Systematic studies on Fig (Moraceae: *Ficus*) and Fig associated wasps (Hymenoptera: Chalcidoidea) of Wayanad Region of Western Ghats

Thesis submitted to

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For the Award of the Degree of

Doctor of Philosophy in Zoology

By

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Under the Supervision of

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CERTIFICATE

This is to certify that this thesis entitled **"Systematic studies on Fig (Moraceae: Ficus) and Fig associated wasps (Hymenoptera: Chalcidoidea) of Wayanad Region of Western Ghats"** is an authentic work carried out by **Ms. Shilpa. K. Satheesan** under my supervision and guidance in partial fulfilment of the requirements of the Degree of Philosophy in Zoology under the Faculty of Science of the University of Calicut, and that no part thereof has been presented earlier for any other degree, diploma or similar titles.

Malabar Christian College, Calicut.
Date:

DECLARATION

I do hereby declare that this thesis entitled **"Systematic studies on Fig (Moraceae: Ficus) and Fig associated wasps (Hymenoptera: Chalcidoidea) of Wayanad Region of Western Ghats"** submitted to the University of Calicut in partial fulfilment of the requirements of the Degree of Philosophy in Zoology, is a bonafide research work done by me under the supervision of **Dr. Santhosh S.**, Assistant Professor, P.G. & Research Department of Zoology, Malabar Christian College, Calicut, and no part of this thesis presented by me has been thereof used for the award of any other degree, diploma or similar titles.

Shilpa. K. Satheesan

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Shilpa K Satheesan

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1. INTRODUCTION

The family Moraceae, also called the mulberry family, comprises nearly 37 genera and about 1150 species worldwide (Mabberley, 2009). In India the family is represented by about 12 genera and nearly 135 species. *Ficus* is the largest genus in this family and it can be identified with its special type of inflorescence - syconium where the flower remains entirely enclosed in an urceolate receptacle. The species under the genus *Ficus* are commonly called figs. They exhibit numerous growth forms like shrubs, trees, climbers, epiphytes as well as hemi-epiphytic stranglers, making it the world's most diverse woody plant genus with nearly 735 species (Berg & Corner, 2005). According to Chaudary et al. (2012) there are about 89 species of *Ficus* in India. It is an important plant resource due to its high economic, nutritional values and as a significant part of biodiversity as a keystone resource in many tropical forests (Rønsted et al., 2005). Globally, a staggering over 1200 vertebrate species feed on figs, which fruit year around, and are considered critically important to wildlife when other fruits are not available (Shanahan et al., 2001). Many fig species are also pioneers and play a significant role in forest succession in the tropics (Corner, 1965).

Ficus is distributed largely in the tropics and subtropics and can be divided, taxonomically, into two main groups (Corner, 1965; Berg, 1989). One group, comprising the subgenera Urostigma and Pharmacosycea, consists of approximately 370 species, all of which are monoecious. The second group comprises the subgenera Ficus and Sycomorus. Whilst the 13 or so sycomorus species are monoecious, all but three of the approximately 350 species in subgenus Ficus are dioecious (Berg, 1989). The dioecious figs are more appropriately called as gynodioecious. The plant has both long-styled and short styled flowers - syconia on male trees have short-styled flowers, while those on female trees are long-styled flowers; the short-styled flowers are called gall figs and the long-styled flowers are called seed figs. Style length dimorphism is a defining feature of dioecious fig species. Female pollinators are attracted to both gall and seed figs and they pollinate both types, but their offspring only develop in gall figs (Weiblen, 2002). Gall figs are functionally considered as male because they foster the wasp larvae that disperse fig pollen as adults. On the other hand, seed figs are functionally females as they produce viable seeds resulting from pollination. Thus, making the figs dioecious functionally.

Ficus being a keystone species in forest ecosystems attracts and sustains animals which feed and disperse seeds of diverse range of fruits. The diversity and widespread distribution of *Ficus* is a reflection of the variety of animals that have been feeding on figs. A study conducted by Shanahan et al. in 2001, recorded 1274 bird and mammal species, comprising 990 bird species in 374 genera belonging to 54 families and 284 mammal species in 153 genera and 38 families feeding on figs. Additionally, they also recorded figs in the diets of less obvious frugivores, such as fish and reptiles too. *Ficus* guilds have roles in maintaining diversity of other plant species and in facilitating regeneration of disturbed habitats. Fleshy-fruited trees are believed to be the most effective species at attracting frugivores over disturbed habitats and *Ficus* in particular is believed to be a very important genus of fleshy-fruited tree for a wide range of frugivores, thus prove to be more effective restoration nuclei than other species (Slocum, 2001). According to a study conducted by Cottee-Jones et al., 2016, the density of saplings growing under *Ficus* trees was found to be twice as high as the density of saplings growing under other non-*Ficus* trees, while the species richness of these saplings was also significantly higher. This indicates that *Ficus* trees are more effective restoration nuclei than other remnant tree types (Cottee-Jones et al., 2016). *Ficus* trees are found to be supporting the regeneration of plant communities that are representative of the general landscape (Corbin & Holl, 2012).

Ficus species are perhaps, best known for their relationship with pollinating wasps (Hymenoptera, Agaonidae), which with relatively few exceptions, are species-specific (Wiebes, 1979). These host specific pollinators are specially adapted to enter the syconia cavity through a small opening called ‘ostiole’ in the receptive fig. These small insects are believed to use the chemical signals for recognizing the receptive and non-receptive *Ficus* trees (Borges et al., 2011). Once inside the syconium, the wasp pollinates the flower and lays eggs in some of the ovules. The eggs induce gall formation in the ovules and the wasp larvae feed and mature in these galls. The wasp offspring emerge 4-6 weeks after the eggs have been laid. Male wasps emerge first and mate with the female ones that are still in the gall (Weiblen, 2002). The males then dig a hole in the syconium through which the mated females can escape. The maturation of the stamens and the wasps are so much synchronized that by the time the wasp emerges, the stamens also mature and dehisce to release the pollens for propagation. The emerging female wasp collects the pollen and exits the fig through the hole created by the male searching for a receptive fig to continue

the cycle. The adult wasp life span varies from a few hours to two to three days, a period within which they have to find a receptive fig to lay their eggs (Harrison, 2005).

Other than the pollinators, non-pollinators also play role in the fig - fig wasp interactions. Three distinct guilds of non- pollinators have been identified, they are gall makers which attack figs from the exterior, gall makers that enter figs like the pollinators, and parasitoids that attacks fig wasp larvae (Cook & Rasplus, 2003). Parasitoids have extraordinarily long ovipositors that are capable of piercing the fig receptacle, and they are classified in the tribe Sycoryctini. They typically attack pollinator larvae. Gallers in the tribe Otitesellini subfamilies Sycophaginae and families Epichrysomalidae and Eurytomidae have short or long ovipositors, depending on whether they attack figs from the interior or the exterior (Weiblen, 2002). Usually, the gallers like Eurytomidae, Epichrysomalidae etc arrive at the receptive syconia prior to pollinator arrival. These early arriving gallers induce a few very large galls that protrude prominently into the syconium lumen while those arrive either just before or concomitant with the pollinators, like some genus in tribe Otitesellini, usually induce medium-sized galls or galls of the same size as that of pollinators (Farache et al., 2018).

The great majority of wasps associated with the fig inflorescence belongs to the superfamily Chalcidoidea, although a few braconids have also been reared from figs (Van Achterberg & Weiblen, 2000, Wei et al., 2013 & Maqbool et al., 2018). All pollinating fig wasps are included in the family Agaonidae. All non-pollinators (interlopers) are classified under five chalcid families (Pteromalidae, Ormyridae, Epichrysomalidae, Eurytomidae and Torymidae). Earlier, all fig wasps were classified into a single family, Agaonidae and six subfamilies - Agaoninae, Epichrysomallinae, Otitesellinae, Sycoryctinae, Sycoecinae and Sycophaginae (Bouček, 1988). Later, based on molecular phylogenetic studies 4 subfamilies, Sycoecinae, Otitesellinae, Epichrysomallinae and Sycoryctinae were assigned to the family Pteromalidae, leaving all the pollinating fig wasps and a small group of non-pollinating wasps (Sycophaginae) in the family Agaonidae (Heraty et al., 2013). Recently, Cruaud et al. in 2022 and Burk et al. (2022) assigned non-pollinators subfamily (Sycophaginae) of Agaonidae to Pteromalidae and Burk et al. (2022) has elevated the subfamily status of Epichrysomalinae to Epichrysomalidae family and grouped the fig associated old world genera of subfamily Otitesellinae and Sycoryctinae into a new tribe Otitesellini within Pteromalinae subfamily

of Pteromalidae. The gall size of most of the parasitoid species are also similar to that of pollinators. They mostly at almost similar time phase to the receptive fig (Ghara & Borges, 2010). As from our observations, Braconids and Ormyrids induce normal sized galls which are larger than the pollinator galls but smaller than that of the galler galls.

Scientists have described approximately 640 species of fig wasps in the world, probably representing 20-30 percent of existing species (Priyadarsanan, 2000). The total number of fig insects reported from India is approximately 83, of which 62 are from Kerala (Priyadarsanan, 2000). According to Pramanik and Dey (2016) 115 fig wasp species are reported in India and 64 species from Kerala, where they reported to be considered as the hotspot in India for the fig wasps. A fig and fig wasp study in South Wayanad Division, in Wayanad district has reported around 24 species of fig and 31 wasps associated with figs (Satheesan, 2016).

Although *Ficus* are considered to be a very important tree, especially in tropics, including the Western Ghats, there are very few studies documenting their species richness and abundance in Forest areas. Wayanad district of Kerala which has a geographic area of 2130 km^2 with around 1581 km^2 forest cover (FSI Report, 2021) has 189 km^2 is very dense forest, 1205 km^2 medium dense forest and 187 km^2 open forest cover (FSI Report, 2021), including the Wayanad Wildlife Sanctuary. WWS is the second largest protected area in Kerala having area of 344.53 $km^{2.}$ Supporting the world's largest population of Asian elephants and also serves as an important habitat for the Bengal tiger population in the country (Management Plan, Wayanad Wildlife Sanctuary 2012-2022). Most of the studies carried out in Wayanad were mainly focused on the vertebral faunal studies, especially larger mammals. Except for all Kerala floral surveys or floral studies conducted by Kerala Forest Research Institute (KFRI) and Fig wasps of Kerala by Priyadarsanan, 2000, other floral assessment and insect diversity assessment focusing particularly on Wayanad are very much limited. Hence the present study was designed to assess richness of the keystone species, the *Ficus* and its associated wasps in the Wayanad regions.

Objectives of research topic are:

- Species inventory survey of *Ficus* and fig wasps using classical taxonomy.
- To discover and describe new species of fig associated wasps from the Wayanad region of Western Ghats

- To develop workable dichotomous keys for the identification of *Ficus* and fig associated wasps of the study area.
- To evaluate the host association of pollinator and non-pollinator fig wasps with selected *Ficus* species.
- To study and map the distribution of *Ficus* species in the protected areas (Wayanad Wildlife Sanctuary) of Wayanad region

2. LITERATURE REVIEW

The family Moraceae, also called Mulberry family comprises nearly 37 genera and about 1150 species worldwide (Mabberley, 2009). In India the family is represented by about 12 genera and nearly 135 species (Chaudary et al., 2017). *Ficus* is the largest genus in this family and it is identified by its special types of inflorescences – syconium, where the flowers remain entirely enclosed in an urceolate receptacle. The species under genus *Ficus* are commonly called figs.

Ficus is one of the most diverse genera with its habit ranging from trees, shrubs, climbers to creepers and it exhibits different growth form as free standing, epiphytes, semi-epiphytic stranglers (Corner, 1988; Berg, 1989). It is one of the largest genera in angiosperms with nearly 735 species (Berg & Corner, 2005). It is predominantly found in the tropical and subtropical regions of the world. The Asian and Australasian regions are the richest in terms of distribution with almost 500 species, followed by Africa and the America (Chaudary et al., 2017).

Oldest description of *Ficus* dates back to Linnaeus (1753) in his 'Species Plantarum' and in 1754 in his 'Genera Plantarum'. Later there was steady increase in the number of species added to this genus in till 1900. Gasperrini (1844, 1845) was first to classify *Ficus* based on floral characters. He split the genus *Ficus* into many genera. Miquel (1947, 1948) also added three more genera to this classification. Later, Miquel (1867) revised the *Ficus*, recognizing some of taxa as subgeneric division of *Ficus*, erecting six subgenera into the unified genus *Ficus*. The first comprehensive revision of *Ficus* was done by Corner and published a series of publication spanning five decades (1960a, 1960b, 1960c, 1960d, 1960e, 1960f; 1961; 1962a, b; 1965; 1967; 1969; 1970a, 1970b; 1972; 1975). Corner in 1960 re-evaluated Miquel's infrageneric classifications in various publications and provided the foundation for the present *Ficus* classification. He recognized four subgenera - Ficus, Pharmacosycea, Sycomorus and Urostigma. Ramirez (1977) suggested changes that reflected the understanding of the fig wasp taxonomy and classification. While Berg (1989, 1990, 1998) has suggested changes based on his work on African members of the genus and he recognized two groups, one comprising the subgenera Ficus and Sycomorus and other consisting subgenera Pharmacosycea and Urostigma. Later Rohwer (1993) recognized five subgenera, he also raised a new subgenera Sycidium. Berg (2003a)

proposed subdivision of the genus comprising six subgenera: Pharmacosycea, Urostigma, Ficus, Sycidium, Synoecia and Sycomorus. Subgenera Pharmacosycea and Urostigma had only monoecious species, whereas Ficus, Sycidium, and Synoecia had only gynodioecious species and Sycomorus with both gynodioecious and few monoecious species. This subdivision was supported by the analyses by Weiblen (2000), which were partly based on molecular data. Berg (2003b, 2003c, 2003d, 2003e; 2004a, 2004b) published detailed record of each subgenus and their subdivisions into sections and subsections, this classification is presently followed. Dixon (2003) did taxonomic revision of Australian *Ficus* belonging to Malvanthera section of sub genus Urostigma of Australian region. Ronsted et al. (2008) in phylogenetic analyses of 100 species of *Ficus*, representing all subgenera, identified fifteen clades within *Ficus* genus. Chantarasuwan et al. (2013) revised *Ficus* subsection Urostigma. Bain et al. in 2015 reviewed *Ficus* and fig wasps of Taiwan. Chantarasuwan et al. (2015) presented a new classification for *Ficus* subsection urostigma, adding two species each to subsection Urostigma and Conosycea together with supporting the concept of subsection Urostigma excluding former section Leucogyne using molecular and morphological evidences. In 2022, Rasplus et al. published detailed account of *Ficus* of Madagascar.

In India, the preliminary work on *Ficus* was carried out by Roxburgh (1832) later, the first systematic account on Indian *Ficus* presented by King (1888) in Hooker's 'The Flora of British India', recorded 112 species and 47 infraspecific taxa of which only 75 species and 16 infraspecific taxa are known from the present Indian political boundary. Gamble and Fischer (1887) in their 'Flora of presidency of Madras' has described 25 species of *Ficus* from peninsular India. At the Indian level, George King's (1887-88; 1888) publications, 'The species of *Ficus* of Indo-Malayan and Chinese countries' and 'The Flora of British India – *Ficus*' after 130 years still remain among the best studies to address the Indian *Ficus* species. There are no comprehensive studies of *Ficus* happened in India and taxonomy and distribution of Indian *Ficus* trees are still a less explored area. There are only random scattered works published across India on the diversity and distribution of *Ficus* species. Some of these were published by Rani (1985), Ghafoor (1985), Sreekumar & Debnath (1992), Basu (1994, 1996), Khanna (1996), Sreekumar (1998), Sasidharan & Augustine (1999), Priyadarsanan (1999), Vanitharani et al. (2009), Khanna & Anand (2002, 2009), Pandey and

Rasingam (2008), Abdul Kader (2009), Upadhyay and Srivastava (2010), Kumar et al. (2011). Chaudhary et al. (2012) published a checklist of Indian *Ficus*, after long years, that reported 115 taxa - 89 species and 26 infraspecific taxa. Murugan et al. (2013) reported 26 species of *Ficus* from Andhra Pradesh. Buragohain et al. (2014) recorded *Ficus geocarpa* from Arunachal Pradesh for the first time in India. Upadhyay & Chakrabarty (2014) discovered *Ficus jarawae* from Andaman Islands. Sudhakar & Murthy (2015) identified *Ficus anamalayana* from Tamil Nadu. Dhungana et al. (2015) reported 28 taxa of *Ficus* from Assam. Buragohain & Swargiari (2016) reported 10 species of *Ficus* from Chakrashila Wildlife Sanctuary, Kokrajhar district of Assam. Pramanick (2016) reported 24 species of *Ficus* from Uttarakhand. In 2017, a book on *Ficus* species of Eastern Ghats recorded 27 wild fig species was published by Chaudhary et al. Madhukar & Nathu (2019) recorded nine species of *Ficus* from Nandgaon and Chandwad tehsils of Nasik District, Maharashtra. Diversity of *Ficus* in Forest research institute, Dehradune, Uttarakhand was studied by Kumar et al. (2021) reporting 16 species. Diversity of Sikkim Himalayas were accessed by Lepcha and Sharma (2021) and recorded 36 species.

The taxonomy and distribution of *Ficus* are not studied across Kerala. Floristic studies that generally cover the whole state is the only documentations available for *Ficus* distribution and diversity across the state. Nair et al. (1997) studied the flora of KFRI campuses in Kerala and they reported nine *Ficus* species and their detailed descriptions. Sasidharan & Augustine (1999) reported *Ficus caulocarpa* and *Ficus costata* from India for the first time. Priyadarsanan (1999) reported 23 species of figs from Kerala. Narayanan (2005) quantified the flora of Wayanad and reported 2034 taxa of flowering plants including 15 *Ficus* species from Wayanad. Sasidharan (2006) studied tree flora in Kerala and reported 21 *Ficus* species and published their taxonomic keys. Satheesan (2016) reported 24 species of *Ficus* species from South Wayanad forest division of Wayanad district.

The interaction between fig trees (Moraceae: *Ficus*) and fig wasps (Hymenoptera, Agaonidae) is well-known. This mutualism has evolved over 60 million years (Ronsted et al., 2005; Compton et al., 2010). Fig trees depend on fig wasps for pollination and the wasps depend on figs for the development and reproduction of their offspring (Janzen, 1979; Compton, 1993; Weiblen, 2002; Herre et al., 2008). The great majority of wasps associated with the fig inflorescence belong to the superfamily Chalcidoidea,

although a few braconids have also been reared from figs (van Achterberg & Weiblen, 2000, Wei et al., 2013 & Maqbool et al., 2018). Pollination within the fig trees depends on female fig wasps. These pollinating fig wasps belong to a single family, Agaonidae. There are over twenty recognized genera of pollinating fig wasps (Wiebes, 1981; Cruaud et al., 2012). Each fig tree species was thought to be pollinated by a fig-specific wasp species; however, it has been shown that many fig tree species are pollinated by two or more wasp species (Berg, 1989; Wiebes, 1979; Compton et al., 2009). In addition to pollinating wasps, a diverse assemblage of non-pollinating wasps also develops within the fig fruits. These non-pollinating fig wasps (NPFW) include gallers, inquilines, cleptoparasites, parasitoids of pollinators, and parasitoids of other non-pollinating wasp species (Bronstein, 1991; Kerdelhue, Rossi & Rasplus, 2000; Chen et al., 2013). The non-pollinating wasps tend to also be specific to a single fig species (Cook & Segar, 2010), but on the other hand, data collected in Asia (Weiblen & Bush, 2002) and in Panama (Marussich & Machado, 2007) show that NPFWs can be less specific to the host fig than pollinators. These non-pollinating wasps belong to several families like Eurytomidae, Ormyridae, Epichrysomallidae, Pteromalidae etc. (Kerdelhue, Rossi & Rasplus, 2000; Cruaud et al., 2022; Burk et al., 2022) from the super family of Chalcidoidea (Segar & Cook, 2012; Heraty et al., 2013).

Walker (1846) erected the family Agaonidae taking the genus *Agaon* as the basis and put all fig pollination insects under it. The first review of fig insect taxonomy was by Mayr in 1885. Ashmead (1904) classified Chalcidoidea to include all pollinating fig insects into the subfamily Agaoninae. The genera *Crossogaster*, *Sycophaga* and *Platyscapa* were included under the subfamily Sycophaginae of Agaonidae while other fig wasp genera were allocated into the subfamily Idarninae of Torymidae. Hill (1967 a, c) divided the torymid fig wasps into two subfamilies; viz., Epichrysomallinae and Sycophaginae and erected a new tribe Sycoecini. Wiebes (1974) divided Agaonidae, the fig pollinators into two subfamilies: Blastophaginae comprising the Old-World pollinators and Agaoninae comprising the New-World pollinators. Bouček (1988) in his "Australasian Chalcidoidea" treated all fig insects under a common family, Agaonidae, including all the fig associated wasps presently classified under Pteromalidae and the Torymidae. Wiebes (1989) was of the opinion for reconsideration of the fig species classification based on pollinators phylogeny, which Ramirez regarded in his new classification for *Ficus* in 1977. Bouček reassigned non-pollinators

in Agaonidae to Ormyridae, Torymidae and Pteromalidae in his revision of Neotropical fig wasps (Bouček, 1993). Later based on morphological and molecular studies by Machado et al., 1996; Kerdelhué, 1997; Rasplus et al., 1998 found that Agaonidae, as defined by Bouček was paraphyletic. Later, three subfamilies of non-pollinating fig wasps, Sycoecinae, Otitesellinae and Sycoryctinae, were reassigned to Pteromalidae and pollinating fig wasps were restricted exclusively to Agaonidae (Rasplus et al., 1998; Campbell et al., 2000). Cruaud et al. (2010) proposed further splitting of the family Agaonidae into three subfamilies Agaoninae, Kradibiinae and Tetrapusiinae. Subsequently, Heraty et al. (2013) recognised Sycophaginae as a sister clade of Agaonidae and included it in this family. The remaining group of non-pollinating fig wasps were placed in family Pteromalidae (Heraty et al., 2013). Cruaud et al. (2022) re-assigned subfamily Sycophaginae of family Agaonidae to Pteromalidae. Burk et al. (2022) has elevated the subfamily status of Epichrysomalinae to Epichrysomalidae family and grouped the fig associated Old World genus of subfamily Otitesellinae and Sycoryctinae of former Pteromalidae family into a tribe Otitesellini of Pteromalinae subfamily of the new classification.

Walker and Saunders were the pioneer researchers on fig and fig wasp interactions in India. Walker reported seven species of fig wasps from India in 1871 and reported on the parasites of fig wasps in 1875. This work was followed by a series of publications, from Saunders (1882, 1883), Westwood (1883), Mayr (1885, 1906) and Grandi (1916). Mani in 1938 recorded 17 species of fig wasp in the Catalogue of Indian insects, part 23-Chalcidoidea. But most of the work on taxonomy of fig wasps in India was carried out by Joseph (1952, 1953a, 1953b, 1953c, 1954a, 1954b, 1956, 1961). Later, Joseph along with Abdurahiman (Abdurahiman & Joseph, 1967a, 1967b, 1975a, 1975b, 1976; Joseph & Abdurahiman, 1968 & 1969) in their series "Contributions to Our Knowledge of Fig Insects in India" and in other publications described and recorded many species of fig wasps. Abdurahiman (1980) studied partner systems of *Ficus hispida* and found that *Philotrypesis pilosa* and *Apocrypta bakeri* are cleptoparasites of *Ceratosolen marchali*. Abdurahiman (1972); Abdurahiman and Joseph (1978, 1979) also carried out research on *Apocrypta bakeri* and Abdurahiman (1986) made observations on behavior and biology of *Philotrypesis pilosa*. Nair and Abdurahiman (1984, 1987) studied the population dynamics of *Kradibia gestoi*, the pollinator of *Ficus exasperata*. Mani (1989) published a checklist of 49 Indian fig wasp

taxa. Later, in 1990s Priyadarsanan along with Abdurahiman (Priyadarsanan & Abdurahiman 1994a, 1994b, 1997a, 1997b; Priyadarsanan 1999) made significant contribution towards the species level taxonomy of fig wasps in southern India. Priyadarsanan (2000) published the only comprehensive work on fig wasp of Kerala. Other aspects of *Ficus* and fig wasp interactions like community structure and life history traits of *Ficus racemosa* has been worked out in India by Proffit et al. (2007) and Ghara et al. (2010; 2011). Borges et al. (2018; 2011) worked on the chemical ecology of the fig and fig-wasp interactions. An updated checklist of 80 fig insects in India was published by Pramanik & Dey in 2016.

India has ten different genera of Agonidae with around 35 species (Noyes, 2019). They are *Blastophaga* Gravenhorst, (Gravenhorst 1827), *Ceratosolen* Mayr (Mayr, 1885), *Dolichoris* Hill (Hill, 1967), *Eukoebelea* Ashmead (Ashmead, 1904), *Eupristina* Saunders (Saunders, 1882), *Kradibia* Saunders (Saunders, 1883), *Neoeukobelea* Lal, Farooqi and Husain (Lal et al., 1991), *Platyscapa* Motschulsky (Motschulsky, 1863) and *Wiebesia* Bouček (Bouček, 1988). Previously, *Sycophaga* Westwood (Westwood, 1840) also belonged to Agaonidae but now *Sycophaga* genus is moved to Pteromalidae (Cruaud et al., 2022; Berg et al., 2022.).

Family Epichrysomalidae is associated with *Ficus* ovarian galls. *Acophila* Ishii (Ishii, 1934), *Sycobia* Walker (Walker, 1871), *Camarothorax* Mayr (Mayr, 1906), *Sycobiomorphella* Abdurahiman & Joseph (Abdurahiman & Joseph, 1967), *Parasycobia* Abdurahiman & Joseph (Abdurahiman & Joseph, 1967), *Sycophilodes* Joseph (Joseph, 1961), *Sycophilomorpha* Joseph & Abdurahiman (Joseph & Abdurahiman, 1969) are the Epichrysomalidae genera that are associated with *Ficus* trees in India. The family Epichrysomalidae was previously considered as a subfamily Epichrysomalinae of Pteromalidae family. It was raised to the family status by Berg et al. in 2022.

Some of the genera of the tribe Otitesellini of subfamily Pteromalinae and also subfamily Sycophaginae of family Pteromalidae is associated with *Ficus* ovarian galls. This tribe Otitesellini is divided into subtribes for convenience like Otitesellina and Sycoryctina. In Otitesellina, *Grasseiana* Abdurahiman & Joseph (Abdurahiman & Joseph, 1967), *Marginalia* Priyadarsanan (Priyadarsanan, 2000), *Micranisa* Walker (Walker, 1875), *Otitesella* Westwood (Westwood, 1883), *Philosycella* Abdurahiman

& Joseph (Abdurahiman & Joseph, 1976), *Walkerella* Westwood (Westwood, 1883) are genera reported from India. Sycoryctina subtribe have the following genera associated with *Ficus* in India - *Apocrypta* Coquerel (Coquerel, 1855), *Philotrypesis* Forster (Forster, 1878), *Watshamiella* Wiebes (Wiebes, 1981), *Adiyodiella* Priyadarsanan (Priyadarsanan, 2000), *Arachonia* Joseph (Joseph, 1957), *Philoverdance* Priyadarsanan (Priyadarsanan, 2000), *Sycoscapter* Saunders (Saunders, 1883). The subfamily Sycophaginae in India is represented by genus *Sycophaga* Westwood (Westwood, 1840).

After Walker (1871) *Sycophila* genus of family Eurytomidae was erected. Some of the *Sycophila* species are seen associated with *Ficus* flower galls. There are around 20 species of *Sycophila* species in India (Noyes, 2019), out of which eight are reported from *Ficus* species (Narendran, 1994, Pramanik & Dey, 2016). Seven species were reported on *Ficus benghalensis* (Walker, 1871, Joseph & Abdurahiman, 1968) and *Sycophila fici* from *Ficus virens* (Joseph, 1961). Ormyridae family has genus *Ormyrus* Westwood (Westwood, 1832) with six species associated with *Ficus* (Narendran & Abdurahiman, 1990, Narendran, 1999). The genus *Ficobracon* of Braconinae subfamily of Braconidae family was established by van Achterberg & Weiblen (2000) was also found associated with *Ficus*. In India, *Ficobracon* was first reported from Kashmir (Maqbool et al., 2018). Samartsev & Ku (2020) synonymized *Ficobracon* to *Syntomernus* Enderlein, 1920.

The fig - fig wasp mutualism had attracted a lot of attention among the ecologists, taxonomists and evolutionary biologists etc. However, there are many facets that still need investigation. Considering the taxonomy of *Ficus* and fig wasps, in Indian scenario, there are much more to discover than what have already identified. As per Chaudhary et al., 2012, Indian *Ficus* are less studied for their distributions and species richness and this was the only recent study on checklist of Indian *Ficus*, pointing to the gaps in *Ficus* studies. There are around 89 species of *Ficus* in India (Chaudhary et al., 2012), which would anyway host around a minimum of 180 species of wasps. According to Pramanik and Dey, 2016 there are only 80 species of fig wasps identified in India, clearly indicating the major lacunae in the taxonomic studies of fig associated wasps of Indian main land.

3. STUDY AREA

Wayanad got the status of district in November 1, 1980. The name Wayanad is said to be derived from 'Vayalnadu' (land of grassy swamps). Wayanad district is located between North latitude 11^0 26' to 12^0 00' and East longitude 75^0 75' to 76^0 56' and lies in the northwest corner of the Nilgiris ranging from 600 to 2100m above sea level with a total geographic area of about 2136 km^2. The name Wayanad, traditionally, refers to the region encompassed by the Wayanad plateau (about 3000 km^2) situated at the confluence of three biologically distinct and diverse regions - the main Western Ghats Mountains, the Nilgiri hills and the Deccan plateau. The Wayanad plateau area is mostly located in Kerala, with small parts of it in Karnataka and Tamil Nadu. The plateau rises steeply from the coastal plains of Kerala and slopes gently eastwards to merge with the Deccan plateau in the east. To the west and south of Wayanad lies the low lands of Malabar, in the east rises the Nilgiri hills, and to the north-east lies the Mysore plateau, while to the north-west Coorg.

The mean average rainfall in this district is 2608 mm and the mean maximum and minimum temperature are 29°C and 18°C respectively. This place experiences a high relative humidity, which goes up to 95 per cent during the south-west monsoon periods. The east-flowing river, the Kabani, and its tributaries water almost the entire area of Wayanad district. With a total catchment area of 1934.50 km^2, the river Kabani has a basin length of 56 km in Wayanad. The west flowing Chaliyar with a catchment area of 50 km^2 in the district runs for 12 km through Wayanad.

Topographically the district can be divided in two parts, the south-western part and the north-eastern part. Along the south-western corner of Wayanad, there is the Chembra-Vellarimala mountain range. The north-eastern corner of Wayanad is the hill range called the Brahmagiris and the north-eastern sides are the Wayanad Wildlife Sanctuary.

Wayanad district is divided into three forest divisions – 1. North Wayanad Forest Division comprising Begur, Periya and Mananthavady ranges, 2. South Wayanad Forest Division with Kalpetta, Meppady and Chedalath ranges and 3. Wayanad Wildlife Division having Kurichiat, Muthanga, Sulthan bathery and Tholpetty range.

Wayanad Wildlife Sanctuary is the only protected (sanctuary) area in the Wayanad district. It as an administrative unit having 344.44 km^2 of area, comprising two

discontinuous units of 77.67 km^2 (called WS-I) and 266.77 km^2 (called WS-II). The larger of the two (WS-II) lies within the geographical extremes of latitudes 11°35'N-11°49'N and longitudes 76°13' E-76°27' E. The other part (WS-I) lies within latitudes 11°50' N - 11°59' N and longitudes 76°02' E - 76°7' E. The Tholpetty range of the sanctuary is located in WS-I, whereas Kurichiad, Sulthan Bathery and Muthanga ranges are situated in WS-II. As per available records and verbal accounts, the natural habitat contiguity between WS-I and WS-II parts was completely severed during late 1970s as a result of the incessant encroachments in Pulpally vested forests. Connectivity between the two patches, however, exists through the Bandipur tiger reserve and Nagarhole tiger reserve on the Karnataka side of the border.

By following Chandrasekharan (1962) and Champion and Seth (1968) the natural vegetation of the study area can be broadly classified into the following types:

a) West-coast tropical evergreen forests (evergreen): This is the major vegetation in the Meppady, Kalpetta, Periya and Manathavady forest ranges at an altitude ranging from 600m to 1300m
b) West-coast tropical semi-evergreen forests (semi-evergreen): It's found below 900m and is intermediate vegetation between the moist-deciduous and wet-evergreen forests. It is a heterogeneous mixture of species that are common in evergreen and moist-deciduous forests. This is seen mainly in slopes of Manikkunnumala, Chooralmala, Mundakai, Kurichairmala, Thariodu, Soojipara, Kanthanpara, Makkimala, Muttilmala, Thirunelli area, etc.
c) Southern moist-mixed deciduous forests (moist deciduous): This type of forests are the dominant vegetation type in the Wayanad Wildlife Sanctuary (Muthanga, Tholpetty forest ranges) and Kurichiad, Naikkuppa, Pathiri and Kuruva forest areas of Chedeleth range having an elevation range of 700 m to 900 m.
d) Southern dry-mixed deciduous forests (dry deciduous): These forests are seen in the Eastern side of the Wayanad Wildlife Sanctuary continuous with the deciduous forests of Mudumalai ranges of Tamil Nadu and Bandhipur, Nagarhola National Park of Karnataka.
e) Southern montane wet-temperate forests (shola): Southern montane wet-temperate forests are seen above 1500 m altitude (1500 m-2000 m), and is essentially a stunted evergreen forest. It is found in Chembra peak, Vellarimala, Kattimattam, Kurichiarmala, Banasuramala and Brahmagiri.

f) Southern wet-montane grasslands (grasslands): Grasslands are confined to the hilltops where the altitude is above 1200m mainly at Chembra hills, Sugandhagiri-Amba, Manikkunnumala, Banasuramala, Kurichiarmala and Brahmagiri hills. The vegetation is dominated by grasses, herbs and sub-shrubs.

Apart from these vegetation types, certain edaphic types such as reed brakes, moist bamboo brakes, secondary evergreen forests, pseudosholas and marshy grasslands are also present in the district (Narayanan, 2005). Gregarious growth of bamboos is found in moist deciduous forests of Wayanad Wildlife Sanctuary, Naikuppa, Kuruva and Pathiri (Narayanan, 2005). Kabani and its tributaries constitute a powerful river system in the landscape of Wayanad and are associated with a more or less defined riparian flora, mostly along the Kuruva regions. Forest plantations also occupy a major part of the district. Teak and Eucalyptus are the most extensively cultivated species in forest areas of Kalpetta and Meppady ranges and in many parts of the Wildlife Sanctuary.

4. MATERIALS AND METHODS

4.1. FIELD SAMPLING

The methodology adopted for surveying *Ficus* was the transect method. The three forest divisions of the district had numerous roads (national highways, state highways, district roads and rural roads) and forest trek paths covering most of the habitats of the area. Hence, the sampling transects were chosen along the roads and the trek paths. *Ficus* were sampled along these paths, covering both sides of the transect. For every encountered *Ficus* tree, GPS location, growth form and flowering status were recorded (Krebs, 1989). Garmin eTrex 10 was used for locating individual *Ficus* trees and mapped using QGIS open-source software. The survey was conducted in the day time from 8.00 AM to 5.00 PM. Sampling was conducted in three forest divisions covering ten different ranges *i.e.*, Kalpetta, Meppady and Chedalath of south Wayanad; Muthanga, Kurichiat, Sulthan Bathery and Tholpetty, of the Wayanad wildlife sanctuary; Begur, Periya and Mananthavady of north Wayanad. King (1888), Sasidharan (2006) and Sudhakar et al (2017) were referred for identification of *Ficus* species. Herbarium collections of KFRI, Peechi and Department of Botany, University of Calicut, Thenhipalam were studies for better understanding and comparison of identified *Ficus* species.

The located *Ficus* trees, if flowering, mature flowers (Syconia or fig) were collected at the D-Phase. D-Phase is that phase when the wasps are ready to emerge (Weiblen, 2002). If the tree is not flowering, frequent visits were conducted for observing the flowering timing and if lucky enough, flowers were collected later when the tree started flowering. Syconia from figs were collected with twigs or as individual syconium. From a tree, around 30 to 35 fig fruits were collected in zip lock bags and labeled. The details of location, name of the collector, name of the tree and date were noted.

4.2. WASP COLLECTION, PRESERVATION AND IDENTIFICATION

4.2.1. Wasp collection and Preservation

The collected figs were split into halves and kept in jars with their mouths tied tightly with cotton cloth, in order to prevent insects from escaping. After five to eight hours, the jars were inverted to allow the insects to move upwards and the cut fig towards the mouth of the jar and then the cut figs were removed carefully. The insects were then killed by

flushing 40 percent alcohol into the jar. The whole community, the pollinators (male and female), parasitoids and inquilines were collected. The insects collected from each fig were sorted to morphospecies and transferred into separate vials, labelled, counted and stored. For long term storage the insects were preserved in 80 per cent alcohol in cold conditions.

4.2.2. Mounting and Identification

One or two specimens were mounted on clean triangular cards for detailed study. The specimens were initially dehydrated by passing through alcohol series *i.e.,* the specimens were transferred to 90 per cent and then to 100 per cent alcohol for dehydration. These were then dried in HMDS (Hexamethyldisilazene). For this, specimens in 100% alcohol were transferred to HMDS in cavity blocks for about half an hour. These were then transferred to a second cavity blocks of HMDS for another half an hour and then the HMDS was allowed to evaporate under a bulb for one hour (Heraty & Hawks, 1998). The dried specimens were then mounted on card triangles about 10 mm long with a base about 3-3.5mm wide, by gluing the right mesopleuron to the card point (Noyes, 1982). The specimen is positioned horizontally with the lower and upper parts of the body freely exposed. Cold water soluble pure-cellulose glue (Ento Sphinx Hercules glue) was used for mounting. Triangular card points were held on standard entomological pins (Ento Sphinx No. 2) of size 38 mm x 0.45 mm. After permanent mounting, labels indicating the name of the country, state and location from which the specimen were collected, the date of collection and the name of collector were added to the pin. The mounted specimens were stored in air tight insect boxes made of teak wood. Para dichlorobenzene (PDB) and naphthalene balls together with rolled cotton swabs soaked in phenol and camphor concoction (25 g of camphor dissolved in 75 ml of phenol solution) were pinned along with the specimens in the insect boxes to check the infestation of insect and mite pests on the stored specimens.

Specimen were sorted and mounted under Leica M60 Stereo zoom Microscope and Leica S9i Stereo zoom Microscope. Observations on the morphological features and identification were done under both Leica S9i Stereo zoom Microscope and Leica M205A Stereo zoom Microscope. For photographing the specimens, images at varying depth were stacked using Leica Auto montage Software V3.80 by Leica S8 APO attached to a Leica DFC 2900 digital camera on Leica M205A Microscope and were stacked into a

single image using Leica Auto montage Software V4.2. Measurements of the specimen under observation and study were obtained using Leica LAS (Leica Application Suite V4.2) microsystems by Leica (Herzberg, Switzerland) and the final illustrations were post-processed for contrast and brightness using Adobe® Photoshop® CS5 (Version 12.0 x64) software.

Type Species Examined: Type species of genus *Sycophila* of Eurytomidae family deposited in Western Ghats regional centre – Zoological Survey of India, Calicut were examined. The examined type species were *Sycophila chaliarensis* Narendran, *Sycophila pilosa* Narendran, *Sycophila kokila* Narendran, *Sycophila petersteni* Narendran, and *Sycophila mukerjeei* Narendran.

4.3. MORPHOLOGICAL TERMINOLOGY & ABBREVIATIONS USED IN INSECT TAXONOMY

Terminologies and images used are referred from Noyes, 2019.

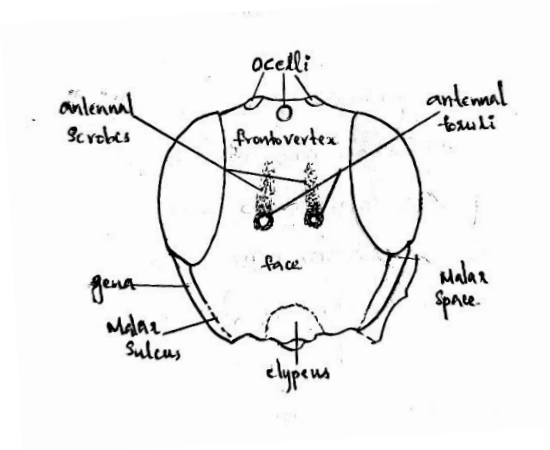
Head in Agaonid wasps usually have forward oriented mouthparts (prognathous) other fig wasp families have vertically oriented mouthparts (orthognathous). In anterior view, the HEAD consists of the FRONS OR FACE - the anterior margin of eye to the lower margin of eye, CLYPEUS- median region just above the mouthparts; a medial depression above antenna forming a SCROBE. In dorsal view face has OCELLUS - an anterior or median ocellus and two posterior or lateral ocelli. Area on the top of head behind the median ocellus forms the VERTEX. The minimum distance between posterior ocelli and eye forms the OOL (OCELLO-OCULAR LENGTH) and the inter distance between two posterior ocelli forms the POL (POSTERIOR OCELLAR LENGTH). In lateral view, the top of the head behind each compound eye forms the GENA. A depression, usually carinate separates the gena from the lower face called MALAR SULCUS. Each antenna is attached on the head capsule by a ring like sclerite opening called TORULUS attached via RADICLE on the head capsule. A typical antenna consists of three parts: SCAPE, PEDICEL and FLAGELLUM. The flagellum is divided into flagellomeres with the terminal flagellomere distinctly formed called CLAVA. The basal flagellomere in some cases form ring-like (anneliform) structure called ANNELLUS. Antenna are also often equipped with longitudinal ridge-like sensory sensilla such as LINEAR SENSILLA and plate sensilla on either some or all flagellar surface, either scattered or dense. The

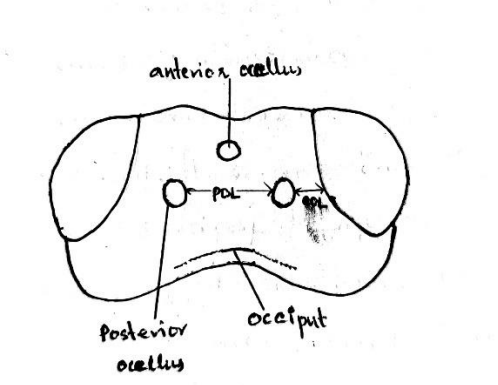
representation of the number of each antennal segments numerically is called ANTENNAL FORMULA.

The MESOSOMA comprises of PRONOTUM, MESONOTUM, and METANOTUM along with the first abdominal segment forming the PROPODEUM. MESONOTUM is divided into an anterior MESOSCUTUM and a posterior SCUTELLUM and axilla complex by a trans-scutal line. The mesoscutum is subdivided into a median lobe and two lateral lobes by grooves called NOTAULI. In some groups, notauli are faint or reduced. The scutellar axillar complex is composed of a median scutellum and two lateral axillae. The METANOTUM is narrow and is fused with the PROPODEUM. FOREWING venation is reduced to a single vein complex near the costal margin. It consists of a basal SUBMARGINAL vein followed by MARGINAL VEIN. The marginal vein is succeeded by the POSTMARGINAL VEIN after the branching point of the STIGMAL VEIN. In LEG the first segment is COXA and the second segment is called FEMUR. Coxa and femur are joined by a small segment, the TROCHANTER. Femur is followed by TIBIA and TARSUS. Each segment of the tarsus is called TARSOMERE, and its first segment is named BASITARSUS (METATARSUS) while the last segment is the PRETARSUS. The first abdominal segment is fused with the thorax and is called the PROPODEUM. The apparent abdomen is called the GASTER. The sternite of 7th segment is broad and long and is termed HYPOPYGIUM. All female agaonids except those of the subfamilies Otitesellinae and Epichrysomallinae possess long protruding ovipositors.

