum (Image 5) with distinct close pits, median area slightly and broadly concave with an arch like carina at basal median part ; spiracle longer than wide (4:3), separated from posterior margin of metanotum by a distance longer than length of spiracle. Hind coxa reticulate punctuate on dorso-lateral part. Relative L: W of hind coxa 34:17; hind tibia 49:7. L of first hind tarsal segment: second hind tarsal segment 21:5. Hind tibia with two apical spurs and more than 15 spine like setae on dorsal margin. Forewing (Image 7) 2.4x as long as its width (187:78); SMV with 7–9 dorsal setae; basal one-third of forewing mostly asetose; relative length of CC 79; SMV 66; PGA 15; MV 24; PMV 11; STV 13.

Metasoma: Metasoma (Image 1) longer than mesosoma (155:118) (petiole L 23+ gaster L 132); petiole 2.6x as long as wide (23:9); closely pitted; posterior ventrolateral distal part carinate (with 10–12 longitudinal carinae). Relative dorsal length of gastral tergites, T1 48; T2 11; T3 29; T4 29; T5 27; T6 9; T7 5.5; ovipositor sheath 5.3.

Male: Unknown.

Host: Emerged from dead wood heavily infested with the beetle *Clytocera chinospila* Gahan (Coleoptera: Cerambycidae).

Etymology: The species name is after the collection area Chinnar Kerala.

Variation: Females vary in length 1.87–3 mm. The reddish-brown marks on mesosoma and legs become black in some paratypes, coxae and femora become more blackish and the tibiae with brownish tinge medially. When the ovipositor is tilted upwards in some paratypes the length of gastral segments is shortened.

Remarks: *Eurytoma chinnarensis* sp. nov. runs to couplet number 5 of the key to species of *Eurytoma* of Indian sub-continent by Narendran (1994) but does not go readily beyond the first couplet because of the presence of several (more than 15) dorsal spine like setae in a row on the hind tibia. Ignoring this character, *Eurytoma chinnarensis* sp. nov. will come to *Eurytoma quadrispina* Narendran and *Eurytoma pentaspina* Narendran, but differs from these species in having: (i) interstices of pronotum spiny (in *E. quadrispina* and *E. pentaspina* interstices of pronotum not spiny); (ii) T3 and T4 equal in dorsal length and largest (in *E. quadrispina* and *E. pentaspina* T4 largest and 1.75 to 1.77x as long as T3). Besides these antennal segments also differ in relative proportions.

Eurytoma chinnarensis sp. nov. resembles *Eurytoma dentata* Mayr, *Eurytoma chaitra* Narendran, *E. punctigastra* Narendran and *Eurytoma nalanda* Narendran in having fore coxa with a tooth (coxal depression) in lateral view but the new species differs from all these species in having: (i) pronotum with short spine like interstices, (ii) hind tibia with more than 15 spine like setae on dorsal margin, metasoma with a long petiole (0.7x length of hindcoxa, 23:34) and in different proportions of antennal segments and gastral tergites. This new species also resembles *E. xylophaga* Yang (1996) in having: (i) F1 relatively long (ii) in facial and pronotal sculture (iii) in having scape with reticulation. However it differs from *E. xylophaga* in having gaster not compressed, elongate and subrounded with ovipositor sheath not protruding, POL 4x OOL (in *xylophaga* gaster compressed, not subrounded and ovipositor sheath protruded, and POL 3.4x OOL). *E. chinnarensis* sp. nov. does not come near any other old world species listed by Noyes (2012).

Superfamily: Stephanoidea
Family: Stephanidae

Foenatopus idukkiensis Sureshan & Narendran sp. nov. (Images 8–14)

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Material examined: Holotype: ZSI/WGRC/IR/INV/2346, 04.iv.2012, female, Kuttar, Chinnar Wildlife Sanctuary, Idukki District, Kerala, India, 10^{0}30'N–77^{0}20'E altitude 450m, emerged form dead wood infested with beetles, coll. P.M. Sureshan.

Paratypes: ZSI/WGRC/IR/INV/2347, 1 female, data same as that of holotype; ZSI/WGRC/IR/INV/2348 (i-ii), 2 males, data same as that of holotype.