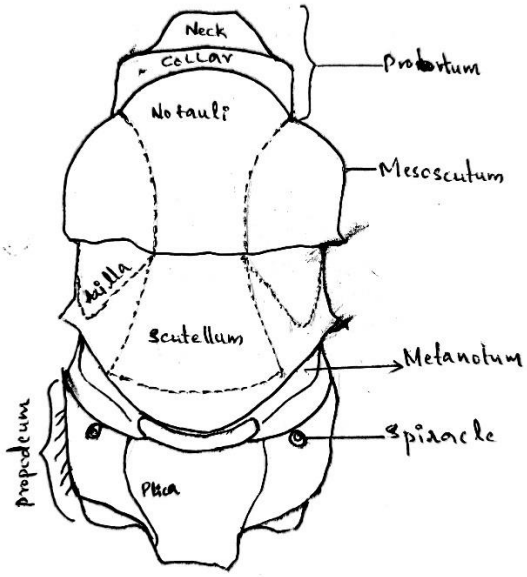
MORPHOLOGICAL PARTS OF CHALCIDOIDEA INSECTS

Head

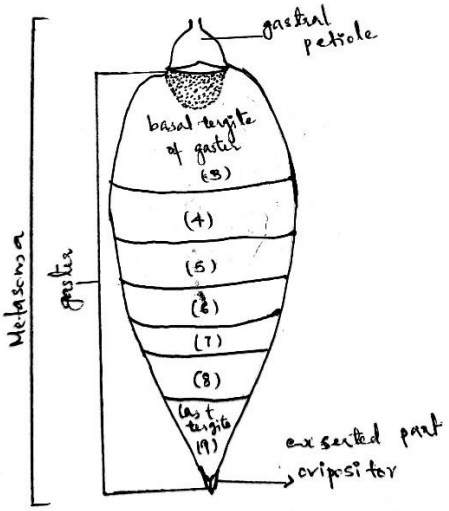




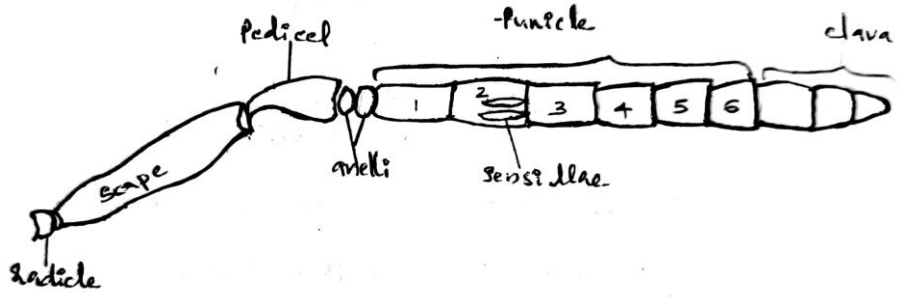
Thorax (dorsal view)



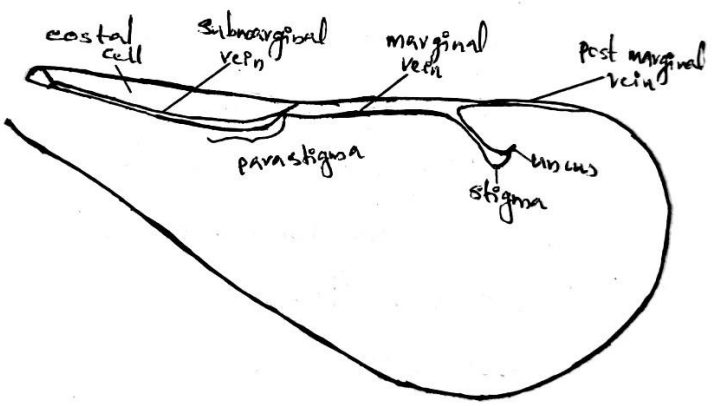
Gaster (dorsal view)



Antenna



Fore wing



OTHER TERMS USED IN INSECT TAXONOMY

Terms used are referred from Harris, 1979.

ALVEOLATE – honeycombed; with regular deep angular cavities separated by thin partitions. Furnished with cells or alveoli

AREOLATE – divided into a number of small irregular spaces

CARINAE – small elevated longitudinal ridges

CARINATE – keeled; having keels or carinae; with one, or several, but usually few longitudinal narrow raised ridges

CORIACEOUS – leather like in texture, with minute cracks like human skin

CRENULATE – having the margin finely notched with small rounded teeth

ECARINATE – without keel or carina

FOVEATE – pitted; with numerous regular depressions or pits

FOVEOLATE – with small deep pits; finely pitted

GLABROUS – smooth, devoid of pubescence

GRANULATE – covered with or made up of very small grains or granules

IMBRICATE – partly overlapping and appearing like shingles on a roof or scales on a fish

IMMACULATE – destitute of spots, marks or sculpturing

IMPRESSED – having shallow depressed areas or markings

IMPUNCTATE – not punctate or marked with punctures

LINEATE – longitudinally marked with raised or depressed parallel lines; with linear marks

OBSCURE – not readily seen; not well defined

PLICA or PLICATE – impressed with striae to produce the appearance of been folded or pleated; folded; with folds

PROMINENT – raised or produced above the surface or beyond the margin; conspicuous by position.

PROTUBERANCE – any excrescence above the surface

PUNCTATE – set with fine impressed points or punctures appearing as pin-pricks

PUNCTICULATE – sparsely punctate with very fine, widely spaced punctures

RETICULATE – superficially net-like or made up of a network of lines; meshed; netted

RIMOSE – with minute, narrow and nearly parallel excavations running into each other; resembling the cracked bark of tree

RIMULOSE – minutely rimose; with minute cracks or fissure-like openings with sharp edges

RUGOSE – wrinkled

RUGULOSE – minutely rugose; minutely wrinkled

SCULPTURE – the markings or pattern of impressions or elevations on a surface

SPARSE – scattered; spread irregularly and some distance apart; thin; mostly setae

STIGATE – having narrow, transverse lines or streaks, either raised or impressed; composed of fine, short lines

STIGULATE – finely or minutely strigate; with numerous short and fine transverse lines, either raised or impressed

STRIATE – marked with parallel fine longitudinal impressed lines or furrows

STRIGATE – having narrow, transverse lines or streaks, either raised or impressed; composed of fine, short lines

4.4. MORPHOLOGICAL TERMINOLOGYS USED IN PLANT TAXONOMY

Terms used are referred from Sudhakar et al., 2017.

ACHENE – a small dry indehiscent one seeded fruit.

ACHINATE – refers to finger like structures which protrude from a surface.

ACROPHYLLUS – leaves formed at some distance of the plant from the ground or base, usually larger in size.

ACUMEN – a rather abruptly tapering point from an otherwise rounded or obtuse apex of leaves.

ACUMINATE – tapering gradually to protracted point.

ALTERNATE – refers to the leaves placed singly along the stem or axis, not opposite or whorled.

APEX – the tip of usually a leaf or fruit

APPRESSED – lying close and flat mostly hairs on a stem or leaves or figs

AREOLATE – of surface pattern or venation; divided into many angular sections

ARTICULATED – jointed, with nodes of apparent articulation

AXIL – the angle between a leaf surface and the stem on which it is borne

BATHYPHYLLUS – leaves formed near the base of the plant, usually smaller in size

BULLATE – with the surface of the leaf raised in blisters or puckers between the veins

BUTTRESSED – refers to the tree trunks which are enlarged at the base to offer balance and stability

CADUCOUS – a plant part that shed early

CALYPTRATE – a cap or lid like covering of younger figs

CAULIFLOROUS – condition wherein flowers and fruits are borne on trunk and old branches rather than from young shoots and new growths

CAUDATE – having a narrow appendage

CHARTAVEOUS – having a papery texture

CILIOLATE – covered with minute hairs

CONVOLUTE – an arrangement of petals in a bud, where each has one side overlapping the neighbouring petal

CORDATE – refers to leaf that is heart shaped; same as CORDIFORM

CORIACEOUS – leathery; stiff and tough, but somewhat flexible

CUNEATE – wedge shaped

DELTOID – refers to triangular shape of leaf

DIMORPHY – having two morphological forms

DIOECIOUS – with male and female flowers on different plants

DISTICHOUS – leaves arranged in two vertical rows on opposite sides on an axis

ELLIPTIC – usually describes a leaf shape that is widest in the middle and tapers at the ends

EPIGEAL – growing on or close to ground

FIG – commonly refers to the inflorescence of the genus *Ficus* or for any species belonging to *Ficus* genus

FLAGELLIFLOROUS – bearing flowers and fruits on long, slender and pedunculous shoots arising from tree trunk

FLOCCULENT – with small tufts of woolly hair

FURCATE – forked; dividing into two or more branches

GIBBOSE – curving or bulging outwards

GLABRESCENT – becoming GLABROUS meaning without hairs or smooth

GLOBOSE – spherical in shape mostly fruits

HETEROPHYLLOUS – having different forms of leaves on the same plant

HISPID-PUBESCENT – with stout, rigid or bristly, erect hairs

HISPIDULOUS – covered with stiff or short hairs

HYPANTHODIUM – the fruit of fig, with numerous flowers lined on the

inside of the fleshy receptacle, also called syconium

IMBRICATE – with overlapping edges

INDUMENTUM – describes the surface covered by trichomes such as hairs, scales etc.

INFLORESCENCE – a stalk with many flowers and arranged in patterns

INVOLUCRE – a series of bracts, usually close together and appressed, below or around a compact head of flowers

LAMINA – the flattened blade of a leaf

LANCEOLATE – a leaf that is narrowly lance-shaped and widest at about one-third from the base

LENTICULAR – shaped like a biconvex lens

LEPTOCLADOUS – with slender twigs, small leaves, and profuse branching

MONOECIOUS – having male and female flowers on the same plant

OBLANCEOLATE – shape of a narrow leaf that resembles an inverted lance

OBLONG – a rectangular object a flat figure with unequal adjacent sides

OBLONGOID – refers to solid form of oblong i.e., broadest at the middle tapering to both ends

OBOVATE – a leaf shape with an outline of an inverted egg, widest in the upper half

OPPOSITE – arising on opposite sides but at the same level

OBTUSE – blunt or round at the apex

ORBICULAR – spherical or rounded in shape

OSTIOLE – the small opening at the distal end of a fig fruit called syconium

OVATE – a leaf shape like an egg in outline, widest in the lower half

OVOID – with shape of an egg, often refers to a fruit

PACHYCLADOUS – with stout twigs, large leaves, and sparse branching

PANDURATE – fiddle-shaped; having round ends and contracted centre

PEDICEL – the stalk of a flower

PEDICELLATE – flower with stalk

PEDUNCLE – the stalk on which many flowers are borne and arranged or stalk of inflorescence

PETIOLE – the stalk of leaf

PISTIL – the female reproductive organ

PISTILLATE – flowers that have pistils, female

POLYMORPHOUS – with several forms, variable

PROP ROOT – an aerial root that develops on branches and reaches ground, increases in size and provides support

PUBERULOUS – covered with minutes soft erect hairs

PUBESCENT – covered with soft hairs

PULVINOUS – swelling at the base of the leaf stalk, helps in leaf movement

PUNCTULATE – marked with minute dots, depressions or glands

PYRIFORM – pear- shaped, broadest in the upper third and abruptly narrowed near the base

RECEPTACLE – the fleshy enlarged part on which the flowers are borne

RETICULATE – like a network

RHEOPHYTE – plant that grows in or near streams and rivers

RHOMBOID – refers to diamond shaped leaf

ROTUND – nearly round, circular in outline

RUGOSE – wrinkled, covered in reticulate lines, with the spaces in between convex

SAGITTATE – refers to a leaf shape like the head of an arrow

SCABERULOUS – slightly rough in texture

SCABRID – rough to the touch

SCABROUS – rough to the touch

SCARIOUS – refers to stipules that are thin, dry and membranous

SEMI-EPIPHYTE or HEMI-EPIPHYTE – a plant that is partially epiphytic, starting life on another plant and later rooting in the soil

SERICEOUS – silky; covered with close- pressed, fine, straight silky hairs

SESSILE – without a stalk

SIMPLE – the leaf that is not divided into leaflets

SPATHULATE – spoon-shaped, broad at the tip with a narrowed projections extending to the base

SPIKE – a receme with flowers borne directly on the axis, not on pedicels

STAMEN – the male reproductive part of the flower containing pollen

STAMINATE – flowers that have stamens, male

STIPULE – an appendage at the base of leaves

STOLON – creeping stem of plant, giving rise to another plant at its tip

STRANGLER – refers to the nature of plant wherein the plant kills its host plant by choking it to death

STRIATE – with parallel longitudinal grooves

STIGULOSE – covered with very short, stiff hairs

SUBCORIACEOUS – slightly leathery

SUBSESSILE – with a short stalk

SUBULATE – with slender tapering ends

SYCONIUM – fruit of a fig or *Ficus* plant, with numerous flowers lined on the inside of the fleshy receptacle

TERETE – round in cross section and tapered or cylindrical

TOMENTOSE – densely covered with numerous minute soft hairs

TRUNCATE – with a base or apex appearing as if cut straight across

TUBERCULATE – with a knob like projection

TURBINATE – top shaped; inversely conical

UMBILICUS – in the shape of an umbel

URCEOLATE – urn shaped with a swollen tube contracted near the top and then slightly expanded in a narrow rim

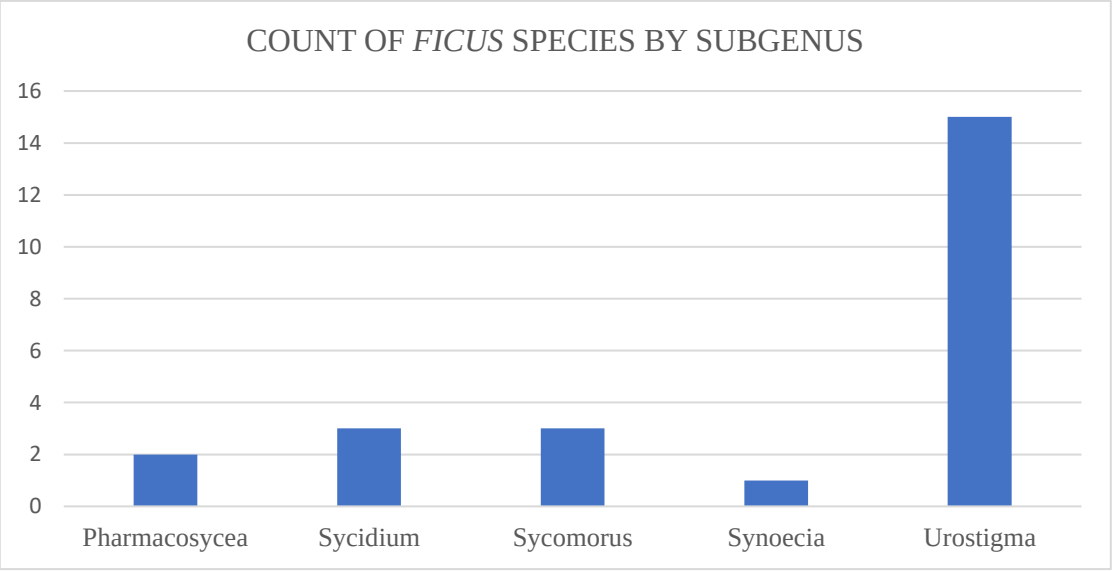
VERRUCATE – refers to surfaces of fig or achenes, warty with a little excrescences or bumps

VILLOUS – with long, fine, soft hairs on the surface

5. RESULTS – 5.1. *FICUS*

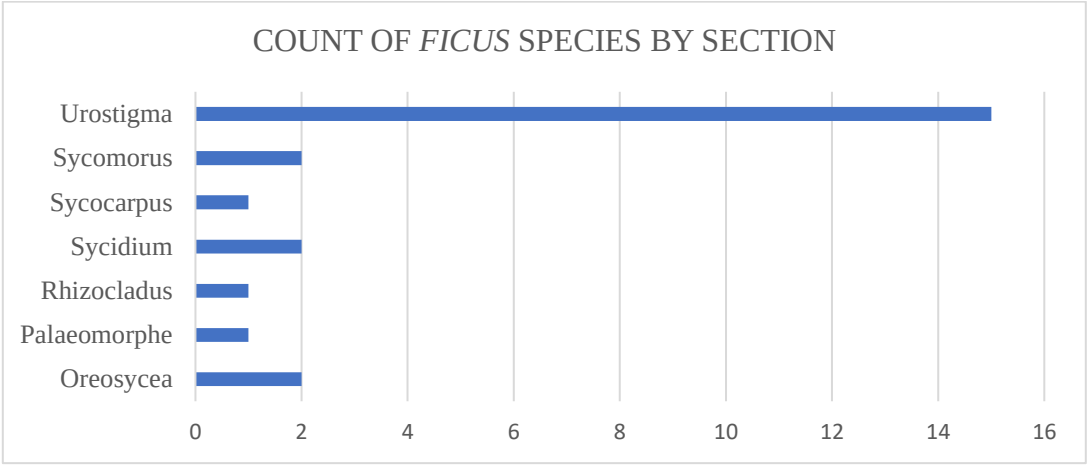
Twenty-four species of *Ficus* belonging to five subgenus Pharmacosycea, Sycidium, Sycomorus, Synoecia and Urostigma are reported from Wayanad in this study. A single species (*Ficus pumila*) is recorded from Synoecia subgenus. Highest number of species (15 species) are reported from subgenus Urostigma. Three species each from subgenus Sycidium (*Ficus exasperata*, *Ficus hetrophylla* and *Ficus tinctoria*) and Sycomorus (*Ficus auriculata, Ficus hispida* and *Ficus racemosa*). Pharmacosycea is represented by two species - *Ficus callosa* and *Ficus nervosa*. Four species of *Ficus* – *Ficus auriculata* (Sycomorus), *Ficus pumila* (Synoecia) and *Ficus benjamina* and *Ficus elastica* (Urostigma) are cultivated species. The genus *Ficus* is subdivided into six subgenera - namely Ficus, Sycomorus, Sycidium, Synoecia, Pharmacosycea, and Urostigma, all of them, except Ficus is reported from the study area. These *Ficus* species belong to six sections and eight subsections of five different subgenus. All the subgenus except subgenus Sycidium is divided into subsections.

FIGURE 1. COUNT OF *FICUS* SPECIES BY SUBGENUS



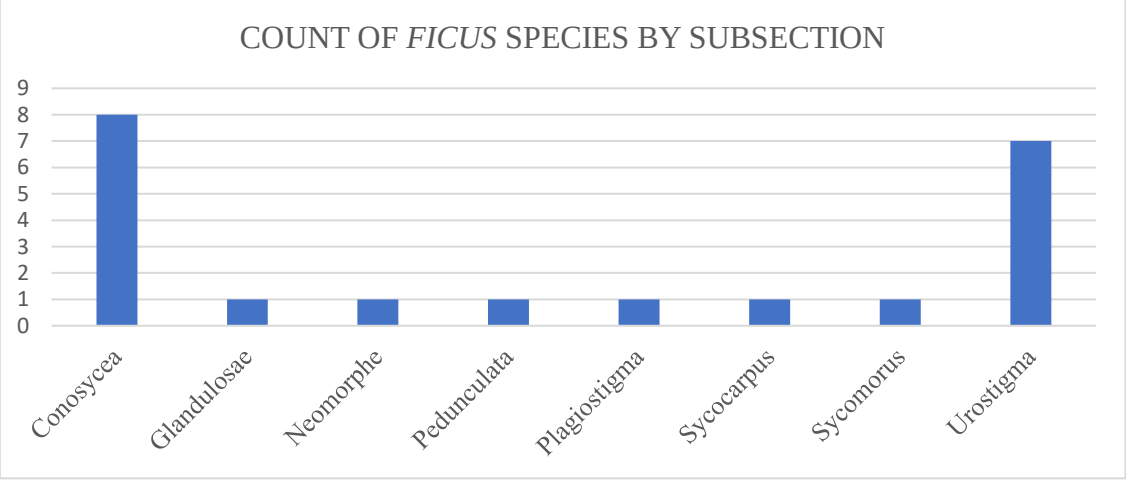
In the present study we recorded two species belonging to subgenus Pharmacosycea, which is further divided into section Oreosycea. Three species representing subgenus Sycidium and subgenus Sycomorus, which are classified into sections Sycidium and Paleomorphe and sections Sycomorus and Sycocarpus respectively. Subgenus Synoecia is divided into section Rhizocladus which is represented by single species and Subgenus Urostigma is divided into section Urostigma representing 15 species.

FIGURE 2. COUNT OF *FICUS* SPECIES BY SECTION



Subsections Pedunculata and Glandulosae of section Oreosycea is represented in the study by *Ficus callosa* and *Ficus nervosa* respectively. Section Sycomorus has *Ficus racemosa*, which belongs to the subsection Sycomorus and *Ficus auriculata* which belongs to subsection Neomorphe. *Ficus hispida* belongs into the subsection Sycocarpus of section Sycocarpus and *Ficus pumila* belongs to subsection Plagiostigma of section Rhizocladus. Section Urostigma which is divided into subsections Conosycea and Urostigma and is represented by seven species belonging to Urostigma and eight species belonging to Conosycea. *Ficus amplissima*, *Ficus arnottiana*, *Ficus caulocarpa*, *Ficus religiosa*, *Ficus rumphii*, *Ficus tsjakela* and *Ficus virens* belongs to Urostigma subsection whereas *Ficus beddomei*, *Ficus benghalensis*, *Ficus benjamina*, *Ficus drupacea*, *Ficus elastica*, *Ficus krishnae*, *Ficus microcarpa* and *Ficus talbotii* belong to Conosycea subsection.

FIGURE 3. COUNT OF *FICUS* SPECIES BY SUBSECTION



Twenty-four species of *Ficus* reported from Wayanad regions are represented in a tabular column with their common and vernacular names. New reports to the study area are also mentioned below.

TABLE 1: CHECKLIST OF *FICUS* FROM WAYANAD

Sl.No.	*Ficus* Species	Common Name	Malayalam Name	Remarks
1.	*Ficus amplissima* Sm.	Indian Bat Fig		New record
2.	*Ficus arnottiana* (Miq.) Miq.	Indian Rock fig	Kallal	New record
3.	*Ficus auriculata* Lour.	Roxburgh fig, Elephant Ear Fig	Thondipazha, Valya-athi	
4.	*Ficus beddomei* King		Koli	New record Endemic
5.	*Ficus benghalensis* L.	Banyan tree, Bengal banyan	Peraal	
6.	*Ficus benjamina* L.	Java fig, Weeping fig		
7.	*Ficus callosa* Willd	Calloused fig	Kadaplavu	New record
8.	*Ficus caulocarpa* Miq.	Stem-fruited fig	Koli	New record
9.	*Ficus drupacae* Thunb.	Brown-woolly fig	Chela-Koli	
10.	*Ficus elastica* Roxb. ex Hornem	Indian rubber tree		
11.	*Ficus exasperata* Vahl.	Sandpaper tree	Parakam	
12.	*Ficus hetrophylla* L. f.	Creeping fig	Vallitherakam	New record
13.	*Ficus hispida* L. f.	Hairy fig	Erumanaakk	
14.	*Ficus krishnae* C. DC.	Krishna Fig, Krishna's butter cup	Krishnanaal	
15.	*Ficus microcarpa* L.f.	Chinese fig	Ithi	
16.	*Ficus nervosa* Heyne ex Roth		Eechamaram	

17.	*Ficus pumila* L.	Climbing fig	Mathilpatti	
18.	*Ficus racemosa* L.	Cluster fig	Atthi	
19.	*Ficus religiosa* L.	Peepal tree, Bodhi tree	Arayal	
20.	*Ficus rumphii* Blume	Golden Rumph's Fig		New record
21.	*Ficus talbotii* King	Talbot fig	Vellakoli	New record
22.	*Ficus tinctoria* G. Forst.	Dye Fig, Humped Fig		
23.	*Ficus tsjakela* Burm. f.	South Indian fig	Koli, karimkoli	
24.	*Ficus virens* Aiton	Mountain fig, Spotted white fig	Paalkoli	

FAMILY MORACEAE: Also known as mulberry family is distinguished by plants with milky latex; simple leaves; large stipules that protect the growing bud; cystoliths in the epidermal cells of leaves; inflorescence racemes, spikes, umbels or heads, syconium and minute unisexual flowers; compound or aggregate fruits. In India the family is represented by 12 genera with *Ficus* being the largest genus.

GENUS *FICUS*: It is a natural group held together taxonomically by the structure of its inflorescence and the characteristic wasp mediated pollination system. The inflorescence or syconium commonly referred to as fig, is an infolded receptacle lined on inner surface with tiny florets. The opening or ostiole is positioned apically and is closed by numerous bracts.

SPECIES KEY TO GENUS *FICUS* IS MODIFIED FROM SUDHAKAR et al. 2017,

1. Leaves opposite or subopposite ---------- ***F. hispida***

− Leaves alternate ---------- 2

2. Climber or bushy climbing shrubs ---------- 3

− Trees and standing shrubs ---------- 5

3. Climbers; Leaves dimorphic, acrophyllus and bathyphyllus ---------- ***F. pumila***

− Bushy climbing shrub; Leaves heterophyllus or asymmetric ---------- 4

4. Leaves heterophyllus on same plant, oblong, ovate to elliptic or lanceolate, one to many pinnately or palmately lobed ---------- ***F. heterophylla***

− Embracing or Basketing the trunks of host plants, old walls and buildings; leaves asymmetric. Gibbose, lamina variable, rhomboid to sub-rhomboid, ovate to elliptic, oblong to lanceolate or oblanceolate, scabrous ---------- ***F. tinctoria***

5. Shrub growing up to 6m tall ---------- 6

− Medium to large sized trees, up to 45 m tall ---------- 8

6. Figs large, depressed turbinate, 3-7 cm in diameter, in long clusters on leafless branches or main stem or collected in bunches around base of the stem on ground; ostiole rosette shaped, with numerous ostiolar bracts; leaves up to 45 cm long ---------- ***F. auriculata***

− Figs small, Oblong to sub-ovate, axillary, solitary or in pairs; other characters also different ---------- 7

7. Stipules very large up to 30 cm long on mature twigs; basal bracts completely fused to form a cup at base of figs ---------- ***F. elastica***

− Stipules less than 5 cm long on mature twigs; bracts do not form a cup at base of figs; Leaf base cupuliform or cone-shaped, sometimes two accessory leaflets at petiole ---- ---------- ***F. krishnae***

8. Figs cauliflorous, arise on old stems or branches or leafless hanging flagelliflorous stolons; leaves chartaceous or subcoriaceous ---------- ***F. racemose***

− Figs axillary or just below the leaves or in clusters on raised tuberculate burs-------- 9

9. Figs sessile or subsessile ---------- 10

− Figs distinctly pedunculate ---------- ---------- 18

10. Apex of leaves caudate with 4 -10 cm long linear to lanceolate tail -------- ***F. religiosa***

− Apex of leaves obtuse, rounded or acute to acuminate, acumen up to 3 cm long ---- 11

11. Aerial prop roots numerous, becoming pillar like accessory trunks ---------- 12

− Aerial prop roots less or absent; usually not becoming pillar like accessory trunks --- 13

12. Figs 1 – 2.5 cm diameter; basal and lateral nerves of leaves conspicuous; lateral nerves 4 to 8 pairs, reticulate ---------- ***F. benghalensis***

− Figs 0.5 – 1 cm in diameter; basal and lateral nerves of leaves inconspicuous; lateral nerves numerous, parallel ---------- ***F. microcarpa***

13. Basal and lateral nerves of leaves inconspicuous; lateral nerves numerous, parallel; figs often wrinkled when dry ---------- ***F. benjamina***

− Basal and lateral nerves of leaves conspicuous; lateral nerves not parallel; figs usually not wrinkled when dry ---------- 14

14. Figs 1.5 – 3.5 cm in diameter, basal bracts concealed, hidden with base of figs ---- 15

− Figs 0.3 – 1.5 cm in diameter, basal bracts not concealed and hidden ---------- 16

15. Leaves coriaceous or leathery, rusty or flocculent tomentose beneath, ultimately glabrescent, apex obtuse or abruptly acuminate; figs yellow, white or greenish dotted, ultimately deep orange to red when ripe ---------- ***F. drupacea***

− Leaves subcoriaceous, glabrous, apex gradually tapering or acuminate; figs pale green with white spots when young, turning yellow to purple to black when ripe ---------- ---------- ***F. rumphii***

16. Apex of leaves caudate acuminate, acumen 1 – 2 cm long; stipules minute, 0.3 – 0.5 cm long ---------- ***F. talbotii***

− Apex of leaves acute, abruptly or obtusely acuminate, acumen 0.5 – 1 cm long; stipules larger, 0.5 – 2.5 cm long ---------- 17

17. Figs obovoid or obconical; stipules 1 – 2.5 cm long; surface of achenes verrucate ---- ---------- ***F. amplissima***

− Figs globose or subglobose; stipules 0.5 – 1 cm long; surface of achenes not verrucate. Leaves oblong to elliptic, margin often entire; young shoots with numerous flaccid leafy scales; stipules glabrous ---------- ***F. tsjakela***

18. Peduncle of figs 2 - 5 mm long; apex of leaves acuminate to caudate, up to 4 cm long; tertiary reticulate nerves finely raised and minutely brown areolate beneath ---------- ---------- ***F. arnottiana***

− Peduncle of figs 0.5 – 2 cm long; apex of leaves acute to acuminate, up to 2 cm long; tertiary reticulate nerves not areolate beneath ---------- 19

19. Leaves scabrous, hispid on both surfaces with calcareous hairs; ostiole of figs erect, with numerous ostiolar bracts; lateral and peduncular bracts present; achenes prominently pitted ---------- ***F. exasperata***

− Leaves glabrous or puberulous to pubescent; ostiole of figs not erect, with 2 or 3 ostiolar bracts; lateral and peduncular bracts absent; achenes not pitted ---------- 20

20. Lateral nerves prominently raised and tertiary nerves depressed beneath the leaves, and bullate in appearance; basal bracts caducous or absent ---------- ***F. nervosa***

− Nerves not bullate in appearance beneath the leaves; basal bracts persistent -------- 21

21. Leaves 5 – 15 cm long, base usually rounded to cuneate or truncate, glabrous; stipules 0.3 – 1.5 cm long at maturity ---------- ***F. virens***

− Leaves 15 – 35 cm long, base usually cordate to deeply cordate or rounded, puberulous to pubescent; stipules 2 – 5 cm long at maturity ---------- 22

22. Figs with 3 persistent bracts at the base, Figs reddish-brown, basal bracts ovate, acute, medially ribbed, glabrous ---------- ***F. beddomei***

− Figs without 3 persistent bracts at the base; other characters also different ---------- 23

23. Figs 0.5-0.7 cm across, 3 or more together, peduncle 2-3 mm long; petiole articulated ---------- ***F. caulocarpa***

− Fig solitary, 2.5-3 cm across, peduncle 1 cm or more long; petiole not articulated ---- ---------- ***F. callosa***

DESCRIPTION OF *FICUS* SPECIES RECORDED FROM THE STUDY AREA

1. *Ficus amplissima* Sm.

Synonyms: *Ficus indica* Willd., *Ficus pseudobenjamina* Miq., *Ficus pseudotsiela* (Miq.) Trimen, *Ficus tsiela* Roxb., *Ficus tsjela* Buch. -Ham., *Ficus tsjela* Buch. -Ham. ex Wall., *Urostigma pseudobenjaminum* Miq., *Urostigma pseudotjiela* Miq., *Urostigma pseudotsiela* Miq., *Urostigma tsiela* Miq.

Diagnosis: Tree, to 25 m high, monoecious, few aerial roots; bark greenish-grey, smooth; Leaves simple, alternate; lamina broadly ovate or ovate-oblong, 5-14 x 2.5-9 cm, base

round, truncate or acute, apex acute, margin entire, glabrous, coriaceous; stipule Ovate – lanceolate, 1 to 2.5 cm long, glabrous, rarely puberulous; petiole 15-50 mm long, slender.

Figs: Obovoid or obconical, 0.4 – 1.5cm in diameter, solitary or paired, axillary or at leaf scars, sessile, young fig light green, purple when ripe.

Distribution in Kerala: Kasaragode, Wayanad, Malappuram, Thrissur, Palakkad, Alappuzha, Idukki, Pathanamthitta.

Materials Examined

INDIA, Wayanad, Kerala, 11.6727N 76.308E; 11.6651N 76.3161E; 11.6246N 76.3158E; 11.6106N 76.3408E; 11.6584N 76.2797E; 11.9209N 76.0915E

2. *Ficus arnottiana* (Miq.) Miq.

Synonyms: *Ficus aegrophylla* Hort.Schoenb., *Ficus aegrophylla* Hort.Schoenb. ex Miq., *Ficus arnottiana* var. *courtallensis* (Miq.) Miq., *Ficus caulobotrya* (Miq.) Miq., *Ficus populeaster* Desf., *Ficus populifolia* Wall., *Urostigma arnottianum* Miq., *Urostigma caulobotryum* Miq., *Urostigma cordifolium* Dalzell & A.Gibson, *Urostigma courtallense* Miq.

Diagnosis: Tree, 4 to 10 m high, monoecious, aerial roots absent; bark surface grey-brown, smooth; Leaves simple, alternate spiral; lamina broadly ovate, base deeply cordate, apex caudate-acuminate, 6-20 x 5-13 cm, margin entire, slightly undulate, glabrous, coriaceous; stipules ovate to lanceolate, 3-5 cm long, glabrous, white or pale (brown on drying); petiole 3-10 cm long, slender, not articulated, glabrous;

Figs: Globose to subglobose. 0.4-1 cm in diameter, in cluster of 3 to 4, in axils of fallen leaves or below the leaves, on short peduncles, light green with white dots or purple with greenish dots when ripe, glabrous.

Distribution in Kerala: Kasaragod, Kannur, Kozhikode, Wayanad, Thrissur, Palakkad, Kottayam, Idukki, Pathanamthitta, Kollam, Thiruvananthapuram.

Materials Examined: INDIA, Wayanad, Kerala, 11°30.796′N, 76°01.089′E, 23.IV.2019

3. *Ficus auriculata* Lour.

Synonyms: *Covellia macrophylla* (Roxb. ex Sm.) Miq., *Ficus angladei* C.E.C.Fisch., *Ficus cochinchinensis* Lour., *Ficus hainanensis* Merr. & Chun, *Ficus hamiltoniana* Wall.,

Ficus macrocarpa H.Lév. & Vaniot, *Ficus macrophylla* Roxb., *Ficus macrophylla* Roxb. & Buch. -Ham. ex Sm., *Ficus oligodon* Miq., *Ficus pomifera* Wall. ex-King, *Ficus regia* Miq., *Ficus rotundifolia* Roxb., *Ficus roxburghii* Wall. ex Steud., *Ficus sclerocarpa* Griff.

Diagnosis: Tree, up to 12m tall, dioecious, shortly buttressed, aerial roots absent. Bark brown, pinkish-brown or yellowish grey, smooth, exfoliating; wood reddish-grey, moderately hard. Leaves alternate, lamina broadly ovate to elliptic to oblong, cordiform to suborbicular to orbicular, 12-45 × 10-32 cm, chartaceous to subcoriaceous to coriaceous, glabrous; Stipules ovate-lanceolate, 1.2-3 cm long, pubescent or minutely velvety, yellowish brown, caducous. Petiole 2.5 - 2.0 cm long, stout, glabrous or pubescent.

Figs: Depressed turbinate, up to 10 cm in diameter, 6-25 in each cluster, from shortened leafless branchlets on larger branches or main stem or collected in bunches around base of stem on ground, yellowish-green, brownish or purplish-red when ripe.

Distribution in Kerala: Cultivated throughout.

Materials Examined

INDIA, Wayanad, Kerala, 11.6825N 76.2528E; 11.6568N 76.2817E; 11.6754N 76.2547E; 11.6742N 76.256E

4. *Ficus beddomei* King

Synonym: *Ficus rama-varmae* Bourd.

Diagnosis: Evergreen trees, epiphytic or independent, to 30 m high; Monoecious; aerial roots none; bark pale brown, smooth; Leaves simple, alternate; lamina broadly ovate, base acute, truncate or round, apex caudate acuminate, 15-25 x 8-15 cm, margin entire, slightly undulate, glabrous, coriaceous; stipules 5-10 cm long, lateral, leafy, golden yellow, glabrous; petiole 5-10 cm long, stout, grooved above, glandular at apex below, glabrous.

Figs: Ovoid or obovoid, green, glabrous, 1.5-2.5 cm in diameter, in axillary pairs, pedunculate, peduncle 1.5-2 cm long, stout, angled, turning greenish-yellow or spotted with yellow when ripe; fig wall thick.

Distribution in Kerala: Kozhikode, Wayanad, Malappuram, Palakkad, Thrissur, Idukki, Thiruvananthapuram. [Endemic to Western Ghats]

Materials Examined

INDIA, Wayanad, Kerala, 11°33.336′N, 76°00.068′E; 11°33.456′N, 75°59.923′E; 11°33.537′N, 75°59.597′E; 11°33.127′N, 75°59.988′E; 11°32.367′N, 76°00.14′E; 11°32.68′N, 76°00.922′E

5. *Ficus benghalensis* L.

Synonyms: *Ficus banyana* Oken, *Ficus benghalensis* var. *benghalensis*, *Ficus benghalensis* var. *krishnae* (C.DC.) C.DC., *Ficus benghalensis* var. *krishnae* (C.DC.) Corner, *Ficus chauvieri* G.Nicholson, *Ficus cotoneifolia* Vahl, *Ficus cotonifolia* Stokes, *Ficus crassinervia* Hort.Berol., *Ficus crassinervia* Hort.Berol. ex Kunth & Bouché, *Ficus indica* L., *Ficus karet* Baill., *Ficus krishnae* DC., *Ficus lancifolia* Moench, *Ficus lasiophylla* Link, *Ficus procera* Salisb., *Ficus umbrifera* Kunth & Bouché, *Ficus umbrosa* Salisb., *Perula benghalensis* (L.) Raf., *Urostigma bengalense* (L.) Gasp., *Urostigma benghalense* (L.) Gasp.

Diagnosis: Tree, up to 40 m high; Monoecious, aerial roots numerous from the branches; Bark greyish-white, smooth, exfoliating in irregular flakes; young parts softly pubescent; branchlets light brownish. Leaves simple, alternate, spiral; lamina ovate, base round or subcordate, apex obtuse, 10-20 x 5- 14 cm, margin entire, coriaceous, glabrescent above, minutely pubescent beneath; stipules deltoid or broadly triangular, 2-3 cm long, sheathing, white pubescent or rusty tomentose, glandular at apex; petiole 1.5-7 cm long, stout, subterete, puberulous.

Fig: Globose to sub globose, 1-2.5 cm in diameter, paired, axillary, sessile, initially enclosed in calyptrate up to 1 cm long, leathery bud covers, bright red or orange red when ripe.

Distribution in Kerala: Kasaragod, Kannur, Kozhikode, Wayanad, Malappuram, Palakkad, Thrissur, Ernakulam, Idukki, Kottayam, Alappuzha, Pathanamthitta, Kollam, Thiruvananthapuram.

Materials Examined

INDIA, Wayanad, Kerala, 11.7365N 76.36607E; 11.7037N 76.3701E; 11.6748N 76.2997E; 11.6411N 76.3484E; 11.6263N 76.3129E; 11.8559N 76.1161E

6. *Ficus benjamina* L.

Synonyms: *Ficus benjamina* f. *warringiana* M.F.Barrett, *Ficus benjamina* subsp. *comosa* (Roxb.) Panigrahi & Murti, *Ficus benjamina* var. *benjamina*, *Ficus benjamina* var. *bracteata* Corner, *Ficus benjamina* var. *bracteata* T.Yamaz., *Ficus benjamina* var. *comosa* (Roxb.) Kurz, *Ficus benjamina* var. *comosa* King, *Ficus benjamina* var. *haematocarpa* (Blume ex Decne.) Miq., *Ficus benjamina* var. *lehuntei* F.M.Bailey, *Ficus benjamina* var. *nuda* (Miq.) Barrett, *Ficus comosa* Roxb., *Ficus cuspidato-caudata* Hayata, *Ficus dictyophylla* Wall., *Ficus exotica*, *Ficus haematocarpa* Blume, *Ficus haematocarpa* Blume ex Decne., *Ficus lucida* Aiton, *Ficus neglecta* Decne., *Ficus nepalensis* Blanco, *Ficus nitida* Thunb., *Ficus notobor* Buch. -Ham., *Ficus notobor* Buch. -Ham. ex Wall., *Ficus nuda* (Miq.) Miq., *Ficus papyrifera* Griff., *Ficus parvifolia* Oken, *Ficus pendula* Link, *Ficus pyrifolia* Salisb., *Ficus reclinata* Desf., *Ficus retusa* f. *nitida* (Thunb.) King, *Ficus retusa* var. *nitida* (Thunb.) F.M.Bailey, *Ficus retusa* var. *nitida* (Thunb.) Miq., *Ficus striata* Roth, *Ficus umbrina* Elmer, *Ficus waringiana*, *Ficus xavieri* Merr., *Urostigma benjamina* (L.) Miq., *Urostigma benjaminum* var. *nudum* Miq., *Urostigma haematocarpum* Miq., *Urostigma neglectum* Miq., *Urostigma nitidum* (Thunb.) Miq., *Urostigma nitidum* Gasp., *Urostigma nudum* Miq.

Diagnosis: Tree, up to 30 m tall, monoecious, aerial roots few; bark grey, very smooth; Leaves simple, alternate, distichous; lamina elliptic or elliptic-ovate, base round, acute or subcordate, apex acute or acuminate, 3-12 x 2-6 cm, margin entire, glabrous, coriaceous; stipules lanceolate, 0.5 – 1.5 cm long, white, glabrous or puberulous; petiole 1.5 – 3 cm long, glabrous.

Fig: Globose or obovoid, 0.4 – 2.2 cm in diameter, in pairs, rarely solitary, axillary, sessile or subsessile, turning from light green to yellow to orange to dark red, rarely pink to purple when ripe.

Distribution in Kerala: Cultivated throughout.

Materials Examined: INDIA, Wayanad, Kerala, 11.6629N 76.3237E; 11.6436N 76.337E; 11.6686N 76.263E; 11.6686N 76.263E

7. *Ficus callosa* Willd.

Synonyms: *Ficus basidentula* Miq., *Ficus cinerascens* Thwaites, *Ficus cordatifolia* Elmer, *Ficus longespathulata* Sata, *Ficus longespathulata* var. *elongatospathulata* Sata, *Ficus longespathulata* var. *grandifolia* Sata, *Ficus longispathulata* Sata, *Ficus longispathulata* var. *elongatospathulata* Sata, *Ficus longispathulata* var. *grandifolia* Sata, *Ficus malunuensis* Warb., *Ficus porteana* Regel, *Ficus scleroptera* Miq.
Varieties: *Ficus longespathulata* var. *elongatespathulata* Sata, 1944 and *Ficus longespathulata* var. *longespathulata*

Diagnosis: Trees, to 45 m high, bark 10-15 mm thick, surface grey, smooth; Monoecious; Leaves simple, alternate spiral; lamina elliptic, broadly oblong or ovate-oblong, base round, obtuse or subcordate, apex obtusely acute, round, 10-30 x 7.5-13 cm, margin entire, slightly recurved, coriaceous, glabrous, glossy above and scabrid beneath; stipules broadly ovate, pubescent, 15-30 mm long; petiole 25-70 mm long, stout, grooved above, glabrous.

Fig: Sub globose, 2.5 cm in diameter, solitary, axillary. Pedunculate, peduncle 1-2 cm long, greenish-yellow when ripe.

Distribution in Kerala: Kasaragod, Kozhikode, Wayanad, Palakkad, Thrissur, Idukki, Pathanamthitta, Kollam, Thiruvananthapuram.

Materials Examined
INDIA, Wayanad, Kerala, 11°33.136′N, 76°00.748′E; 11°33.427′N, 75°59.199′E; 11°32.396′N, 76°00.221′E

8. *Ficus caulocarpa* Miq.

Synonyms: *Ficus caulobotrya* var. *dasycarpa* Corner, *Ficus caulocarpa* var. *dasycarpa* Corner, *Ficus infectoria* subsp. *caulocarpa* (Miq.) King, *Ficus infectoria* var. *caulocarpa* (Miq.) King, *Ficus stipulosa* (Miq.) Miq., *Ficus virens* var. *caulocarpa* (Miq.) M.R.Almeida, *Ficus weinlandii* K.Schum., *Urostigma caulocarpum* Miq., *Urostigma stipulosum* Miq.

Diagnosis: Large trees with aerial roots, buttressed; bark greyish-brown, smooth; Monoecious; Leaves simple, alternate spiral; lamina ovate-oblong or broadly ovate, base round, subcordate or slightly cuneate, apex obtusely acuminate, 10-19 x 4-10 cm, margin

entire, glabrous, coriaceous; stipule 12-15 mm long, lateral, ovate, grey-puberulus; petiole 40-80 mm long, slender, grooved above, swollen at base, articulated, glabrous, deciduous at base of the lamina.

Fig: Globose to sub globose, glabrous, white, 5-8 mm in diameter, 2-8 in the axils of leaf scars and on the twigs, peduncle 1-4 mm long.

Distribution in Kerala: Kasaragod, Wayanad, Idukki

Materials Examined: INDIA, Wayanad, Kerala, 11.7602N 76.2531E

9. *Ficus drupacea* Thunb.

Synonyms: *Ficus auranticarpa* Elmer, *Ficus chrysochlamys* K.Schum. & Lauterb., *Ficus chrysocoma* Blume, *Ficus citrifolia* Willd., *Ficus drupacea* var. *auranticarpa* (Elmer) Corner, *Ficus drupacea* var. *drupacea*, *Ficus drupacea* var. *glabrata* Corner, *Ficus drupacea* var. *mysorensis* (B.Heyne ex Roth) M.R.Almeida, *Ficus drupacea* var. *pedicellata* Corner, *Ficus drupacea* var. *pubescens* (Roth) Corner, *Ficus drupacea* var. *subrepanda* (Wall. ex-King) D.Basu, *Ficus ellipsoidea* F.Muell., *Ficus ellipsoidea* F.Muell. ex Benth., *Ficus gonia* Buch. -Ham., *Ficus mysorensis* B.Heyne, *Ficus mysorensis* B.Heyne ex Roth, *Ficus mysorensis* Roth ex Roem. & Schult., *Ficus mysorensis* f. parvifolia Miq., *Ficus mysorensis* var. *dasycarpa* (Miq.) Barrett, *Ficus mysorensis* var. *pubescens* Roth, *Ficus mysorensis* var. *pubescens* Roth ex Roem. & Schult., *Ficus mysorensis* var. *subrepanda* Wall., *Ficus mysorensis* var. *subrepanda* Wall. ex-King, *Ficus payapa* Blanco, *Ficus pilosa* Reinw., *Ficus pilosa* Reinw. ex Blume, *Ficus pilosa* var. *chrysocoma* (Blume) King, *Ficus rupestris* Buch. -Ham., *Ficus subrepanda* (Wall. ex-King) King, *Ficus vidaliana* Warb., *Urostigma bicorne* Miq., *Urostigma chrysotrix* Miq., *Urostigma dasycarpum* Miq., *Urostigma drupaceum* (Thunb.) Miq., *Urostigma mysorense* (B.Heyne ex Roth) Miq., *Urostigma pilosum* (Blume) Miq., *Urostigma subappendiculatum* Miq., *Urostigma subcuspidatum* Miq.

Diagnosis: Tree up to 35 m tall; Monoecious; aerial roots numerous, arising in tufts from the stout branches; bark surface greyish-brown, smooth; young shoots brown pubescent. Leaves simple, alternate, spiral; lamina ovate or elliptic-ovate, base round or subcordate, apex abruptly acuminate, 10-22 x 6-15 cm, margin entire, tender leaves tomentose below, glabrous above and scurfy tomentose beneath when mature, coriaceous; stipule 0.8 – 2

cm long, broadly lanceolate, tomentose; petiole 1.2-3.5 cm long, stout, grooved above, glandular at apex below, tomentose.

Figs: Ellipsoid-globose, sessile, in axillary pairs, thick walled, tomentose, 1.5-2 cm across, green turning yellow, ultimately orange red when ripe.

Distribution in Kerala: Kasaragod, Kannur, Kozhikode, Wayanad, Malappuram, Palakkad, Thrissur, Ernakulam, Idukki, Kottayam, Alappuzha, Pathanamthitta, Kollam, Thiruvananthapuram.

Materials Examined

INDIA, Wayanad, Kerala, 11.71441 N 76.32326 E; 11.72815 N 76.32313 E; 11.8274 E 76.09494 E; 11.7447 N 76.304 E; 11.6744 N 76.2979 E; 11.8718 N 76.1003 E

10. *Ficus elastica* Roxb. ex Hornem

Synonyms: *Ficus clusiifolia* Summerh., *Ficus cordata* Hort.Berol., *Ficus cordata* Hort.Berol. ex Kunth & Bouché, *Ficus decora*, *Ficus elastica* Roxb. ex Hornem., *Ficus elastica* var. *belgica* L.H.Bailey & E.Z.Bailey, *Ficus elastica* var. *benghalensis* Blume, *Ficus elastica* var. *decora* Guill., *Ficus elastica* var. *karet* (Miq.) Miq., *Ficus elastica* var. *minor* Miq., *Ficus elastica* var. *odorata* (Miq.) Miq., *Ficus elastica* var. *rubra* L.H.Bailey & E.Z.Bailey, *Ficus elastica* var. *rubrinervis* Sata, *Ficus elastica* var. *variegata* Roxb., *Ficus elastica* var. *variegata* Roxb. ex Hornem., *Ficus elastica* var. *variegata* Sata, 1944, *Ficus karet* (Miq.) King, *Ficus metallica*, *Ficus skytinoderma* Summerh., *Ficus skytinodermis* Summerh., *Ficus taeda* Hort.Berol., *Ficus taeda* Hort.Berol. ex Kunth & Bouché, *Macrophthalma elastica* (Roxb.) Gasp., *Stilpnophyllum elasticum* (Roxb.) Drury, *Urostigma circumscissum* Miq., *Urostigma elasticum* (Roxb.) Miq., *Urostigma elasticum* var. *latifolium* Miq., *Urostigma karet* Miq., *Urostigma odoratum* Miq., *Visiania elastica* (Roxb.) Gasp.

Diagnosis: Large tree, up to 35 m tall, with dense crown, monoecious, epiphytic and terrestrial, buttressed; aerial roots copious. Bark reddish-brown or grey, smooth; Leaves alternate, lamina elliptic, ovate to elliptic to oblong, rarely obovate, 8-35 × 4-16 cm, leaving annular scars, coriaceous, leathery, shining, colour variable – green, pinkish, dark brown and variegated, glabrous on both surfaces; petiole 2.5 – 6.5 cm long, stout, glabrous, articulated. Stipules very large, lanceolate, tapering into a fine point, 2.5 – 30

cm long or almost as long as lamina, leaving prominent scars, dark rose or pink, flaccid, glabrous or white puberulous, caducous.

Figs: Oblong, ovate to oblong or broadly elliptic, 0.7-1.2 cm in diameter, in pairs, rarely solitary, sessile, axillary or just below the leaves, initially enclosed by calyptrate, hooded bud cover, later falls off, green, greenish-yellow or yellow dotted, glabrous.

Distribution in Kerala: Cultivated throughout.

Materials Examined: INDIA, Wayanad, Kerala, 11.6898N 76.2558E

11. *Ficus exasperata* Vahl

Synonyms: *Ficus asperrima* Roxb., *Ficus hispidissima* Wight, *Ficus hispidissima* Wight ex Miq., *Ficus politoria* Moon, *Ficus punctifera* Warb., *Ficus scabra* Willd., *Ficus serrata* Forssk., *Ficus silicea* Sim, *Synoecia guillielmi-primi* de Vriese

Diagnosis: Dioecious tree, up to 18 m tall; aerial roots none; bark brown or pale, brittle, wood greyish-white, soft; all parts coarsely and harshly scabrid with stout white hairs. Leaves simple, alternate spiral to opposite or sub-distichous; lamina elliptic, ovate, oblong-lanceolate, or obovate, basal acute, round or cuneate, apex acute to shortly acuminate, 5.5-19 x 3-9 cm, margin denticulate or sinuate-crenate to serrate, scabrid on both surfaces, coriaceous; stipules short, paired, lateral, cauducous; petiole 1 - 6.5 cm long, slender, not articulated.

Figs: Subglobose or ellipsoid, 1.5 – 2 cm in diameter, axillary, in pairs; peduncle 0.5 to 1.5 cm, ostoole with numerous ostiole bracts, yellow or purple when ripe.

Distribution in Kerala: Kasaragod, Kannur, Kozhikode, Wayanad, Malappuram, Palakkad, Thrissur, Ernakulam, Idukki, Kottayam, Alappuzha, Pathanamthitta, Kollam, Thiruvananthapuram.

Materials Examined

INDIA, Wayanad, Kerala, 11.68282N 76.26623E; 11.8473N 76.0738E; 11.7483N 76.2344E; 11.6049N 76.344E; 11.6402N 76.3457E; 11.7237N 76.28E

12. *Ficus heterophylla* L. f.

Synonyms: *Ficus acutiloba* Miq., *Ficus aquatica* J.Koenig, *Ficus aquatica* J.Koenig ex Willd., *Ficus biglandula* Blume, *Ficus cannabina* Lour., *Ficus denticulata* Vahl, *Ficus*

denticulata Willd., *Ficus elongata* Miq., *Ficus grossularioides* var. *subpanduriformis* (Miq.) Kuntze, *Ficus heterophylla* var. *elongata* (Miq.) Miq., *Ficus heterophylla* var. *scabrella* (Roxb.) King, *Ficus morifolia* Vahl, *Ficus panduriformis* Miq., *Ficus politoria* Lour., *Ficus repens* Rottler, *Ficus rufescens* Vahl, *Ficus scabrella* Roxb., *Ficus subpanduriformis* Miq., *Ficus torteana* Miq., *Ficus truncata* Vahl., *Urostigma subpanduriforme* Miq.

Diagnosis: Shrub or strangler, up to 3m tall, dioecious; aerial roots on nodes of branches. Leaves alternate, distichous, polymorphous, more or less asymmetric or symmetric, lamina very variable heterophyllous, one to many pinnately or palmately lobed, lobes oblong, ovate to elliptic or lanceolate, 3.5-16 × 1.2-5 cm, chartaceous to subcoriaceous, scabrous with stiff hairs. Stipules terminal and axillary or intrapetiolar, ovate-lanceolate, 0.3-1 cm long, brownish, scarious, glabrous or puberulous at margin, caducous.

Figs: Ellipsoid to globose, pyriform, 1-2 cm in diameter, solitary, due to abortion of one in pair, axillary, narrowed into short stipe, stipe up to 5mm long, green when young, turning yellow to orange to dark red when ripe, scabrid, more or less hispid, warted; peduncle 0.6 – 1 cm long, pubescent.

Distribution in Kerala: Kannur, Wayanad

Materials Examined: INDIA, Wayanad, Kerala, 11.8033N 76.0041E

13. *Ficus hispida* L. f.

Synonyms: *Covellia assamica* Miq., *Covellia courtallensis* Miq., *Covellia daemonum* (Vahl) Miq., *Covellia dasycarpa* Miq., *Covellia hispida* (L.fil.) Miq., *Covellia oppositifolia* (Roxb.) Gasp., *Covellia setulosa* Miq., *Covellia wightiana* Miq., *Ficus courtallensis* (Miq.) Baill., *Ficus daemonum* (J.Koenig) Vahl, *Ficus fecunda* Blume, *Ficus goolereea* Roxb., *Ficus hispida* f. *borneensis* Miq., *Ficus hispida* f. *obovifolia* Hochr., *Ficus hispida* var. *incana* Kuntze, *Ficus hispida* var. *viridis* Kuntze, *Ficus hispidioides* L.f., *Ficus hispidioides* S.Moore, *Ficus letaqui* H.Lév. & Vaniot, *Ficus lima* Royen, *Ficus lima* Royen ex Miq., *Ficus mollis* Willd., *Ficus oppositifolia* Roxb., *Ficus oppositifolia* Willd., *Ficus perinteregam* Pennant, *Ficus poilanei* Gagnep., *Ficus prominens* Wall. ex Miq., *Ficus sambucixylon* H.Lév., *Ficus sambucixylon* Lév., *Ficus scabra* Jacq., *Ficus simphytifolia* Lam., *Ficus symphytifolia* Spreng., *Gonosuke demonum*

(Vahl) Raf., *Gonosuke hispida* (L.fil.) Raf., *Gonosuke scaber* Raf., *Gonosuke scabra* (Jacq.) Raf., *Sycomorphe roxburghii* Miq.

Varieties: *Ficus hispida* var. *hispida* and *Ficus hispida* var. *rubra* Corner

Diagnosis: Shrub or medium sized tree, up to 10 m tall, laxly branched; Dioecious; bark grey, smooth; young shoots hispid; internodes of branchlets hollow. Leaves simple, opposite; lamina 7-20 x 6-10 cm, elliptic-oblong, ovate-oblong or obovate-oblong, base round, subcordate or cuneate, apex abruptly acute or acuminate or cuspidate, margin subentire to minutely dentate, membranous, scabrid, hispid-pubescent; lamina 7-20 x 6-10 cm, elliptic-oblong, ovate-oblong or obovate-oblong, base round, subcordate or cuneate, apex abruptly acute or acuminate or cuspidate, margin subentire to minutely dentate, membranous, scabrid, hispid-pubescent.

Figs: Depressed-globose, 2-2.5 cm across, fascicled on trunk or on elongated pendulous or trailing leafless branches, base narrowed, sticky pubescent; peduncle 5-15 mm long, stout; yellow when ripe.

Distribution in Kerala: Kasaragod, Kannur, Kozhikode, Wayanad, Malappuram, Palakkad, Thrissur, Ernakulam, Idukki, Kottayam, Alappuzha, Pathanamthitta, Kollam, Thiruvananthapuram.

Materials Examined

INDIA, Wayanad, Kerala, 11.68181N 76.27307E; 11.7411N 76.2407E; 11.8637N 76.0726E; 11.6049N 76.344E; 11°33.481′N, 76°59.34′E; 11.6391N 76.3044E

14. *Ficus krishnae* C. DC.

Synonym: *Ficus benghalensis* var. *krishnae* (C. DC.) Corner

Diagnosis: Small to medium sized tree, up to 15 m tall, monoecious; aerial prop roots usually absent; Bark greyish-white, smooth, with scattered lenticels. Leaves alternate, lamina elliptic to ovate, 8-16 × 6-8 cm; base cup shaped on dorsal side or rarely without cup, with one or two leafy appendages at apex of petiole, leaflets variable obovate or spathulate, 0.5-8 × 0.3-2 cm, petiolules 1- 1.5cm long, coriaceous, glabrous above, puberulous or downy beneath; petiole 3-8 cm long, subflattened and pulvinous towards base, terete at apex, puberulous. Stipules narrowly triangular, 2-5 cm long, coriaceous, densely whitish appressed puberulous, caducous.

Figs: Globose, subglobose, 1.5-2 cm in diameter, paired, axillary, sessile, green when young, orange to red to bright red when ripe, white puberulous.

Distribution in Kerala: Cultivated almost throughout India.

Materials Examined: INDIA, Wayanad, Kerala, 11.8179N 76.2174E

15. *Ficus microcarpa* L. f.

Synonyms: *Ficus aggregata* Vahl, *Ficus amblyphylla* (Miq.) Miq., *Ficus cairnsii* Warb., *Ficus condaravia* Buch. -Ham., *Ficus condoravia* Buch. -Ham., *Ficus dahlii* K.Schum., *Ficus dictyophleba* F.Muell. ex Benth., *Ficus dictyophleba* F.Muell. ex Miq., *Ficus dilatata* Miq., *Ficus littoralis* Blume, *Ficus microcarpa* f. *crassifolia* (W.C.Shieh) S.S.Ying, *Ficus microcarpa* f. *pubescens* Corner, *Ficus microcarpa* subsp. *latifolia* (Miq.) Corner, *Ficus microcarpa* subsp. *macrocarpa*, *Ficus microcarpa* var. *crassifolia* (W.C.Shieh) J.C.Liao, *Ficus microcarpa* var. *fuyuensis* J.C.Liao, *Ficus microcarpa* var. *latifolia* (Miq.) Corner, *Ficus microcarpa* var. *naumannii* (Engl.) Corner, *Ficus microcarpa* var. *nitida* (King) F.C.Ho, *Ficus microcarpa* var. *nitida* (King) R.R.Fernandez, *Ficus microcarpa* var. *oluangpiensis* J.C.Liao, *Ficus microcarpa* var. *pusillifolia* J.C.Liao, *Ficus naumannii* Engl., *Ficus regnans* Diels, *Ficus retusa* f. *parvifolia* Miq., *Ficus retusa* f. *pubescens* Miq., *Ficus retusa* var. *crassifolia* W.C.Shieh, *Ficus retusa* var. *nitida* King, *Ficus retusa* var. *pisifera* (Miq.) Miq., *Ficus retusiformis* H.Lév., *Ficus retusiformis* Lév., *Ficus rubra* Roth, *Ficus rubra* var. *amblyphylla* (Miq.) Baker, *Ficus thyneana* F.M.Bailey, *Ficus thyneana* var. *minor* Domin, *Ficus thynneana* var. *typica* Domin, *Urostigma accedens* var. *latifolia* Miq., *Urostigma amblyphyllum* Miq., *Urostigma littorale* (Blume) Miq., *Urostigma microcarpum* (L.fil.) Miq., *Urostigma pisiferum* Miq.

Subspecies: *Ficus microcarpa* subsp. *crassifolia* L.f., *Ficus microcarpa* subsp. *fuyuensis* L.f., *Ficus microcarpa* subsp. *oluangpiensis* L.f. and *Ficus microcarpa* subsp. *pusillifolia* L.f.

Varieties: *Ficus microcarpa* var. *hillii* (F.M.Bailey) Corner, *Ficus microcarpa* var. *microcarpa* L.f., 1782 and *Ficus microcarpa* var. *saffordii* (Merr.) Corner

Diagnosis: Tree, usually epiphytic, to 18 m high, aerial roots numerous, slender, arching from the branches; Monoecious; bark surface grey to greyish-brown, smooth; branchlets 2-3 mm thick, angled, glabrous. Leaves simple, alternate, spiral; lamina 4-12 x 2-5 cm,

elliptic, elliptic-ovate, elliptic-obovate or obovate, base acute or obtuse, apex acute, obtusely acute or retuse, margin entire, undulate, glabrous, coriaceous; stipules 10-15 mm long, lateral, ovate-lanceolate, glabrous or the edges ciliate; cauducous, leaving an annular scar; petiole 10-15 mm long, glandular at apex below, glabrous, flattened above, slender, not articulate.

Figs: globose, 0.5 – 1 cm in diameter, sessile, in axillary pairs, white or pale when young, turning from pale green to purple or black when mature.

Distribution in Kerala: Kasaragod, Kannur, Kozhikode, Wayanad, Malappuram, Palakkad, Thrissur, Ernakulam, Idukki, Kottayam, Alappuzha, Pathanamthitta, Kollam, Thiruvananthapuram.

Materials Examined

INDIA, Wayanad, Kerala, 11.7269N 76.3545E; 11.7201N 76.379E; 11.7156N 76.3772E, 11.6709N 76.308E; 11.6435N 76.3015E

16. *Ficus nervosa* Heyne ex Roth

Synonyms: *Ficus nervosa* B.Heyne, *Ficus nervosa* subsp. *longifolia* Sata, *Ficus pubinervis* f. *sibulanensis* (Elmer) Sata, *Ficus pubinervis* var. *diandra* Corner, *Ficus pubinervis* var. *sibulanensis* (Elmer) Corner, *Ficus pubinervis* var. *teijsmannii* King, *Ficus sibulanensis* Elmer

Subspecies: *Ficus nervosa* subsp. *minor* (King) C.C.Berg, *Ficus nervosa* subsp. *nervosa* and *Ficus nervosa* subsp. *pubinervis* (Blume) C.C.Berg

Diagnosis: Tree, up to 30 m tall; monoecious; buttresses to 6 m high; bark grey to greyish-brown, often mottled with black, smooth; Leaves simple, alternate, spiral, pinkish-brown when young; lamina 6-17.5 x 4-8 cm, elliptic, oblong-lanceolate, ovate-elliptic or oblanceolate, base round or acute, apex acute or acuminate, margin entire, or slightly undulate, glabrous, glossy, coriaceous; stipule 10-12 mm long, lateral, ovate-lanceolate, membranous, puberulous, cauducous, leaving an annular scar; petiole 10-25 mm long, stout, grooved above, glabrous.

Figs: Depressed globose to pyriform or globose, 0.7 – 1.5 cm in diameter, axillary and on twigs behind the leaves, paired or solitary, pedunculate, turning greenish – yellow to orange to red when mature.

Distribution in Kerala: Kannur, Wayanad, Malappuram, Palakkad, Thrissur, Idukki, Kollam, Thiruvananthapuram.

Materials Examined: INDIA, Wayanad, Kerala, 11°33.423′N, 75°59.199′E

17. *Ficus pumila* L.

Synonyms: *Ficus hanceana* Maxim., *Ficus longipedicellata* H.Perrier, *Ficus minima* Hort., *Ficus nagayamae* Yamam., *Ficus pumila* var. *lutchuensis* Koidz., *Ficus pumila* var. *pumila*, *Ficus repens* var. *lutchuensis* Koidz., *Ficus scandens* Lam., *Ficus stipulacea* Noronha, *Ficus stipulata* Lem., *Ficus stipulata* Thunb., *Ficus vestita* Desf., *Plagiostigma pumila* (L.) Zucc., *Plagiostigma stipulata* (Thunb.) Zucc., *Tenorea heterophylla* Gasp., *Urostigma scandens* (Lam.) Liebm., *Varinga repens* Raf.
Subspecies: *Ficus pumila* subsp. *awkeotsang* L. and *Ficus pumila* subsp. *pumila*
Variety: *Ficus pumila* var. *awkeotsang* (Makino) Corner

Diagnosis: Procumbent root climber, dioecious; Leaves alternate, dimorphic, acrophyllus, ovate, elliptic to oblong, 5-10 × 2.5–5 cm, coriaceous, glabrous above, villous beneath; petiole 1.2-2 cm long, pubescent and bathyphyllus – Ovate or cordate, 1–2.5 × 0.7–2 cm, chartaceous, green above, pale beneath; petiole very short, 1.5–5 mm long, slender, 0.3-0.5 mm thick, glabrous, brown. Stipules of bathyphylls in pairs, opposite at nodes, ovate-lanceolate, 4-5 mm long, glabrous or puberulous, persistent; stipules of acrophylls terminal in groups, lanceolate, 1.5-1.7 cm long, villous, with golden yellow hairs, glabrous beneath, persistent.

Figs: Sub-globose to pyriform, obovoid to turbinate, 2.7-5.5 × 2-3 cm, solitary, axillary, borne on acrophyllus branches, pedunculate, peduncle up to 1.5 cm long, light green when young, turning dark green to purple when ripe, thinly villose, pubescent or puberulous.

Distribution in Kerala: Cultivated throughout.

Materials Examined: INDIA, Wayanad, Kerala, 11°32.448′N, 76°01.22′E

18. *Ficus racemosa* L.

Synonyms: *Covellia glomerata* (Roxb.) Miq., *Covellia lanceolata* (Buch. -Ham. ex Roxb.) Miq., *Covellia mollis* Miq., *Ficus acidula* King, *Ficus chittagonga* Miq., *Ficus glomerata* Roxb., *Ficus glomerata* var. *chittagonga* (Miq.) King, *Ficus glomerata* var.

elongata King, *Ficus glomerata* var. *miquelii* King, *Ficus glomerata* var. *mollis* (Miq.) King, *Ficus henrici* King, *Ficus lanceolata* Buch. -Ham., *Ficus lanceolata* Buch. -Ham. ex Roxb., *Ficus leucocarpa* (Miq.) Miq., *Ficus lucescens* Blume, *Ficus mollis* (Miq.) Miq., *Ficus racemosa* subsp. *vesca* (F.Muell. ex Miq.) Barrett, *Ficus racemosa* var. *elongata* (King) M.F.Barrett, *Ficus racemosa* var. *miquelii* (King) Corner, *Ficus racemosa* var. *mollis* (Miq.) Barrett, *Ficus racemosa* var. *racemose, Ficus racemosa* var. *vesca* (F.Muell. ex Miq.) M.F.Barrett, *Ficus semicostata* F.M.Bailey, *Ficus trichocarpa* Decne., *Ficus trichocarpa* f. *glabrescens* Engl., *Ficus vesca* F.Muell., *Ficus vesca* F.Muell. ex Miq., *Urostigma leucocarpum* Miq., *Urostigma lucescens* (Blume) Miq.

Diagnosis: Tree, up to 30 m tall; buttressed; Monoecious; bark surface reddish-brown or yellowish-brown smooth, coarsely flaky, fibrous; young shoots and twigs finely white hairy. Leaves simple, alternate; lamina 6-15 x 3.5-6 cm, elliptic-oblong, elliptic-lanceolate, elliptic-ovate or oblong-ovate, base acute, obtuse or cuneate, apex narrowed, blunt or acute, margin entire, membranous, glabrous, blistered appearance on drying; stipules 12-18 mm long, lanceolate, linear-lanceolate, pubescent, often persistent on young shoots; petiole 10-50 mm long, slender, grooved above, becoming brown scurfy.

Figs: Sub-globose to pyriform, smooth, 1.5 – 5 cm in diameter, cauliflorous, on trunk from base to top and on branches, in clusters on up to 20cm long racemes, racemes branched or unbranched, rarely axillary, pedunculate, turning light green to pink, red, orange when ripe, producing sweet aromatic flavour when ripe.

Distribution in Kerala: Kasaragod, Kannur, Kozhikode, Wayanad, Malappuram, Palakkad, Thrissur, Ernakulam, Idukki, Kottayam, Alappuzha, Pathanamthitta, Kollam, Thiruvananthapuram.

Materials Examined

INDIA, Wayanad, Kerala, 11.7458N 76.2416E; 11.6689N 76.2783E; 11.5961N 76.3508E; 11.8692N 76.073E; 11.9552N 76.0851E; 11°32.962′N, 76°02.329′E; 11°33.398′N, 75°58.711′E

19. *Ficus religiosa* L.

Synonyms: *Ficus caudata* Stokes, *Ficus peepul* Griff., *Ficus religiosa* var. *cordata* Miq., *Ficus religiosa* var. *rhynchophylla* Miq., *Ficus rhynchophylla* Steud., *Ficus superstitiosa* Link, *Urostigma affine* Miq., *Urostigma religiosa* (L.) Gasp.

Diagnosis: Trees, up to 25 m tall; monoecious; aerial roots absent; bark grey, smooth. Leaves simple, alternate, spiral; new leaves pink; lamina 5-13 x 4.5-12 cm, broadly ovate, base truncate or subcordate, apex caudate-acuminate, margin entire, undulate, glabrous, shining, coriaceous; stipules 1-1.5 cm long, lateral, ovate-lanceolate, puberulous; petiole 60-120 mm long, stout, glabrous, articulated, a gland at the apex below.

Figs: obovoid or globose, 0.6 – 1.5 cm in diameter, sessile, axillary, in pairs, tunring from green to purple to black when ripe.

Distribution in Kerala: Kasaragod, Kannur, Kozhikode, Wayanad, Malappuram, Palakkad, Thrissur, Ernakulam, Idukki, Kottayam, Alappuzha, Pathanamthitta, Kollam, Thiruvananthapuram.

Materials Examined

INDIA, Wayanad, Kerala, 11.71986N 76.32443E; 11.6622N 76.3304E; 11.6406N 76.303E; 11.8552N 76.1134E; 11.9556N 76.0668E; 11.7685N 76.2885E, 14.I.2019

20. *Ficus rumphii* Blume

Synonyms: *Ficus affinior* Griff., *Ficus conciliorum* Oken, *Ficus cordifolia* Roxb., *Ficus coriacea* Aiton, *Ficus damit* Gagnep., *Ficus populiformis* Schott, *Ficus populiformis* Schott ex Miq., *Ficus populnea* Kunth & Bouché, *Urostigma cordifolium* (Roxb.) Miq., *Urostigma rumphii* (Blume) Miq.

Diagnosis: Tree, up to 25 m tall, monoecious, epiphytic, embracing other trees truncks; aerial roots absent; Bark yellowish grey or grey, exfoliating into irregular flakes, not pitted, smooth; Leaves alternate, symmetric, sometimes asymmetric, lamina ovate, broadly ovate to elliptic, 7.5-17 × 5-10 cm, apex gradually tapering or acuminate, sub-cariaceous, dark green and shining above, young foliage red, glabrous on both surfaces; petiole 4-10 cm long, slender, glabrous, grooved, articulated. Stipules ovate-lanceolate, 1-2.5 cm long, glabrous, caducous.

Figs: Globose to sub-globose or obovoid, 1.5-2 cm in diameter, in pairs, axillary or below the leaves on leaf scars, sessile, whitish or pale green with white spots when young, turning yellow to purple to black when mature.

Distribution in Kerala: Wayanad

Materials Examined: INDIA, Wayanad, Kerala, 11.6588N 75.9914E

21. *Ficus talbotii* King

Synonyms: *Ficus pierrei* Gagnep., *Ficus pierrei* hort., *Ficus pierrei* hort. ex Gentil

Diagnosis: Tree, up to 30 m tall; aerial roots none or very few; Monoecious; bark surface green, smooth; Leaves simple, alternate, spiral, stipulate; lamina elliptic-ovate or ovate-oblong, base cuneate or acute, apex acuminate, 5-12 x 2.5-5 cm, margin entire, coriaceous, glabrous; stipules 5 mm long, ovate, pubescent, cauducous; petiole 15-30 mm, slender, glabrous, grooved above.

Figs: Obovoid, obconical or sub-globose; 4-8mm in diameter, sessile, in axillary pairs of 3 or 4, greenish yellow or with brown dots on mature.

Distribution in Kerala: Kasaragod, Kannur, Kozhikode, Wayanad, Malappuram, Palakkad, Idukki, Pathanamthitta, Kollam.

Materials Examined

INDIA, Wayanad, Kerala, 11.9033 N 76.0619 E; 11.9556 N 76.0668 E; 11.9556 N 76.0668 E; 11.8888 N 76.1009 E; 11.6809 N 76.3813 E; 11.6898 N 76.2525 E

22. *Ficus tinctoria* G. Forst.

Synonyms: *Ficus dodonaeifolia* Zipp., *Ficus dodonaeifolia* Zipp. ex Miq., *Ficus gibbosa* f. *parasitica* (J.Koenig ex Willd.) King, *Ficus michelii* H.Lév., *Ficus neoehudarum* Summerh., *Ficus rhomboidalis* H.Lév. & Vaniot, *Ficus tinctoria* var. *neoehudarum* (Summerh.) Fosberg, *Ficus tinctoria* var. *parasitica* (Blume) Corner, *Ficus tinctoria* var. *rigida* (Miq.) Corner

Subspecies: *Ficus tinctoria* subsp. *gibbosa* (Blume) Corner and *Ficus tinctoria* subsp. *tinctoria* G.Forst.

Varieties: *Ficus gibbosa* var. *gibbose* and *Ficus gibbosa* var. *parasitica* (J.Koenig ex Willd.) Prain, 1903

Diagnosis: Climbing bushy shrub or small free-standing tree, up to 8 m tall, dioecious. Hemi-epiphytic, embracing the trunk of host plants forming network of branches (basketing) or creeping along old walls, wells and rocks; aerial roots absent or few. Bark pale greenish yellow or grey; Leaves alternate, distichous, asymmetric, lamina variable

rhomboid to subrhomboid, ovate to elliptic, oblong to lanceolate, or oblanceolate, 3-20 × 2-10cm, coriaceous or subcoriaceous, gibbose, scabrous, hispidulous, sparsely puberulous or glabrous on both sides, petiole 0.3 – 1.5 cm long, slender. Stipules terminal or axillary, lanceolate or ovate-lanceolate, 0.3-1 cm long, convolute, glabrous or puberulous, caducous.

Figs: Globose to subglobose or depressed globose, pyriform, 0.3-1.2 cm in diameter, in pairs, solitary, axillary or just below the leaves, pedunculate, peduncle 0.5 – 1 cm long, very slender; light to dark green turning yellow to orange to red when ripe.

Distribution in Kerala: Kasaragod, Kannur, Kozhikode, Wayanad, Malappuram, Palakkad, Thrissur, Ernakulam, Idukki, Kottayam, Alappuzha, Pathanamthitta, Kollam, Thiruvananthapuram.

Materials Examined

INDIA, Wayanad, Kerala, 11.7221N 76.3795E; 11.7695N 76.3001E; 11.6648N 76.3426E; 11.9203N 76.0916E

23. *Ficus tsjakela* Burm. f.

Synonyms: *Ficus tiakela* Miq., *Ficus tsjahela* Burm.f., *Ficus venosa* Aiton, *Urostigma ceylonense* Miq., *Urostigma tjakela* Miq., *Urostigma tsjakela* (Burm.f.) Miq.

Diagnosis: Tree, often epiphytic, up to 35 m tall; aerial roots absent; monoecious; bark surface dark brown, rough, blaze red, fibrous; Leaves simple, alternate spiral, stipulate; lamina 9-21 x 3.5-12 cm, elliptic-oblong or ovate-oblong, base rounded, subtruncate or cuneate, apex abruptly acuminate, margin entire; coriaceous, glabrous, glossy above; stipule 4-7 cm long, lateral, ovate-lanceolate, yellowish-red, foliaceous; petiole 3.5-10 cm long, slender, grooved above, glandular at apex below, glabrous, articulate.

Figs: Depressed-globose, wall thin, 3-8 mm in diameter, sessile, in clusters of 4-6, on very short crowded tubercles in the axils of the leaves or most frequently at the scars of fallen leaves; green or greenish with white dots or white to yellowish with pale spots.

Distribution in Kerala: Kasaragod, Kannur, Kozhikode, Wayanad, Malappuram, Palakkad, Thrissur, Ernakulam, Idukki, Kottayam, Alappuzha, Pathanamthitta, Kollam, Thiruvananthapuram.

Materials Examined

INDIA, Wayanad, Kerala, 11.9638N 76.0912E; 11.9166N 76.0981E; 11.8553N 76.1149E; 11.8286N 76.0748E; 11.6439N 76.433E; 11.6064N 76.364IE; 11.7016N 76.2425E

24. *Ficus virens* Aiton

Synonyms: *Ficus aegeirophylla* (Miq.) Miq., *Ficus ampla* Kunth & Bouché, *Ficus apiculata* (Miq.) Miq., *Ficus carolinensis* Warb., *Ficus caulobotrya* var. *fraseri* (Miq.) Miq., *Ficus cunninghamii* (Miq.) Miq., *Ficus fraseri* (Miq.) F.Muell., *Ficus glabella* Blume, *Ficus glabella* f. *grandifolia* (Miq.) Miq., *Ficus glabella* var. *nesophila* (Miq.) K.Schum., *Ficus infectoria* (Miq.) Miq., *Ficus infectoria* Roxb., *Ficus infectoria* Willd., *Ficus infectoria* var. *aegeirophylla* (Miq.) Miq., *Ficus infectoria* var. *cunninghamii* (Miq.) Domin, *Ficus infectoria* var. *forbesii* King, *Ficus infectoria* var. *fraseri* (Miq.) Domin, *Ficus infectoria* var. *lambertiana* (Miq.) King, *Ficus infectoria* var. *psychotriifolia* (Miq.) Domin, *Ficus infectoria* var. *typica* Domin, *Ficus infectoria* var. *wightiana* (Wall. ex Miq.) King, *Ficus infrafoliacea* Buch.-Ham., *Ficus infrafoliacea* Buch.-Ham. ex Sm., *Ficus lacor* var. *cunninghamii* (Miq.) Barrett, *Ficus lacor* var. *lambertiana* (Miq.) Barrett, *Ficus lambertiana* (Miq.) Miq., *Ficus mariannensis* Merr., *Ficus monticola* Miq., *Ficus nesophila* (Miq.) F.Muell., *Ficus nesophila* (Miq.) Miq., *Ficus nitentifolia* S.Moore, *Ficus pilhasi* Sm., *Ficus prolixa* subsp. *carolinensis* (Warb.) Fosberg, *Ficus prolixa* var. *carolinensis* (Warb.) Fosberg, *Ficus psychotriifolia* (Miq.) Miq., *Ficus racemosa* Willd., *Ficus saxophila* var. *sublanceolata* (Miq.) Corner, *Ficus saxophila* var. *sublanceolata* Miq., *Ficus scandens* Buch.-Ham., *Ficus syringifolia* C.Fraser, *Ficus syringifolia* C.Fraser ex C.Moore, *Ficus tenii* Lév., *Ficus tenuistipula* Merr., *Ficus terminalioides* Griff., *Ficus terminalis* B.Heyne, *Ficus terminalis* B.Heyne ex Roth, *Ficus timorensis* (Miq.) Miq., *Ficus timorensis* Decne., *Ficus virens* var. *glabella* (Blume) Corner, *Ficus virens* var. *sublanceolata* (Miq.) Corner, *Ficus virens* var. *wightiana* (Miq.) Chithra, *Ficus virens* var. *wightiana* (Miq.) M.R.Almeida, *Ficus wightiana* (Miq.) Benth., *Ficus wightiana* Wall., *Urostigma accedens* Miq., *Urostigma aegeirophyllum* Miq., *Urostigma apiculatum* Miq., *Urostigma canaliculatum* Miq., *Urostigma cunninghamii* Miq., *Urostigma fraseri* Miq., *Urostigma glabellum* (Blume) Miq., *Urostigma infectorium* (Roxb.) Miq., *Urostigma lambertianum* Miq., *Urostigma moritzianum* Miq., *Urostigma nesophilum* Miq., *Urostigma perseifolium* Miq.,

Urostigma psychotriifolium Miq., *Urostigma timorense* Miq., *Urostigma wightianum* Miq.

Diagnosis: Trees, up to 40 m tall, often epiphytic; aerial roots few, often fluted; monoecious; bark surface dark brown, smooth; leaves simple, alternate, spiral; lamina 5-17.5 x 3-10 cm, oblong-ovate or ovate, base round, truncate or subcordate, apex, obtusely acuminate, margin entire, glabrous, coriaceous; stipules 10-12 mm long, lateral, broadly ovate, pubescent; petiole 3.7-6 cm long, slender, glabrous, grooved above, articulated, glandular at apex below.

Figs: globose, often obconical; 0.8 1.2 cm in diameter, axillary, paired, peduncle 1-6 mm long, slender, pubescent; white, green, pale white with pink or red spots, some turning from greenish to pink to purple to red and even black.

Distribution in Kerala: Wayanad, Palakkad, Idukki.

Materials Examined

INDIA, Wayanad, Kerala, 11.887N 76.0687E; 11.9388N 76.0747E; 11.9673N 76.0642E; 11.9202N 76.0915E; 11.68282N 76.26623E; 11.7216N 76.3545E; 11.6404N 76.354E; 11.5945N 76.3561E; 11.7705N 76.2996E; 11.7439N 76.2271E, collected by Shilpa K. Satheesan, ex *Ficus virens* Aiton.

5.2. FIG WASPS

Fig wasps belonging to six families - Agaonidae, Braconidae, Eurytomidae, Epichrysomalidae, Ormyridae and Pteromalidae are reported in this study. A single genus is reported from Braconidae, Eurytomidae and Ormyridae, they are *Syntomernus*, *Sycophila* and *Ormyrus* respectively. Fig wasps are collected and studied from 13 species of *Ficus* species. A total of 66 species of fig wasps are reported from 13 species of *Ficus*. Maximum number of species (around 40 species) are reported from Pteromalidae family, followed by Agaonidae with 12 species and then by Eurytomidae and Epichrysomalidae with around 10 species each.