Female: (Holotype): Body Length 11mm; terebra

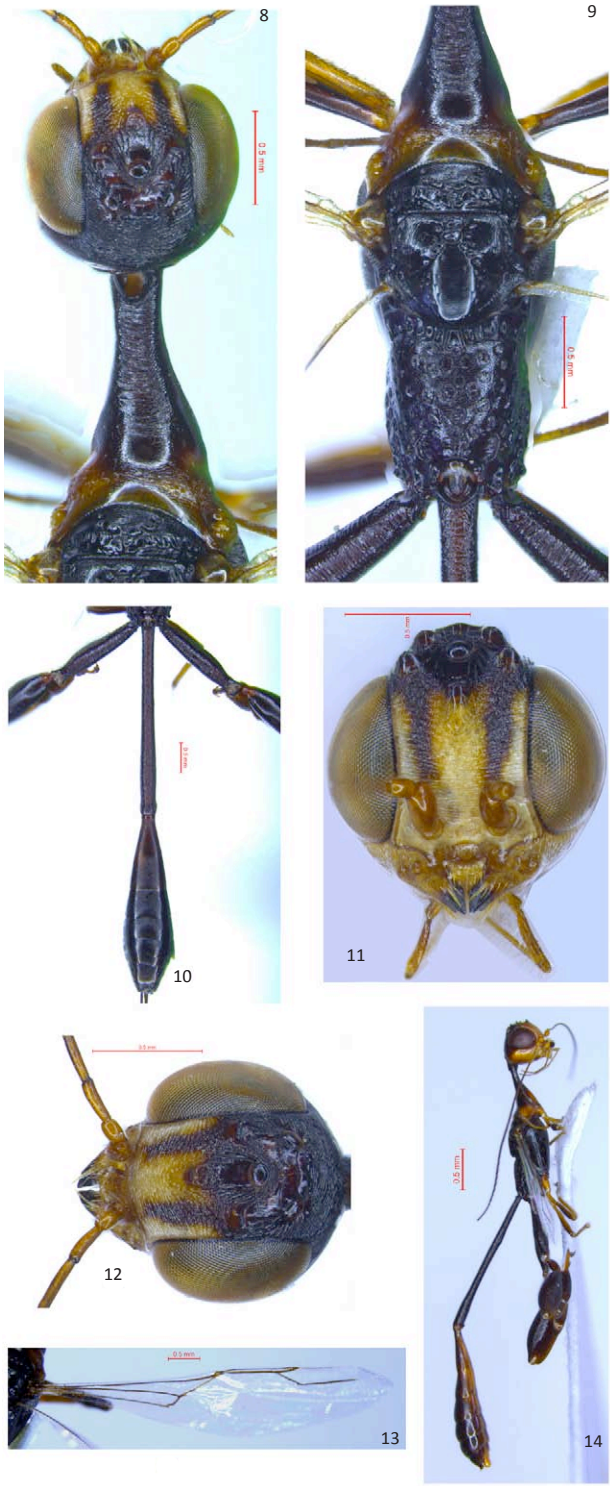


Image 8–14. *Foenatopus idukkiensis* Sureshan & Narendran sp. nov. Female: 8 - Head and pronotum in dorsal view; 9 - Mesosoma dorsal view; 10 - Metasoma and part of hind legs dorsal view; 11 - Head front view; 12 - Head dorsal view; 13 - Fore wing; 14 - male body in profile. © WGRC, ZSI, Calicut

10mm. Colour: body blackish brown with following parts as follows: face upto front ocellus yellow with two longitudinal brown bands starting from toruli, parallel to eye margin reaching upto coronal teeth; gena of same colour reaching upto upper level of eye; mouth parts yellowish-brown except tips of mandible black. Antennae with radicula, scape and pedicel testaceous, remaining segments brown; ocelli concolorous with body; eyes brassy brown; ventral and posterior-dorsal part of pronotum and tegula testaceous; tibiae and tarsi testaceous, larger spines of hind femora white, fore and mid coxae, middle tibiae and tarsi mostly testaceous; gaster ventrally testaceous, terebra with a subapical white band.

Head: (Images. 8, 11, 12) in dorsal view width 1.1x length, vertex distinctly trans-straite carinate, ocellar area obliquely striate; posterior margin of head sharply bordered. Head width in anterior view 1.5x distance between front ocellus and lower margin of clypeus; eye length 1.34x width in profile; area between upper margin of toruli and front ocellus transversely striate-carinate, interstices finely reticulate, area below toruli finely reticulate, gena shiny; three anterior coronal teeth large, lobe shaped, both posterior ones small and part of transverse lamella widened at both end, after this lamella four strong complete regular lamelliform and more or less straight carinae (third one curved), followed by distinct transverse striae, which ends little above occipital carina; area inside the coronal teeth with longitudinal carinae with interstices finely reticulate, almost shiny; temples smooth and shiny; occipital carina distinct. Antennae with 30 segments. Relative lengths of scape, pedicel, first, second and third flagellar asegments as 16, 8, 14.5, 21.5, 23.5.