FIGURE 4. FIG WASPS RECORDED FROM THE STUDY AREA

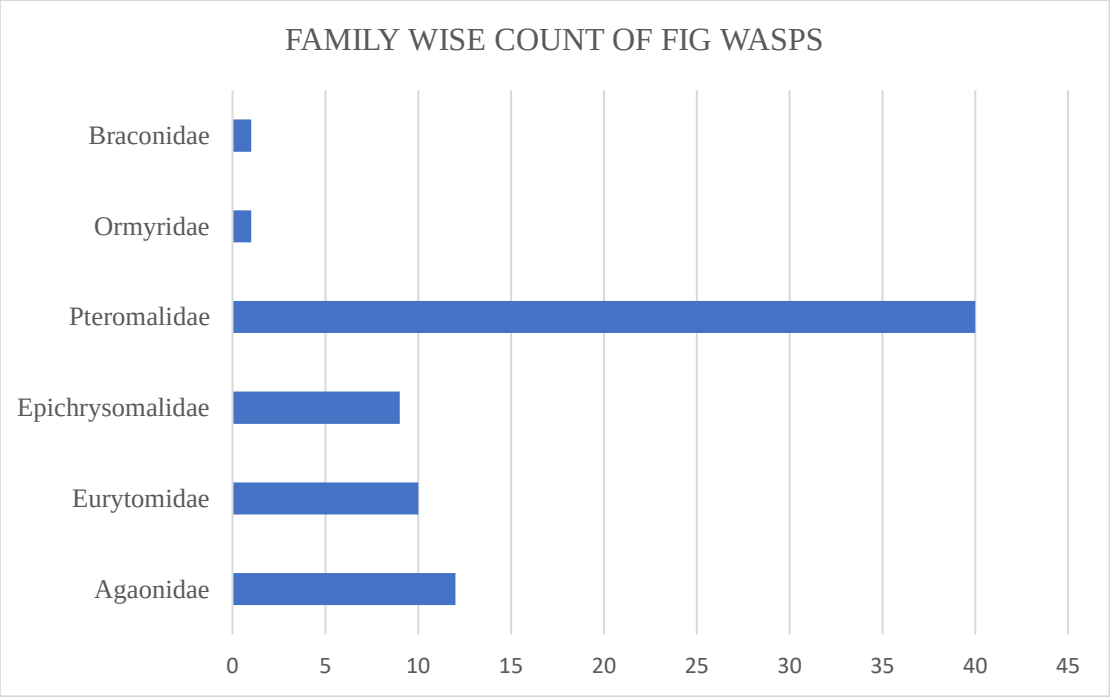


TABLE 2. LIST OF FIG ASSOCIATED WASPS RECORDED FROM THE STUDY AREA

Sl. No	Fig wasp species	Family: Subfamily	Host *Ficus* species
1	*Eupristina belgaumensis*	Agaonidae: Agaoninae	*Ficus drupacea*
2	*Eupristina delhiensis*		*Ficus amplissima*
3	*Eupristina keralensis*		*Ficus talbotii*
4	*Eupristina masoni*		*Ficus benghalensis*
5	*Eupristina verticillata*		*Ficus microcarpa*

6	*Platyscapa arnottiana*		*Ficus arnottiana*
7	*Platyscapa quadraticeps*		*Ficus religiosa*
8	*Platyscapa sahiana*		*Ficus virens*
9	*Platyscapa tjahela*		*Ficus tsjahela*
10	*Ceratosolen fusciceps*	Agaonidae: Kradibinae	*Ficus racemosa*
11	*Ceratosolen solmsi*		*Ficus hispida*
12	*Kradibia gestroi*		*Ficus exasperata*
13	*Syntomernus codonatus.*	Braconidae: Braconinae	*Ficus tinctoria*
14	*Ornatapedicelum arnottiana* gen. nov. sp. nov.	Epichrysomalidae	*Ficus arnottiana*
15	*Neosycophila omeomorpha*		*Ficus tinctoria*
16	*Odontofroggatia corneri*		*Ficus microcarpa*
17	*Rahimaniella drupacea gen. nov.* sp. nov.		*Ficus drupacea*
18	*Sycobia mathewi*		*Ficus drupacea*
19	*Sycobia bethyloides*		*Ficus benghalensis*
20	*Sycobiomorphella religiosa* sp. nov.		*Ficus religiosa*
21	*Camarothorax bimasculinus*		*Ficus virens*
22	*Sycobiomorphella lacorensis*		*Ficus virens*
23	*Sycophila drupacea* sp. nov.	Eurytomidae: Eurytominae	*Ficus drupacea*
24	*Sycophila mysurensis* sp. nov		*Ficus drupacea*
25	*Sycophila arnottiana* sp. nov.		*Ficus arnottiana*
26	*Sycophila religiosa* sp. nov.		*Ficus religiosa*
27	*Sycophila virens* sp. nov.		*Ficus virens*

28	*Sycophila infectoria* sp. nov.		*Ficus virens*
29	*Sycophila wayanadensis* sp. nov		*Ficus virens*
30	*Sycophila batheri* sp. nov.		*Ficus virens*
31	*Sycophila tinctoria* sp. nov.		*Ficus tinctoria*
32	*Sycophila gibbosa* sp. nov.		*Ficus tinctoria*
33	*Ormyrus bouceki*	Ormyridae	*Ficus virens*
34	*Marginalia religiosa*	Pteromalidae: Pteromalinae: Otitesellini	*Ficus religiosa*
35	*Micranisa ashtamudiensis*		*Ficus talbotii*
36	*Micranisa claviscapa*		*Ficus drupacea*
37	*Micranisa microcarpae* sp. nov.		*Ficus microcarpa*
38	*Otitesella digitata*		*Ficus religiosa*
39	*Otitesella minima*		*Ficus virens*
40	*Otitesella virens* sp. nov.		*Ficus virens*
41	*Otitesella tsjahela*		*Ficus tsjakela*
42	*Philosycella wiebesina*		*Ficus arnottiana*
43	*Walkerella kurandensis*		*Ficus microcarpa*
44	*Walkerella talboti*		*Ficus talbotii*
45	*Apocrypta bakeri*		*Ficus hispida*
46	*Apocrypta microcarpae* sp. nov.		*Ficus microcarpa*
47	*Apocrypta westwoodi*		*Ficus racemosa*
48	*Arachonia plumosa*		*Ficus drupacea*
49	*Philotrypesis affinis*		*Ficus benghalensis*
50	*Philotrypesis anguliceps*	Pteromalidae: Pteromalinae: Otitesellini	*Ficus religiosa*
51	*Philotrypesis indica*		*Ficus arnottiana*
52	*Philotrypesis longispinosa*		*Ficus drupacea*
53	*Philotrypesis pilosa*		*Ficus hispida*
54	*Philotrypesis quadrisetosa*		*Ficus exasperata*

55	*Philotrypesis virens* sp. nov.		*Ficus virens*
56	*Philotrypesis talboti* sp. nov.		*Ficus talbotii*
57	*Sycoscapter arnottianus*		*Ficus arnottiana*
58	*Sycoscapter infectorius*		*Ficus virens*
59	*Sycoscapter longipalpus*		*Ficus exasperata*
60	*Sycoscapter religiosa*		*Ficus religiosa*
61	*Sycoscapter racemosa* sp. nov.		*Ficus racemosa*
62	*Sycoscapter tsjahela* sp. nov.		*Ficus tsjakela*
63	*Sycoscapter stabilis*		*Ficus benghalensis*
64	*Sycoscapter triformis*		*Ficus drupacea*
65	*Sycophaga agraensis*	Pteromalidae: Sycophaginae	*Ficus racemosa*
66	*Sycophaga brevitarsus*		*Ficus racemosa*

KEY TO FAMILY OR SUBFAMILY OR TRIBE OF FIG WASP, MODIFIED FROM BOUČEK, 1988

1 Fully winged or almost fully winged (females and some males) ---------- 2

–Apterous or brachypterous, in latter case wing stumps not exceeding middle of gaster; body mostly yellowish, without eyes or with eyes unusually small (only males) ---- 8

2 Mandible underneath with conspicuous flat appendages which bear distinct transverse ridges and adhere to the underside of head; Antenna usually placed in a broad median channel, scapes always distinctly enlarged, third segment produced into a curved spine; head often prognathous, sometimes longer than broad; fore tibia always much shorter than the femur; ovipositor simple, thin, usually shorter than body ---------- ---------- AGAONINAE

– Mandibles normal, without appendages; Antenna different, third antennal segment anelliform or scape not enlarged; head often orthognathous; fore tibia often as long as femur; ovipositor or the narrowly tubular gastral tail often longer than body -------- 3

3 Gaster with narrow tail, this formed either by protruding ovipositor with its valvulae or also by the last tergit which is unusually narrow, tubular, covering part or whole of ovipositor; only females ---------- 4

–Gaster without narrow tail at apex (both sexes) ---------- 5

4 Gastral tail formed only by ovipositor and its sheath, not by last tergite which is very short and bears distinct cerci on its sides; fore tibia often strongly shortened ---------- ---------- SYCOPHAGINAE (*Sycophaga*)

–Tail dorsally, at least in basal half, covered by tubular extension of one or two terminal tergites (but not in *Apocrypta*, which has a keeled thorax); cerci very small or indistinct, situated at end of the narrowed last tergite, far behind gastral body; fore tibia normal, always more than half as long as femur -------- OTITESELLINI (Sycoryctina)

5 Stigmal vein almost sessile and unusually short, less than one sixth the length of marginal vein; wing pilosity moderately dense but basal two fifths of wing almost bare; thorax with only few sparse bristles; male ---------- ORMYRIDAE

–Stigmal vein different, relatively longer; otherwise also different ---------- 6

6 Body mostly with some metallic gloss, thorax often finely densely reticulate; only females here, with gaster tapering posteriorly, apex mostly compresses from side to side and curving downward ---------- OTITESELLINI (Otitesellina)

–Body (both sexes) yellowish, brown or black, always non-metallic; thorax mostly less sculptured gaster different ---------- 7

7 Stigmal vein normal, diagonal, i.e. at angle much less than 90°, post-marginal vein often longer than the stigmal; Gaster often compressed from side to side; marginal vein moderately to very strongly widened, stigma and post-marginal veins short and not widened; propodeum with wavy cross-carina which medially adheres to anterior margin; petiole narrow, often dorsally concealed by convex base of gaster (in female) ---------- EURYTOMIDAE (*Sycophila*)

–Stigmal vein unusual, rather long, arising at about a right angle and longer than post-marginal vein; head and thorax mostly smooth and shiny usually with only few pairs of outstanding and mostly long setae including two bristles curving forward at apex of scutellum ---------- EPICHYSOMALIDAE

8 Posterior gastral segments soft, long and narrow, telescoping, usually turned in U-shape forward under the body; fore and hind femora enormously enlarged, middle femora less so or not enlarged; Antenna cylindrical or slightly clavate, sometimes retractable into special cavities which may be over roofed dorsally ---------- AGAONIDAE

−Gaster different; posterior segments not strongly telescoping, either quite short or dorso-ventrally flattened, gastal apex not strongly turned forward; all femora sometimes enlarged; Antenna never in adeep united and if gaster soft as in alternate the antennal sockets are shallow, clearly visible, distinctly apart ---------- 9

9 Antenna inserted in anterior quarter of head or, if slightly behind one quarter, then sockets close to each other ---------- 10

−Antenna inserted behind anterior third of head, their sockets usually wide apart ---------- OTITESELLINI (Otitesellina)

10 Tibiae normal, with some setae, sometimes with sparse bristles but not with dense stout spines lateral panels of pronotum vertical, closely applied to body; head elongated or not, but never strongly flattened ---------- EPICHRYSOMALIDAE

−Tibiae more or less shortened and widened, with at least some groups of stout spines pronotum often without vertical lateral panels of pronotum vertical lateral panels but with sides usually projecting as thin roof ---------- 11

11 Torulus on inner side slightly over roofed by a fold, as if base of antenna was pushed towards median line; second flagellar segment often unusually larger than the third ---------- OTITESELLINI (Sycoryctina)

−Toruli without swelling on inner side; scape flat and broad, flagellum usually strongly shortened ---------- SYCOPHAGINAE

FAMILY AGAONIDAE

Agaonidae Walker, 1846; Type genus: *Agaon* Dalman

Blastophagidae Kirchner, 1867; Type genus: *Blastophaga* Gravenhorst

Female: Colour usually black, dark brown to yellowish brown. The head dorso-ventrally flattened; usually with 3 ocelli. Face medially has a groove into which the antennal scapes fit, when folded back. Antenna usually 11 segmented (a few with 10); the scape large and flat; 3rd antennal segment apically produced into an appendage; flagellum with either sensilla chaetica or sensilla linearia or with both. Mandibles are situated underneath the head, possess a posterior flat appendage provided with ventral lamellae or rows of teeth; labium and maxilla fused and vestigial. Thorax usually smooth and flat. Fore and hind legs short and strong; tibia with stout teeth fore wings with the peculiar venation of premarginal, marginal and postmarginal veins and stigmal vein almost perpendicular to it. The pollen carrying structures, the mesothorasic pollen pockets and or coxal corbiculae are present in most species. Gaster laterally compressed; hypopygium usually with a spine; valves of the ovipositor extruding.

Male: Vermiform and apterous. Colour yellowish brown. Eyes vestigial; ocelli are absent. Antenna with scape, pedicel annular segments and a club; only a few sensilla linearia present. Mouthparts, labium and maxillae reduced in most species; mandibles strong, and bidentate. Antenna situated in separate grooves on either side of a median prominence or in a common groove in the frontal part of the head. Mesonotum and metanotum fused in many; metanotum and propodeum usually fused; fore and hind legs are with short and spiny tibiae; mid legs long and slender. Gaster with long and telescopic apical segments; aedeagus protrusible-with claspers and claws in some species.

KEY TO GENUS OF AGAONIDAE, MODIFIED FROM BOUČEK, 1988

1 Antenna strongly clavate; Ovipositor longer than gaster ---------- 2

−Antenna not or hardly clavate or if moderately clavate, then ovipositor shorter than body ---------- 3

2 Pigmentation of venation ending with a knob on parastigma, rest of veins colourless, indistinct; wings almost bare; notauli incomplete, middle of scutum often with deep sparse punctures ---------- ***EUPRISTINA***

−Venation normally developed and pigmented, wings with dense pilosity; mesoscutum with distinct notauli but without deep punctures ---------- ***PLATYSCAPA***

3 Spiracles of sixth tergite surrounded by large concave and elongate peritremal areas with granulate surface; Marginal vein broad, stigmal vein without end knob ---------- ---------- ***CERATOSOLEN***

−Gastral spiracles with only small peritremata; Marginal vein normal, stigmal vein with end knob ---------- ***KRADIBIA***

EUPRISTINA Saunders

Blastophaga (*Eupristina*) Saunders, 1882; Type species: *Eupristina masoni* Saunders
Eupristina Saunders, 1882; Type species: *Eupristina masoni* Saunders
Eupristina (*Parapristina*) Hill, 1967; Type species: *Eupristina verticillata* Waterston
Maniella Abdurahiman and Joseph, 1967; Type species: *Maniella delhiensis* Abdurahiman & Joseph
Parapristina Hill, 1967; *Eupristina verticillata* Waterston

Female: Antenna 11 segmented; appendage of 3rd segment long; funicular segments more or less cup shaped and bearing long sensilla chaetica or funicular segments sybcylindrical and bear sensilla linearia, which extent beyond the apex of the segment. Mandible bidentate. Spiracular peritremata of the 8th urotergite small and subcircular or slightly oval. Wings hyaline; venation reduced.

Male: Antennal scrobes separate. Pronotal collar present; meso and metanotum fully fused; fore tarsus bimerous. Genitalia simple.

KEY TO SPECIES OF *EUPRISTINA*, MODIFIED FROM PRIYADARSANAN, 2000

1 Female ---------- 2

− Male ---------- 6

2 Appendage of the third antennal segment long; funicular segments cup-shaped, bearing a row of sensilla chaetica at the rim of each segment ---------- 3

− Appendage of the third antennal segment short and less acuminate; funicular segments more cylindrical, bearing sensilla linearia ---------- 5

3 Compound eye as long as the cheek; two teeth in the dorsa-apical comb of fore tibia; ovipositor valves are 1.25 times as long as the gaster ---------- ***E. verticillata***

− Compound eye 1.5 times as long as the cheek; ovipositor valves as long as or a little shorter than the gaster ---------- 4

4 Head wider than long; fore wing, only the submarginal vein developed ---- ***E. delhiensis***

− Head as long as wide; fore wing with submarginal, marginal and stigmal veins ---------- ***E. keralensis***

5 Antenna, pedicel with spines; seventh segment widening apicad; Mandibular appendage with a lateral lobe; principal appendage with 11 lamellae ---------- ***E. masoni***

− Antenna, pedicel without spines; seventh segment not widening apicad; Mandibular appendage without a lateral lobe, the appendage with less than 11 lamellae ---------- ***E. belgaumensis***

6 Antennal scrobes separate; fore leg coxa not fused to the thorax laterally ---------- 7

− Antenna situated in a common groove; fore leg coxa laterally fused to the thorax --- 9

7 Mid and hind tarsi trimerous ---------- ***E. delhiensis***

− Fore and hind legs have four or five segmented tarsi ---------- 8

8 Mid and hind tarsi tetramerous; antenna with a single annellus ---------- ***E. verticillata***

− Fore, mid and hind tarsi pentamerous; antenna with two anelli ---------- ***E. keralensis***

9 Head almost as long as wide; mandible unidentate ---------- ***E. belgaumensis***

− Head distinctly shorter than its width; mandible not unidentate ---------- ***E. masoni***

Eupristina belgaumensis Joseph, 1954

(Figure 15 - 18)

Synonyms: *Eupristina* (*Eupristina*) *belgaumensis* Joseph, 1954

Materials Examined

INDIA, Wayanad, Kerala, 11.71441 N 76.32326 E; 11.72815 N 76.32313 E; 11.8274 E 76.09494 E; 11.7447 N 76.304 E; 11.6744 N 76.2979 E; 11.8718 N 76.1003 E collected by Shilpa K. Satheesan, ex *Ficus drupacea* Thunb.

Diagnosis: ***Female***. Length 1.6mm excluding ovipositor valve. General brownish black; Head with pubescence; Head width 1.2x distance between front ocellus and clypeal margin, with POL 1.45x OOL. Eyes as 1.25x long as wide. Malar groove complete, 0.85x eye length. Antennal formula 11063; Mesosoma smooth with little pubescence. Pronotum 0.5× as long as mesoscutum. Mesoscutum 1.03x as long as scutellum. Notauli incomplete. Scutellum 1.4x wider than long. Propodeum smooth medially reduced and lateral halves triangular. Wings: Fore wing hyaline, 2.3× as long as wide, 3x SMV, wing obsolete after SMV; Metasoma smooth and shiny. Gaster 1.2x longer than thorax. Hypopygium ending after gaster body.

Male: Length 1.2–1.4 mm. Head wider than long; eye length 0.2× length of head; anellus distinct; mandible bidentate; propodeum 1.8× as wide as long; fore tarsus bimerous; mid and hind tarsi pentamerous.

Host: Syconia galls of *Ficus drupacea* Thunb.

Eupristina delhiensis (Abdurahiman and Joseph), 1967

(Figure 1 - 5)

Synonyms: *Eupristina* (*Parapristina*) *delhiensis* (Abdurahiman and Joseph, 1967); *Maniella delhiensis* Abdurahiman and Joseph, 1967

Materials Examined

INDIA, Wayanad, Kerala, 11.6727N 76.308E; 11.6651N 76.3161E; 11.6246N 76.3158E; 11.6106N 76.3408E; 11.6584N 76.2797E; 11.9209N 76.0915E collected by Shilpa K. Satheesan, ex *Ficus amplissima* Sm.

Diagnosis: ***Female***. Length 1mm excluding ovipositor valve. General brownish black; Head with pubescence; Head width 1.7x distance between front ocellus and clypeal margin, with POL 1.8x OOL. Eyes as 1.25x long as wide. Malar sulcus absent, gena 0.93x

eye length. Antennal formula 11063; Funicular segments small and loosely arranged, each segment with longitudinal sensilla starting at distal margin and extending over next funicular segment. Mesosoma smooth without pubescence. Pronotum 0.5× as long as mesoscutum. Mesoscutum 1.07x as long as scutellum. Notauli incomplete. Scutellum 1.4x wider than long. Propodeum smooth rectangular. Wings: Fore wing hyaline, 2.1× as long as wide, 2.8x SMV, wing obsolete after a very small marginal vein; Metasoma smooth and shiny. Gaster 1.13x longer than thorax. Hypopygium ending after gaster body.

Male: Length 1.5mm, including the exerted claspers. Head long as wide; eye 0.2× length of head, 2× long as gena; antennal formula 1122; mandible bidentate; pronotum long as wide; metanotum and pronotum fused; fore tibia with five ventral teeth; hind tibia with 3 teeth; gaster simple.

Host: Syconia galls of *Ficus amplissima* Sm.

Eupristina keralensis (Priyadarsanan and Abdurahiman), 1994

(Figure 39 - 42)

Synonyms: *Eupristina* (*Parapristina*) *keralensis* (Priyadarsanan and Abdurahiman, 1994); *Waterstoniella keralensis* Priyadarsanan and Abdurahiman, 1994

Materials Examined

INDIA, Wayanad, Kerala, 11.9033 N 76.0619 E; 11.9556 N 76.0668 E; 11.9556 N 76.0668 E; 11.8888 N 76.1009 E; 11.6809 N 76.3813 E; 11.6898 N 76.2525 E, collected by Shilpa K. Satheesan, ex *Ficus talbotii* King.

Diagnosis: ***Female***. Length 0.7mm excluding ovipositor valve. General brownish black; Head with pubescence; Eyes as 1.55x long as wide. Head width 1.2x distance between front ocellus and clypeal margin. Malar sulcus 1.17x eye length. Antennal formula 11063; Mesosoma smooth without pubescence. Pronotum 0.5× as long as mesoscutum. Mesoscutum as long as scutellum. Notauli incomplete. Scutellum 1.3x wider than long. Propodeum smooth rectangular. Wings: Fore wing hyaline, 2.3× as long as wide, 2.9x SMV, SMV 3.25x MV, 4x STV, 4.7x PMV; MV 1.23x STV, 1.45x PMV; STV 1.18x PMV. Metasoma smooth and shiny. Gaster 1.03x longer than thorax. Hypopygium ending after gaster body.

Male: Length 1.5mm, including the exerted claspers. Head as long as wide. Antenna with 2 funicular segments and a club. Mandible bidentate. Fore tibia with prominent axial tooth, tarsus bimerous. Hindleg, tibia with two apical teeth.

Host: Syconia galls of *Ficus talbotii* King.

***Eupristina masoni* Saunders, 1882**

(Figure 10 - 14)

Synonyms: *Eupristina grassii* Grandi, 1916; *Eupristina* (*Eupristina*) *masoni* Saunders, 1882

Materials Examined

INDIA, Wayanad, Kerala, 11.7365N 76.36607E; 11.7037N 76.3701E; 11.6748N 76.2997E; 11.6411N 76.3484E; 11.6263N 76.3129E; 11.8559N 76.1161E, collected by Shilpa K. Satheesan, ex *Ficus benghalensis* L.

Diagnosis: *Female*. Length 1.2mm excluding ovipositor valve. General brownish black; Head with pubescence; Head width 1.1x distance between front ocellus and clypeal margin, with POL 1.18x OOL. Eyes as 1.28x long as wide. Malar sulcus absent, gena 0.78x eye length. Antennal formula 11063; Mesosoma smooth. Pronotum 0.34× as long as mesoscutum. Mesoscutum 1.12x as long as scutellum. Notauli incomplete. Scutellum 1.1x wider than long. Propodeum smooth, rectangular. Wings: Fore wing hyaline, 1.86× as long as wide, 2.47x SMV, wing obsolete after SMV; Metasoma smooth and shiny. Gaster 1.2x longer than thorax. Hypopygium ending after gaster body.

Male: Length 1.2–1.4 mm. Head shorter than wide, occiput strongly convex posteriorly; eyes 0.17 times the length of head; Antennal formula 1111, anellus distinct. Mandible bidentate. Pronotum expanded anterio-laterally; propodeum 1.6 times as wide as long; Foreleg tibia with number of teeth and denticles; tarsus bimerous.

Host: Syconia galls of *Ficus benghalensis* L.

***Eupristina verticillata* Waterston, 1921**

(Figure 27 - 30)

Synonyms: *Blastophaga (Parapristina) verticillata* (Waterston, 1921*); Euprista okinavensis Ishii, 1934; Eupristina (Parapristina) verticillata* Waterston, 1921*; Parapristina verticillata* (Waterston, 1921)

Materials Examined

INDIA, Wayanad, Kerala, 11.7269N 76.3545E; 11.7201N 76.379E; 11.7156N 76.3772E, 18.III.2019, collected by Shilpa K. Satheesan, ex *Ficus microcarpa* L. f.

Diagnosis: ***Female***. Length 1.4mm excluding ovipositor valve. General brownish black; Head with pubescence; Head width 1.3x distance between front ocellus and clypeal margin, with POL 1.16x OOL. Eyes as 1.13x long as wide. Malar groove complete, 0.53x eye length. Antennal formula 11063; Mesosoma smooth with little pubescence. Pronotum 0.3× as long as mesoscutum. Mesoscutum 1.1x as long as scutellum. Notauli incomplete. Scutellum 1.2x wider than long. Propodeum smooth medially reduced and lateral halves triangular. Wings: Fore wing hyaline, 2× as long as wide, 3.3x SMV, wing obsolete after SMV; Metasoma smooth and shiny. Gaster 1.2x longer than thorax. Hypopygium ending after gaster body.

Male: Head almost trapeziform, slightly wider; occiput extended as a convex middle lobe; eyes placed near mandible; antennal grooves separate, deep and extending posteriorly beyond the eyes. Antenna with one anellus; club indistinctly divided into three. Mandible with a large apical tooth, one subapical and two smaller basal teeth. Pronotum and mesonotum fused; metanotum incompletely fused with propodeum. Fore leg femur small; tibia almost 0.5 times the length of femur, tibia with three large dorso-apical teeth and one small ventro-apical tooth; Hind leg short and robust; femur 1.3 times its width, with few long setae on its dorsal margin, with two large bicuspid ventro-apical teeth and two small teeth on dorsal margin; tarsus tetramerous. Genitalia simple.

Host: Syconia galls of *Ficus microcarpa* L. f.

PLATYSCAPA **Motschoulsky**

Platyscapa Motschulsky, 1863; Type species: *Platyscapa frontalis* Motschulsky

Female: Head subquadrate about as long as wide across the compound eyes; eyes longer than the cheek. Antenna 11 segmented; scape flat with a ventral node funicular segment cylindrical to cup shaped, segments with sensilla linearia which in some species project beyond the apex of the segment, the sensillae arranged in one row, seldom in two rows. Mandible bidentate; Labium and maxillae vestigial. Thorax with pollen pockets. Fore coxa with coxal comb only or with corbicula and comb. Venation of fore wing complete. Fore leg tibia with either two or three dorso-apical teeth and a smaller ventral tooth; hind

femur with a ventral depression to which the tibia fits in. The hypopygium with a blunt spine. Peritremata of the 8th urotergite small and circular. Ovipositor valves as long as or up to 12/3 times as long as the gaster.

Male: Head shorter than its width (except in one species); occiput strongly convex; face transverse in front; compound eyes placed in front, 116 to 1/4 the length of head. Antenna usually with two anelli (in one species only one anellus and in other 3 anelli). Pronotum transverse; meso and metanotum are usually separate; metanotum and propodeum separate. Genitalia simple.

KEY TO SPECIES OF *PLATYSCAPA*, MODIFIED FROM PRIYADARSANAN, 2000

1 Female ---------- 2

− Male ---------- 5

2 Coxal corbiculae absent ---------- 3

− Coxal corbiculae present ---------- 4

3 Compound eyes small, 1/3 the length of head; pollen pockets present; coxal comb absent ---------- ***P. quadraticeps***

− Compound eyes 1/2 the length of the head; coxal comb formed of a few hairs ---------- ***P. tjahela***

4 Funicular segments of the antenna with only one row of sensilla linearia; tip of the sensillae not projecting beyond the apex of the segment ---------- ***P. arnottiana***

− Funicular segments with more than one irregular row of sensillae, tip of which project beyond the apex of the segment ---------- ***P. sahiana***

5 Antenna has three sub quadrangular anelli; mesonotum and metanotum fused; propodeum not separate ---------- ***P. arnottiana***

− Antenna has only one or two anelli; mesonotum and metanotum separate; propodeum separate ---------- 6

6 Antenna has two large unequal anelli ---------- 7

− Antenna has two short anelli of equal length; Metanotum larger than the propodeum ---------- ***P. sahiana***

7 Lateral margins of the head almost parallel; antennal groove reaches only 1/3 the length of the head, with its posterior end just in level with the posterior margin of the compound eye ---------- ***P. quadraticeps***

− Lateral margins of the head converge anterior; antennal groove reaches almost one half of the length of the head, with its posterior margin far exceeding the posterior proximity of the compound eyes ---------- ***P. tjahela***

***Platyscapa arnottiana* Abdurahiman, 1980**

(Figure 6 - 9)

Materials Examined

INDIA, Wayanad, Kerala, 11°30.796′N, 76°01.089′E, 23.IV.2019 collected by Shilpa K. Satheesan, ex *Ficus arnottiana* (Miq.) Miq.

Diagnosis: ***Female***. Length 1.5mm excluding ovipositor valve. General brownish black; Head with pubescence; Head is long as wide across the compound eyes; compound eye over 0.3 times the length of gena. Antenna 11 segmented; scape wider than 0.5 times its length; pedicel longer than wide and with 12 to 16 spines; appendage of 3rd segment short, reaching beyond the apex of the 4th segment; Mandible with a bifid apical tooth and a distinct subapical tooth; appendages with 9 lamellae laterally produced into teeth. Pollen pockets, coxal corbiculae and comb present. The post marginal vein of the forewing, less than 0.2 of the stigmal vein. Foretibia has two dorso-apical teeth. Hind tibia with a stout axial tooth and a bicuspidate tooth. Spiracular peritremata of 8th urotergite small and circular. The valve of the ovipositor 1.5 times as long as the gaster and more than 0.5 times the body length.

Male: Length 0.9mm; Colour brownish yellow; Head slightly wider than long; length of the eye, as long as gena and 0.2 times of the head. Antenna with rather large sub-quadrangular anelli. Meso and metanotum are completely fused; the metanotum and propodeum completely separate. Fore leg tibia with three dorso-apical and one ventral teeth. Hind tibia with a tricuspid tooth and bifurcate tooth. Genitalia simple.

Host: Syconia galls of *Ficus arnottiana* (Miq.) Miq.

Platyscapa quadraticeps (Mayr, 1885)

(Figure 35 - 38)

Synonyms: *Blastophaga arnottiana* Joseph, 1953; *Blastophaga quadraticeps* Mayr, 1885

Materials Examined

INDIA, Wayanad, Kerala, 11.71986N 76.32443E; 11.6622N 76.3304E; 11.6406N 76.303E; 11.8552N 76.1134E; 11.9556N 76.0668E; 11.7685N 76.2885E, 14.I.2019, collected by Shilpa K. Satheesan, ex *Ficus religiosa* L.

Diagnosis: ***Female***. Length 1.3mm excluding ovipositor valve. General brownish black; Head with pubescence; Head width 1.2x distance between front ocellus and clypeal margin, with POL 1.6x OOL. Eyes as 1.2x long as wide. Malar groove absent, gena 1.12x eye length. Antennal formula 11063; Mesosoma smooth with little pubescence. Pronotum as long as mesoscutum. Mesoscutum 0.83x as long as scutellum. Notauli incomplete. Scutellum 1.78x wider than long. Propodeum smooth, rectangular. Wings: Fore wing hyaline, 1.68× as long as wide, 2.3x SMV, SMV 4.5x MV, 4.4x STV; PMV absent; MV a little less than STV; Metasoma smooth and shiny. Gaster 0.87x shorter than thorax. Hypopygium ending after gaster body.

Male: Head subquadrate; length of the eye is 0.2 times the length of head; antennal groove exceeds 0.7 times length of head. Antenna has two unequal anelli. Mandible bidentate, with large subapical truncate tooth; Meso and metanotum fully separate; mesonotum and propodeum separate. Foreleg tibia with a dorsal comb of 3 teeth and many odontoid spines, a ventrally tricuspid tooth and a median tooth; Hind tibia has two ventrally bidentate teeth and a few odontoid spines on its dorsal side. Propodeal spiracles large, triangular. Genitalia simple.

Host: Syconia galls of *Ficus religiosa* L.

Platyscapa sahiana Priyadarsanan and Abdurahiman, 1997

(Figure 47 - 50)

Materials Examined

INDIA, Wayanad, Kerala, 11.887N 76.0687E; 11.9388N 76.0747E; 11.9673N 76.0642E; 11.9202N 76.0915E; 11.68282N 76.26623E; 11.7216N 76.3545E; 11.6404N 76.354E; 11.5945N 76.3561E; 11.7705N 76.2996E; 11.7439N 76.2271E, collected by Shilpa K. Satheesan, ex *Ficus virens* Aiton.

Diagnosis: ***Female***. Length 1mm excluding ovipositor valve. General brownish black; Head with pubescence; Head width 1.2x distance between front ocellus and clypeal margin. Eyes as 1.4x long as wide. Malar groove complete, 0.7x eye length. Antennal formula 11063; Mesosoma smooth with little pubescence. Pronotum 0.5× as long as mesoscutum. Mesoscutum 1.2x as long as scutellum. Notauli incomplete. Scutellum 1.64x wider than long. Propodeum smooth medially reduced and lateral halves triangular. Wings: Fore wing hyaline, 2.2× as long as wide, 3.4x SMV, SMV 2x MV, 3.6x STV, 6.8x PMV; MV 1.8x STV, 3.4x PMV; STV 1.8x PMV; Metasoma smooth and shiny. Gaster a little shorter than thorax. Hypopygium ending after gaster body.

Male: Head as long as wide. Antenna 5 segmented; pedicel joined to the club by two anelli, separated only ventrally. Mandible tridentate, with a small ventral sub apical tooth and a mid-dorsal truncate tooth. Pronotum wider than its own length; mesonotum width 2 times its own length; metanotum and propodeum fused. Fore leg tibia with a larger ventro apical tooth and a smaller subapical ventral tooth; dorsal crest consists of 3 teeth, one larger apical, one subapical and smaller tooth; tarsus bimerous. Hind leg, dorsal plate of femur projected posteriorly to form a basal disc; tibia, armature with a ventral crest consists of two bicuspid teeth. Apodemes long but not distinct; aedeagus subapically expanded.

Host: Syconia galls of *Ficus virens* Aiton.

***Platyscapa tjahela* (Abdurahiman and Joseph, 1975)**

(Figure 43 - 46)

Synonyms: *Blastophaga tjahela* Abdurahiman and Joseph, 1975

Materials Examined

INDIA, Wayanad, Kerala, 11.9638N 76.0912E; 11.9166N 76.0981E; 11.8553N 76.1149E; 11.8286N 76.0748E; 11.6439N 76.433E; 11.6064N 76.364IE; 11.7016N 76.2425E, collected by Shilpa K. Satheesan, ex *Ficus tsjakela* Burm.f.

Diagnosis: ***Female***. Length 0.63mm excluding ovipositor valve. General brownish black; Head with pubescence; Head width 1.2x distance between front ocellus and clypeal margin, with POL 1.45x OOL. Eyes as 0.89x long as wide. Malar groove complete, 0.95x eye length. Antennal formula 11063; Mesosoma smooth with little pubescence. Pronotum 0.58× as long as mesoscutum. Mesoscutum 0.74x as long as scutellum. Notauli incomplete. Propodeum smooth medially reduced and lateral halves triangular. Wings:

Fore wing hyaline, 2.24× as long as wide, 2.8x SMV, SMV 2.4x MV, 4.2x STV; PMV absent; MV 1.7x STV; Metasoma smooth and shiny. Gaster a little longer than thorax. Hypopygium ending after gaster body.

Male: Head is shorter than wide. Antennal groove reaches half the length of the head; length of the eye in 0.2 times the head. The Antenna with 2 large unequal anelli. Mesonotum and metanotum completely separate; the metanotum and propodeum only laterally separate; propodeal spiracles large. Fore tibia has one dorsal and two ventral teeth. Hind tibia has two bidentate teeth.

Host: Syconia galls of *Ficus tsjakela* Burm.f.

***CERATOSOLEN* Mayr**

Blastophaga (*Ceratosolen*) Mayr, 1885; Type species: *Blastophaga appendiculata* Mayr
Ceratosolen Mayr, 1885; Type species: *Blastophaga appendiculata* Mayr
Ceratosolen (*Ceratosolen*) Mayr, 1885; Type species: *Blastophaga appendiculata* Mayr
Ceratosolen (*Rothropus*) Wiebes, 1994; Type species: *Blastophaga crassitarsa* Mayr
Ceratosolen (*Strepitus*) Wiebes, 1994; Type species: *Ceratosolen armipes* Wiebes
Ceratosolensia Girault, 1915; Type species: *Ceratosolensia ficophaga* Girault
Sycocrypta Coquerel, 1855; Type species: *Sycocrypta coeca* Coquerel

Female: The head as long as wide across the compound eyes or slightly longer. Antenna 10 or 11 segmented; flagellum with sensilla linearia. Mandible bidentate at the apex.; appendage with 6-8 lamellae. Maxillae with bacilliform process. The thorax has large pollen pockets, but fore coxa has no corbiculae. Post marginal vein of fore wing distinctly longer than the stigmal. Fore leg tibia with a dorso-apical comb of 4 teeth. Spiracular peritremata of the 8th urotergite very large and gauge like. Ovipositor sheath as long as the gaster.

Male: The head distinctly longer than its width. Eyes small or lacking. Antenna situated in grooves on either side of a trilobed process of the epistomal margin. Antenna 4 segmented,3rd segment not annular. Thorax is elongated and with a long pronotum and a transverse mesonotum; metanotum incompletely separated from the propodeum; propodeum bears large sublateral spiracular peritremata. Genitalia with claspers

KEY TO SPECIES OF *CERATOSOLEN*, MODIFIED FROM PRIYADARSANAN, 2000

1 Female ---------- 2

− Male ---------- 3

2. Head distinctly longer than wide across the compound eyes; funicular segments of the antenna with more than one (usually 3) rows of sensillae; appendage of the mandible has nine lamellae; post marginal vein of the fore wing twice as long as the stigma ---- ---------- ***C. solmsi***

− Head as long as wide across the compound eyes; funicular segments of the antenna with one row of sensillae; appendage of the mandible has only five lamellae; postmarginal vein of the fore wing as long as the stigma ---------- ***C. fusciceps***

3. 3rd antennal segment is longer than the pedicel; genitalia bear claspers with 4-5 claws ---------- ***C. fusciceps***

− 3rd antennal segment is 1/3 the pedicel; genitalia without the claspers ---------- ---------- ***C. solmsi***

***Ceratosolen fusciceps* (Mayr, 1885)**

(Figure 31 - 34)

Synonyms: *Blastophaga* (*Ceratosolen*) *fusciceps* Mayr, 1885; *Ceratosolen* (*Ceratosolen*) *fusciceps* (Mayr, 1885)

Materials Examined

INDIA, Wayanad, Kerala, 11.7458N 76.2416E; 11.6689N 76.2783E; 11.5961N 76.3508E; 11.8692N 76.073E; 11.9552N 76.0851E; 11°32.962′N, 76°02.329′E; 11°33.398′N, 75°58.711′E, collected by Shilpa K. Satheesan, ex *Ficus racemosa* L.

Diagnosis: *Female*. Length 1.12mm excluding ovipositor valve. General brownish black; Head with pubescence; Head width 1.13x distance between front ocellus and clypeal margin, with POL 1.13x OOL. Eyes as 1.37x long as wide. Malar groove complete, 0.72x eye length. Antennal formula 11063; Mesosoma smooth with little pubescence. Pronotum 0.58× as long as mesoscutum. Mesoscutum 1.4x as long as scutellum. Notauli incomplete. Propodeum smooth, rectangular. Wings: Fore wing hyaline, 1.53× as long as wide, 2.9x

SMV, SMV 2.8x MV, 2.9x STV, 2.4x PMV; MV 1.03x STV, 0.85x PMV; STV 0.81x PMV; Metasoma smooth and shiny. Gaster a little longer than thorax. Hypopygium ending after gaster body.

Male: Yellowish brown in colour; Head 1.5 times as long as wide; strongly convex posteriorly. Eyes 2 times gena; Antennal groove partially closed; Antenna four segmented, third and fourth segments subequal and almost 1.5 times pedicel. Pronotum 2 times as long as mesonotum; metanotum and propodeum not completely separated. Fore coxa without a comb or a corbicula. Fore tibia has four teeth dorsally and three teeth ventrally; Hind tibia with many spines, with a bidentate anti axial tooth and a simple axial tooth.

Host: Syconia galls of *Ficus racemosa* L.

***Ceratosolen solmsi* (Mayr, 1885)**

(Figure 23 -26)

Synonyms: *Blastophaga solmsi* Mayr, 1885; *Ceratosolen berlandi* Grandi, 1928; *Ceratosolen marchali* Mayr, 1906; *Ceratosolen solmsi marchali* Mayr, 1906; *Ceratosolen* (*Ceratosolen*) *marchali* Mayr, 1906; *Ceratosolen* (*Ceratosolen*) *solmsi* Mayr, 1885; *Ceratosolen* (*Ceratosolen*) *solmsi marchali* Mayr, 1906; *Ceratosolen* (*Ceratosolen*) *solmsi solmsi* (Mayr, 1885)

Materials Examined

INDIA, Wayanad, Kerala, 11.68181N 76.27307E; 11.7411N 76.2407E; 11.8637N 76.0726E; 11.6049N 76.344E; 11°33.481′N, 76°59.34′E; 11.6391N 76.3044E, collected by Shilpa K. Satheesan, ex *Ficus hispida* L. f.

Diagnosis: ***Female***. Length 1.5mm excluding ovipositor valve. General brownish black; Head with pubescence; Head width 1.2x distance between front ocellus and clypeal margin, with POL 1.33x OOL. Eyes as 1.36x long as wide. Malar groove complete, 0.63x eye length. Antennal formula 11063; Mesosoma smooth with little pubescence. Pronotum 0.56× as long as mesoscutum. Mesoscutum 0.88x as long as scutellum. Notauli incomplete. Scutellum 1.26x wider than long. Propodeum smooth, rectangular. Wings: Fore wing hyaline, 2.3× as long as wide, 2.8x SMV, SMV 2.66x MV, 3.3x STV, 2x PMV; MV 1.25x STV, 0.74x PMV; STV 0.59x PMV; Metasoma smooth and shiny. Gaster 1.01x longer than thorax. Hypopygium ending after gaster body.

Male: Head 1.5 times as long as wide; eyes absent; antennal groove open and broad behind. Antenna five segmented with one anellus. Mandible strongly bidentate; inner tooth tricuspid. Pronotum 2 times as long as mesonotum; mesonotum laterally convex and projects outwards; Propodeum transverse with peritremata as long as the lateral length of propodeum. Fore tibia with three dorso-apical teeth and two ventral teeth; Hind tibia with two small ventral teeth; Claspers with three claws.

Host: Syconia galls of *Ficus hispida* L. f.

***KRADIBIA* Saunders**

Blastophaga (*Kradibia*) Saunders, 1883; Type species: *Kradibia cowani* Saunders
Kradibia Saunders, 1883; Type species: *Kradibia cowani* Saunders
Kradibiella Girault, 1915; Type species: *Kradibiella nigricorpus* Girault,
Liporrhopalum Waterston, 1920; Type species: *Liporrhopalum rutherfordi* Waterston
Paraceratosolen Girault, 1915; Type species: *Paraceratosolen latipennis* Girault

Female: Colour dark brown. Head a little shorter than wide across the compound eyes. Compound eyes longer than the cheek. Antenna with 11 segments with 2 or 3 rows of sensilla linearia. The mandible has two teeth, two glands and the appendage bear four to· six ventral lamellae. The maxillae are simple. Large pollen pockets present. Fore wing veins are distinct, disc is full of microtrichiae. The fore tibia has a dorso-apical comb of four or five subequal or six alternately long and short teeth. The hind tibia bears a bicuspidate anti-axial tooth and a simple axial tooth. All tarsi are pentamerous. The hypopygium has an acute spine, with a row of (six or seven) hyaline setae approximately at its half-length. Spiracles of the eighth urotergite small and circular. The ovipositor less than half as long as the gaster.

Male: Colour yellowish. Head as long 'as wide, in a few species a bit shorter, but in others a bit longer. The eye is one to two times as long as the cheek. There is a median groove, reaching to almost half the length of the head. The Antenna are born in a common groove and consist of a scape, a pedicel and anellus and two funicular segments. Thorax with terga free, dorso-lateral plates representing the metanotum may be fully or almost fused in at the middle or two plates are distinct and widely spaced, or not fully separated from the propodeum; the spiracular peritremata, mostly lateral in position, in most species occupy the full length of the propodeum. The fore tibia bears a dorso-apical comb of

seven or more teeth, but some species have only four or five; the tarsus bimerous. The midleg is atrophied but complete, altogether with an oligomerous tarsus with oligomerous tarsus. The hind tibia has an armature consisting of ventral and anti-axial and some dorsal teeth; the tarsus is pentamerous in most species, but tetramerous in some. The genitalia bear with two to five claws.

Kradibia gestroi (Grandi, 1916)

(Figure 19 - 22)

Synonyms: *Blastophaga gestroi* Grandi, 1916; *Kradibia gestroi afrum* (Wiebes, 1969); *Liporrhopalum gestroi afrum* Wiebes, 1969

Materials Examined

INDIA, Wayanad, Kerala, 11.68282N 76.26623E; 11.8473N 76.0738E; 11.7483N 76.2344E; 11.6049N 76.344E; 11.6402N 76.3457E; 11.7237N 76.28E, collected by Shilpa K. Satheesan, ex *Ficus exasperata* Vahl.

Diagnosis: ***Female***. Length 1.3mm excluding ovipositor valve. General brownish black; Head with pubescence; Head width 1.5x distance between front ocellus and clypeal margin, with POL 2.5x OOL. Eyes as 1.3x long as wide. Malar sulcus absent, 0.6x eye length. Antennal formula 11063; Mesosoma smooth with little pubescence. Pronotum 0.5× as long as mesoscutum. Mesoscutum 1.2x as long as scutellum. Notauli incomplete. Scutellum 1.3x wider than long. Propodeum smooth, rectangular. Wings: Fore wing hyaline, 2× as long as wide, 2.6x SMV, SMV 4.1x MV, 3x STV, 2.25x PMV; MV 0.7x STV, 0.54x PMV; STV 0.73x PMV; Metasoma smooth and shiny. Gaster 1.03x longer than thorax. Hypopygium ending after gaster body.

Male: Head as long as wide; eyes 2 times as long as gena. Antennal groove reaches almost middle of the head. Antenna five segmented; third segment anulliform; funicular segment sub equal in length. Mandible bidentate. Thoracic segments distinct; spiracles subcircular; Fore coxa with five unequal teeth dorsally and two ventrally; tarsus bimerous. Mid leg slender and tarsus tetramerous; Hind leg tibia with three dorsal apical teeth, three dorsal and ventral spines. Genitalia with claspers having 4 claws.

Host: Syconia galls of *Ficus exasperata* Vahl.

FAMILY BRACONIDAE

SYNTOMERNUS Enderlein, 1920

Syntomernus Enderlein 1920; Type species: *Syntomernus pusillus* Enderlein, 1920.

Ficobracon Van Achterberg & Weiblen, 2000; Type species: *Ficobrcon brusi* van Achterberg and Weiblen.

Diagnosis: Antenna with 20–27 segments, the last antennal segment with apical spine; clypeus convex, not separated from face, with ventral margin thin and upcurved; propleuron smooth and flat; mesoscutum smooth, partly glabrous, only near notauli and medio-posteriorly setose; scutellum wide, semi-circular and flat; median carina of propodeum anteriorly absent; Fore wing: angle between veins 1-SR and C+SC+R about 55˚, vein 3-M strongly sclerotized; tarsal claws ventrally convex and with rounded lobe; second and third tergites united to a wide syntergite, medially second tergite approximately twice as long as third tergite; ovipositor with teeth ventro-apically hypopygium protruding apically beyond metasoma, narrowly truncate medio-apically.

Syntomernus codonatus (Huang & van Achterberg, 2013)

(Figure 57 - 60)

Materials Examined

INDIA, Wayanad, Kerala, 11.7221N 76.3795E; 11.7695N 76.3001E; 11.6648N 76.3426E; 11.9203N 76.0916E, collected by Shilpa K. Satheesan, ex *Ficus tinctoria* G. Forst.

Diagnosis: ***Female***. Length 3mm excluding ovipositor valve, fore wing length 3.2 mm. Antenna with 23 segments; Height of head less than width across eyes; face with a brown spot malar space approximately one third length of eye; clypeal ventral margin thin and slightly upcurved, width 0.4 times width of face; POL:OOL is 2:7; mesopleuron large and smooth, with some setae; metapleuron covered by long setae, with a black posterior rugose margin; notauli shallow and posteriorly obsolescent; mesoscutum largely glabrous and smooth but with many long setae along notauli; scutellar sulcus distinctly crenulate, deep, wide and straight; scutellum smooth; smooth, as long as scutellum, with medio-longitudinal carina on its posterior half, and with a dark-black posterior margin. Fore wing: r:3-SR:SR1 = 5:10:42; 2-SR:3-SR:r-m = 2:2.3:1.3; angle between veins 2-SR and

2-M about 57; CU1a straight and long. Hind wing: M+CU:1-M = 1:4; 2-M as long as 1-M. Length of first tergite 1.1 times its apical width, medial area largely smooth, bell-shaped and divided by medial groove, posteriorly coarsely rugose; sublateral grooves rugose-punctate, converging to medial groove at anterior margin; second tergite approximately as long as third tergite, second tergite largely smooth, submedial grooves finely rugose, sublateral grooves absent; third tergite largely rugose-reticulate; second and base of third tergite with sharp lateral crease; other following tergites smooth and transverse. Ovipositor sheath1.6 times as long as metasoma. Hypopygium long and narrow, apically acute.

Male: Antenna 20–23 segments; first tergite apically narrowly coarsely rugose, without medial groove; third to sixth tergites black, largely with fine punctures and rugose margin dorsally; Body yellow, antenna, hind tibiae, tarsal claws, ovipositor sheath, pterostigma, ventral part of mesopleuron, and largely third tergite brown, groove of pronotum, propleuron, scutellar sulcus, side of scutellum, propodeum largely and first tergite and second tergite medially dark brown or black; wings subhyaline. Others same as female.

Host: Syconia galls of *Ficus tinctoria tinctoria* G. Forst.

FAMILY ORMYRIDAE

Ormyridae Foerster, 1856. Type genus: *Ormyrus* Westwood, 1832.

Diagnosis. Antenna with 12 flagellomeres, including a small 4th clavomere. Eyes not ventrally divergent. Clypeus bilobed, without transverse subapical groove. Labrum hidden behind clypeus, flexible, subrectangular with marginal setae in a row. Mandibles with 2 or 3 teeth. Subforaminal bridge with postgenal lobe separating the secondary posterior tentorial pit from the hypostoma and restricting it to the vicinity of the occipital foramen; postgenal bridge present or separated (and therefore lower tentorial bridge reaching or not reaching hypostoma); postgenal lamina usually absent; hypostomal carina usually (but not always) convergent; occipital carina present (Fig. 121). Axilla advanced (Fig. 123). Mesoscutellum with frenum indicated at least laterally, without axillular sulcus. Mesopleural area without an expanded acropleuron; mesepimeron extending over anterior margin of metapleuron (Fig. 122). All legs with 5 tarsomeres; protibial spur stout and curved; basitarsal comb longitudinal. Fore wing stigmal vein not at a right angle with

anterior fore wing margin. Metasoma with syntergum and therefore without an epipygium, convex or (more frequently) strongly sclerotized and carapace-like (Fig. 124).

ORMYRUS Westwood, 1832

Synonyms: *Avrasyamyrus* Doganlar, 1991; *Cyrtosoma* Perris, 1840; *Cyrtosoma* (Monobaeus) Foerster, 1860; *Cyrtosoma* (Tribaeus) Foerster, 1860; *Monobaeus* Foerster, 1860; *Ormyrus* Westwood, 1832; *Periglyphus* Boheman, 1834; *Siphonura* Nees, 1834; *Torymus* (Chrysoideus) De Stefani, 1898; *Tribaeus* Foerster, 1860; *Wania* Risbec, 1951

Indo-Australian species of *Ormyrus* can be separated from Eubeckerella and Ormyrulus in having Normal eyes and MV; non transverse; presence of occipital carina; not having a sharp arcuate dorsal ridge; POL usually less than 5x OOL.

Ormyrus bouceki Narendran, 1999

(Figure 51 - 56)

Synonyms: *Ormyrus bouceki* Narendran, 1999

Materials Examined

INDIA, Wayanad, Kerala, 11.887N 76.0687E; 11.9388N 76.0747E; 11.9673N 76.0642E; 11.9202N 76.0915E; 11.68282N 76.26623E; 11.7216N 76.3545E; 11.6404N 76.354E; 11.5945N 76.3561E; 11.7705N 76.2996E; 11.7439N 76.2271E, collected by Shilpa K. Satheesan, ex *Ficus virens* Aiton.

Diagnosis: ***Female***. Length 1.6mm excluding ovipositor valve. Head and mesosoma metallic green with bluish tinge on sides; gaster alternates with liver brown colour; eyes brownish red. Head width in dorsal view 1.9× its median length; POL 2.5× OOL; vertex with weak cross striae. Gena faintly and obliquely striate; face rugolo punctate; Antennal formula 1126; scape not reaching front ocellus. Pronotum and mesonotum cross striate; notauli distinct; scutellum with curved cross striae. Pronotum asetose medially with 9 pair of setae on either side; mesoscutum with five pair of setae; scutellum with four pair of setae. Propodeum mostly smooth without any median or sub median carinae, on sides. Wings hyaline, veins pale yellow brown; pubescence white. Gaster subequal to combined length of head and mesosoma in side view, slightly compressed from sides.

Male: Length 1.2–1.4 mm. Similar to female except following: hind coxa brownish yellow with recticulations faint; gaster length subequal to that of mesosoma; foveolae not fully visible on T3 and T4; T5 aciculate and faintly reticulate.

Host: Syconia galls of *Ficus virens* Aiton.

FAMILY EPICHRYSOMALLIDAE

Epichrysomallinae Hill & Riek, 1967. Type genus: *Epichrysomalla* Girault, 1915.

Diagnosis. Antenna with 10–12 flagellomeres, including a small 4th clavomere. Eyes not ventrally divergent. Labrum hidden behind clypeus, flexible. Mandibles with 3 teeth. Sub-foraminal bridge with post-genal bridge separating secondary posterior tentorial pits from hypostoma. Notauli complete. Mesoscutellum with frenum indicated laterally, without axillular sulcus. Meso-pleural area without an expanded acropleuron; mesepimeron extending over anterior margin of metapleuron. All legs with 5 tarsomeres in most, except tarsi 4-segmented in *Odontofroggatia* Ishii and *Josephiella* Narendran; protibial spur stout and curved; basitarsal comb longitudinal. Metasoma with syntergum, therefore without epipygium.

KEY TO GENUS OF EPICHRYSOMALIDAE, MODIFIED FROM NARENDRAN & SHEELA, 1993

1 Anterior margin of scutellum narrower than hind margin of mid lobe of mesoscutum; axillae may or may not be separated medially ---------- 2

− Anterior margin of scutellum not narrower than hind margin of mid lobe of mesoscutum; axillae well separated medially ---------- 5

2 Antenna without an anellus ---------- 3

− Antenna always with an annellus ---------- 4

3 Antennal formula 1106(3); tarsi 4 segmented; axillae almost touching medially --------
---------- ***ODONTOFROGGATIA***

− Antenna formula 1105(3); tarsi 5 segmented; axillae separated medially ----------
---------- ***RAHIMANIELLA* gen. nov.**

4 Antennal formula 1117(3); width of mesoscutum in female a little more than 1.5x its median length; gaster not compressed from sides ---------- ***NEOSYCOPHILA***

− Antennal formula 1116(3); width of mesoscutum in female distinctly than 1.5x its median length; gaster sub-compressed from sides ---------- ***SYCOBIA***

5 Antennal formula 1105(3); maxillary and labial palpi one or two segmented each ------ ---------- 6

− Antennal formula 1106(3); maxillary and labial palpi two segmented each; marginal vein not touching anterior wing boarder ---------- ***SYCOBIOMORPHELLA***

6 Notauli placed widely apart until it touches the hind margin of mid lobe of mesonotum; maxillary and labial palpi two segmented; Supra clypeal area distinctly, completely delimited ---------- ***ORNATAPEDICELUM* gen nov.**

− Notauli strongly convergent backward, fusing to form a short median line just before the transcutal line; maxillary and labial palpi single segmented; Supra clypeal area not delimited, partially boarded anteriorly ---------- ***CAMAROTHORAX***

ORNATAPEDICELUM gen. nov.

Description: Females mostly brown colour; Body mostly smooth; Antennae located just above the anterior margin of eye. Antennal formula 11053; Antennal funicular segments with two rows of sensilla; Axilla not almost touching medially; scutellum narrowly bordering. Notauli complete; axilla broader, arise inside of the notauli meeting. pilosity of wings highly reduced; Stigmal vein without sensilla. Abdomen longer than thorax; Smooth and shiny, not compressed from sides; First three tergum margins incised medially; T4 like two lateral flaps joined together medially; Last three tergite with a single row of small setae; Hypopygium ends before the last tergite.

Males mostly yellow Wings short, reduced, hyaline; Head, thorax and abdomen smooth. Smooth, sparsely pubescent; Antennae placed at the anterior border of clypeus. Antenna formula 11063; Funicular segments subequal in length without sensilla; Petiole distinctly longer than wide. first tarsal segment is largest, almost equal to total length of the preceding segments; Hind tibia with numerous (more than 10) strong short stout spines

dorsally and two spurs at the posterior margin; Abdomen is smooth and shiny; its shorter than thorax; last four tergite has setae arranged in a row.

Comments: *Ornatapedicelum* gen. nov. is similar to *Camarothorax* Mayr in having anterior antenna without an anellus, five funicular segments and tarsi with five segments. The new genus differs from *Camarothorax* Mayr in having antennal with a proximal carinae like circular structural line (not present in *Camarothorax*); notauli placed widely apart and anterior margin of scutellum almost touches the hind margin of mid lobe of mesonotum (Notauli strongly convergent backward, fusing to form a short median line just before the transcutal line in *Camarothorax*); maxillary and labial palpi two segmented (maxillary and labial palpi single segmented in *Camarothorax*); supra clypeal area distinctly, completely delimited (Supra clypeal area not delimited, partially boarded anteriorly in *Camarothorax*); males are similar to females (dimorphic brachypterous males in *Camarothorax*).

***Ornatapedicelum arnottiana* sp. nov.**

(Figure 94 - 100)

Materials Examined

INDIA, Wayanad, Kerala, 11°30.796′N, 76°01.089′E, 23.IV.2019 collected by Shilpa K. Satheesan, ex *Ficus arnottiana* (Miq.) Miq.

Description of female

Size and colour. Blackish brown colour, 1.709mm in length; Head, Mesosoma, all coxa, metasoma blackish brown; Femora, tibia, tarsi all yellow; Antennal scape pale yellow, pedicel and flagellum yellow; Clypeal area pale yellow; Eyes and ocelli grey.

Head (Fig. 1B, 1C, 1D, 1F). Smooth, sparely pubescent; Head 1.6x wider than long; Eye 1.2x longer than wide; Antenna located a little above the posterior margin of eye. Antennal formula 11153. Antenna stout with small subequal segments with a single row of sensilla; Length of torulus to inner eye margin 2.44x diameter of torulus; torular diameter 2.8x inter-torular distance; Scape 4x longer than wide; Scape 2.2x longer than pedicel; Clava as long as wide; POL 1.88x OOL. Clypeus bilobed; Superaclypeal area 0.14x wider than long. Malar space 0.3x eye length.

Mesosoma (Fig. 1C, 1E). Smooth and shiny; Mesonotum 4x the length of pronotum and length of scutellum 1.8x mesonotum and 7.5x pronotum. Notauli complete and anterior

margin of scutellum almost touches the hind margin of mid lobe of mesonotum. Scutellum with three pair of setae; Propodeum 4.7x wider than long. Spiracles circular, propodeum smooth and shiny without any carinae; a tuft of setae at the lateral corner of propodeum. Pilosity of wing highly reduced, setae present at the fringe of the wing; no sensilla on STV; Forewing 2.77x SMV; MV 1.6x STV. Foreleg femur 1.9x longer than wide; tibia 4.6x longer than wide; femur and tibia almost same length. Midleg coxa 1.3x longer than wide; femur 3.8x longer than wide; femur 2x longer than coxa; tibia 6x longer than wide; Tibia 1.2x longer than femur, 1.8x tarsi. Hindleg coxa 2.3x longer than wide; femur 3.3x longer than wide; femur 1.3x coxa length, 1.08x tibia length; tibia 8.4x longer than wide; tibia 1.2x tarsi; Tarsal segments in ratio 0.138; 0.047; 0.046; 0.033; 0.052.

Metasoma (Fig. 1G). Abdomen slightly longer than thorax; T1, T2 and T3 margin with small incision medially; Last four segments with a row of setae.

Description of male

Size and colour. Length 1.386mm; Whole insect yellow colour; Abdomen with brown band; eye grey colour; Body Smooth and shiny; Ocelli greyish pink.

Head (Fig. 2A, 2D). Smooth and shiny; Antenna located above the lower margin of the eye. Eye 1.15x longer than wide; Head 2.23x wider than long; POL 1.9x OOL; Antennal formula 11153; Torulus to inner eye margin distance 8.6x inter torular distance; Diameter of torulus 2.2x inter torular distance; Scape 3.8x longer than wide; Pedicel 1.3x longer than wide; Scape 1.8x longer than pedicel; funicles stout and subequal.

Mesosoma (Fig. 2B). Sooth, shiny; Propodeal spiracle circular with a broad boarder; Length of mesonotum 2.5x length of pronotum and slightly (1.04x) longer than scutellum. Wings hyaline almost 1/3rd of the wing bare; forewing length 2.7x SMV; MV length1.8x STV. Fore leg femur 2x as long as wide; tibia 5x as long as wide; tibia 1.15x femur; Mid leg femur 4.2x its width; tibia 6.3x its width; femur and tibia subequal in length and 1.4x tarsi length. Hind leg femur 2.5x wide; tibia 9x its width; tibia length 1.8x femur. Tarsal segments in the ratio 0.153; 0.060; 0.050; 0.056; 0.032.

Metasoma (Fig. 2C). Yellow colour banded with brown yellow; Abdomen a little shorter than thorax.

Host: Syconia galls of *Ficus arnottiana* (Miq.) Miq.

Etymology: ‘arnottiana’ derived from the name of host plant *Ficus arnottiana*

CAMAROTHORAX Mayr

Camarothorax Mayr, 1906; Type species: *Camarothorax obscurus* Mayr

Pilkhanivora Farooqi and Menon, 1973; Type species: *Pilkhanivora trimorpha* Farooqi & Menon

Sycobiomorpha Joseph, 1961; Type species: *Sycobiomorpha bimasculinus* Joseph

Diagnosis: Tarsi 5-segmented. Notauli reaching the transcutal line. Notauli strongly convergent backward, fusing to form a short median line just before the transcutal line. Female funicular 5-segmented, article transverse, annellus unconspicuous. Male flagellum club-like, segment fused so the flagellum appears bisegmented.

Camarothorax bimasculinus (Joseph, 1961)

(Figure 76 - 81)

Synonym: *Sycobiomorpha bimasculinus* Joseph, 1961

Materials Examined

INDIA, Wayanad, Kerala, 11.887N 76.0687E; 11.9388N 76.0747E; 11.9673N 76.0642E; 11.9202N 76.0915E; 11.68282N 76.26623E; 11.7216N 76.3545E; 11.6404N 76.354E; 11.5945N 76.3561E; 11.7705N 76.2996E; 11.7439N 76.2271E, collected by Shilpa K. Satheesan, ex *Ficus virens* Aiton.

Diagnosis: ***Female***. Length 1.6mm. General brownish black; Head with pubescence; Head width 1.5x distance between front ocellus and clypeal margin, with POL 0.86x OOL. Eyes as 1.15x long as wide. Malar groove complete, 0.45x eye length. Antennal formula 11053; Mesosoma smooth with little pubescence. Pronotum 0.63× as long as mesoscutum. Mesoscutum 0.87x as long as scutellum. Notauli complete. Scutellum wider than long. Anterior margin of scutellum narrower than hind margin of mid lobe of mesoscutum. Propodeum smooth, rectangular. Wings: Fore wing hyaline, 2.3× as long as wide, 2.4x SMV, SMV 5.6x MV; MV and STV almost same length; PMV absent; Metasoma smooth and shiny. Gaster 1.3x longer than thorax.

Male: Wingless; Length 0.9mm. No ocelli; Head, mesosoma, metasoma, wing remnants and all legs yellow; Head 1.32x length to width, subrectangular; frons with fine engraved striation; eye long, 1.66× as long as wide; Antennal formula 1101; Mesosoma large. Pronotum subquadrangular, about 4.5× as long as mesonotum, mesonotum 0.5x scutellum; propodeum 1.7× as long as scutellum. Fore wing vestigial, nearly invisible,

punctiform. Metasoma yellow in colour weakly sclerotized slightly longer than wide and depressed.

Winged; Length 1mm. No ocelli; Head, mesosoma, metasoma, wing remnants and all legs yellow; Head 1.2x length to width, subrectangular; frons with fine engraved striation; eye long, 1.3× as long as wide; POL 0.97x OOL; Gena 0.5x eye length; Antennal formula 11023; Mesosoma large. Pronotum subquadrangular, about 1.1× as long as mesonotum, mesonotum 0.7x scutellum; propodeum 0.4x scutellum. Fore wing present, same as female. Metasoma yellow 0.7x small as thorax.

Host: Syconia galls of *Ficus virens* Aiton.

NEOSYCOPHILA Grandi

Neosycophila Grandi, 1923; Type species: *Neosycophila omeomorpha* Grandi

Diagnosis: Anterior margin of scutellum narrower than hind margin of mid lobe of mesoscutum; axillae almost touching medially. Antennal formula 1117(3); width of mesoscutum in female a little more than 1.5x its median length; gaster not compressed from sides.

Neosycophila tinctoria sp. nov.

(Figure 113 -117)

Materials Examined

Holotype ♀: INDIA, Wayanad, Kerala, 11.7221N 76.3795E; 11.7695N 76.3001E; 11.6648N 76.3426E; 11.9203N 76.0916E, collected by Shilpa K. Satheesan, ex *Ficus tinctoria* G. Forst.

Description of female

Size and colour. Length 1.358mm; General colour brownish yellow; Femur, tibia, tarsal yellow colour; Eye, ocelli pink; Antenna brown; Antennal scape yellow; Body smooth and shiny.

Head (Fig. 1B, 1C, 1D, 1F). Smooth, few large setae present; Antenna located little above the anterior margin of the eye; Eye 1.17x longer than wide; Head 2.2x wider than long; Inter torular distance shorter than diameter of torulus; torulus inner eye margin distance 2.6x inter torular distance; Antenna 11273, stout with subequal segments with one row of

sensillae; Scape 4.2x as long as wide; Pedicel 1.3x as long as wide; Scape 2.4x as long as pedicel; clava 1.6x as long as wide; Malar sulcus absent.

Mesosoma (Fig. 1C, 1E). Smooth, shiny; Notauli complete and pitted along the margin. A pair of setae at the base of mesoscutum, a pair on axilla; a pair at the middle and at the base of scutellum; axilla margin fully pitted along; A black line like colouration on the median half of mesonotum. Propodeum slightly rugulose; circular spiracles; small carinae present on the surface; plica present; few setae present lateral to plica. Scutellum length 1.22x Mesonotum and 7.3x Pronotum; Mesonotum 6x pronotum length; Anterior margin of scutellum wider than the hind margin of mid lobe of mesoscutum. Wing hyaline, anterior 1/3rd bare without setae; Fore wing 2.67x SMV; SMV with nine setae; MV with eight setae; SMV 4x MV; MV 1.27x STV. STV without sensilla. Fore coxa 1.5x as long as wide; femur 1.42x as long as wide; tibia 3.3x longer than wide; coxa 1.1x long as femur; tibia 1.4x as long as femur, 1.3x as long as cox; tibia with a long spine. Mid femur 3.3x as long as wide; tibia 2.5x as long as wide; femur 2.1x longer than tibia; tibia with a long spur; Hind coxa 2.5x as long as wide; femur 2.9x as long as wide; tibia 5x as long as wide; femur is slightly longer than coxa, tibia and tarsus; tibia with two spurs; first tarsal segment is longest, its almost as long as all other tarsal segments; Hind tarsal segments in the ratio 0.108; 0.027; 0.024; 0.021; 0.035.

Metasoma (Fig. 1G). Dorsum of abdomen dark brown colour; Abdomen distinctly 1.4x longer than thorax; last four tergum with a row of setae.

Description of male

Size and colour. Length 1.128; Dark yellow with dark brown colour at many portions of abdomen; Scape and pedicel yellow.

Head (Fig. 2A, 2D). Head 1.9x wider than long; Antennal formula 11253; Eyes 1.4x longer than wide; Antenna located little above the anterior margin of the eye; Scape 3x longer than wide; pedicel 1.2x as long as wide; Scape 2,6x pedicel; Clava 2.7x as long as wide; Torulus inner eye margin distance 4.2x inter torular distance and 1.9x torular diameter. Antennal funicles sub equal in length. Malar sulcus absent.

Mesosoma (Fig. 2B). Thorax same as female except in having SMV with 10 bristles and MV with eight setae; Propodeum with few setae lateral to the circular spiracle; Plica present only at the anterior half; Median carinae or median line present only anteriorly.

Tibia with numerous (more than 10) stout, strong, short spines and two large spines at posterior end.

Metasoma (Fig. 2C). Abdomen 0.8x as long as thorax; last four tergum with a row of setae.

Host: Syconia galls of *Ficus tinctoria* G. Forst.

Etymology: 'tinctoria' derived from the name of host plant *Ficus tinctoria*

Comments: *N. tinctoria* sp. nov. is similar to *N. omeomorpha* Grandi in having notauli and axilla margin fully pitted along. The new species differs from *N. omeomorpha* Grandi in not having sublateral furrow in mesoplueral region (with one anterior longitudinal and one posterior oblique sublateral furrow in *N. omeomorpha*); head twice wider than long (Head almost wider than long in *N. omeomorpha*); SMV 4× MV (SMV 6× MV in *N. omeomorpha*); antennal scape 4.2× its width (scape five times its maximum width in *N. omeomorpha*); antennae sensilla not projecting beyond the anterior margin (sensilla just projecting beyond the anterior margin in *N. omeomorpha*).

ODONTOFROGGATIA Ishii

Odontofroggatia Ishii, 1934; Type species: *Odontofroggatia gajimaru* Ishii

Diagnosis: Tarsi 4-segmented. Occipital carina absent. Female head transverse. Antennal formula 11063, scape long reaching the median ocellus. Supraclypeal area not delimited. Scutellum bearing 2x2 setae. Axillar grooves well marked. Male: mandible long and falcate (fig. b). Petiole apparent, sometimes with a ventral hook or lateral teeth.

Odontofroggatia corneri Wiebes, 1980

(Figure 66 - 70)

Synonym: *Odontofroggatia corneri* Wiebes, 1980

Materials Examined

INDIA, Wayanad, Kerala, 11.7269N 76.3545E; 11.7201N 76.379E; 11.7156N 76.3772E, 18.III.2019, collected by Shilpa K. Satheesan, ex *Ficus microcarpa* L. f.

Diagnosis: ***Female***. Length 1.2mm. General brownish black; Head with pubescence; Head width 1.47x distance between front ocellus and clypeal margin, with POL 1.45x

OOL. Eyes as 1.25x long as wide. Malar groove absent, 0.42x eye length. Antenna located at the anterior margin of eye; Antennal formula 11063; Mesosoma smooth with little pubescence. Pronotum 0.73× as long as mesoscutum. Mesoscutum 1.2x as long as scutellum. Notauli complete. Anterior margin of scutellum wider than hind margin of mid lobe of mesoscutum. Scutellum wider than long. Propodeum smooth, rectangular. Wings: Fore wing hyaline, 2.74× as long as wide, 2.33x SMV; SMV 4.6x MV; Mv 1.1 STV; PMV absent; Metasoma smooth and shiny. Gaster 1.2x longer than thorax. Hypopygium ending after gaster body.

Male: Length 1.2mm. Body strigulate; Head, mesosoma, metasoma, wing remnants and all legs yellow; Head almost same length to width, subrectangular; frons with fine engraved striation; Antenna located at the clypeal margin; POL 0.64x OOL; Mesosoma large. Pronotum subquadrangular, about 1.25× as wide as long; mesonotum 1.2x scutellum; propodeum normal. Petiole 1.7x longer than wide; Fore wing same as female. Metasoma 0.36x abdomen, colour weakly sclerotized slightly longer than wide and depressed.

Host: Syconia galls of *Ficus microcarpa* L. f.

***RAHIMANIELLA* gen. nov.**

(Figure 101 - 106)

Material Examined. Holotype f#: INDIA, Wayanad, Kerala, 11°37.479′N, 076°18.991′E, 17.II.2021, collected by Shilpa K. Satheesan, ex *Ficus drupacea* Thunb.

Description. Females mostly brown colour; Body mostly smooth; Antennae located just above the anterior margin of eye. Antennal formula 11053; Antennal funicular segments with two rows of sensilla; Axilla not almost touching medially; scutellum narrowly bordering. Notauli complete; axilla broader, arise inside of the notauli meeting. pilosity of wings highly reduced; Stigmal vein without sensilla. Abdomen longer than thorax; Smooth and shiny, not compressed from sides; First three tergum margins incised medially; T4 like two lateral flaps joined together medially; Last three tergite with a single row of small setae; Hypopygium ends before the last tergite.

Males mostly yellow wings short, reduced, hyaline; Head, thorax and abdomen smooth. Smooth, sparsely pubescent; Antennae placed at the anterior border of clypeus. Antenna

formula 11063; Funicular segments subequal in length without sensilla; Petiole distinctly longer than wide. first tarsal segment is largest, almost equal to total length of the preceding segments; Hind tibia with numerous (more than 10) strong short stout spines dorsally and two spurs at the posterior margin; Abdomen is smooth and shiny; its shorter than thorax; last four tergite has setae arranged in a row.

Comments: *Rahimaniella* gen. nov. is similar to *Odontofroggatia* Ishii in having anterior margin of scutellum narrower than hind margin of mid lobe of mesoscutum; antenna without an anellus and tarsi with five segments, although most of *Odontofroggatia* species have four tarsi. The new genus differs from *Odontofroggatia* Ishii in having antenna with five funicular segments in females and three funicular segments in males (six funicular segments in *Odontofroggatia* Ishii); antennal funicular segments with two rows of sensilla in females (single row of sensilla in *Odontofroggatia* Ishii); presence of complete malar sulcus (incomplete or absence of malar sulcus in *Odontofroggatia* Ishii); supraclypeal area completely delimited (supra clypeal area not delimited in *Odontofroggatia* Ishii); marginal vein of fore wing distinctly shorter than stigma vein (STV and MV almost same length in *Odontofroggatia* Ishii); axillae not touching medially (axillae touching medially in *Odontofroggatia* Ishii).

***Rahimaniella drupacea* sp. nov.**

(Figure 101 - 106)

Material Examined.

Holotype f#: INDIA, Wayanad, Kerala, 11°37.479′N, 076°18.991′E, 17.II.2021, collected by Shilpa K. Satheesan, ex *Ficus drupacea* Thunb.

Description of female

*Size and colour***.** Total length is 1.709mm; Vertex, thorax and abdomen brown colour; Yellowish legs, lateral side of pronotum, propodeum and head except vertex; Antennae brownish yellow; Eyes and ocelli greyish pink. Pilosity of wings highly reduced; Body smooth with pronotum and posterior region of vertex lightly imbricate; Abdominal terga smooth with brown colour.

Head. Mostly smooth; Head 1.6× wider than long; Eye 1.2× longer than wide. Antennae located just above the anterior margin of eye. Antennal formula 11053; Antennae placed closely intertorular distance distinctly less than torular diameter; Torulus to inner eye

distance is 2.6× torulus diameter; Scape length 4.9× its own width; Pedicel 1.13× wider than length; Scape 5.3× pedicel length; Antennal funicular segments with two rows of sensilla; F1 longer than all the preceding funicles, which are subequal in length; F1 1.5× the length of F2 and 2.3× length of pedicel; clava length 1.9× its width; Supraclypeal area clearly demarcated and 1.7× wider than long; Malar sulcus 0.36× eye length. POL 0.9× OOL; clypeus bilobed.

Mesosoma. Thorax smooth with few bristles; Pronotum slightly imbricate; Propodeum smooth without any carinae with circular spiracle with margin raised to form a circular broad outline; Notauli complete; axilla broader, arise inside of the notauli meeting. Pronotum 3.8× wider than long; Mesonotum wider than long (w- 0.447mm; l- 0.263mm); scutellum longer than wide (l- 0.305mm; w- 0.272mm); propodeum 1.7× wider than long; Mesonotum 2.6× longer than pronotum; Scutellum 1.2× longer than mesonotum and 3.8× longer than pronotum. Forewing length is 2.3× the length of SMV; pilosity of wings highly reduced; SMV 7.6× MV; STV 1.5× longer than MV; Stigmal vein without sensilla. Hind wing SMV 1.3× MV. Foreleg coxa 2× longer than wide; femur 2× longer than its width; tibia 2.7× longer than wide; Femur1.14× longer than coxa, 1.24× tibia and 1.3× tarsi. Midleg femur 3× longer than wide; tibia 12× longer than wide, tibia and tarsal almost same length; first tarsal segment is 1.3× longer than the preceding segments. Hind leg coxa 2.5× longer than wide; coxa almost equal to femur length; femur 2.1× longer than wide, tibia 4.3× longer than wide; tibia 1.2× longer than femur; tibia and tarsi of same length tarsal; first tarsal segment is the longest, its 1.22× longer than the preceding segments; segments in ratio 0.167; 0.040; 0.039; 0.031; 0.033.

Metasoma. Abdomen is 1.4× longer than thorax; Smooth and shiny, not compressed from sides; T1, T2, T3 margin incised medially; T4 like two lateral flaps joined together medially; T5 margin slightly incised medially. Last three tergite with a single row of small setae; Hypopygium ends before the last tergite.

Description of male

Size and colour. Length 0.263mm; Head, pronotum, legs, abdomen yellow; Antennae light yellow; Mesonotum pale greenish; Eye grey; Ocelli whitish or silver in colour; Wings short, reduced, hyaline; Head, thorax and abdomen smooth.

Head. Smooth, sparsely pubescent; Eye 1.6× longer than wide; Head 1.13× longer than wide; Antennae placed at the anterior border of clypeus. Antenna formula 11063;

Funicular segments subequal in length without sensilla; Scape 2.7× longer than its width; Pedicel 1.86× longer than wide; scape 2× pedicel; diameter of torulus is distinctly larger than the intertorular distance; Malar space 0.82× length of eye;

Mesosoma. Smooth with sparsely rugulose; Pronotum as long as wide; pronotum 2.4× longer than mesonotum, 1.4× longer than scutellum; Mesonotum 2.3× wider than long; scutellum as long as wide; Scutellum 1.7× longer than mesonotum; Propodeum 2.14× wider than long. Spiracles round with peritremata extended and broadened, large setae rising from pits lateral to the spiracles; Petiole 1.8× longer than wide. Hind coxa 1.6× longer than wide; Femur 1.9× longer than wide; Coxa 1.2× femur length; Tibia 3× longer than its width; tibia 0.9× tarsi; first tarsal segment is largest, almost equal to total length of the preceding segments; Hind tibia with numerous (more than 10) strong short stout spines dorsally and two spurs at the posterior margin; tarsal segment in ratio 0.102; 0.030; 0.021; 0.025; 0.038.

Metasoma. Abdomen is smooth and shiny; its shorter than thorax about 0.6× of thorax; Exerted claspers; last four tergite has setae arranged in a row.

Etymology: 'drupacea' derived from the name of host plant *Ficus drupacea*

Host: Fruit galls of *Ficus drupacea*

***SYCOBIA* Walker**

Agrianisa Walker, 1875; Type species: *Agrianisa myrmecoides* Walker

Sycobia Walker, 1871; Type species: *Sycobia bethyloides* Walker

Diagnosis: Anterior margin of scutellum narrower than hind margin of mid lobe of mesoscutum; axillae almost touching medially. Antennal formula 1116(3); width of mesoscutum in female distinctly than 1.5x its median length; gaster sub-compressed from sides.

***Sycobia bethyloides* Walker, 1871**

(Figure 61 - 65)

Synonyms: *Agrianisa myrmecoides* Walker, 1875

Materials Examined

INDIA, Wayanad, Kerala, 11.7365N 76.36607E; 11.7037N 76.3701E; 11.6748N 76.2997E; 11.6411N 76.3484E; 11.6263N 76.3129E; 11.8559N 76.1161E, collected by Shilpa K. Satheesan, ex *Ficus benghalensis* L.

Diagnosis: ***Female***. Length 2.2mm. General yellow; Head with pubescence; Head width 1.4x distance between front ocellus and clypeal margin, with POL 0.88x OOL. Eyes as 1.2x long as wide. Malar groove incomplete, 0.38x eye length. Antennal formula 11163; Mesosoma smooth with little pubescence. Pronotum 0.44× as long as mesoscutum. Mesoscutum as long as scutellum. Notauli complete. Scutellum wider than long. Propodeum rugulose, rectangular. Wings: Fore wing hyaline, 3× as long as wide, 2.7x SMV; SMV 4.4x MV; MV 1.33x STV; Metasoma smooth and shiny. Gaster 1.25x longer than thorax, compressed and with setae from third tergit.

Male: Length 2mm. Head, metasoma, wing remnants and all legs yellow, mesosoma and scutellum light green; Propodeum and petiole red colour; Head almost same length to width, subrectangular; frons with fine engraved striation; Antenna located at clypeal margin; Antennal formula 11053; Mesosoma large. Pronotum subquadrangular, about 1.8x as wide as mesonotum; mesonotum 1.13x scutellum; propodeum as long as scutellum; Petiole 1.17x as long as wide, petiole with lateral spine, stigulate. Fore wing same as female. Metasoma yellow in colour weakly sclerotized slightly longer than wide and depressed.

Host: Syconia galls of *Ficus benghalensis* L.

***Sycobia mathewi* Joseph, 1957**

(Figure 71 - 75)

Materials Examined

INDIA, Wayanad, Kerala, 11.71441 N 76.32326 E; 11.72815 N 76.32313 E; 11.8274 E 76.09494 E; 11.7447 N 76.304 E; 11.6744 N 76.2979 E; 11.8718 N 76.1003 E collected by Shilpa K. Satheesan, ex *Ficus drupacea* Thunb.

Diagnosis: ***Female***. Length 2.7mm. General Yellow; Head with pubescence; Head width 1.52x distance between front ocellus and clypeal margin. Eyes as 1.3x long as wide. Malar groove complete, 0.4x eye length. Antenna located just below anterior margin of eye; Antennal formula 11163; Mesosoma smooth with little pubescence. Pronotum 0.64× as long as mesoscutum. Mesoscutum 0.9x as long as scutellum. Notauli complete. Scutellum

1.1x longer than wide. Propodeum with few carinae medially, rectangular. Wings: Fore wing hyaline, 2.64× as long as wide, 2.5x SMV, SMV 3.3x MV, 5.75x STV; MV 1.7x STV; PMV absent. Metasoma smooth and shiny. Gaster 1.33x longer than thorax.

Male: Length 1.3 mm. Head, mesosoma, metasoma, wing remnants and all legs yellow; Head 1.52x longer to width, subrectangular; frons with fine engraved striation; eye long, 0.7× as long as wide; Antannae located at clypeus; Antennal formula 11152; Mesosoma large. Pronotum subquadrangular, about 2× as long as mesonotum, mesonotum 0.9x scutellum; propodeum normal, rectangular 0.5x scutellum length. Fore wing same as female. Metasoma yellow, smooth, with setae. weakly sclerotized slightly longer than wide and depressed.

Host: Syconia galls of *Ficus drupacea* Thunb.

SYCOBIOMORPHELLA Abdurahiman & Joseph

Parapilkhanivora Farooqi and Menon, 1973; Type species: *Parapilkhanivora testacea* Farooqi & Menon
Sycobiomorphella Abdurahiman and Joseph, 1967; Type species: *Sycobiomorphella lacorensis* Abdurahiman & Joseph

Diagnosis: Anterior margin of scutellum not narrower than hind margin of mid lobe of mesoscutum; axillae well separated medially. Antennal formula 1106(3); maxillary and labial palpi two segmented each; marginal vein not touching anterior wing boarder.

Sycobiomorphella lacorensis Abdurahiman & Joseph

(Figure 82 - 93)

Synonyms: *Parapilkhanivora testacea* Farooqi and Menon, 1973; *Sycobiomorphella lacorensis* Abdurahiman and Joseph, 1967

Materials Examined

INDIA, Wayanad, Kerala, 11.887N 76.0687E; 11.9388N 76.0747E; 11.9673N 76.0642E; 11.9202N 76.0915E; 11.68282N 76.26623E; 11.7216N 76.3545E; 11.6404N 76.354E; 11.5945N 76.3561E; 11.7705N 76.2996E; 11.7439N 76.2271E, collected by Shilpa K. Satheesan, ex *Ficus virens* Aiton.

Redescription of female

Size and colour. Blackish brown colour, 1.709mm in length; Head, Mesosoma, all coxa, metasoma blackish brown; Femora, tibia, tarsi all yellow; Antennal scape pale yellow, pedicel and flagellum yellow; Clypeal area pale yellow; Eyes and ocelli grey.

Head. Smooth, sparely pubescent; Head 1.6× wider than long; Eye 1.2× longer than wide; Antennae located a little above the posterior margin of eye. Antennal formula 11053. Proximal region of antennal pedicel with a circular carinae like structured line. Antennae stout with small subequal segments with a single row of sensilla; Length of torulus to inner eye margin 2.44× diameter of torulus; torular diameter 2.8× inter-torular distance; Scape 4× longer than wide; Scape 2.2× longer than pedicel; Clava as long as wide; POL 1.88× OOL. Clypeus bilobed; Superaclypeal area 0.14× wider than long. Malar sulcus incomplete; Malar space 0.3× eye length.

Mesosoma. Smooth and shiny; Mesonotum 4× the length of pronotum and length of scutellum 1.8× mesonotum and 7.5× pronotum. Notauli complete and anterior margin of scutellum almost touches the hind margin of mid lobe of mesonotum. Scutellum with three pair of setae; Propodeum 4.7× wider than long. Spiracles circular, propodeum smooth and shiny without any carinae; a tuft of setae at the lateral corner of propodeum. Pilosity of wing highly reduced, setae present at the fringe of the wing; no sensilla on STV; Forewing 2.77× SMV; MV 1.6× STV. Foreleg femur 1.9× longer than wide; tibia 4.6× longer than wide; femur and tibia almost same length. Midleg coxa 1.3× longer than wide; femur 3.8× longer than wide; femur 2× longer than coxa; tibia 6× longer than wide; Tibia 1.2× longer than femur, 1.8× tarsi. Hindleg coxa 2.3× longer than wide; femur 3.3× longer than wide; femur 1.3× coxa length, 1.08× tibia length; tibia 8.4× longer than wide; tibia 1.2× tarsi; Tarsal segments in ratio 0.138; 0.047; 0.046; 0.033; 0.052.

Metasoma. Abdomen slightly longer than thorax; T1, T2 and T3 margin with small incision medially; Last four segments with a row of setae.

Male: Length 2mm. Head, mesosoma, metasoma, and all coxa black; tibia, femur and tarsals yellow; Head almost same length to width, rectangular; frons with fine engraved striation, covered in setae; Antenna located at clypeal margin; Antennal formula 11073. Propodeum with a median Y-shaped pitted grove; Petiole longer than wide, distinctly reticulate. Metasoma smooth, slightly wider than long.

Host: Syconia galls of *Ficus virens* Aiton.

***Sycobiomorphella religiosa* sp. nov.**

(Figure 107 - 112)

Materials Examined

Holotype ♀: INDIA, Wayanad, Kerala, 11.71986N 76.32443E; 11.6622N 76.3304E; 11.6406N 76.303E; 11.8552N 76.1134E; 11.9556N 76.0668E; 11.7685N 76.2885E, 14.I.2019, collected by Shilpa K. Satheesan, ex *Ficus religiosa* L.

Description of female

Size and colour. Length 1.669; Yellow colour; Darker yellow band on abdomen; Eye pink; Smooth with sparse setae.

Head (Fig. 1B, 1C, 1D, 1F). Smooth and shiny; Antenna located above anterior margin of eye; Head 2.1x wider than long; Eye slightly (1.08x) longer than wide; Malar sulcus absent; POL 1.18x OOL. Torulus to eye margin 7x inter torular distance; Inter torular distance less than the diameter of torulus; Torulus 1.6x Inter torular distance; Antennal formula 11063; Scape 4.3x longer than wide; Pedicel 1.4x wider than long; Scape 4x longer than pedicel; funicular segments subequal; clava 1.3x longer than wide; Supra clypeal area 1.8x wider than long; Mandible tridentate.

Mesosoma (Fig. 1C, 1E). Smooth, shiny; Pronotum with two rows of bristles; five pair of long setae on scutellum; circular propodeal spiracle; Propodeum smooth; Pronotum 3.5x wider than long; Mesonotum 2.24x longer than pronotum; Scutellum 1.37x mesonotum and 3x pronotum; Notauli complete and anterior margin of scutellum almost touches the hind margin of mid lobe of mesonotum. Wing hyaline and 1/3rd of the wing bare, without setae; Forewing 1.9x SMV; MV 1.29x STV. Foreleg femur 1.2x longer than wide; foretibia 3.2x longer than wide; Femur 1.2x tibia, tarsal; tibia and tarsal subequal; Mid coxa and femur1.22x longer than wide; tibia 6.7x longer than wide; coxa as long as femur, 0.4x tibia, 0.5x tarsi; tibia 1.4x tarsus. Hind coxa 2.1x longer than wide; femur 2x as long as wide; tibia 3.8x as long as wide; femur slightly longer than coxa, 0.9x tibia; tibia 1.2x longer than tarsus; tibia with a bifid spur at posterior end. Hind tarsal segments in the ratio 0.075; 0.041; 0.044; 0.041; 0.027.

Metasoma (Fig. 1G). Dark yellow colour band on abdomen; Abdomen slightly longer than thorax; hypopygium ending before last terga; last three tergum with a row of setae.

Description of male

Size and colour. Length 0.979mm; Yellow colour

Head (Fig. 2A, 2D). Smooth; Antenna located above anterior margin of eye; Eyes 1.06x wider than long; Head 1.84x wider than long; Inter torular distance is slightly less than the diameter of the torulus; torulus inner eye margin distance 4.7x inter torular distance; Antennal formula 11163; Scape 3.8x longer than wide. Pedicel 1.3x longer than wide; Scape 2.7x longer than pedicel; Funicular segments subequal in length; Clava 1.9x longer than wide; Malar sculcus absent.

Mesosoma (Fig. 2B). Smooth and shiny; Pronotum with evenly spaced long setae rising from pits. Mesonotum and scutellum with few setae near the notauli and the axillary line. Propodeum smooth without setae, with circular spiracles; lateral side of spiracle with few setae. Scutellum 1.34x longer than Mesonotum and 6.2x pronotum. Mesonotum 4.7x pronotum; Wings hyaline, 1/3rd portion bare without setae; Forewing 4.48x SMV; MV1.25x STV. Fore femur 1.7x longer than wide; tibia 4x as long as wide; Femur as long as tibia; tibia 1.75x tarsus. Mid femur 1.5x as long as wide; tibia 9.5x longer than wide; tibia 2.2x femur, 1.2x tarsus. Hind coxa 2.4x as long as wide; femur 3.06x longer than wide; tibia 2.8x as long as wide; Femur 1.14x coxa. 1.5x tibia, 1.4x tarsus.

Metasoma (Fig. 2C). Abdomen 0.65x length of thorax.

Host: Syconia galls of *Ficus religiosa* L.

Etymology: ‘religiosa’ derived from the name of host plant *Ficus religiosa*.

Comments: *S. religiosa* sp. nov. differs from *S. lacorensis* Abdurahiman and Joseph in having supra clypeal area completely delimited (Supra clypeal area not delimited in *S. lacorensis* Abdurahiman and Joseph); Eyes as long as wide (Eye 2× longer than wide in *S. lacorensis* Abdurahiman and Joseph); Mandible tridentate (Mandible bidentate *S. lacorensis* Abdurahiman and Joseph); dorsum of head smooth and sparsely setose (dorsum of head irregularly rugose with scattered long setae in *S. lacorensis*).

FAMILY EURYTOMIDAE

SYCOPHILA Walker

Sycophila Walker, 1871. Type species *Sycophila decatomoides* Walker.
Decatomidea Ashmead, 1888. Type species *Decatomidea xanthochroa* Ashmead.
Eudecatoma Ashmead, 1888. Type species *Decatoma batatoides* Ashmead.
Isanisa Walker, 1875. Type species: *Sycophila decatomoides* Walker, by monotypy.
Pseudisa Walker, 1875. Type species: *Pseudisa smicroides* Walker, by monotypy.
Tineomyza Rondani, 1872. Type species: *Tineomyza pistacina* Rondani, by monotypy.

Diagnosis. Antennal formula 11153; MV enlarged, stigmated, with dark brown shading below MV, PMV absent or short, hind femur with enlarged in the middle, gaster petiolate and mostly compressed laterally; propodeum with cris-cross carina medially adhering to the anterior margin.

KEY TO SPECIES OF *SYCOPHILA*, MODIFIED FROM NARENDRAN, 1994

1 Antenna pedicel as long as F1 or shorter than F1 ---------- 2

− Antenna pedicel always longer than F1 ---------- 5

2 Pedicel long as F1 ---------- 3

− Pedicel shorter then F1 ---------- 4

3 Median length of pronotum distinctly shorter than half the median length of scutellum; MV 2x STV; SMV having 12 bristles in row ---------- ***S. tinctoria*** sp. nov.