Mesosoma: (Images 8,9) pronotal neck anteriorly distinctly concave, anterior and middle part distinctly transverse reticulate, posterior part finely reticulate, posterior marginal area smooth and shiny, ventrally with a median carina throughout the length and carinae on ventro lateral margins. Posterior part of pronotum distinctly differentiated from middle part, ventral part uniformly and moderately reticulate. Mesoscutum with a broad transverse band of broad pits in the posterior half, anterior half finely and transversely reticulate; axillae separated by a large median pit which is divided into two by a transverse carina, axillae finely but distinctly and longitudinally reticulate. Median part of scutellum with fine aciculations and with sparse small pits on sides. Mesospleuron with dense and closely set white pubescence in the anterior half, very finely reticulate with scattered pits on other regions. Metapleuron with a deep

pit in the anterior part followed by 5–6 transverse carinae distally. Propodeum with broad and shallow pits dorsally and deep and broad pits laterally, interstices distinctly reticulate. Hind coxae strongly annulate carinate, hind femora length subequal to hind coxal length and 2.8x its width , ventral margin with two large teeth, base with two tubercles, interspace between the large teeth with three small denticles, hind tibia 1.13x as long a hind femur, gradually widened sub medially, inner distal part with many bristly setae. Relative dorsal lengths of pronotum 35, mesoscutum 7.5, scutellum 14.5, propodeum 26.5.

Metasoma: (Image.10) Petiole uniformly annulate carinate, length 1.1 xs as long as post petiolar segments. Relative lengths of petiole 88.5, postpetiolar segments combined 86.5, terebra 1.52x as long as rest of gaster, first tergite 2x as long as its maximum width, hind margin straight, basal part with 3-4 transverse carinae remaining area finely granulate reticulate dorsally and shiny ventrally, hind margin of remaining tergites concave, all tergites similarly sculptured as on first tergite. Forewing venation as in Imageure 13.

Male: (Image 14) length 9mm. Resembles female but differs in colour of face which is uniformly yellow below front ocellus, antennal segments up to fourth flagellar segment, mouth parts except tip of mandible, fore and mid legs including coxae, hind femora basally, tarsi except last segment, distal and ventro lateral parts of pronotum golden yellow, gaster with posterior margin of all tergites straight. Antennae with 26 segments.

Etymology: The species name is after the Idukki District of Kerala, where the specimens were collected.

Variation: Length of female varies between 10.3–11 mm and male between 6.1–9 mm.

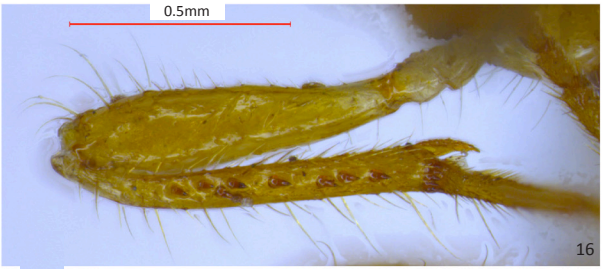
Remarks: In the key to *Foenatopus* species of Indian subcontinent given by Narendran et al. (2001), this species runs to couplet five and resembles *F. jodhpurensis* Narendran in having hind femur with two large teeth, terebra shorter than body, vertex with two distinct carinae between hind ocelli, etc but differs from it in not having a medina fovea on posterior half of pronotum, propodeum without longitudinal fovea, terebra 0.93x length of body with a distinct subapical white band and different sculpture of the body (in *jodhpurensis*, pronotum with a median fovea on posterior half, propodeum with a longitudinal fovea, terebra 0.73x length of body without sub apical band and different sculpture on vertex, mesoscutum and propodeum).

In having petiole distinctly longer than rest of metasoma, hind femur with two large teeth and terebra with subapical white band this species resembles *F. indicus* (Westwood) but distinctly difers from it in having different body sculpture, terebra shorter than body, occiput without small longitudinal depression. This species also resembles *F. frontilenea* (Morley) (=*Diastephanus frontilenea*) in having hind femur bidentate, petiole longer than combined length of postpetiolar segments, terebra shorter than body with subapical white band, body length and similar body colour but differs from *frontilenea* in general sculpture of the body which is more coarse, antenna with first and second flagellar segments not equal in length (in *frontilenea* body sculpture more fine on frons, vertex, occiput and propodeum antenna with first and second flagellar segment equal in length).