− Median length of pronotum distinctly longer than half the median length of scutellum; MV 1.3x STV; SMV having 9 bristles in row ---------- ***S. gibbosa*** sp. nov.

4 Anterior width of head 1.45x length; POL 2x OOL ---------- ***S. drupacea*** sp. nov.

− Anterior width of head 1.7x length; POL 1.2x OOL ---------- ***S. virens*** sp. nov.

5 POL < OOL distance; Anterior width of head 1.6x length ---------- ***S. infectoria*** sp. nov.

− POL > OOL distance; Anterior width of head < 1.6x length ---------- 6

6 Eye length less than 2x malar space; POL < 2x OOL ---------- 7

− Eye length more than or equal to 2x malar space; POL > 2x OOL ---------- 9

7 POL 1.85x OOL; scape 2.7x pedicel; Anterior width of head1.3x length ---------- ***S. mysurensis*** sp. nov.

− POL almost equal to OOL; Other characters also different ---------- 8

8 Pronotum distinctly shorter than half the median length of scutellum; T5 longest ---------- ***S. batheri*** sp. nov.

− Median length of pronotum longer than the median length of scutellum; T3 longest ---------- ***S. wayanadensis*** sp. nov.

9 Median length of pronotum shorter than the median length of scutellum; T4 longest; MV 2x STV; SMV with 15 bristles in a row ---------- ***S. arnottiana*** sp. nov.

− Median length of pronotum longer than the median length of scutellum; T5 longest; MV 1.6x STV; SMV with 5 bristles in a row ---------- ***S. religiosa*** sp. nov.

Sycophila drupacea **sp. nov.**

(Figure 160 - 164)

Material examined: INDIA: Kerala, Wayanad district, Kuruva (11.82098 N 76.09564 E), Host: Syconia galls of *Ficus drupacea* Thunb., 19.04.2016. Coll. Shilpa K.S.

Description: **Female**. *Holotype*. Length 2.7mm. General colour yellow; lateral lobe of mesoscutum and propodeum, mostly black. The posterior 3/4 of T1, T2, T3 and lateral side of T4 black. Wings semi hyaline with area below costal cell bare, veins brown with rusty brown patch adjoining the dark infuscation; Antennal scape and pedicel yellow and funicle brownish yellow.

Head (Fig. 1B & 1C): Head alveolate with pubescence; Head width (anteriorly) 1.4x distance between front ocellus and clypeal margin, with POL 1.9x OOL. Eyes as long as wide (width 0.212 to length 0.239). Malar space 0.135mm. Scrobe deep, not reaching front ocellus; Scrobe is 0.015mm from front ocellus; clypeal margin bilobed; Malar

groove complete. Antennal formula 11153; scape reaching front ocellus, not reaching level of vertex; F1 longer than pedicel (pedicel 0.082mm and F1 0.097). Flagellum plus pedicel is 0.63mm. Pedicel is 1.7 times as long as broad while F1 is 1.6 times as long as broad. Flagellar segments stout-filiform.

Mesosoma (Fig. 1A, 1D & 1E): Dorsum of thorax with irregular areolae sculpturing and pubesent; Median length of pronotum distinctly shorter than half the median length of scutellum; mesoscutum little shorter than scutellum; scutellum as wide as long. Notauli complete. Propodeum declining sharply, with a median shallow depression, which is carinate on sides, anteriorly delimited by oblique cross carinae diverging from the middle of base. Surface of depression rugulose with short carinae at lateral third; area lateral to fovea mostly rugulose with a short carinae or short costula, plica present, spiracle bean shaped having setae rising from black pits to the lateral side; Forewing length 2.4x length of SMV; PMV absent; costal cell (CC) with minute pilosity; basal 1/3 of forewing bare. SMV having 14 bristles in row; MV broad and distinctly longer than STV. MV 1.48 times STV. Rusty infuscation extends beyond the posterior margin of MV. The infuscation is wider than long (length 0.108mm and width 0.157mm). Hind coxa with 14 bristles on ventral side; Hind tibia with a series of setae and 2 prominent spurs at apex, tarsal segments in ratio 9:5:4:3 :4.

Metasoma (Fig. 1A): Petiole as long as broad but distinctly less than length of hind coxa; gaster strongly compressed, its surface smooth and shiny; T4 longest. Gaster little longer than thorax. Hypopygium ending shortly before middle of gaster body.

Male: Length 2.8mm. Similar to female in general except in having: antenna with four funicular segments and one club with four fused segments; gaster small with sooty brown to black patches; petiole longer than gaster with a characteristic hump dorsally.

Host: Syconia galls of *Ficus drupacea* Thunb.

Etymology: 'drupacea' derived from the name of host plant *Ficus drupacea*

Remarks: Colour variation on the propodeum from black to dark rusty brown is seen. Dark patches on thorax are also seen in lighter shades in paratypes.

Comments: *S.* drupacea sp. nov. differs from all other *Sycophila* species' in having these combination of characters – First funicular segment (F1) a little longer than pedicel; Median length of mesoscutum little shorter than the median length of scutellum; pterostigmal area wider than long. Anterior width of head 1.45× length between front

ocellus and clypeal margin; POL 2× OOL; SMV with 14 bristles in a row; propodeum with a median smooth fovea, bounded by lateral carinae, anteriorly delimited by oblique cross carinae.

S. drupacea sp. nov. is similar to S. *virens* sp. nov., in having similar shorter pedicel than F1; length ratios of scape and pedicel; length of scutellum larger than length of mesoscutum but differs in *S. drupacea* sp. nov. having anterior width of head 1.45× its length (*S. virens* sp. nov. having width 1.7× length); POL 2× OOL (POL 1.2× OOL in *S. virens* sp. nov.) and having propodeal fovea smooth (fovea imbricate and rugulose in *S. virens* sp. nov.).

***Sycophila mysurensis* sp. nov.**

(Figure 165 - 169)

Material Examined: INDIA: Kerala, Wayanad district, Kuruva (11.82098 N 76.09564 E), Host: Syconia galls of *Ficus drupacea* Thunb., 19.04.2016. Coll. Shilpa K.S.

Description: **Female**. Length 1.4mm. General colour pale yellow; very light brown patches on thorax except on propodeum. Wings semi hyaline with area below costal cell bare, veins brown with rusty brown patch adjoining pterostigma; Antenna yellow.

Head (Fig. 2B & 2C): Head width (anteriorly) 1.45x distance between front ocellus and clypeal margin with POL 1.85x OOL. Eyes as long as wide (width 0.169 to length 0.199). Malar space 0.123mm. Scrobe deep, not reaching front ocellus; Scrobe is 0.044mm from front ocellus; clypeal margin bilobed; Malar groove complete. Antennal formula 11153; scape not reaching front ocellus; pedicel is longer than F1 (pedicel 0.065mm and F1 0.049). Pedicel is 1.5 times as long as broad while F1 is 1.4x as broad as long.

Mesosoma (Fig. 2A, 2D & 2E): Dorsum of thorax with alveolate sculpturing and moderately seatous; Median length of pronotum distinctly shorter than half the median length of scutellum; mesoscutum little shoter than scutellum; scutellum as wide as long. Notauli complete, Propodeum declining sharply, with a broad depressed median fovea bounded laterally by carinae, surface of fovea smooth ; area lateral to fovea mostly smooth with a plica present, spiracle bean shaped having three setae rising from black pits to the lateral side;

Forewing length 2.6x length of SMV; PMV absent; costal cell (CC)with minute pilosity; basal 1/3 of forewing bare. SMV having 6 bristles in row; MV broad and distinctly longer

than STV. MV is little shorter than STV; Pterostigma a trifle wider than long (length 0.062mm and width 0.078mm).

Hind coxa with four bristles on ventral side; Hind tibia with a series of setae and one prominent spur at apex, tarsal segments in ratio 9:10:8:5 :5.

Metasoma (Fig. 2A): Petiole distinctly less than length of hind coxa; gaster strongly compressed, its surface smooth and shiny; T4 longest. Gaster little longer than thorax. Hypopygium ending shortly before middle of gaster body.

Male: Similar to female in general except in having: antenna with four funicular segments and one club with four fused segments; gaster small with sooty brown to black patches; petiole longer than gaster.

Host: Syconia galls of *Ficus drupacea* Thunb.

Etymology: 'mysurensis' derived from the synonymised name of host plant *Ficus drupacea*.

Comments: *S. mysurensis* sp. nov. differs from all other *Sycophila* species' in having these combination of characters - POL 1.85x OOL; scape 2.7x pedicel; Anterior width of head1.3x; Eye length less than 2x malar space; POL < 2x OOL; T4 longest. It is similar to *S. batheri* sp. nov. but later differs from former in the following combination of characters - POL almost equal to OOL; Head width (anteriorly) 1.43× distance between front ocellus and clypeal margin; length of scape is 2.4× length of pedicel; T5 longest.

***Sycophila arnottiana* sp. nov.**

(Figure 118 - 123)

Material examined: INDIA: Kerala, Wayanad district, Lakkidi 11°30.796′N, 76°01.089′E, 23.IV.2019 collected by Shilpa K. Satheesan, ex *Ficus arnottiana* (Miq.) Miq.

Description: **Female**. Length 1.4mm. General colour yellowish brown or honey brown. Wings semi hyaline with area below costal cell bare, veins brown with rusty brown patch adjoining pterostigma; Antenna yellowish brown.

Head (Fig. 2B & 2C): Head width (anteriorly) 1.34x distance between front ocellus and clypeal margin with POL 2.8x OOL. Eyes as long as wide (width 0.171 to length 0.233). Malar space 0.110mm. Scrobe deep, almost reaching front ocellus; Scrobe is 0.070mm

from front ocellus; Para scrobal space smooth; Median ocellus red and lateral ocelli white; eyes glaborous. clypeal margin bilobed; Malar groove complete. Malar groove moderately carinate at the distal half Antennal formula 11153; scape not reaching front ocellus; pedicel is longer than F1 (pedicel 0.084mm and F1 0.064). Pedicel is 2.2 times as long as broad while F1 is 1.75x as broad as long. P. 0.032w, l 0.087; f1 w 0.049 l 0.069

Mesosoma (Fig. 2A, 2D & 2E): Pronotum with faint or weak areola extending as a weak rugulae laterally. Mesoscutum and scutellum impricate with scattered white seatae. Median length of pronotum shorter than half the median length of scutellum; mesoscutum shoter than scutellum; scutellum as wide as long. Notauli complete, Propodeum declining sharply, with a broad depressed median fovea bounded laterally by carinae, surface of fovea smooth; area lateral to fovea regulose with a plica present, spiracle bean shaped having five setae rising from black pits to the lateral side.

Forewing length 2.3x length of SMV; PMV absent; costal cell (CC)with minute pilosity; basal 1/3 of forewing bare. SMV having 15 bristles in row; MV broad and distinctly longer than STV. STV 2x MV. Pterostigma a wider than long (length 0.066mm and width 0.093mm).

Hind tibia with a series of setae and one prominent bifid spur at apex, tarsal segments in ratio 3:2:3.3:2 :0.7.

Metasoma (Fig. 2A): Petiole distinctly less than length of hind coxa; gaster strongly compressed, its surface smooth and shiny; T4 longest. Gaster longer than thorax. Hypopygium ending before middle of gaster body.

Male: Similar to female in general except in having: antenna with four funicular segments and one club with four fused segments; gaster small with yellowish colour; petiole longer than gaster.

Host: Syconia galls of *Ficus arnottiana* (Miq.) Miq.

Etymology: ‘arnottiana’ derived from the name of host plant *Ficus arnottiana*

Comments: *S. arnottiana* sp. nov. differs from all other *Sycophila* species’ in having these combination of characters – Antenna pedicel always longer than F1; Median length of pronotum shorter than the median length of scutellum; T4 longest; MV 2× STV; SMV with 15 bristles in a row. Eye length 2.1× malar space; POL 2.8× OOL; Anterior width of head 1.44× length between front ocellus and clypeal margin.

S. arnottiana sp. nov. is similar to *S. religiosa* sp. nov. in having longer pedicel than F1; similar eye length to malar space ratio, POL - OOL ratio, head length to width ratio but differs in having length of pronotum shorter than scutellum in *S. arnottiana* sp. nov. where as in *S. religiosa* sp. nov. length of pronotum is longer than scutellum; MV 2× STV and SMV with 15 bristles in a row in *S. arnottiana* sp. nov. whereas MV 1.6× STV and SMV with 5 bristles in a row in *S. religiosa* sp. nov.; In *S. arnottiana* sp. nov. fourth tergite is the longest whereas in *S. religiosa* sp. nov. fifth tergite is longest; propodeal median fovea smooth, slightly rugulose in *S. arnottiana* sp. nov. whereas propodeal median fovea is imbricate with carinae in *S. religiosa* sp. nov.

***Sycophila religiosa* sp. nov.**

(Figure 124 - 129)

Material examined: INDIA: Kerala, Wayanad district, 11.71986N 76.32443E; 11.6622N 76.3304E; 11.6406N 76.303E; 11.8552N 76.1134E; 11.9556N 76.0668E; 11.7685N 76.2885E, 14.I.2019, collected by Shilpa K. Satheesan, ex *Ficus religiosa* L.

Description: Female *Holotype*. Length 1.6mm. General colour yellowish brown or honey brown. Wings semi hyaline with area below costal cell bare, veins brown with rusty brown patch adjoining pterostigma; Antenna yellowish brown.

Head (Fig. 2B & 2C): Head width (anteriorly) 1.34x distance between front ocellus and clypeal margin with POL 2.8x OOL. Eyes as long as wide (width 0.171 to length 0.233). Malar space 0.110mm. Scrobe not reaching front ocellus; Scrobe is 0.070mm from front ocellus; Para scrobal space smooth; Median ocellus and lateral ocelli white; eyes glaborous. clypeal margin bilobed; Malar groove complete. Malar groove moderately carinate at the distal half Antennal formula 11153; scape not reaching front ocellus; pedicel is longer than F1 (pedicel 0.084mm and F1 0.064). Pedicel is 2.2 times as long as broad while F1 is 1.75x as broad as long. P. 0.032w, l 0.087; f1 w 0.049 l 0.069

Mesosoma (Fig. 2A, 2D & 2E): Pronotum with weak areola extending as a weak rugulae laterally. Mesoscutum strigulated anteriorly posterior mesoscutum and scutellum impricate with scattered white seatae. Median length of pronotum longer than half the median length of scutellum; mesoscutum shorter than scutellum; scutellum wider than long. Notauli complete, Propodeum declining sharply, with a broad depressed median

fovea bounded laterally by carinae, surface of fovea imbricate rugulose; area lateral to fovea with numerous carinae, spiracle bean shaped;

Forewing length 2.23x length of SMV; PMV absent; costal cell (CC)with minute pilosity; basal 1/3 of forewing bare. SMV having 5 bristles in row; MV broad and distinctly longer than STV. MV 1.6 x STV. Pterostigma a wider than long (length 0.051mm and width 0.079mm).

Hind tibia with a series of setae and one prominent bifid spur at apex, tarsal segments in ratio 0.108; 0.054; 0.038; 0.043; 0.034.

Metasoma (Fig. 2A): Petiole distinctly less than length of hind coxa; gaster strongly compressed, its surface smooth and shiny; T5 longest. Gaster longer than thorax. Hypopygium ending before middle of gaster body.

Male: Similar to female in general except in having: antenna with four funicular segments and one club with three fused segments; gaster small with yellowish colour; petiole longer than gaster.

Host: Syconia galls of *Ficus religiosa* L.

Etymology: 'religiosa' derived from the name of host plant *Ficus religiosa*.

Comments: *S. religiosa* sp. nov. is similar to *S. arnottiana* sp. nov. but differs from it and all other *Sycophila* species' in having these combination of characters – Antenna pedicel always longer than F1; Median length of pronotum longer than the median length of scutellum; T5 longest; MV 1.6× STV; SMV with 5 bristles in a row; propodeal median fovea imbricate rugulose; Eye length 2.1× malar space; POL 2.8× OOL; Anterior width of head 1.41× length between front ocellus and clypeal margin.

***Sycophila virens* sp. nov.**

(Figure 140 - 144)

Material examined: *Holotype.* ♀, INDIA: Kerala, Wayanad district, 11.887N 76.0687E; 11.9388N 76.0747E; 11.9673N 76.0642E; 11.9202N 76.0915E; 11.68282N 76.26623E; 11.7216N 76.3545E; 11.6404N 76.354E; 11.5945N 76.3561E; 11.7705N 76.2996E; 11.7439N 76.2271E, collected by Shilpa K. Satheesan, ex *Ficus virens* Aiton.

Description: **Female**. *Holotype.* Length 2 mm. General colour yellow; lateral lobe of mesoscutum and propodeum, mostly black. The posterior 3/4 of T1, T2, T3 and lateral

side of T4 black. Wings semi hyaline with area below costal cell bare, veins brown with rusty brown patch adjoining the dark infuscation; Antennal scape and pedicel yellow and funicle brownish yellow.

Head (Fig. 1B & 1C): Head alveolate with pubescence; Head width (anteriorly) 1.2x distance between front ocellus and clypeal margin, with POL 1.2x OOL. Eyes slightly longer than wide (width 0.18 to length 0.2). Malar space 0.112mm. Scrobe deep, almost reaching front ocellus; clypeal margin bilobed; Malar groove complete. Antennal formula 11153; scape reaching front ocellus. F1 longer than pedicel (pedicel 0.068mm and F1 0.080). Pedicel is 1.7 times as long as broad while F1 is 1.8 times as long as broad. Flagellar segments stout-filiform.

Mesosoma (Fig. 1A, 1D & 1E): Pronotum faintly coriaceous; Median length of pronotum distinctly shorter than half the median length of scutellum; mesoscutum little shorter than scutellum; scutellum slightly wider than long. Notauli complete. Propodeum declining, with a median area carinate on sides. Surface of depression rugulose; area lateral to fovea mostly rugulose with a short carinae or short costula, plica present, spiracle bean shaped having setae rising from black pits to the lateral side; Forewing length 2.2x length of SMV; PMV absent; costal cell (CC) with minute pilosity; basal 1/3 of forewing bare. SMV having 10 bristles in row; MV broad and distinctly longer than STV. MV 1.27 times STV. Rusty infuscation extends beyond the posterior margin of MV. The infuscation is wider than long (length 0.073mm and width 0.066mm). Hind tibia with a series of setae with prominent spurs at apex, tarsal segments in ratio 0.124; 0.063; 0.047; 0.033; 0.043.

Metasoma (Fig. 1A): Petiole as length 1.67x times wide; gaster strongly compressed, its surface smooth and shiny; T5 slightly longer than T4. Gaster little longer than thorax. Hypopygium ending shortly before middle of gaster body.

Male: Unknown; not represented in collection.

Host: Syconia galls of *Ficus virens* Aiton.

Etymology: 'virens' derived from the name of host plant *Ficus virens*.

Comments: *S. virens* sp. nov. is similar to *S. drupacea* sp. nov. but differs from it and all other *Sycophila* species' in having these combination of characters – First funicular segment (F1) of antenna a little longer than pedicel; Median length of mesoscutum little shorter than the median length of scutellum; pterostigmal area wider than long; anterior

width of head 1.7× length between front ocellus and clypeal margin; POL 1.2× OOL; SMV with 10 bristles in a row; propodeum with a median fovea imbricate and rugulose, bounded by lateral carinae, anteriorly not delimited by oblique cross carinae.

***Sycophila infectoria* sp. nov.**

(Figure 145 - 149)

Material examined: *Holotype.* ♀, INDIA: Kerala, Wayanad district, 11.887N 76.0687E; 11.9388N 76.0747E; 11.9673N 76.0642E; 11.9202N 76.0915E; 11.68282N 76.26623E; 11.7216N 76.3545E; 11.6404N 76.354E; 11.5945N 76.3561E; 11.7705N 76.2996E; 11.7439N 76.2271E, collected by Shilpa K. Satheesan, ex *Ficus virens* Aiton.

Description: Female. *Holotype.* Length 1.3 mm. General colour yellow. The median portion of T1, T2, T3 and T4 black. Wings semi hyaline with area below costal cell bare, veins brown with rusty brown patch adjoining the dark infuscation; Antennal scape and pedicel yellow and funicle brownish yellow.

Head (Fig. 1B & 1C): Head weakly coriaceous with pubescence; Head width (anteriorly) 1.09x distance between front ocellus and clypeal margin, with POL 0.73x OOL. Eyes 1.2x longer than wide (width 0.142mm to length 0.172mm). Malar space 0.115mm. Scrobe deep, not reaching front ocellus; clypeal margin bilobed; Malar groove complete. Antennal formula 11153; scape not reaching front ocellus. Pedicel longer than F1 (Pedicel 0.056mm and F1 0.049). Pedicel is 1.8 times as long as broad while F1 is 1.32 times as long as broad. Flagellar segments stout-filiform; Inter-torular distance 1.3x each torulus width.

Mesosoma (Fig. 1A, 1D & 1E): Pronotum faintly coriaceous; Median length of pronotum distinctly shorter than half the median length of scutellum; mesoscutum little longer than scutellum; scutellum slightly wider than long, with four pair of setae. Notauli complete. Propodeum declining, with a median area carinate on sides on the posterior half. Surface of depression wrinkled and glaborous; area lateral to fovea mostly smooth, pale yellowish with small brown shades at the anterior part mostly in the median area; an inverted Y shaped carinae lateral side just above the next of the propodeum, laterally; spiracle bean shaped having setae rising from black pits to the lateral side; Forewing length 2.12x length of SMV; PMV absent; costal cell (CC) with minute pilosity; basal 1/3 of forewing bare. SMV having 10 bristles in row; MV broad and distinctly longer than STV. MV 1.5 times STV. Rusty infuscation extends beyond the posterior margin of MV. The infuscation is

longer than wide (length 0.1mm and width 0.062mm). Hind tibia with a series of setae with prominent spur at apex, tarsal segments in ratio 0.072; 0.052; 0.037; 0.031; 0.037.

Metasoma (Fig. 1A): Petiole as long as wide; gaster strongly compressed, its surface smooth and shiny; T4 longest. Gaster longer than thorax.

Male: Unknown; not represented in collection.

Host: Syconia galls of *Ficus virens* Aiton.

Etymology: 'infectoria' derived from the synonymised name of host plant *Ficus arnottiana*.

Comments: Antenna pedicel always longer than F1; POL 0.73× OOL distance; Anterior width of head 1.6× length; Eyes 1.2× longer than wide; scape length is 2.2× length of pedicel; median length of pronotum distinctly shorter than half the median length of scutellum; Propodeal fovea wrinkled and glaborous; an inverted Y shaped carinae just above the neck of the propodeum, laterally. MV 1.5 times STV. T4 longest.

S. infectoria sp. nov. is different from all the other *Sycophila* species with above mentioned combination of characters. It shares similar character with *S. benghalensis* in having antennal pedicel always longer than F1; median length of pronotum distinctly shorter than half the median length of scutellum and differs from it in having these combination of characters, like, POL 0.73× OOL distance (POL 1.5× OOL in *S. benghalensis*) ; Anterior width of head 1.6× length (head width is 1.4× length in *S. benghalensis*); scape length is 2.2× length of pedicel (2.44× in *S. benghalensis*); propodeum with inverted Y shaped carinae just above the neck of the propodeum (propodeum without inverted Y shaped carinae in *S. benghalensis*).

***Sycophila wayanadensis* sp. nov.**

(Figure 150 - 154)

Material examined: *Holotype.* ♀, INDIA: Kerala, Wayanad district, 11.887N 76.0687E; 11.9388N 76.0747E; 11.9673N 76.0642E; 11.9202N 76.0915E; 11.68282N 76.26623E; 11.7216N 76.3545E; 11.6404N 76.354E; 11.5945N 76.3561E; 11.7705N 76.2996E; 11.7439N 76.2271E, collected by Shilpa K. Satheesan, ex *Ficus virens* Aiton.

Description: **Female**. *Holotype.* Length 1.4mm. Brownish yellow colour thorax, head; pale yellow legs except coxa; later side of gens below the eye, lateral lobe of mesoscutum

and propodeum, hind coxa black. The dorsal side of tergites black and ventral side tergites mostly black with yellow patches. Wings semi hyaline with area below costal cell bare, veins brown with rusty brown patch adjoining the dark infestation; Antennal scape and pedicel yellow and funicle honey yellow.

Head (Fig. 1B & 1C): Head faintly strigulate with pubescence; Head width (anteriorly) 0.9x distance between front ocellus and clypeal margin, with POL 1.02x OOL. Eyes slightly longer than wide (width 0.172 to length 0.187). Scrobe deep, reaching front ocellus; clypeal margin bilobed; Malar groove complete. Antennal formula 11143; scape not reaching front ocellus. F1 shorter than pedicel (Pedicel 0.089mm and F1 0.072). Pedicel is 2.1 times as long as broad while F1 is 1.4 times as long as broad. Flagellar segments stout-filiform.

Mesosoma (Fig. 1A, 1D & 1E): Pronotum coriaceous and mesosoma and scutellum imbricate strigulate. Median length of pronotum longer than median length of scutellum; mesoscutum longer than pronotum and scutellum; scutellum as wide as long. Notauli complete. Propodeum declining sharply, with a median shallow depression, anteriorly delimited by oblique cross carinae diverging from the middle of base. Surface of depression rugulose with each rugae boarded by short wavey or circular carinae; area above the fovea rugulose with a short carinae bordering each rugae, spiracle round shaped having white setae rising from pits to the lateral side; Forewing length 1.86x length of SMV; PMV absent; costal cell (CC) with minute pilosity; basal 1/3 of forewing bare. SMV having 15 bristles in row; MV broad and distinctly longer than STV. MV 2.2 times STV. Rusty infuscation extends beyond the posterior margin of MV. The infuscation is wider than long (length 0.065mm and width 0.13mm). Hind tibia with a series of setae and prominent spur at apex, tarsal segments in ratio 0.118: 0.069: 0.054: 0.038: 0.035.

Metasoma (Fig. 1A): Gaster strongly compressed, its surface smooth and shiny; T3 longest. Gaster shorter than thorax.

Male: Length 1.5mm. Similar to female in general except in having: yellow colour; antenna with four funicular segments and one club; gaster small with sooty brown to black patches medially on T1 and T4; setaceous with setae raising from dark pits. 13 bristles on SMV and four round sensilla on stigma vein; petiole 4.4x longer than broad.

Host: Syconia galls of *Ficus virens* Aiton.

Etymology: 'wayanadensis' derived from the name of the place of collection of the specimen, Wayanad.

Comments: Antenna pedicel always longer than F1; POL 1.02× OOL distance; Anterior width of head 1.4× length; Eyes slightly longer than wide; scape length is 2× length of pedicel; median length of pronotum longer than the median length of scutellum; Propodeum anteriorly delimited by oblique cross carinae diverging from the middle of base. Surface of propodeal fovea rugulose with each rugae boarded by short wavey or circular carinae. MV 2.2 times STV. T3 longest.

S. wayanadensis sp. nov. is different from all the other *Sycophila* species with above mentioned combination of characters. It shares similar character with *S. benghalensis* in having antennal pedicel always longer than F1; Anterior width of head 1.4× length and differs from it in having these combination of characters, like, POL 1.02× OOL distance (POL 1.5× OOL in *S. benghalensis*); scape length is 2× length of pedicel (2.44× in *S. benghalensis*); median length of pronotum larger than the median length of scutellum (length of pronotum shorter than length of scutellum in *S. benghalensis*); Surface of propodeal fovea rugulose with each rugae boarded by short wavey or circular carinae (Surface of propodeal fovea smooth in *S. benghalensis*).

***Sycophila batheri* sp. nov.**

(Figure 155 - 159)

Material examined: *Holotype.* ♀, INDIA: Kerala, Wayanad district, 11.887N 76.0687E; 11.9388N 76.0747E; 11.9673N 76.0642E; 11.9202N 76.0915E; 11.68282N 76.26623E; 11.7216N 76.3545E; 11.6404N 76.354E; 11.5945N 76.3561E; 11.7705N 76.2996E; 11.7439N 76.2271E, collected by Shilpa K. Satheesan, ex *Ficus virens* Aiton.

Description: Female. *Holotype.* Length 1.7mm. General colour brownish yellow; with propodeum and median area of gaster brown. Wings semi hyaline with area below costal cell bare, veins brown with rusty brown patch adjoining the dark infuscation; Antennal scape and pedicel yellow and funicle brownish yellow.

Head (Fig. 1B & 1C): Head faintly imbricate strigulate with pubescence; Head width (anteriorly) 1.1x distance between front ocellus and clypeal margin, with POL 1.01x OOL. Eyes 1.15x longer than wide (width 0.151 to length 0.174). Malar space 0.118mm. Scrobe deep, not reaching front ocellus; Scrobe is 0.031mm from front ocellus; clypeal

margin bilobed; Malar groove complete. Antennal formula 11153; scape not reaching front ocellus; Pedicel longer than F1 (Pedicel 0.065mm and F1 0.047). Pedicel is 1.8 times as long as broad while F1 is 1.2 times as long as broad. Flagellar segments stout-filiform.

Mesosoma (Fig. 1A, 1D & 1E): Dorsum of thorax with faintly imbricate strigulate and pubesent; Median length of pronotum distinctly shorter than half the median length of scutellum; mesoscutum little shorter than scutellum; scutellum longer than wide. Notauli complete. Propodeum declining sharply, with a median shallow depression, which is carinate on sides, anteriorly delimited by oblique cross carinae diverging from the middle of base. Surface of depression slightly rugulose with several short carinae and depressions; area lateral to fovea mostly rugulose, spiracle circular having setae to the lateral side; Forewing length 2.2x length of SMV; PMV absent; costal cell (CC) with minute pilosity; basal 1/3 of forewing bare. SMV having 12 bristles in row; MV broad and distinctly longer than STV. MV 1.6 times STV. Rusty infestation extends beyond the posterior margin of MV. The infestation is wider than long (length 0.064mm and width 0.105mm); tarsal segments in ratio 0.098: 0.076: 0.047: 0.04: 0.056.

Metasoma (Fig. 1A): Gaster strongly compressed, its surface smooth and shiny; T5 longest. Gaster distinctly longer than thorax.

Male: Unknown

Host: Syconia galls of *Ficus virens* Aiton.

Etymology: 'batheri' derived from the name of the place of collection of the specimen, Sulthan Bathery.

Comments: Antenna pedicel always longer than F1; POL 1.01× OOL distance; Anterior width of head 1.5× length; Eyes 1.15× longer than wide; scape length is 2.4× length of pedicel; median length of pronotum distinctly shorter than half the median length of scutellum; Propodeal fovea slightly rugulose with several short carinae and depressions. MV 1.6 times STV. T5 longest.

S. batheri sp. nov. is different from all the other *Sycophila* species with above mentioned combination of characters. It shares similar character with *S. benghalensis* in having antennal pedicel always longer than F1; median length of pronotum distinctly shorter than half the median length of scutellum; scape length is 2.4× length of pedicel and differs from it in having these combination of characters, like, POL 1.01× OOL distance (POL

1.5× OOL in *S. benghalensis*) ; Anterior width of head 1.5× length (head width is 1.4× length in *S. benghalensis*); MV 1.6 times STV (MV 3.75× STV in *S. benghalensis*); Propodeal fovea slightly rugulose with several short carinae and depressions (Surface of propodeal fovea smooth in *S. benghalensis*).

***Sycophila tinctoria* sp. nov.**

(Figure 130 - 134)

Material examined: INDIA: Kerala, Wayanad district, 11.7221N 76.3795E; 11.7695N 76.3001E; 11.6648N 76.3426E; 11.9203N 76.0916E, collected by Shilpa K. Satheesan, ex *Ficus tinctoria* G. Forst.

Description: Female. *Holotype.* Length 1.9mm. General colour yellow; anterior part of head, lateral side of thorax, propodeum, petiole, T1, T2 and lateral and median portion of T3 black. Wings semi hyaline with area below costal cell bare, veins brown with rusty brown patch adjoining the dark infestation; antennal scape and pedicel yellow and funicle brownish yellow to greyish black at the ends.

Head (Fig. 1B & 1C): Head faintly strigulate with pubescence; Head width (anteriorly) 1.32x distance between front ocellus and clypeal margin, with POL 0.92x OOL. Eyes 1.1x longer than wide (width 0.196 to length 0.212). Malar space 0.103mm. Scrobe deep, not reaching front ocellus; Scrobe is 0.029mm from front ocellus; clypeal margin bilobed; Malar groove complete. Antennal formula 11153; scape almost reaching front ocellus; Pedicel almost equal to F1 (Pedicel 0.074mm and F1 0.072). Pedicel is 1.95 times as long as broad while F1 is 1.94 times as long as broad. Flagellar segments stout-filiform.

Mesosoma (Fig. 1A, 1D & 1E): Dorsum of thorax with irregular areolae sculpturing and pubesent; Median length of pronotum distinctly shorter than half the median length of scutellum; mesoscutum little longer than scutellum; scutellum longer than wide. Notauli complete. Propodeum declining sharply, with a median shallow depression, anteriorly delimited by oblique cross carinae diverging from the middle of base. Surface of depression irregularly reticulate with short carinae bordering these reticulations; area above the fovea mostly impricate with a short carinae, spiracle circular having setae rising from lateral side; Forewing length 2.06x length of SMV; PMV absent; costal cell (CC) with minute pilosity; basal 1/3 of forewing bare. SMV having 12 bristles in row; MV broad and distinctly longer than STV. MV 2.1 times STV. STV with four sensilla. Rusty infuscation extends beyond the posterior margin of MV. The infuscation is longer than

wide (length 0.0124mm and width 0.106mm); tarsal segments in ratio 0.091: 0.047: 0.056: 0.04: 0.04.

Metasoma (Fig. 1A): Petiole as long as broad; gaster strongly compressed, its surface smooth and shiny; T4 longest. Petiole 1.12x wider than long; Gaster as long as thorax.

Male: Length 1.2mm. Colour yellow, T4 posteriorly black and T5 anteriorly black. Numerous setae coving the body. Similar to female in general except in having: antenna with four funicular segments and one club with three fused segments; petiole 3.26x longer than wide.

Host: Syconia galls of *Ficus tinctoria* G. Forst.

Etymology: 'tinctoria' derived from the name of host plant *Ficus tinctoria*.

Remarks: Colour variation of fully yellow-coloured individuals with black petiole observed. Dark patches on T1, T2 and T3 are also seen in yellow coloured in paratypes.

Comments: *S. tinctoria* sp. nov. differs from all other *Sycophila* species' in having these combination of characters – Pedicel as long as F1; POL 0.92× OOL; Anterior width of head 1.38× length between front ocellus and clypeal margin; median length of pronotum distinctly shorter than half the median length of scutellum; MV 2× STV; SMV having 12 bristles in row; pterostigma is longer than wide; propodeal fovea with large irregular reticulations each delimited with carinae.

S. tinctoria sp. nov. is similar to *S. gibbosa* sp. nov. in having Pedicel as long as F1; POL < OOL; similar eye length to malar space ratio, but differs in having anterior width of head 1.38× length between front ocellus and clypeal margin (head width 1.68× length in *S. gibbosa* sp. nov.); median length of pronotum distinctly shorter than half the median length of scutellum (length of pronotum distinctly longer than half the length of scutellum in *S. gibbosa* sp. nov.); MV 2× STV (MV 1.3× STV in *S. gibbosa* sp. nov.); SMV having 12 bristles in row (SMV having nine bristles in *S. gibbosa* sp. nov.); pterostigma is longer than wide (pterostigma wider than long in *S. gibbosa* sp. nov.); propodeal fovea with large irregular reticulations each delimited with carinae (propodeal fovea imbricate-reticulate and smooth in *S. gibbosa* sp. nov.).

Sycophila gibbosa sp. nov.

(Figure 135 - 139)

Material examined: INDIA: Kerala, Wayanad district, 11.7221N 76.3795E; 11.7695N 76.3001E; 11.6648N 76.3426E; 11.9203N 76.0916E, collected by Shilpa K. Satheesan, ex *Ficus tinctoria* G. Forst.

Description: Female. *Holotype.* Length 1.6mm. General colour yellow; Wings semi hyaline with area below costal cell bare, veins brown with rusty brown patch adjoining the dark infestation; antennal scape and pedicel yellow and funicle yellow.

Head (Fig. 1B & 1C): Head faintly imbricate; Head as wide as length between front ocellus and clypeal margin, with POL 0.96x OOL. Eyes 1.08x longer than wide (width 0.203 to length 0.221). Malar space 0.113mm. Scrobe not reaching front ocellus; Scrobe is 0.036mm from front ocellus; clypeal margin bilobed; Malar groove complete. Antennal formula 11153; scape not reaching front ocellus; Pedicel almost equal to F1 (Pedicel 0.067mm and F1 0.066). Pedicel is 1.52 times as long as broad while F1 is 1.13 times as long as broad. Flagellar segments stout-filiform.

Mesosoma (Fig. 1A, 1D & 1E): Dorsum of thorax coriaceous and imbricate; Median length of pronotum distinctly longer than half the median length of scutellum; mesoscutum longer than scutellum; scutellum wider than long. Notauli complete. Propodeum declining sharply, with a median shallow depression, which is carinate on sides, anteriorly delimited by oblique cross carinae diverging from the middle of base. Surface of depression reticulate and smooth; area lateral to fovea reticulate with a short carinae or short costula, plica present, spiracle bean shaped having setae rising from black pits to the lateral side; Forewing length 2.26x length of SMV; PMV absent; costal cell (CC) with minute pilosity; basal 1/3 of forewing bare. SMV having nine bristles in row; MV broad and distinctly longer than STV. MV 1.31 times STV. Rusty infuscation extends beyond the posterior margin of MV. The infestation is wider than long (length 0.074mm and width 0.098mm); tarsal segments in ratio 0.078: 0.072: 0.07: 0.044: 0.048.

Metasoma (Fig. 1A): Petiole as 1.77x wider than long; gaster strongly compressed, its surface smooth and shiny; T4 distinctly longest. Gaster little longer than thorax.

Male: Length 1.2mm. Colour yellow. Similar to female in general except in having: antenna with four funicular segments and one club with three fused segments; SMV with 10 setae and four sensilla at the end of stigma vein.

Host: Syconia galls of *Ficus tinctoria* G. Forst.

Etymology: 'gibbosa' derived from the name of the variety gibbose of the host plant *Ficus tinctoria*.

Comments: *S. gibbosa* sp. nov. is similar to *S. tinctoria* sp. nov. but differs from it and all other *Sycophila* species' in having these combination of characters – Pedicel as long as F1; POL 0.96× OOL; Anterior width of head 1.68× length between front ocellus and clypeal margin; median length of pronotum distinctly longer than half the median length of scutellum; MV 1.3× STV; SMV having nine bristles in row; pterostigma is wider than long; propodeal fovea with imbricate-reticulate and smooth.

FAMILY PTEROMALIDAE

Pteromalini Dalman, 1820. Type genus: *Pteromalus* Swederus, 1795. Treated as Pteromalidae by Walker (1834).

Diagnosis: Antenna with 12 flagellomeres in nearly all cases (except in some fig associates), including a small 4th clavomere; with at least 5 funiculars, and if with 5 then with 2 or more anelli. Eyes not ventrally divergent. Clypeus subquadrate and without ventral transverse groove. Labrum flexible and hidden behind clypeus. Mandibles with 3 or 4 teeth each (except in some fig associates (1–3 teeth). Subforaminal bridge with postgena separated by lower tentorial bridge; posterior surface of the head without postgenal lamina or postgenal groove. Mesoscutellum with frenum indicated at least laterally, with axillular sulcus (except in some fig associates). Mesopleural area without an enlarged acropleuron. All legs with 5 tarsomeres; protibial spur stout and curved; basitarsal comb longitudinal. Gaster, while sometimes rigidly convex, not strongly sclerotized; metasomal apex in most species with a syntergum and therefore without an epipygium (except in some fig associates).

Subfamily Pteromalinae

Diagnosis: Antennal nearly always with 12 flagellomeres (exceptions: some Otitesellini, *Amphidocius* Dzhanokmen, *Termolampa*). Mandibles usually not falcate. Scapula not anteriorly exposed by pronotum. Notauli usually incomplete, but if complete then clypeus with median tooth or teeth, propodeum with plicae, or petiole distinct and not strongly transverse. Axillula usually not enlarged, but if enlarged then not convex. Fore wing with marginal vein usually slender, if distinctly thickened, then mandibles not falcate. Petiole simple or with small anterolateral processes.

Tribe Otitesellini

Otitesellini Joseph, 1964. Type genus: *Otitesella* Westwood, 1883.
Sycoryctini Wiebes, 1966 new synonymy. Type genus: *Sycoryctes* Mayr, 1885.
Sycoecini Hill, 1967 new synonymy. Type genus: *Sycoecus* Waterston, 1914.

Diagnosis. Antenna with 10 or 11 or 12 flagellomeres. Notauli mostly complete. Propodeal spiracle usually separated from the anterior propodeal margin by about their own length, or more (except *Marginalia*, some *Walkerella* and *Robertsia*). Males usually

apterous (except in most members of previous Sycoecinae, some *Watshamiella* Wiebes, and *Sycoryctes* Mayr).

Subtribe Otitesellina

The females of this group are recognizable by their dark colour with bluish or greenish gloss, reticulate body sculpture, gaster tapering posteriorly and ovipositor and its sheaths exerted slightly outward. Males are recognizable by the position of their antenna which is behind the anterior one third of the head and wide apart.

KEY TO GENUS OF OTITESELLINA, MODIFIED FROM BOUČEK, 1988

1 Female ---------- 2

− Male ---------- 6

2 Notauli complete, post marginal vein much shorter than the stigma; Propodeum long ---------- ***MARGINALIA***

− Notauli very weak and shallow, often partly obliterated; propodeum different ------ 3

3 Antenna with 3 short anelli ---------- 4

− Antenna with 2 anelli ---------- 5

4 Clypeal margin with narrow median emargination, Margins of the second and third tergites excised ---------- ***MICRANISA***

− Clypeal margin with wide median emargination, Margins of second and third urotergites incised ---------- ***PHILOSYCELLA***

5 Clypeal margin with median tooth; margin of gastral tergites 2 and 3 shallow or indistinct excisions ---------- ***OTITESELLA***

− Clypeal margin with small median emargination; tergites 2 and 3 usually deeply excised ---------- ***WALKERELLA***

6 Antenna are inserted almost at the middle of head and their toruli are separated only by a narrow ridge ---------- ***PHILOSYCELLA***

− Antenna are lateral and toruli separated at least by a distance equal to its diameter -- 7

7 Head and pronotum very large, with enormous mandibles ---------- 8

− Head not unusually large, pronotum not expanding forward; mandibles not so oversized; last segment of hind tarsus often greatly inflated ---------- ***OTITESELLA***

8 Antennal toruli close to each other, or about as much apart as distant from eyes; clypeal margin emargination with small median tooth or tubercle ---------- ***WALKERELLA***

− Toruli far apart, much closer to eyes than to each other; clypeal margin emargination without tooth ---------- ***MICRANISA***

MARGINALIA Priyadarsanan

Marginalia Priyadarsanan, 2000; Type species: *Marginalia religiosa* Priyadarsanan

Diagnosis: Head as wide as the thorax. The appendage of the cybarium is not forked; labial palpus long, narrow and unisegmented. Antenna is different in general appearance, only two anelli present. Mandible is bidentate. Notauli are complete but shallow, especially the proximal half. Marginal veins of the forewing unusually thick and postmarginal vein reduced. The gaster is straight and the tergites have straight margins. Dorsally visible pronotum; complete notauli; relatively long propodeum compared with other genera.

Marginalia religiosa Priyadarsanan, 2000

(Figure 178 - 180)

Materials Examined

INDIA, Wayanad, Kerala, 11.71986N 76.32443E; 11.6622N 76.3304E; 11.6406N 76.303E; 11.8552N 76.1134E; 11.9556N 76.0668E; 11.7685N 76.2885E, 14.I.2019, collected by Shilpa K. Satheesan, ex *Ficus religiosa* L.

Diagnosis: ***Female***. Length 1.5 mm. General colour iridescent green with brown, legs except coxa pale yellow; Head with pubescence; Head wider than long; toruli placed in level with anterior margin of eye; inter toruli distance 0.3 times toruli to inner eye distance. Scrobe not reaching median ocellus. OOL 4 times POL. Antenna 11 segmented, antennal formula 11243; scape 6 times its width, 2.5 times length of pedicel. Mandible

monodentate. Pronotum distinctly visible dorsally, short and wide; scutum longer than scutellum; notauli complete, distinct; Fore wing, marginal vein broad, 0.2 times its length, post marginal vein reduced. Fore coxa 1.5 times its width and 2 times combined length of femur and trochanter, tibia with one long subapical ventral spur. Hind coxa 2 times its width, as long as femur with four long setae, tibia with two ventral spurs. Gaster as long as the length of head and thorax combined. Exerted ovipositor sheath 0.3 times gaster.