Superfamily: Ichneumonoidea
Family: Braconidae
Subfamily: Doryctinae

***Doryctus* sp. (Images 15, 16)**

Material examined: ZSI/WGRC/IR/INV/2344 (i-iii), 04.iv.2012, 3 females: Kuttar, Chinnar Wildlife Sanctuary, Idukki District, Kerala, India, 10°30'N–77°20'E altitude 450m, emerged from dead wood infested with beetles, coll. P.M. Sureshan; ZSI/WGRC/IR/INV/2345 (i-v), 5 males, data same as above.



Images 15–16. *Doryctus* sp. Female: 15 - Body in profile; 16 - Fore femora and tibia. © WGRC, ZSI, Calicut

Diagnosis: Female (Images 15, 16) Length body 5.32mm, ovipositor 2.74mm. Head at most very slightly narrower behind eyes than across them; antenna with scape 1.92 as long as its maximum width, third antennal segment 1.3x as long as second segment; vertex, frons, temple and face laterally smooth; face striate medially; sides of ocellar triangle equal; vertex, frons, temple and face with sparse long erect hairs; eyes glabrous, height 1.25x width; mesoscutum not high, coarsely and sparsely crenulate, notauli shallow, wide, complete; sternaulus shallow, narrow ; scutellem convex, foveate anteriorly, smooth medio-posteriorly; propodeum densely rugulose-reticulate with two dorsal carinae posteriorly and without lateral tubercles; fore tibia with strong spines arranged in single row on inner side; forewing 3.9x as long as its maximum width; r raising from middle of pterostigma; 3-RS 1.5x r, 0.03x 3R1, 1.08 x 2-SR; 1 SR+M slightly sinuate; m-cu distinctly antefurcal, as long as 2-SR; hind wing vein m-cu antefurcal; gaster with first tergite slightly narrowed basally, sides slightly widened to apex; length of first tergite 1.30x its maximum apical width; first and second tergites longitudinally striate with rugulosity between striae, remaining tergites weakly rugose.

Remarks: Due to non-availability of relevant literature on the genus and need of more specimens of allied species to compare with, the specimens couldn't be confirmed up to species level. Since *Doryctus* is a rare braconid genus little known in the oriental region, there is every possibility of these specimens belonging to an undescribed species.

Family: Pteromalidae
Subfamily: Cleonyminae

***Solenura ania* (Walker) (Image 17)**

1846. *Epistenia ania* Walker, 93–94. F, Philippines (BMNH)

1961. *Solenura ania* (Walker): Hedqvist, *Ent. Ts. Arg*. 90(3): 98. (For further synonymy, see Bouček et al. 1979 and Gibson 2003).

Material examined: ZSI/WGRS/IR-INV-2212 (i-xx), 20 females, ZSI/WGRS/IR-INV-2212 (xxi-xxx), 10 males, 5.iv.2012, Vasyapara, Chinnar Wildlife Sanctuary, Idukki District, Kerala, India, coll. P.M. Sureshan.

Distribution: Oriental region: China, India, Indonesia, Malaysia, Philippines, Taiwan, Thailand; Palearctic Region (China, Japan).

Remarks: The distribution of *Solenura ania* was extended up to Maharashtra, by the record of the species from Lonar Crater Wildlife Sanctuary, Buldhana District, by Sureshan (2005). The present specimens were reared from the dead wood of a forest tree heavily infested with wood boring beetles *Clytocera chionospila*, which form the probable host of it (Images 18–19). This is the first record of the species from Western Ghats and Kerala with the new host record. *Solenura ania* was earlier reared from *Chrysobothris succedanea* (Buprestidae) and *Trichoferus campestris* (Cerambycidae) (Gibson (2003). Sureshan (2005) reared the species from dead wood of *Ficus* sp. infested with *Olenocamptus bilobus* (Cerambycidae).

Images 17–19. 17 - *Solenura ania* (Walker). Female on the dead wood infested with beetles; 18 - The piece of dead wood (cut view) with tunnels of infestation and beetle grub; 19 - *Clytocera chinospila* Gahan. © WGRC, ZSI, Calicut

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