Male: Unknow; not recorded in the present collection.

Host: Syconia galls of *Ficus religiosa* L.

MICRANISA Walker

Micranisa Walker,1875:18. Type species: *Idarnes pteromaloides* Walker
Sycobiella Westwood,1883:33. Type species: *Sycobiella saundersii* Westwood
Epicolystichus Girault,1915:285. Type species: *Epicolystichus aereicorpus* Girault

Diagnosis: This genus is very close to *Otitesella* and *Walkerella*. It is recognizable in female by the margins of 2nd and 3rd urotergites which is straight and deeply incised; the antenna has 3 anelli, but it is often difficult to see; the clypeal margin has a median emargination. In male the Antenna are placed laterally, very close to the eyes.

KEY TO SPECIES OF *MICRANISA*, MODIFIED FROM PRIYADARSANAN, 2000

1 Female ---------- 2

− Male ---------- 4

2 The distance between the toruli longer than their distance to the inner margin of the compound eye ---------- ***M. claviscapa***

− Distance between toruli shorter than their distance to the inner margin of eyes ------ 3

3 Scape 2 times its width; OOL 4x POL ---------- ***M. ashtamudiensis***

− Scape 4 times its width; OOL 0.7x POL ---------- ***M. microcarpae*** sp. nov

4 Antennal scape tapering-proximad to the shape of a club ---------- ***M. claviscapa***

− Antennal scape with almost parallel sides ---------- ***M. ashtamudiensis***

Micranisa ashtamudiensis Priyadarsanan, 2000

(Figure 181 - 184)

Materials Examined

INDIA, Wayanad, Kerala, 11.9033 N 76.0619 E; 11.9556 N 76.0668 E; 11.9556 N 76.0668 E; 11.8888 N 76.1009 E; 11.6809 N 76.3813 E; 11.6898 N 76.2525 E, collected by Shilpa K. Satheesan, ex *Ficus talbotii* King.

Diagnosis: ***Female***. Length 1.2mm excluding ovipositor valve. General colour metallic green with bronzy tinge on thorax and abdomen; Eyes pink. Head with pubescence; Head distinctly wider than long; eyes 0.75 times length of gena. Antennal toruli almost in middle of the head; inter torular distance 0.75 times inner eye margin to toruli distance. OOL 4 times POL. Antenna 13 segmented, antennal formula 11353. Scape 2 times its width, twice the length of pedicel. Mandible tridentate. Pronotum not visible dorsally; notauli complete; scutum and scutellum subequal. Sub marginal, marginal, stigmal and post marginal vein of the forewing in 14:11:5:4 ratio. Gaster tergites slightly excised; Ovipositor and its valve short.

Male: Length 1 mm, including mandibles. Head, mesosoma, metasoma, wing remnants and all legs yellow; Head wider than long; Eyes 0.5 times the length of head. Antenna placed near the posterior margin of the eye. Inter torular distance 7 times toruli to inner eye distance. Long thick setae on posterior side of head. Antenna 8 segmented; Scape broad and flat, 2 times its width; 8^{th} segment is sucker shaped. Mandible as long as head, two apical and sub apical teeth. Pronotum large, 0.67 times its width; mesonotum 2 segmented, nearly half as long as pronotum; propodeum 0.25 times length of pronotum, metanotum clearly demarcated. Metasoma yellowish brown in colour, weakly sclerotized slightly longer than wide and depressed.

Host: Syconia galls of *Ficus talbotii* King.

Micranisa claviscapa (Joseph, 1957)

(Figure 170 - 173)

Synonyms: *Sycobiella claviscapa* Joseph, 1957

Materials Examined

INDIA, Wayanad, Kerala, 11.71441 N 76.32326 E; 11.72815 N 76.32313 E; 11.8274 E 76.09494 E; 11.7447 N 76.304 E; 11.6744 N 76.2979 E; 11.8718 N 76.1003 E collected by Shilpa K. Satheesan, ex *Ficus drupacea* Thunb.

Diagnosis: ***Female***. Length 1.7 mm. General coloue iridescent green mixed with blue; legs except coxa yellowish brown; Antenna smoky brown; Eyes pink. Head with pubescence; Head wider than long; Eyes 0.8 times length of head; gena 0.3 times eye length. Antenna placed in middle of the head, slightly anterior; inter torular distance longer than toruli to inner eye distance. Antenna 13 segmented, antennal formula 11353. Scape 4 times its own width and almost 2 times pedicel length. Mandible tridentate. Pronotum dorsally visible, 0.2 times length of scutum; scutum and scutellum subequal; propodeum narrow. Submarginal, marginal, stigma and postmarginal vein in 15:5:3:4 ratio. Fore coxa 2 times its width, 0.67 times femur and sub equal to tibial length; tibia with a long bifid ventral spur and two small dorsal teeth. Hind coxa bears a crown of long setae, 2 times as long as its width, slightly shorter than femur, tibia with a row of about 10 spines dorsally and two long spurs at the apex. Margin of 2nd and 3rd tergite excised; last segment with an acute bend; excreted ovipositor valve 0.3 times the length of gaster.

Male: Length 1.3–1.4 mm. Head, mesosoma, wing remnants and all legs, metasoma brownish yellow, distal half of the scape and rest of the antenna pale yellow. Head width 1.7x its length; subrectangular; eye length 0.2 mm; Antenna located at posterior margin of eye; Inter toruli diatance 0.62mm; Scape length 2x its width. Mandible unidentate, bifid; Mandible length 3.2x its width. Mesosoma large. Pronotum subquadrangular, about 1.74× as wide as long; mesonotum, metanotum and propodeum combined 2× as wide as long, a little less than 0.75× as long as pronotum. Fore wing vestigial, punctiform, 0.6mm long with 6 setae. Metasoma yellow in colour weakly sclerotized slightly longer than wide and depressed.

Host: Syconia galls of *Ficus drupacea* Thunb.

***Micranisa microcarpae* sp. nov.**

(Figure 202 - 206)

Materials Examined

INDIA, Wayanad, Kerala, 11.7269N 76.3545E; 11.7201N 76.379E; 11.7156N 76.3772E, 18.III.2019, collected by Shilpa K. Satheesan, ex *Ficus microcarpa* L. f.

Description of female

Size and colour. Length 0.8mm. Metallic-green; Femur, tibia, tarsals yellow; antenna brownish yellow; Eyes and Ocelli pink. Head and thorax reticulate.

Head (Fig. 1B, 1C, 1D, 1F): Reticulate; Antenna located at the middle of the head; Antenna with subequal segments bearing single row of sensilla; Clypeal margin bilobed; scape almost reaching front ocellus; Eye 1.36x longer than wide; Malar sulcus present; Eye length 4.7x Malar space; Antennal formula 11353; Head 1.4x wider than long; Inter toruli distance 1.167x larger than diameter of toruli; torulus to inner eye margin length 1.54x inter torular diameter; scape 5.9x longer than wide; Pedicel 1.44x wider than long; Scape 4.6x pedicel; F1 1.04x pedicel length; POL 1.43x OOL.

Mesosoma (Fig. 1B, 1C, 1D, 1F): Thorax reticulate; Pronotum invisible dorsally and laterally present; Mesonotum 1.92x wider than long; Notauli complete; Scutellum as long as wide; Scutellum 1.06x longer than mesonotum; Propodeum like two triangular lateral halves jointed together medially and median area reduced. Wing with minimum pilosity; fringes with hairs; SMV 1.69x longer than MV; MV 1.9x STV; PMV is 1.05x longer than STV; MV 1.2x PMV. Fore leg coxa 1.8x its width; femur 4.2x its width; coxa 0.5x femur; tibia 6x its width; tibia 1.1x tarsal; Mid femur 5.5x wider; mid tibia 6x as wide; Mid tibia 1.1x tarsus; Hind tibia 6.3x as long as wide; Hind femur 4.3x longer than wide; femur and tibia almost equal length.

Metasoma (Fig. 1B, 1C, 1D, 1F): Abdomen reticulate, shiny; T1, T2, T3 median marginal area invaginated; T4 largest; ovipositor exerted outside. Gaster 1.55x longer than thorax; last six tergits with a single row of setae.

Male: Unknown

Host: Associated with the syconia galls of *Ficus microcarpa* L. f.

Etymology: 'microcarpae' derived from the name of host plant *Ficus microcarpa*.

Comments: This species is similar to *M. ashtamudiensis* Priyadarsanan but differs from it in having scape 4 times its width; OOL 0.7x POL in *M. microcarpae* while scape 2 times its width; OOL 4x POL in *M. ashtamudiensis*.

OTITESELLA Westwood

Otitesella Westwood, 1883:39-40. Type species: *Otitesella digitata* Westwood

Paracolystichus Girault, 1915:284. Type species: *Paracolystichus compressiventris* Girault

Diagnosis: The major characters of this genus are, the females the epistomal margin is with a median prominence, the antenna is 12 segmented with two anelli; the pronotum is short and usually visible only laterally; scutellum subcircular in outline. In males the scape is broad, tapering to its base, broadest beyond the middle; head usually slightly longer than broad; terga of the thorax almost completely free and pre-tarsi greatly inflated.

KEY TO SPECIES OF *OTITESELLA*, MODIFIED FROM PRIYADARSANAN, 2000

1 Female ---------- 2

− Male ---------- 5

2 Propodeum a little less than 3x as wide as long ---------- ***O. minima***

− Propodeum more than 10x as wide as long, medially reduced ---------- 3

3 Notauli complete ---------- ***O. virens*** sp. nov.

− Notauli incomplete ---------- 4

4 Gaster longer than the combined length of head and thorax ---------- ***O. digitata***

− Gaster shorter than combined length of head and thorax ---------- ***O. tsjahela***

5 Antenna without anellus ---------- 6

− Antenna with one anellus ---------- 7

6 Quadridentate mandible ---------- ***O. minima***

− Bidentate mandible ---------- ***O. digitata***

7 Tridentate mandible ---------- ***O. tsjahela***

− Bidentate mandible ---------- ***O. virens*** sp. nov.

Otitesella digitata Westwood, 1883

(Figure 174 - 177)

Synonyms: *Terastiozoon incompletum* Joseph, 1961; *Walkerella incompleta* (Joseph, 1961)

Materials Examined

INDIA, Wayanad, Kerala, 11.71986N 76.32443E; 11.6622N 76.3304E; 11.6406N 76.303E; 11.8552N 76.1134E; 11.9556N 76.0668E; 11.7685N 76.2885E, 14.I.2019, collected by Shilpa K. Satheesan, ex *Ficus religiosa* L.

Diagnosis: ***Female***. Length 1.14mm. General metallic green with brownish colour on the abdomen; Body reticulates except propodeum and abdomen smooth, but imbricate; Head with pubescence; Head width 1.35x distance between front ocellus and clypeal margin, with POL 1.07x OOL. Eyes as 1.24x long as wide. Antennal formula 11253; Malar space distinct, 1.26x eye length; Mesosoma smooth with little pubescence. Pronotum invisible dorsally. Mesoscutum 1.3x as long as scutellum. Notauli incomplete. Scutellum wider than long. Propodeum smooth medially reduced and lateral halves triangular joining medially. Wings: Fore wing hyaline, 2.25× as long as wide; Metasoma smooth and shiny. Gaster 1.3x longer than thorax.

Male: Length 1mm. General dark brown colour with scape, Antenna yellow; scape broad; Pronotum, legs yellow, abdomen dark brown; Head 1.16x wider than long; frons with fine engraved striation; eye long, 1.66× as long as wide; Antenna located middle of the head; Mandible bidentate; Mesosoma large. Pronotum subquadrangular, about 1.48× as long as mesonotum, metanotum and propodeum combined. Fore wing vestigial, nearly invisible, punctiform. Metasoma brown in colour weakly sclerotized slightly shorter than thorax and depressed.

Host: Syconia galls of *Ficus religiosa* L.

Otitesella minima Joseph, 1957

(Figure 185 - 189)

Synonyms: *Terastiozoon sanctijohani* Joseph, 1957

Materials Examined

INDIA, Wayanad, Kerala, 11.887N 76.0687E; 11.9388N 76.0747E; 11.9673N 76.0642E; 11.9202N 76.0915E; 11.68282N 76.26623E; 11.7216N 76.3545E; 11.6404N 76.354E;

11.5945N 76.3561E; 11.7705N 76.2996E; 11.7439N 76.2271E, collected by Shilpa K. Satheesan, ex *Ficus virens* Aiton.

Diagnosis: ***Female***. Length 1.3mm. Iridescent green and blue; eyes pinkish; Antenna smoky brown; coxa of fore and mid legs and coxa and femur of hind legs iridescent green; Head with pubescence; Head width 1.25x distance between front ocellus and clypeal margin. Eyes as 1.6x long as wide. Dorsum of the head behind the antennal toruli with a V shaped furrow. Antenna 12 segmented, Antennal formula 11253; Mandible 1.5x as long as wide, tridentate. Mesosoma smooth with little pubescence. Mesonotum 1.5× as wide as long. Notauli incomplete. Scutellum wider than long. Propodeum smooth medially reduced and lateral halves triangular; 3x as wide as long. Wings: Fore wing hyaline, 2.2× as long as wide, SMV 2x MV; marginal vein a little longer than post marginal vein; Stigmal vein longer than the half the length of PMV. Metasoma smooth and shiny. Gaster 1.8x longer than wide. Ovipositoe valve and ovipositor a little projecting beyond the posterior end.

Male: Length 1.2–1.4 mm. Head rusty yellow brown; mandibles pale reddish brown; antennal scape yellowish brown, rest of Antenna pale yellow; eyes black; thorax, propodeum, legs and abdomen yellowish brown. Head 1.3x wide as long, subrectangular; frons with fine engraved striation; dorsum of head with a triangular furrow with numerous long and short macrochetae; eye as long as wide; Antenna ten segmented, Antennal formula 11152; Mandible large and massive, 2x as long as wide. Mesosoma large. Pronotum subquadrangular, about 2× as wide as long. Metasoma sub depressed, 1.5x as long as wide.

Host: Syconia galls of *Ficus virens* Aiton.

Otitesella tsjahela **Priyadarsanan, 2000**

(Figure 190 - 193)

Materials Examined

INDIA, Wayanad, Kerala, INDIA, Wayanad, Kerala, 11.9638N 76.0912E; 11.9166N 76.0981E; 11.8553N 76.1149E; 11.8286N 76.0748E; 11.6439N 76.433E; 11.6064N 76.364IE; 11.7016N 76.2425E, collected by Shilpa K. Satheesan, ex *Ficus tsjakela* Burm.f.

Diagnosis: ***Female***. Length 1.3mm. Iridescent green, legs except coxa brown; Head with pubescence; Head width 1.3x distance between front ocellus and clypeal margin. Eye 0.67

times length of head and 3 times the length of gena. Antennal toruli placed at a distance equal to 0.3 times the length of head; Inter torular distance 0.25 times torular inner eye distance. OOL: 0.2 POL. Antennal formula 1 1 2 5 3; scape 4 times its width and 2.5 times as long as pedicel; Mandible tridentate. Pronotum almost fully concealed by the mesonotum except along its lateral edges; scutum not well defined, notauli very shallow and visible only in anterior half; scutellum as long as the scutum and slightly shorter than its width. Fore wing submarginal, marginal, stigmal and post marginal veins in the ratio 10: 4: 2: 3. Gaster normal.

Male: Length 1mm. Head, mesosoma, metasoma, wing remnants and all legs yellow; Subquadrate, slightly longer than wide; Eyes 0.3 times its length. Antenna placed wide apart; Inter toruli distance 1.75 times toruli to inner eye distance. Antenna 8 segmented; scape flat, tapering to its base and almost 4 times the length of pedicel; 2nd and 4th funicular segments smaller. Mandible quadridentate - one apical tooth, one subapical and two towards the middle; apical tooth bifid. Pronotum 0.6 times its width; length of pronotum, mesonotum and metanotum-propodeum in the ratio 13: 5: 5; mesonotum narrower than the pronotum and propodeum; wings rudimentary. Claspers with 4 claws.

Host: Syconia galls of *Ficus tsjakela* Burm.f.

***Otitesella virens* sp. nov.**

(Figure 207 - 211)

Materials Examined

INDIA, Wayanad, Kerala, 11.887N 76.0687E; 11.9388N 76.0747E; 11.9673N 76.0642E; 11.9202N 76.0915E; 11.68282N 76.26623E; 11.7216N 76.3545E; 11.6404N 76.354E; 11.5945N 76.3561E; 11.7705N 76.2996E; 11.7439N 76.2271E, collected by Shilpa K. Satheesan, ex *Ficus virens* Aiton.

Description of female

Size and colour. Metallic-green; scape, tibiae, tarsi yellowish-brown; pedicel and flagellum dark brown. Total length excluding ovipositor valves 1.2 mm. eyes and ocelli pink; wings hyaline. Body reticulate, Gastral tergites smooth, metallic green colour, three terminal tergites with transverse row of long setae.

Head (Fig. 1B, 1C, 1D, 1F). Head distinctly reticulate; Oval, 1.7 times wider than long. Eye 1.38 times longer than wide. Cheek length 0.2 times eye length. POL 3 times OOL. TE 0.6 times scrobe length. Distance between inner margin of eye 3.8 times torulus-eye distance; Inter torular diameter 1.75 times toruli width; Distance between torulus and inner eye margin 1.5× inter-torular distance. Antenna inserted close together, approximately at middle of the head. Antennal formula 11253. Scape cylindrical, 4× as long as wide, 2.6× as long as pedicel, almost reaching median ocellus. Pedicel 1.7× as long as its maximum width. First two flagellar segments forming two distinct anelli; Funicular segments symmetrical, clearly separated, subequal in length and width, with trichoid sensilla arranged in single whorls; first funicular segment 1.4× as long as wide and 0.8× as long as pedicel; clava clearly three segmented fused to form club; Malar space 0.3× length of compound eye, malar sulcus distinct. Clypeal margin with medial tooth (Fig. 10); Mandible tridentate (Fig. 11), 1.3 times longer than wide; Two sub equal labial palp segments present; four maxillary palp segments present (Fig. 12).

Mesosoma (Fig. 1C, 1E). Reticulate. Pronotum is short and only laterally visible, almost invisible medially. Mesoscutum 1.76 times as wide as long. Notauli complete. Scutellum as long as wide. Propodeum (Fig. 1E) recticulate, medially converges at a point, forming two horizontal, smooth, triangular lateral halves (Fig. 13); spherical propodeal spiracles. Wings: Fore wing hyaline, Forewing 1.8 times as long as wide, fringes on apical margin (Fig. 1H); Submarginal vein with 6 widely placed setae, 18 closely placed setae on marginal and post marginal vein combained; Sub-marginal vein 2.3 times marginal vein; Marginal vein 1.9 times stigma vein, 1.3 times post marginal vien; stigmal vein with four rounded sensilla distally. Hind wing 3.3× as long as wide. Femur 3.6 times longer than wide; 0.68× length of femur; tibia 2.4 times as long as tarsus; tarsel segments almost subequal. Mid-tibia 2.4 times as long as first tarsel segment; tarsel segments almost in 9:4:3:2:2 ratio. Hind leg: Femur 3 times longer than wide; tibia 4 times as long as wide and almost as long as femur; hind-tibia 2.3 times as long as first tarsel segment; tarsel segments almost in 5: 2: 2: 1: 1 ratio.

Metasoma (Fig. 1G). 1.5 times longer than mesosoma, with transverse row of setae. 3.4 times longer than wide, and curved downwards, ovipositor sheath protruding (Fig. 16). Ovipositor sheath 0.2 times longer than metasomal length, length of ovipositor

(protruding ovipositor sheath) 1.2 times length of ovipositor sheath, 0.23 times metasomal length.

Description of male

Size and colour. Length 1.03 mm. Head, mesosoma, wing remnants and all legs, metasoma yellow; mandibles reddish-brown; antennal scape, pedicel and basal three flagellar segments pale yellow; eyes pinkish red.

Head (Fig. 2A, 2D). Head almost same length to width, sub-rectangular; frons with fine engraved striation; Eyes small; eye long, 1.7× as long as wide; Antenna located above the posterior eye margin; the distance between toruli 1.7× minimum distance to inner margin of eye and barely 0.5× diameter of torulus. Antennal formula 11053; scape gradually widening distally, about 1.8× its maximum width; pedicel 1.6× as long as wide, flagellum without anellus, five almost subequal funicular segments, and three claval segments forming a club 1.7× its maximum width. Mandible large, considerably long, unidentate with very sharp tip. Malar sulcus absent.

Mesosoma (Fig. 2B). Prothorax large. Pronotum about 2.3× as wide as long; mesonotum 1.3× as wide as long, scutellum (metanotum) 3.3× as wide as long and propodeum 3.5× as wide as long. Fore wing vestigial, punctiform with a long seta. Fore wing stub 0.5x fore coxa length; Fore coxa 1.8× as long as wide; Mid coxa 2.2× long as wide; femur 4.2× long as wide; tibia with numerous setae. Hind coxa 4.3× as long as wide; femur 2.6× as long as wide; tibia as long as femur, 2.5× as long as wide, with a long spur; tarsus 0.88× tibia, last tarsal segment large and inflated with 2× longer than wide; its 3.2x longer, 3x wider than other tarsal segments combined.

Metasoma (Fig. 2C). Gaster yellow in colour weakly sclerotized and nearly half the length of thorax.

Host: Associated with the syconia galls of *Ficus virens* Aiton.

Etymology: 'virens' derived from the name of host plant *Ficus virens*.

Comments: *O. virens* sp. nov. is similar to *O. minima* Joseph but differs from it in having a medially reduced propodeum which is 10x shorter than the propodeum width (propodeum 3x as wide as long in *O. minima*).

PHILOSYCELLA Abdurahiman & Joseph

Philosycella Abdurahiman and Joseph, 1976; Type species: *Philosycella wiebesina* Abdurahiman and Joseph

Diagnosis: Females of this genus can be recognized by a comparatively longer gaster and the margins of 2nd & 3rd urotergites deeply incised on the dorsal side. In males, antenna is 11 segmented with 1 anellus and placed in the middle of the head and the inner margins of their toruli and only by a narrow ridge; the mandible is long, falcate and unidentate.

Philosycella wiebesina Abdurahiman and Joseph, 1976

(Figure 194 - 197)

Materials Examined

INDIA, Wayanad, Kerala, 11°30.796′N, 76°01.089′E, 23.IV.2019 collected by Shilpa K. Satheesan, ex *Ficus arnottiana* (Miq.) Miq.

Diagnosis: ***Female***. Length 1.5mm. Iridescent green, blue colour; legs except coxa yellow; Antenna rusty brown; eyes pink; Head reticulate with pubescence; Head width 1.4x distance between front ocellus and clypeal margin. Eyes as 1.6x wider than long. Antennal toruli close to each other; Antennal formula 11353; Mandible 1.4x long as wide, tridentate. Mesosoma reticulate with little pubescence. Pronotum 3× as long as wide. Mesoscutum little wider than long. Notauli incomplete. Scutellum slightly wider than long. Propodeum smooth medially reduced and lateral halves triangular. Wings: Fore wing hyaline, 2.25× as long as wide, SMV 3.6x MV; PMV distinctly longer than MV and 1.5x STV; Distal end of STV with four sensilla. Metasoma recticulate; Ovipositor not excerted. Gaster 3x long as wide, depressed laterally.

Male: Length 1.5mm, including madibles. Generally pale yellowish brown; hind femora and eyes rusty brownish black. Head 1.5x wide as long; frons with fine engraved striation; eye long, 1.66× as long as wide; Antennal toruli close together at the middle of the head; Antennal formula 11153; Scape 1.5x as long as wide; Mandible long and slender, 3x as long as wide; Tridentate, apical tooth prominent. Mesosoma large. Pronotum subquadrangular, about 1.6× as wide as long; mesonotum 5x wide as long; metanotum and propodeum combined 3× as wide as long. Fore wing vestigial, punctiform with long spines. Metasoma yellow in colour 1.5x longer than wide and depressed.

Host Plant: Syconia galls of *Ficus arnottiana* (Miq.) Miq.

WALKERELLA Westwood

Walkerella Westwood, 1883:32–33. Type species: *Walkerella temereria* Westwood
Asemantoideus Girault, 1916: 483–484. Type species: *Asemantoideus dubius* Girault
Terastiozoon Grandi, 1921: 312–313. Type species: *Terastiozoon jacobsoni* Grandi

Diagnosis: Female. Body black with metallic green or blue lustre, with coxae and femora black or dark brownish with an iridescent tinge. Body including coxae robustly built and well sclerotized. Head and mesonotum finely punctate-reticulate. Antenna 12-segmented with two anelli. Antennal formula 11253. Fore wing with stigmal vein normal, diagonal, at an acute angle to the wing margin. Second and third tergites with posterior margins usually deeply excised medially.

Male. Head large, with large sclerotized mandibles. Antennal toruli either close to each other or about as far from each other as from torulus to eye; mesonotum, metanotum and propodeum fused together. Only forewing remnants present which is slender and with macrochaeta. Coxae unusually slender and long.

KEY TO SPECIES OF *WALKERELLA*, MODIFIED FROM PRIYADARSANAN, 2000

1 Female ---------- 2

– Male ---------- 3

2 POL 4.1× as long as OOL. Notauli incomplete. Scape 7× as long as wide. Stigmal vein with four rounded sensilla distally ---------- ***W. talboti***

– POL 3.67× as long as OOL. Notauli complete. Scape 6× as long as wide. Stigmal vein without sensilla ---------- ***W. kuruandensis***

3 Head with posterior transverse groove either not produced forward to the eye margins or shallow and narrowed towards dorsal margin of eyes ---------- ***W. talboti***

– Head with posterior transverse groove deepened and widened towards dorsal margins of eyes ---------- ***W. kuruandensis***

Walkerella kurandensis Bouček, 1988

(Figure 198 - 201)

Materials Examined

INDIA, Wayanad, Kerala, 11.7269N 76.3545E; 11.7201N 76.379E; 11.7156N 76.3772E, 18.III.2019, collected by Shilpa K. Satheesan, ex *Ficus microcarpa* L. f.

Diagnosis: ***Female***. Length 1.1mm; Head length 0.6 times its own width; Eyes 0.5 times as long as head and 1.5 times as long as the gena. Antennal toruli placed in the middle of the head; Inter torular distance 0.25 times distance between toruli and inner eye margin. POL 3.6 times OOL. Antenna 12 segmented, antennal formula 1 1 2 5 3; scape 6 times its width and 4 times as long as pedicel; funicular segments subequal. Mandible long, twice its maximum width, tridentate. Pronotum narrow, hardly 0.25 times the length of scutum; notauli complete; scutellum 0.75 times the length of scutum, its anterior margin slightly broader than the posterior margin of scutum; propodeum narrow. Fore wing hyaline; submarginal, marginal, stigmal and post marginal veins in the ratio 30: 15: 5: 7. Gaster longer than thorax.

Male: Length 0.94 mm. Head, mesosoma, metasoma, wing remnants and all legs yellow, Scape posterior half and funicles pale yellow, clava black; Head smooth, 1.2x wider than long, subrectangular; frons with fine engraved striation; eye long, 1.66× as long as wide; Antenna located middle of the eye; Antennal formula 11043; mandible large, unidentate; Mesosoma large. Pronotum subquadrangular, about 2.36x as long as mesonotum, metanotum combined; propodeum 1.34× as long as mesonotum, 0.57x as long as pronotum. Fore wing vestigial, nearly invisible, punctiform. Metasoma yellow in colour weakly sclerotized slightly longer than wide and depressed.

Host: Syconia galls of *Ficus microcarpa*

Walkerella talboti Shilpa & Santhosh, 2022

(Figure 212 - 216)

Materials Examined

INDIA, Wayanad, Kerala, 11°49.142′N, 076°06.108′E, 08.III.2016, collected by Shilpa K. Satheesan, ex *Ficus talboti* King., Deposited in Zoological Survey of India, Western Ghats Regional Centre, Calicut

Description of female

Size and colour. Length 1.1–1.3 mm. Head, mesosoma, and all coxae and femora black with iridescent blue, other parts of legs transparent yellow, metasoma black with distinct iridescent bluish-green tinge; eyes and ocelli greyish pink; antenna testaceous; antennal scape and pedicel brownish-yellow; wings hyaline. Body strongly sclerotized, surface reticulate, clypeal region strigulate, Gastral tergites smooth, black with metallic bluish green colour, three terminal tergites with transverse row of long setae.

Head (Fig. 1B, 1C, 1D, 1F). Head distinctly reticulate; Head 1.5× wider than long, in frontal view; eye longer than wide, about 1.3× as long as wide; POL 4.1× OOL; POL 4.9× median ocellus diameter; Antenna inserted close together, approximately at middle of the head. Lower clypeal margin (Fig. 1F) with a distinct deep inward emargination forming a median cleft; Clypeal region including the cleft strigulate, supraclypeal area reticulate and almost 2.5× as long as frons. Scrobes very shallow, never reaching median ocellus. Inter-torular distance 2× torular diameter; distance between torulus and inner eye margin 7× inter-torular distance. Antennal formula 11253. Scape cylindrical, 7× as long as wide, 3× as long as pedicel, almost reaching median ocellus; pedicel 1.7× as long as its maximum width; first two flagellar segments forming two distinct anelli; funicular segments symmetrical, clearly separated, subequal in length and width, with trichoid sensilla arranged in single whorls; first funicular segment 0.7× as long as wide and 0.5× as long as pedicel; clava clearly three segmented fused to form club 1.78× longer than maximum width; Malar space 0.36× length of compound eye, malar sulcus distinct. Mandible tridentate. Maxillary palpus (Fig. 1F) 4 segmented; labial palpus (Fig. 1F) 2 segmented.

Mesosoma (Fig. 1C, 1E). Reticulate-punctate. Pronotum 0.35× longer than wide, 0.72× as long as mesoscutum. Mesoscutum 0.57× as long as wide. Notauli incomplete, clearly visible in anterior half. Scutellum as long as wide. Propodeum (Fig. 1E) recticulate-punctate, with three carina, a median and 2 sub-lateral carinae; spherical propodeal spiracles. Wings: Fore wing hyaline, 4.43× as long as wide (Fig. 1H); relative measurement of submarginal, marginal, postmarginal, stigmal veins approximately in a ratio of 19:9:5:4. Submarginal vein with 3 widely placed setae; marginal vein, 2.5× longer than stigma vein, with 3 setae; postmarginal vein with 4 setae; stigmal vein (Fig. 1H) with four rounded sensilla distally. Hind wing 3.26× as long as wide, sub marginal vein 1.2× times marginal vein. Fore leg with coxa 2.4× long as wide; femur 2.57× long as wide, widest in the middle; tibia slightly longer than coxa, 0.77× length of femur, 3.4× long as

wide, distally with a spine on dorsal side. Mid leg with coxa 1.4× as long as wide, femur 4× as long as wide, widest in middle; tibia long 8.3× as long as wide, about 1.2× length of femur, with numerous setae and a long apical spur and a small spine; tarsus about 0.75× length to femur, 0.63 length of tibia; basal tarsomere 0.36× length of tarsus and shorter than following three tarsomeres combined. Hind leg: Coxa 2.4× longer than wide; femur 2.9× longer than wide and 1.24× as long as coxa; tibia 3.8× longer than wide and almost as long as femur, tibia with 2 subapical ventral spurs; tarsal segments in ratio of 5:4:3:2:1.

Metasoma (Fig. 1G). Little longer than mesosoma. posterior margin of tergites 2 and 3 deeply incised in the middle, three terminal tergites with transverse row of long setae. Ovipositor sheath slightly protruding.

Description of male

Size and colour. Length 1.2–1.4 mm. Head, mesosoma, wing remnants and all legs yellow, metasoma black; mandibles reddish-brown; antennal scape yellow, pedicel and basal three flagellar segments brownish yellow, remainder smoky black; eyes black.

Head (Fig. 2A, 2D). Head almost same length to width, subrectangular; frons with fine engraved striation; eye long, 1.66× as long as wide; supraclypeal area smooth, raised into a median ridge-like raised area, with lateral carina on either side reaching mandibular base; clypeus depressed, with short setae and two long setae; Antenna inserted close together near middle of head, the distance between toruli 0.18× minimum distance to inner margin of eye and barely 0.5× diameter of torulus. Antennal formula 11152; scape gradually widening distally, sub-clavate, about 2.8× its maximum width; pedicel 2× as long as wide, flagellum with one small anellus, five almost subequal funicular segments, and two claval segments forming a club shorter than 2× its maximum width. Mandible large, considerably long, tridentate with very sharp tip. Malar space 0.3× length of compound eye. posterior transverse groove on head deep but shallows and narrows as it prolonged forward to eye.

Mesosoma (Fig. 2B). Prothorax large. Pronotum subquadrangular, about 1.3× as wide as long; mesonotum, metanotum and propodeum combined 1.7× as wide as long, a little less than 0.7× as long as pronotum. Fore wing vestigial, nearly invisible, punctiform. Fore leg: coxa as long as wide, with 5 short bristles; femur 2.36× as long as wide; tibia little shorter than femur, 4.4× as long as wide, with 10 odontoid spines on posterior lateral margin; tarsus 0.57× long as tibia, four tarsal segments subequal in length. Mid leg: coxa

1.87× long as wide; femur 2.4× long as wide; tibia almost as long as femur, with numerous setae, 2 apical spurs; tarsus 0.7× length of tibia. Hind leg: Coxa 4.8× long as wide; femur almost as long as coxa and 3× as long as wide; tibia 1.15× as long as femur, 6.67× as long as wide, with a long spur; tarsus 0.58× tibia, four tarsal segments in almost in ratio of 11:14:9:8.

Metasoma (Fig. 2C). Gaster black in colour weakly sclerotized slightly longer than wide and depressed.

Host: Syconia galls of *Ficus talbotii* King

Subtribe Sycoryctina

Diagnosis: It is characterized in the females by the undivided scutellum and long extruding ovipositor valves covered by its extended last tergite wholly or for a greater part. Males with torulus on inner side slightly over roofed by a fold, as if base of antenna was pushed towards median line; second flagellar segment often unusually larger than the third.

KEY TO GENUS OF SYCORYCTINA, MODIFIED FROM BOUČEK, 1988

1 Female ---------- 2

− Male ---------- 5

2 Gastral tail formed only by ovipositor and its sheath, not by last tergite which is very short and bears distinct cerci on its sides; ventrally keeled thorax --------- ***APOCRYPTA***

− Tail dorsally, at least in basal half, covered by tubular extension of one or two terminal tergites; cerci very small or indistinct, situated at end of the narrowed last tergite, far behind gastral body; Thorax different ---------- 3

3 Gastral tail consisting of two or three parts, broader anterior part formed by two narrowed last tergites and posterior thin part consisting only of ovipositor and its sheaths; notauli complete, linear; antenna almost always with 3 anelli ---------- ***PHILOTRYPESIS***

− Tail undivided, thin, only base and apex usually appering a little thicker; whole length of ovipositor covered by thin epipygium; notauli incomplete, seen only in anterior half of scutum; Antenna with 2 anelli ---------- 4

4 Body metallic green, punctate; Antenna with single row sensilla, without hairs ---------- ***SYCOSCAPTER***

− Body iridescent blue, not punctate; Antenna with strong hairs raising from each segment, single row of sensilla ---------- ***ARACHONIA***

5 Head subcylindrical, very long, bare, with antennal toruli close to each other in one broad cavity; scape stout, cylindrical ---------- ***APOCRYPTA***

− Head more or less flattened, different from above; scape usually strongly flattened and closely applied to head surface ---------- 6

6 Both Antenna in a common broad cavity, toruli slightly apart, their inner margins low but separated in middle by a low keel; scape not flattened, flagellar segments regular; head posteriorly often with thin long bristles; hypostomal margin deeply distinctly emarginate in middle ---------- ***PHILOTRYPESIS***

− Antenna not in common cavity, toruli close or apart; scape usually flattened and enlarged, adpressed to head surface; hypostomal margin at most shallowly emarginate in middle; second flagellar segment often unusually larger than third ---------- ***SYCOSCAPTER***

APOCRYPTA Coquerel

Apocrypta Coquerel,1885:367. Type species: *Apocrypta perplexa* Coquerel
Goniogaster Mayr, 1885:157-240. Type species: *Goniogaster varicolor* Mayr
Agaonella Baker, 1913:72. Type species: *Agaonella larvalis* Baker
Idarnoides Girault,1913:100. Type species: *Idarnoides channingi* Girault
Goniogastrella Girault and Dodd, 1915:286. Type species: *Goniogastrella caudatus* Girault

Diagnosis: This genus is easily recognizable by their ventrally keeled gaster of the females. scutellum in dorsal view is without any lateral (axillular) grooves, marginal vein much longer than the stigmal; gaster compressed from side to side. In the male head is

subcylindrical and long; antennal toruli close to each other in a common cavity and scape is stout and cylindrical.

KEY TO SPECIES OF *APOCRYPTA*, MODIFIED FROM PRIYADARSANAN, 2000

1 Female ---------- 2

− Male ---------- 4

2 Antenna with two anelli; notauli incomplete or indistinct; body black colour ---------- ***A. bakeri***

− Antenna with three anelli; notauli complete and distinct; metallic green body ------- 3

3 Eyes wider than long; POL 0.43x OOL ---------- ***A. microcarpae*** sp. nov.

− Eyes longer than wide; POL 1.66x OOL ---------- ***A. westwoodi***

4 Head twice as long as wide ---------- ***A. westwoodi***

− Head 3 times as long as wide ---------- ***A. bakeri***

***Apocrypta bakeri* (Joseph, 1952)**

(Figure 223 - 227)

Synonyms: *Goniogaster bakeri* (Joseph, 1952); *Lipothymus bakeri* Joseph, 1952

Materials Examined

INDIA, Wayanad, Kerala, 11.68181N 76.27307E; 11.7411N 76.2407E; 11.8637N 76.0726E; 11.6049N 76.344E; 11°33.481′N, 76°59.34′E; 11.6391N 76.3044E, collected by Shilpa K. Satheesan, ex *Ficus hispida* L. f.

Diagnosis: ***Female***. Length 1.9mm including ovipositor valve. Iridescent green with yellowish-brown on ventral side; leg and scape brownish yellow, rest of Antenna sooty brown. Wing hyaline; Head with pubescence; Head wider than distance between front ocellus and clypeal margin. Eyes as long as wide. Malar groove complete, 0.85x eye length. Antennal formula 11253; Mandible bidentate; Mesosoma smooth with little pubescence. Pronotum distinctly wider than long. Notauli incomplete. Scutellum sub ovoidal, longer than wide. Propodeum 2.5x as wide as long, anterior margin faintly and posterior margin deeply emarginate, few setae posterior laterally. Wings: Fore wing

hyaline, 2.4× as long as wide; SMV 2x MV, 2.5x PMV; STV 0.5x PMV; Metasoma smooth and shiny, 2.5x long as wide. Sternites of T2 to T4 produces to form a keel like structure; ovipositor 3.3x as long as abdomen.

Male: Length 2.6 mm. Head, mesosoma, metasoma, wing remnants and all legs yellow; Head almost 3x as long as wide; frons with fine engraved striation; eye long, 1.66× as long as wide; Antenna inserted in anterior depression of head, three segmented; Mandible 2x as long as broad, bidentate; Mesosoma large. Pronotum elongated 2x as long as wide; metanotum and propodeum combined 2.1× as long as wide, with minute setae and punctulae. Fore wing vestigial, nearly invisible, punctiform. Metasoma a little over 3x as long as wide; eight segments with a papir of spiracles with large peritremes.

Host: Syconia galls of *Ficus hispida* L. f.

***Apocrypta westwoodi* Grandi, 1916**

(Figure 232 - 236)

Synonyms: *Apocrypta glomerata* (Joseph, 1953); *Lipothymus glomeratus* Joseph, 1953

Materials Examined

INDIA, Wayanad, Kerala, 11.7458N 76.2416E; 11.6689N 76.2783E; 11.5961N 76.3508E; 11.8692N 76.073E; 11.9552N 76.0851E; 11°32.962′N, 76°02.329′E; 11°33.398′N, 75°58.711′E, collected by Shilpa K. Satheesan, ex *Ficus racemosa* L.

Diagnosis: ***Female***. Length 1.53mm excluding ovipositor valve. Ovipositor length 2x body length; Body with reticulation, generally metallic green with black eyes, anterior head black, legs except coxa yellow, keel yellow; Head with pubescence; Head width 1.8x distance between front ocellus and clypeal margin, with POL 1.66x OOL. Eyes as 0.94x long as wide. Malar groove complete, 1.55x eye length. Antenna located middle of the eye. Antennal formula 11353; Mesosoma smooth with little pubescence. Pronotum invisible dorsally. Mesoscutum 1.2x as long as scutellum. Notauli complete and distinct. Scutellum as wide as long. Propodeum smooth, normal, rectangular with sublateral cariane. Wings: Fore wing hyaline, 2.25× as long as wide, 3x SMV; SMV 2x MV; MV 1.9x STV, 1.06x PMV; Metasoma smooth and shiny. Gaster 1.55x longer than thorax. Hypopygium ending after gaster body.

Male: Unknown; not recorded in present collection.

Host: Syconia galls of *Ficus racemose* L.

***Apocrypta microcarpae* sp. nov.**

(Figure 217 - 222)

Materials Examined

INDIA, Wayanad, Kerala, 11.7269N 76.3545E; 11.7201N 76.379E; 11.7156N 76.3772E, 18.III.2019, collected by Shilpa K. Satheesan, ex *Ficus microcarpa* L. f.

Description of female

Size and colour. Metallic green; Reticulate; Eye and ocelli pink; femur, tibia, tarsi and thoracic keel yellow; Length 1.219mm without ovipositor, ovipositor length 2 mm.

Hea (Fig. 1B, 1C, 1D, 1F).: Pronotum and mesoscutum metallic green, reticulate, shiny; Propodeum smooth, yellow; Eye 1.26x longer than wide; Antenna located almost middle of the head; Antennal formula 11253; Head 1.6x wider than long; Scape 5.2x longer than wide; POL 0.43x OOL (2.3x POL). Inter torular distance almost equal to torulus to inner eye distance and torulus diameter; pedicel 1.7x as long as wide; Scape 3.4x as long as pedicel; Pedicel 1.2x F1; Clava 1.8x longer than wide; Malar sulcus present; Eye length 2.4x Malar space.

Mesosoma (Fig. 1B, 1C, 1D, 1F): Pronotum not visible dorsally, laterally visible; Mesonotum 1.4x wider than long; Scutellum 1.04x longer than wide; Mesonotum 1.35x longer than scutellum; propodeum with a carapace like structure; Wings hyaline, 1/3rd of the wing bare without setae; SMV 2.33x MV, SMV with eight setae; SMV 6.1x STV and 3x PMV; MV 2.6x STV, 1.3x PMV; PMV 2x longer than STV. Fore leg is very small; fore coxa 2.9x longer than wide; coxa 2.5x as long as femur; coxa 1.9x tibia; coxa 2.2x tarsal length; tibia 1.3x femur and 1.2x tarsi length; Mid leg femur 7.7x longer than wide; tibia 13x as long as wide; mid tarsal 5.42x longer than wide; Hind coxa 3.4x longer than wide; femur 6.6x as long as wide; tibia 1.2x as long as wide; tarsal 1.1x as long as tibia. Thoracic keel a longer than wide.

Metasoma (Fig. 1B, 1C, 1D, 1F): Gaster 1.3x longer than thorax. Last few tergits with a single row of setae.

Male: Unknown

Host: Associated with the syconia galls of *Ficus microcarpa* L. f.

Etymology: 'microcarpae' derived from the name of host plant *Ficus microcarpa*.

Comments: *Apocrypta microcarpae* sp. nov. is similar to *Apocrypta westwoodi* Grandi and *Apocrypta bakeri* (Joseph). *A. westwoodi* and *A. bakeri* differs from the new species in having POL 2.3x OOL (POL 1.7x OOL in *A. westwoodi* and POL 1.5x OOL *A. bakeri*); malar groove 0.4x eye length (Malar groove 0.5x eye length in *A. westwoodi* and malara groove 0.9x eye length *A. bakeri*); Ovipositor length 3.2x the length of gaster (Ovipositor length 4.5x gaster length in *A. westwoodi* and Ovipositor length 3.3x gaster length *A. bakeri*); costal cell having five setae (nine setae in costal cell in *A. westwoodi* and costal cell having six setae in *A. bakeri*). *A. bakeri* also differs from *A. microcarpae* sp. nov. in having notauli which is anteriorly distinct and posteriorly obsolete (distinct and complete notauli in *Apocrypta microcarpae* sp. nov.).

ARACHONIA Joseph

Arachonia Joseph, 1957; Type species: *Arachonia plumosa* Joseph, 1957

Diagnosis: The females of this genus can be easily recognized by their antenna, the funicular segments which are asymmetric and distinctly dilated on the ventral side. The males are very similar to Sycoscapter.

Arachonia plumosa Joseph, 1957

(Figure 237 - 241)

Materials Examined

INDIA, Wayanad, Kerala, 11.71441 N 76.32326 E; 11.72815 N 76.32313 E; 11.8274 E 76.09494 E; 11.7447 N 76.304 E; 11.6744 N 76.2979 E; 11.8718 N 76.1003 E collected by Shilpa K. Satheesan, ex *Ficus drupacea* Thunb.

Diagnosis: ***Female***. Length 2.15mm including ovipositor valve. Iridescent green and blue, legs yellow except mid and hid coxa brown; eyes pink; Head with pubescence; Head width 1.2x distance between front ocellus and clypeal margin. Eyes as long as wide. Gena 0.66x eye length. Antennal formula 11253; Mesosoma smooth with little pubescence. Mesoscutum 1.5x wider than long. Notauli complete. Scutellum wider than long. Propodeum 4x as wide as long; Wings: Fore wing hyaline, 2.75× as long as wide; SMV

1.75x MV; PMV 2x STV; MV little shorter than PMV; Metasoma smooth and shiny. Gaster 1.71x longer than wide. Ovipositor valve 6x as long as gaster.

Male: Not collected.

Host: Syconia galls of *Ficus drupacea* Thunb.

PHILOTRYPESIS **Förster**

Polanisa Walker, 1875:17. Type species: *Polanisa lutea* Walker

Philotrypesis Förster, 1878:59. Type species: *Philotrypesis longicauda* Förster

Sycoscaptella Westwood, 1883:36. Type species: *Sycoscaptella affinis* Westwood

Idarnella Westwood, 1883:37. Type species: *Idarnes transiens* Walker

Idarnodes Westwood, 1883. Type species: *Cynips caricae* Linnaeus

Sycoscapterella Ashmead, 1904:239. Type species: *Sycoscaptella anguliceps* Westwood

Tetranemopteryx Ashmead, 1904:239. Type species: *Sycoscaptella quadrisetosa* Westwood

Philotrypomorpha Abdurahiman and Joseph, 1976:541. Type species: *Philotrypomorpha indica* Abdurahiman & Joseph

Diagnosis: The female of this genus can be recognized by its long, tubular urotergites of terminal segments and its subquadrate narrow pronotum. The males resemble more to the *Sycoscapter* males. Sometimes it is difficult to recognize them due to polymorphism, i.e., in the same species apterous forms as well as short winged and fully winged forms may occur.

KEY TO SPECIES OF *PHILOTRYPESIS*, MODIFIED FROM PRIYADARSANAN, 2000

1 Female ---------- 2

− Male ---------- 9

2 Colour basically metallic green or black ---------- 3

− Colour basically yellowish brown ---------- 4

3 Pronotum longer than mesonotum; SMV 1.5x MV; MV 5.8x STV ---- ***P. virens*** sp. nov.

− Pronotum shorter than mesonotum; SMV 1.8x MV; MV 3.5x STV ------ ***P. anguliceps***

4 Antenna 12 segmented; 2 anelli ---------- ***P. indica***

− Antenna 13 segmented; anelli different ---------- 5

5 Antenna with 1 anellus ---------- 6

− Antenna with 3 anellus ---------- ***P. talboti*** sp. nov.

6 Eighth tergite equal in length or shorter than the combined length of 3-7 gastral segments ---------- 7

− Eighth tergite distinctly longer than 3-7 gastral segments combined ---------- 8

7 Eighth urotergite almost equal in length to the combined length of 3-7 gastral segments; 9th urotergite less than 1/2 the length of 8th; protruding parts of ovipositor and its sheath 1.25 the combined length of the 3-9 gastral segments ---------- ***P. quadrisetosa***

− Eighth urotergite distinctly shorter than 3-7 gastral segments; 9th urotergite 1/2 the length of 8th or longer; protruding part of ovipositor and its sheaths 1.6 as long as 3-9 gastral segments ---------- ***P. affinis***

8 Ninth urotergite 1/4 the length of 8th gastral segment; length of protruding ovipositor and its sheaths 1.33 times as long as the. combined length of 2-9 urotergites ---------- ---------- ***P. pilosa***

− Ninth urotergite 1/3 the length of the 8th; length of protruding part of ovipositor and its sheaths 1.67 times as long as the combined length of 2-9 urotergites ---------- ---------- ***P. longispinosa***

9 Head as long as or longer than its width ---------- 10

− Head not as long as its width ---------- 13

10 Only basitarsus of hind leg inflated ---------- ***P. indica***

− 1st and 2nd tarsomeres of hind leg inflated ---------- 11

11 Mid leg tarsi pentamerous (not fused) ---------- ***P. anguliceps***

− Mid leg tarsi reduced and fused to the pretarsus ---------- 12

12 Head and thorax bears numerous long setae ---------- ***P. affinis***

− Head and thorax bears few long setae; legs heavily pilose with robust hairs ---------- ---------- ***P. pilosa***

13 Antennal anellus short ---------- ***P. quadrisetosa***

− Antennal anellus distinctly long ---------- ***P. longispinosa***

***Philotrypesis affinis* (Westwood, 1883)**

(Figure 280 - 283)

Synonyms: *Philotrypesis travancoricus* Joseph, 1954; *Sycoscaptella affinis* Westwood, 1883

Materials Examined

INDIA, Wayanad, Kerala, 11.7365N 76.36607E; 11.7037N 76.3701E; 11.6748N 76.2997E; 11.6411N 76.3484E; 11.6263N 76.3129E; 11.8559N 76.1161E, collected by Shilpa K. Satheesan, ex *Ficus benghalensis* L.

Diagnosis: ***Female***. Length 1.64mm excluding ovipositor valve. Ovipositor 1.5x longer than the length of the body. General yellow colour with black band on abdomen; ovipositor valve black; Antenna funicle brownish black; Eye grey. Head strigulate with pubescence; Head width 1.76x distance between front ocellus and clypeal margin, with POL 1.62x OOL. Eyes as 1.32x long as wide. Malar groove absent; Gena 0.45x eye length. Antennal formula 11353; Mesosoma srigulate with little pubescence. Pronotum 0.84× as long as mesoscutum. Mesoscutum 0.97x as long as scutellum. Notauli complete. Scutellum 1.2x wider than long. Propodeum smooth, rectangular. Wings: Fore wing hyaline, 2.9× as long as wide, 2.86x SMV; SMV 1.46x MV; MV 3.16x STV, 1.2x PMV; PMV 2.65x STV. Metasoma yellow, smooth and shiny with three broad black bands spreading on T2, T3, T5, T6; Gaster as long as thorax.

Male: Unknown; not recorded in the present study.

Host: Syconia galls of *Ficus benghalensis* L.

Philotrypesis anguliceps (Westwood, 1883)

(Figure 289 - 293)

Synonyms: *Sycoscaptella anguliceps* Westwood, 1883; *Sycoscapterella anguliceps* (Westwood, 1883)

Materials Examined

INDIA, Wayanad, Kerala, 11.71986N 76.32443E; 11.6622N 76.3304E; 11.6406N 76.303E; 11.8552N 76.1134E; 11.9556N 76.0668E; 11.7685N 76.2885E, 14.I.2019, collected by Shilpa K. Satheesan, ex *Ficus religiosa* L.

Diagnosis: ***Female***. Length 1.1mm excluding ovipositor valve. Ovipositor 1.16x longer than the length of the body. General strigulate, black colour; legs except mid coxa yellow; Eyes pink; Antenna scape and pedicle yellow, funicles brown. Head with pubescence; Head width 1.5x distance between front ocellus and clypeal margin. Eyes as 1.15x long as wide. Malar groove complete, 0.5x eye length. Antenna located middle of the eye. Antennal formula 11353; Mesosoma strigulate with little pubescence. Pronotum 0.76× as long as mesoscutum. Mesoscutum 0.64x as long as scutellum. Notauli complete. Scutellum reticulate, 1.5x as long as mesoscutum. Propodeum smooth, rectangular. Wings: Fore wing hyaline, 2.46× as long as wide, 2.55x SMV, SMV 1.77x MV; MV 3.5x STV, 1.5x PMV; PMV 2.3x STV. Metasoma smooth and shiny; imbricate strigulate. Gaster longer than thorax.

Male: Unknow; Not recorded in present collection.

Host: Syconia galls of *Ficus religiosa* L.

Philotrypesis indica (Abdurahiman and Joseph, 1976)

(Figure 275 - 279)

Synonyms: *Philotrypomorpha indica* Abdurahiman and Joseph, 1976

Materials Examined

INDIA, Wayanad, Kerala, 11°30.796′N, 76°01.089′E, 23.IV.2019 collected by Shilpa K. Satheesan, ex *Ficus arnottiana* (Miq.) Miq.

Diagnosis: ***Female***. Length 1.86 mm excluding ovipositor valve. Head, thorax and abdomen yellowish brown; Antenna except scape and ovipositor sheath smoky brown; eyes and ocelli brownish black, Wings hyaline. Head with pubescence; Head width 1.25x

distance between front ocellus and clypeal margin. Eyes as 1.5x long as wide. Antennal formula 11253; scape 3.3x long as wide; pedicel 1.6x as long as wide; Club 2x as long as wide. Mandible distinctly longer than wide, Bidentate. Mesosoma smooth with little pubescence. Pronotum 2× as long as wide. Mesoscutum 1.5x longer than wide. Notauli incomplete. Scutellum 1.33x wider than long. Propodeum rectangular, 3x as long as wide. Wings: Fore wing hyaline, 2.2× as long as wide; SMV 1.75x MV; PMV 0.5x MV, 2x STV. Metasoma smooth and shiny. Gaster 1.67x as long as wide. Projecting part of ovipositor 1.33x as long as abdomen.

Male: Length 1.4 mm. Head, pronotum, fore coxa yellowish brown; mandibles, fore legs except coxa, mid and hind tibia rusty yellowish brown; remaining part of mid and hind legs and Antenna pale yellowish brown; Eyes black. Head little longer than wide, subrectangular; frons with fine engraved striation; eye as long as wide; Antenna 11 segmented, Antennal formula 11153; Scape 2x as long as wide; Club 1.5x as long as wide. Mandible 2x long as wide, Bidentate. Mesosoma large. Pronotum large, massive, as wide as long; mesonotum, metanotum and propodeum fused 1.5× as long as wide. Fore wing vestigial, nearly invisible, punctiform. Metasoma 1.2x as long as wide, weakly sclerotized slightly longer than wide and depressed.

Host: Syconia galls of *Ficus arnottiana* (Miq.) Miq.

***Philotrypesis longispinosa* Joseph, 1954**

(Figure 270 -274)

Materials Examined

INDIA, Wayanad, Kerala, 11.71441 N 76.32326 E; 11.72815 N 76.32313 E; 11.8274 E 76.09494 E; 11.7447 N 76.304 E; 11.6744 N 76.2979 E; 11.8718 N 76.1003 E collected by Shilpa K. Satheesan, ex *Ficus drupacea* Thunb.

Diagnosis: ***Female***. Length 1.4mm excluding ovipositor valve. Ovipositor 2.4x longer than the length of the body. Generally yellow with black broad band on abdomen, Antenna funicles brownish black; Eyes grey; Body imbricate strigulate; Head with pubescence; Head width 1.68x distance between front ocellus and clypeal margin, with POL 1.4x OOL. Eyes as 1.36x long as wide. Malar groove indistinct, 0.5x eye length. Antennal formula 11253; Mesosoma smooth with little pubescence. Pronotum 0.4× as long as mesoscutum. Mesoscutum 1.2x as long as scutellum. Notauli complete. Scutellum

wider than long. Propodeum normal, rectangular. Wings: Fore wing hyaline, 3.26× as long as wide, 2.8x SMV; SMV 1.7x MV; MV 6.3x STV, 1.16x PMV; PMV 5.4x STV. Metasoma smooth and shiny, black band in the median region of T2 to T7. Gaster longer than thorax.

Male: Unknown; not collected in present study.

Host: Syconia galls of *Ficus drupacea* Thunb.

***Philotrypesis pilosa* Mayr, 1906**

(Figure 228 - 231)

Materials Examined

INDIA, Wayanad, Kerala, 11.68181N 76.27307E; 11.7411N 76.2407E; 11.8637N 76.0726E; 11.6049N 76.344E; 11°33.481′N, 76°59.34′E; 11.6391N 76.3044E, collected by Shilpa K. Satheesan, ex *Ficus hispida* L. f.

Diagnosis: ***Female***. Length 1.3mm excluding ovipositor valve. Ovipositor 1.5x longer than the length of the body. General yellow colour with black band on abdomen; Antennal finicles brownish black; eyes grey, ocelli greyish; Head with pubescence; Head width 1.85x distance between front ocellus and clypeal margin. Eyes as 1.1x long as wide. Malar groove complete, 0.27x eye length. Antennal formula 11353; Mesosoma smooth with little pubescence. Pronotum 0.67× as long as mesoscutum. Mesoscutum 1.03x as long as scutellum. Notauli complete. Scutellum 1.2x wider than long. Propodeum rectangular, normal. Wings: Fore wing hyaline, 2.9× as long as wide, 3.3x SMV, SMV 1.2x MV; MV 4.6x STV, 1.5x PMV; PMV 3.1x STV. Metasoma smooth with black band on all tergites and median region of ovipositor extended tergit, T4, T5 has larger bands that spread completely, others have medial bands. Gaster 1.2x longer than thorax.

Male: Unknown; Not recorded in present study.

Host: Syconia galls of *Ficus hispida* L. f.

***Philotrypesis quadrisetosa* (Westwood, 1883)**

(Figure 284 -288)

Synonyms: *Sycoscaptella setosa* Westwood, 1883; *Sycoscaptella quadrisetosa* Westwood, 1883; *Tetranemopteryx quadrisetosa* (Westwood, 1883)

Materials Examined

INDIA, Wayanad, Kerala, 11.68282N 76.26623E; 11.8473N 76.0738E; 11.7483N 76.2344E; 11.6049N 76.344E; 11.6402N 76.3457E; 11.7237N 76.28E, collected by Shilpa K. Satheesan, ex *Ficus exasperata* Vahl.

Diagnosis: ***Female***. Length 1.8mm excluding ovipositor valve. General brownish red colour; antennal funicle brownish black; Eyes greyish black; Ocelli light grey; leg except coxa pale yellow. Head smooth with pubescence, vertex strigulate; Head width 1.6x distance between front ocellus and clypeal margin, with POL 1.2x OOL. Eyes as 1.24x long as wide. Malar groove complete, 0.26x eye length. Antennal formula 11363; Mesosoma strigulate with little pubescence. Pronotum 0.8× as long as mesoscutum. Mesoscutum stigulate 0.8x as long as scutellum. Notauli complete. Scutellum reticulate, 1.18x wider than long. Propodeum smooth, rectangular. Wings: Fore wing hyaline, 2.4× as long as wide, 3.4x SMV, SMV 0.9x MV; MV 4.4x STV, 2x PMV; PMV 2.1x STV. Metasoma smooth with black band with the medial area, medial part of ovipositor extension. Gaster 1.3x longer than thorax.

Male: Unknown; not represented in present collection.

Host: Syconia galls of *Ficus exasperata* Vahl.

***Philotrypesis talboti* sp. nov.**

(Figure 294 -299)

Materials Examined

INDIA, Wayanad, Kerala, 11.9033 N 76.0619 E; 11.9556 N 76.0668 E; 11.9556 N 76.0668 E; 11.8888 N 76.1009 E; 11.6809 N 76.3813 E; 11.6898 N 76.2525 E, collected by Shilpa K. Satheesan, ex *Ficus talbotii* King.

Description of female

Size and colour. Head, thorax and abdomen yellow colour, Ovipositor valve smoky brown; legs except coxa pale yellow; Antenna except scape and pedicel brownish yellow; Eye pink and ocelli silver; Body length 1.071mm; extended abdomen length 0.356mm; Ovipositor length without extended abdominal segment 0.963mm.

Head (Fig. 1B, 1C, 1D, 1F): Smooth; Eye 1.23x longer than wide; Malar sulcus absent; Antennal formula 11353; Head 1.48x wider than long; Scape 4.3x longer than wide; Inter

torular distance 2.09x longer than the diameter of torulus. POL 1.36x OOL. Torulus to inner eye distance almost equal to inter torular distance; Inter torular distance 1.4x torulus diameter; Pedicel 1.5x as long as wide; Antenna with single row of longitudinal sensilla; Antenna located near the anterior margin of eye; Supra clypeal area not clearly demarcated.

Mesosoma (Fig. 1B, 1C, 1D, 1F): Pronotum strigate, Mesoscutum and axilla transverse strigulate, scutellum reticulate; propodeum smooth, normal; Notauli complete and distinct; Pronotum 1.36x wider than long; Pronotum almost as long as mesonotum; Mesonotum 2x wider; Scutellum as long as wide. Scutellum almost as long as pronotum and mesonotum length. Propodeal spiracles circular; Wing sparsely and evenly setose; Fore wing length 2x its width and 2.3x SMV; SMV 2.5x MV, 6.5x STV, 3.6 PMV; MV 2.6x STV, 1.45x PMV; PMV 1.8x STV. Fore coxa 2.1x longer than wide; femur 2.8x longer than wide; coxa 0.52x femur; Mid coxa 2x longer than wide; femur 4.5x longer than wide; coxa 0.36x femur; tibia 12.8x longer than wide; femur 0.63x tibia; Hind coxa 2.45x longer than wide; femur 3.55x longer than wide; tibia 6x longer than wide; tibia with two spurs; tibia 0.79x tarsi; Coxa 0.7x femur and tibia; Femur as long tibia, 0.8x tarsals; First tarsal segment longest, 0.9x total length of other tarsal length.

Metasoma (Fig. 1B, 1C, 1D, 1F): Abdomen smooth and shiny with two transverse bands of brown colour on T3 and T4; row of setae on the distal tergits; Gaster together without extension on ovipositor slightly less than the length of thorax.

Male: Unknown

Etymology: 'talboti' derived from the name of host plant *Ficus talbotii*

Host: Associated with the syconia galls of *Ficus talbotii* King.

Etymology: 'talboti' derived from the name of host plant *Ficus talbotii*.

Comments: *P.talboti* sp. nov. is similar to *P. pilosa* Mayr in having same body colour; same number of anelli and same eye length to width and eye length to gena length ratio; but different in having head width 1.5x length (length to gena length ratio; but different in having head width 1.5x length (1.9x in *P. pilosa*); scape length 4.3x width (5.4x in *P. pilosa*); pedicel length 1.5x width (2x in *P. pilosa*); pronotum as long as mesonotum (pronotum shorter than mesonotum); SMV 2.5x MV (SMV 1.2x MV in *P. pilosa*); MV 2.6x STV (MV 6.3x STV in *P. pilosa*).

***Philotrypesis virens* sp. nov.**

(Figure 300 - 305)

Materials Examined

INDIA, Wayanad, Kerala, 11.887N 76.0687E; 11.9388N 76.0747E; 11.9673N 76.0642E; 11.9202N 76.0915E; 11.68282N 76.26623E; 11.7216N 76.3545E; 11.6404N 76.354E; 11.5945N 76.3561E; 11.7705N 76.2996E; 11.7439N 76.2271E, collected by Shilpa K. Satheesan, ex *Ficus virens* Aiton.

Description of female

Size and colour. Head, thorax and abdomen black colour; Posterior portion of coxa, femur, tibia and tarsal yellow; Antenna brownish yellow; Eye and ocelli pink; Body length 1.302mm; extended abdomen length 0.678mm; Ovipositor length without extended abdominal segment 1.9mm.

Head (Fig. 1B, 1C, 1D, 1F): Smooth and shiny; sparsely setose; Eye 1.2x longer than wide; Malar sulcus 0.05mm; Antennal formula 11353; Head 1.55x wider than long; Scape 6.3x longer than wide; Inter torular distance 2.7x longer than the diameter of torulus. POL 1.58x OOL. Torulus to inner eye distance 1.1x inter torular distance; Inter torular distance 2x torulus diameter; Pedicel 1.5x as long as wide; Scape 6.3x as long as wide; Scape 2.8x as long as pedicel; Pedicel 1.4x F1; Clava 1.4x longer than wide; Malar sulcus present; Eye length 2.7x Malar space.

Mesosoma (Fig. 1B, 1C, 1D, 1F): Pronotum, Mesonotum, propodeum reticulate, black; Pronotum 1.78x wider than long; Pronotum 1.3x longer than mesonotum; Mesonotum 2.4x wider; Scutellum 1.05x longer than wide. Scutellum longest, 1.25x pronotum length, 1.6x mesonotum length. Propodeal spiracles circular and distance between them is 0.134mm; Wing hyaline 1/3rd of the wing bare, Fringes with setae; Fore wing length 2.8x SMV; SMV with nine setae; SMV 1.5x MV, 8.6x STV, 1.8 PMV; MV 5.8x STV, 1.2x PMV; PMV 4.8x STV. Fore coxa 2.3x longer than wide; femur 3.1x longer than wide; coxa 0.62x femur; Mid coxa 2.1x longer than wide; femur 5x longer than wide; coxa 0.4x femur; tibia 12.8x longer than wide; femur 0.66x tibia; Hind coxa 2.6x longer than wide; femur 3.7x longer than wide; tibia 6x longer than wide; tibia with two spurs; tibia 0.85x tarsi; Coxa 0.73x femur and tibia; Femur as long tibia, 0.85x tarsals; First tarsal segment longest, 0.9x total length of other tarsal length.

Metasoma (Fig. 1B, 1C, 1D, 1F): Reticulate; T1 and T2 invaginated medially; Gaster together with extension on ovipositor 2.3x as long as thorax; Last few tergits with long setae.

Male: Unknown

Host: Associated with the syconia galls of *Ficus virens* Aiton.

Etymology: 'virens' derived from the name of host plant *Ficus virens*.

Comments: *P.virens* sp. nov. is similar to *P. anguliceps* (Westwood) in having same body colour; same number of anelli and same eye length to width and head length to width ration; but different in having scape length 6.3x width (5.2x in *P. anguliceps*); pedicel length 1.5x width (2x in *P. anguliceps*); pronotum slightly longer than mesonotum (Pronotum slightly shorter than mesonotum); SMV 1.5x MV (SMV 1.8x MV in *P. anguliceps*); MV 5.8x STV (MV 3.5x STV in *P. anguliceps*).

***SYCOSCAPTER* Saunders**

Sycoscapter Saunders, 1883:34-35. Type species: *Sycoscapter insignis* Saunders
Sycoryctes Mayr, 1885:157, 160, 211. Type species: *Sycoryctes patellaris* Mayr
Sycoscapteridea Ashmead. 1904:239. Type species: *Sycoscapter monilifer* Westwood
Idarnomorpha Girault, 1915:281. Type species: *Idarnomorpha subaenea* Girault
Philotrypesella Girault, 1919. Type species: *Philotrypesella huberi* Girault
Ideoidarnes Girault, 1931. Type species: *Ideoidarnes miltoni* Girault
Neosycoecus Joseph, 1953:62. Type species: *Neosycoecus indicus* Joseph
Indothymus Joseph, 1953:73. Type species: *Indothymus infectorius* Joseph
Grandimyia Risbec, 1956:148. Type species: *Grandimyia tananarivensis* Risbec
Sycorycteridea Abdurahiman and Joseph, 1975:99. Type species: *Sycorycteridea keralensis* Abdurahiman & Joseph

Diagnosis: The females are recognized by the long slender ovipositor and its sheaths, slightly swollen at the apex, the whole length of ovipositor being covered over by the extended last tergites; the marginal vein is much longer than the stigmal, basal sternites and hind coxa extremely long and antenna usually 12113 segmented with 2-3 anelli and 5 funicular segments. In males, the antenna is not in a common cavity and hypostomal margin shallowly emarginate.

KEY TO SPECIES OF *SYCOSCAPTER*, MODIFIED FROM PRIYADARSANAN, 2000

1 Female ---------- 2

− Male ---------- 9

2 Stigmal knob unusually produced downwards; fore wing with some long robust hairs below the marginal vein; but otherwise pilosity reduced ---------- 3

− Stigmal knob small, not produced downward ---------- 6

3 Head longer than wide; stigmal vein as long as the marginal ---------- ***S. arnottianus***

− Head wider than long; stigmal vein of fore wing no~ as much long as marginal ---- 4

4 Cheek 3/4 the length of compound eyes or slightly shorter ---------- 5

− Cheek as long as compound eyes or slightly shorter ---------- ***S. stabilis***

5 Scape 4 times its width; ovipositor sheath almost 5 times the length of apparent gaster ---------- ***S. infectorius***

− Scape 3 times as long as width; ovipositor sheath 6 times the apparent gaster ---------- ---------- ***S. triformis***

6 Antennae with 1 anellus ---------- 7

− Antennae with 2 anelli ---------- 8

7 Malar groove 0.83× eye length, SMV 2× MV, PMV longer than MV, STV longer than 0.5× PMV ---------- ***S. longipalpus***

− Malar groove 0.3× eye length, SMV < 2× MV, PMV equal to MV, STV 0.5× PMV -- ---------- ***S. religiosa***

8 Pronotum medially reduced and almost invisible dorsally ---------- ***S. racemosa* sp. nov.**

− Pronotum normal, rectangular and visible dorsally ---------- ***S. tsjahela* sp. nov.**

9 Basal segments of hind tarsus small but the last one sometimes enlarged ---------- 10

− Hind basitarsus enlarged, compressed and bears long setae on their dorsal side-------- ---------- ***S. longipalpus***

10 Head equal in length to its width or longer ---------- 11

− Head wider than long ---------- ***S. triformis***

11 Head as long as wide; 4th antennal segment longer than other funicular segments; fore tibia has a long dorsal spur reaching almost the base of pre-tarsus -------- ***S. arnottianus***

− Head longer than wide; 4th & 6th antennal segments longer than the other funicular segment; dorsal spur of fore tibia smaller ---------- ***S. stabilis***

Sycoscapter arnottianus Abdurahiman and Joseph, 1976

(Figure 247 - 250)

Materials Examined

INDIA, Wayanad, Kerala, 11°30.796′N, 76°01.089′E, 23.IV.2019 collected by Shilpa K. Satheesan, ex *Ficus arnottiana* (Miq.) Miq.

Diagnosis: ***Female***. Length 1.4mm excluding ovipositor valve. Ovipositor 2.7mm long. Iridescent green with blue colouration; legs and scape pale yellowish brown; remaining parts of Antenna smoky brown; ovipositor yellowish brown; Eyes pink. Head recticulate and punctate with pubescence; Head width 1.3x distance between front ocellus and clypeal margin. Eyes as 1.25x long as wide. Antennal formula 11253; Mandible bidentate, 1.5x long as wide. Mesosoma closely reticulate and pitted punctate with little pubescence. Pronotum 2× wide as long. Mesoscutum longer than wide. Notauli incomplete. Scutellum 1.2x wider than long. Propodeum recticulate, medially reduced and lateral halves triangular. Wings: Fore wing hyaline, 2.3× as long as wide, SMV 1.5x MV; distal end of stigma vein dialated, it bears four sensilla; Metasoma smooth and shiny. Gaster 1.66x long as height. Length of ovipositor 3.33x abdomen.

Male: Length 1.6mm. Head, pronotum yellowish brown; mandibles and foretibia reddish brown; Eyes black; rest of the body pale yellowish brown colour. Head almost same length to width, subrectangular; frons with fine engraved striation; eye long, 1.66× as long as wide; Antennal formula 11152; Mesosoma large. Pronotum subquadrangular, about 1.3× as wide as long; mesonotum, metanotum and propodeum combined 1.7× as

wide as long, a little less than 0.7× as long as pronotum. Fore wing vestigial, nearly invisible, punctiform. Metasoma black in colour weakly sclerotized slightly longer than wide and depressed.

Host: Syconia galls of *Ficus arnottiana* (Miq.) Miq.

***Sycoscapter infectorius* (Joseph, 1953)**

(Figure 265 - 269)

Synonyms: *Indothymus infectorius* Joseph, 1953

Materials Examined

INDIA, Wayanad, Kerala, 11.887N 76.0687E; 11.9388N 76.0747E; 11.9673N 76.0642E; 11.9202N 76.0915E; 11.68282N 76.26623E; 11.7216N 76.3545E; 11.6404N 76.354E; 11.5945N 76.3561E; 11.7705N 76.2996E; 11.7439N 76.2271E, collected by Shilpa K. Satheesan, ex *Ficus virens* Aiton.

Diagnosis: ***Female***. Length 1.27mm excluding ovipositor valve. Iridescent green; legs pale yellow; scape and finicle of Antenna darkm brownish yellow; eyes pale pinkish red; wings hyaline. Head with pubescence; Head distinctly wider distance between front ocellus and clypeal margin. Eyes longer than wide. Malar groove complete. Antenna 12 segmented, Antennal formula 11253; Scape 4x as long as wide; Mandible 1.5x as long as wide; bidentate. Mesosoma minutely punctate with little pubescence. Pronotum wider than long. Mesoscutum as long as wide. Notauli incomplete. Scutellum large with punctation, a little wider than long. Propodeum rectangular, divided into a median and two lateral regions. Wings: Fore wing hyaline, 2.5× as long as wide, SMV 1.5x MV; PMV 2x STV; stigma vein having four sensilla. Metasoma long about 2.7x as long as wide; Ovipositor about 5x as long as abdomen.

Male: Unknown, not represented in the collection.

Host: Syconia galls of *Ficus virens* Aiton.

***Sycoscapter longipalpus* (Joseph, 1953)**

(Figure 256 - 260)

Synonyms: *Neosycoecus longipalpus* Joseph, 1953; *Sycoscapteridea longipalpa* (Joseph, 1953); *Sycoscapteridea longipalpus* (Joseph, 1953)

Materials Examined

INDIA, Wayanad, Kerala, 11.68282N 76.26623E; 11.8473N 76.0738E; 11.7483N 76.2344E; 11.6049N 76.344E; 11.6402N 76.3457E; 11.7237N 76.28E, collected by Shilpa K. Satheesan, ex *Ficus exasperata* Vahl.

Diagnosis: ***Female***. Length 1.8 mm excluding ovipositor valve. Dorsum of head, thorax and abdomen iridescent green, blue and gold; all legs, the ventral sides of head,thorax, abdomen, antennal scape pale brownish yellow; rest of Antenna pale smoky brown; wings hyaline; Ovipositor valves dark brown; Eyes greyish black. Head obscurely rugulosely punctate with pubescence; Head distinctly wider than distance between front ocellus and clypeal margin. Eyes as 1.5x long as wide. Malar groove complete, 0.85x eye length. Antenna with 11 segments, Antennal formula 11153; Scape 4.5x long as wide; club 3x as long as wide. Mandibles 1.5x as long as wide; Bidentate. Mesosoma reticulately punctate with little pubescence. Pronotum 3× as wide as long. Mesoscutum as long as wide. Notauli incomplete, present only in the anterior half. Scutellum finely rugulose, large, as wide as long. Propodeum rectangular, 6x as wide as long, carinae divides the propodeum into a median and two lateral regions. Wings: Fore wing hyaline, 2.5× as long as wide; SMV 2x MV; PMV longer than MV; Stigmal vain a little longer than half the PMV, STV with four rounded sensila. Metasoma long, 2x as long as wide, eighth tergit with a pair of spiracles with subrotund peritremes; ovipositor 4x long as abdomen.

Male: Unknown, not represented in the collection.

Host: Syconia galls of *Ficus exasperata* Vahl.

***Sycoscapter stabilis* (Walker, 1871)**

(Figure 251 - 255)

Synonyms: *Idarnes orientalis* Walker, 1875; *Idarnes stabilis* Walker, 1871; *Indothymus crenulatus* Joseph, 1953; *Sycoscapter insignis* Saunders, 1883

Materials Examined

INDIA, Wayanad, Kerala, 11.7365N 76.36607E; 11.7037N 76.3701E; 11.6748N 76.2997E; 11.6411N 76.3484E; 11.6263N 76.3129E; 11.8559N 76.1161E, collected by Shilpa K. Satheesan, ex *Ficus benghalensis* L.

Diagnosis: ***Female***. Length 1.1mm excluding ovipositor valve. Ovipositor length 2.4x body length; General metallic green, legs except anterior coxa pale yellow; anterior half of scape yellow, others brownish; Eyes greyish pink, ocelli grey or silver. Ovipositor

brown. Head punctiform with pubescence; Head width 1.2x distance between front ocellus and clypeal margin, with POL 1.6x OOL. Eyes as 1.16x long as wide. Malar groove invisible; Gena 2.47x eye length. Antenna located above the anterior margin of eye. Antennal formula 11253; Mesosoma punctiform and metallic. Pronotum 0.3× as long as mesoscutum. Mesoscutum 0.6x as long as scutellum. Notauli indistinct posteriorly. Scutellum, recticulate 1.09x wider than long, 1.56x mesoscutum. Propodeum rectangular and strigulate with lateral carinae. Wings: Fore wing hyaline, 2.5× as long as wide, 2.8x SMV, SMV 1.76x MV; MV 1.6x STV, 0.71x PMV; PMV 2.3x STV; Metasoma smooth and imbricate. Gaster 1.42x longer than thorax, T1, T2, T3, T4 slightly emarginated in the margin medially.

Male: unknow; not recorded in this study.

Host: Syconia galls of *Ficus benghalensis* L.

***Sycoscapter triformis* Joseph, 1957**

(Figure 242 - 246)

Materials Examined

INDIA, Wayanad, Kerala, 11.71441 N 76.32326 E; 11.72815 N 76.32313 E; 11.8274 E 76.09494 E; 11.7447 N 76.304 E; 11.6744 N 76.2979 E; 11.8718 N 76.1003 E collected by Shilpa K. Satheesan, ex *Ficus drupacea* Thunb.

Diagnosis: *Female*. Length 2.2 mm including ovipositor valve. Iridescent green and blue; legs pale brownish-yellow; eyes and ocelli pink. Head with pubescence; Head width 1.3x distance between front ocellus and clypeal margin. Eyes as 1.25x long as wide. Gena 0.5x eye length. Antennal formula 11253; Mesosoma smooth with little pubescence. Mesoscutum 2x as long as wide. Notauli complete. Scutellum little wider than long. Propodeum smooth. Wings: Fore wing hyaline, 2.5× as long as wide, SMV 1.3x MV; MV a little shorter than PMV; PMV 2x stigma; Metasoma smooth and shiny. Gaster 1.75x longer than wide. Ovipositor valve 6x as long as abdomen.

Male: Not recorded in the collection.

Host: Syconia galls of *Ficus drupacea* Thunb.

***Sycoscapter racemosa* sp. nov.**

(Figure 306 - 311)

Materials Examined

INDIA, Wayanad, Kerala, 11.7458N 76.2416E; 11.6689N 76.2783E; 11.5961N 76.3508E; 11.8692N 76.073E; 11.9552N 76.0851E; 11°32.962′N, 76°02.329′E; 11°33.398′N, 75°58.711′E, collected by Shilpa K. Satheesan, ex *Ficus racemosa* L.

Description of female

Size and colour. Generally metallic green with yellow at anterior potion of head. Posterior portion of coxa, femur, tibia and tarsal yellow; Antenna brownish yellow; Eye and ocelli pink; Length 2.783mm; Body length 1.007mm; Ovipositor length 1.808mm.

Head (Fig. 1B, 1C, 1D, 1F): Pronotum, Mesonotum, propodeum reticulate, metallic green; Eye 1.36x longer than wide; Antennal scape 11253; Head 1.5x wider than long; Scape 4.2x longer than wide; Inter toruli distance a little less than diameter of torulus. POL 1.55x OOL; torulus to inner eye distance 3.1x Inter torular distance and torulus diameter 1.2x Inter torular distance; pedicel 1.3x as long as wide; Scape 4.6x as long as wide; Scape 2.5x as long as pedicel; Pedicel 1.3x F1; Clava 2.1x longer than wide; Malar sulcus absent.

Mesosoma (Fig. 1B, 1C, 1D, 1F): Pronotum 3.2x wider than long; mesonotum 1.9x wider than long; Scutellum 1.08x longer than wide; Wing hyaline 1/3rd of the wing bare; SMV 1.6x MV, 2.83x STV, 1.4x PMV; MV 1.76x STV; PMV longer than 1.99x STV and 1.13x MV. Wing length 0.849mm width 0.375mm; Fore coxa 2.1x longer than wide; femur 3.9x longer than wide; coxa 0.72x femur; Mid coxa 1.4x longer than wide; femur 6.2x longer than wide; coxa 0.34x femur; tibia 8.4x longer than wide; femur 0.9x tibia; Hind coxa 3.4x longer than wide; femur 3x longer than wide; tibia 6.6x longer than wide; tibia 1.6x tarsi; Coxa 0.65x femur; 0.5x tibia; Femur 0.8x tibia, 1.3x tarsals.

Metasoma (Fig. 1B, 1C, 1D, 1F): Gaster 1.42x of thorax. Reticulate, T3 onwards a single row of setae.

Male: Unknown

Host: Associated with the syconia galls of *Ficus racemosa* L.

Etymology: ‘racemosa’ derived from the name of host plant *Ficus racemosa*.

Comments: *S. racemosa* sp. nov. is similar to *S. religiosa* Wiebes in having a similar ovipositor to gaster length; same antennal formula; similar MV, STV and PMV ratio; POL: OOL value; differ from it in having gena 0.35× eye length (gena 0.5× eye length in *S. religiosa*); SMV 1.6× MV (SMV 3× MV in *S. religiosa*); body closely reticulate in *S. racemosa* (body strigulate or longitudinally reticulate in *S. religiosa*)

***Sycoscapter tsjahela* sp. nov.**

(Figure 312 - 317)

Materials Examined

INDIA, Wayanad, Kerala, INDIA, Wayanad, Kerala, 11.9638N 76.0912E; 11.9166N 76.0981E; 11.8553N 76.1149E; 11.8286N 76.0748E; 11.6439N 76.433E; 11.6064N 76.364IE; 11.7016N 76.2425E, collected by Shilpa K. Satheesan, ex *Ficus tsjakela* Burm.f.

Description of female

Size and colour. Generally metallic green with yellow at anterior potion of head and ventral region. Posterior portion of coxa, femur, tibia and tarsal yellow; Antenna brownish yellow; Eye and ocelli pink; Length 1.851mm; Body length 0.735mm; Ovipositor length 1.243mm.

Head (Fig. 1B, 1C, 1D, 1F): Reticulate, metallic green; Eye 1.27x longer than wide; Head 1.82x wider than long; Upper margin of clypeus to lower margin of clypeus 0.033mm; Antennal formula 11253; POL 1.48x OOL. Torulus to inner eye distance 2.1x torular diameter; Inter torular distance less than torulus diameter; pedicel 1.62x as long as wide; Scape 4.3x as long as wide; Scape 2x as long as pedicel; Pedicel 2.4x F1; Clava 2.7x longer than wide; Malar sulcus absent.

Mesosoma (Fig. 1B, 1C, 1D, 1F): Pronotum, Mesonotum, propodeum reticulate, metallic green; Pronotum small and dorsally almost invisible; Mesonotum 2.16x wider than long; scutellum 1.06x wider than long; Spiracles circular in shape; Wing hyaline 1/3rd of the wing bare, setae present at half of the fringes; Fore wing length 2.8x SMV; SMV 1.84x MV, 3.6x STV, 1.81x PMV; MV 2x STV, PMV 2x STV and PMV almost equal to MV. Mid coxa 1.4x longer than wide; femur 6.2x longer than wide; coxa 0.34x femur; tibia 11x longer than wide; tibia 1.3x tarsal; Hind coxa 3.4x longer than wide; femur 2.2x

longer than wide; tibia 5.7x longer than wide; tibia 1.3x tarsi; Femur 0.6x tibia, 0.72x tarsals.

Metasoma (Fig. 1B, 1C, 1D, 1F): Abdomen 1.8x longer than thorax. Last few tergits with a single row of setae.

Male: Unknown

Host: Associated with the syconia galls of *Ficus tsjakela* Burm.f.

Etymology: 'tsjahela' derived from the name of host plant *Ficus tsjakela*.

Comments: *S. tsjahela* sp. nov. is similar to *S. racemosa* sp. nov. in having a similar gena to eye length, ovipositor to gaster length, antennal formula, MV, STV and PMV length; POL: OOL value; eye length to width ratio; *S. tsjahela* sp. nov. differs from *S. racemosa* sp. nov. in having SMV 1.9× MV (SMV 1.6× MV in *S. racemosa* sp. nov.); have four round sensilla at the end of STV (a pair of setae on STV in *S. racemosa* sp. nov.); scape length 4.3× its width (scape length 4.6× its width in *S. racemosa* sp. nov.); Head width 1.8× its length (head width 1.5× its length in *S. racemosa* sp. nov.); torulus to inner eye distance is 2× to torular diameter (torulus to inner eye distance is 3× torular diameter in *S. racemosa* sp. nov.); pedicel length 1.6× its width (pedicel length 1.3× its width in *S. racemosa* sp. nov.); scape length is 2× to pedicel length in *S. tsjahela* sp. nov. (Scape length 2.5× pedicel length in *S. racemosa* sp. nov.); pedicel length is 2.4× F1 length (pedicel and F1 length in almost equal in *S. racemosa* sp. nov.); Inter torular distance is less than the torular diameter (Inter torular distance is equal to torular diameter in *S. racemosa* sp. nov.); pronotum laterally visible and dorsally almost invisible in *S. tsjahela* sp. nov. (Pronotum completely visible dorsally in *S. racemosa* sp. nov.).

***Sycoscapter religiosa* Wiebes, 1967**

(Figure 261 - 264)

Synonyms: *Sycoryctes religiosae* Wiebes, 1967

Materials Examined

INDIA, Wayanad, Kerala, 11.71986N 76.32443E; 11.6622N 76.3304E; 11.6406N 76.303E; 11.8552N 76.1134E; 11.9556N 76.0668E; 11.7685N 76.2885E, 14.I.2019, collected by Shilpa K. Satheesan, ex *Ficus religiosa* L.

Diagnosis: ***Female***. Length 1.12mm excluding ovipositor valve. Ovipositor length 1.7x body length; General metallic green, anterior part of head yellow, eye pink, antenna brown, Antenna brownish, legs except anterior part of coxa yellow, ocelli pink; Head reticulate at vertex and anterior part strigulate; Abdomen imbricate stigulate, brown colur; Head with pubescence; Head width 1.5x distance between front ocellus and clypeal margin, with POL 1.44x OOL. Eyes as 1.2x long as wide. Malar groove complete, 0.3x eye length. Antenna located at the anterior margin of eye; Antennal formula 11153; Mesosoma smooth with little pubescence. Pronotum 0.24x as long as mesoscutum. Mesoscutum 0.8x as long as scutellum. Notauli complete. Scutellum 1.2x mesoscutum, 5x pronotum. Propodeum strigulate, rectangular. Wings: Fore wing hyaline, 2.3× as long as wide, 2.6x SMV, SMV 1.76x MV; MV 2x STV; MV as long as PMV, PMV 2x STV; Metasoma smooth and shiny. Gaster imbricate strigulae,1.6x longer than thorax.

Male: Male specimen is not recorded in this collection.

Host: Syconia galls of *Ficus religiosa* L.

Subfamily Sycophaginae

Sycophagoidae Walker, 1875. Type genus: *Sycophaga* Westwood, 1840. Treated as Sycophaginae by Ashmead (1904).

Diagnosis: Antennal variable in flagellomere count. Mandibles not falcate. Scapula anteriorly exposed by narrow pronotum. Axilla not strongly advanced. Axilla enlarged and convex. Petiole simple, transverse. Males usually apterous (except in a few genera), residing inside figs.

SYCOPHAGA Westwood, 1840

Apocryptophagus Ashmead, 1904; Type species: *Chalcis explorator* Coquerel
Dynatogmus Mayr, 1906; Type species: *Dynatogmus robustus* Mayr
Koebelea Girault, 1915; Type species: *Koebelea fusca* Girault
Parakoebelea Joseph, 1957; Type species: *Parakoebelea stratheni* Joseph
Sycophaga Westwood, 1840; Type species: *Sycophaga crassipes* Westwood,
Sycophagella Joseph, 1953; Type species: Sycophagella agraensis Joseph

Diagnosis: In the females, the antenna is distinctly below the middle of the face, pronotum much shorter than the scutum, clypeus and supra-clypeal areas not distinctly separated. In the male the head is strongly elongate; scape very broad and flat and adpressed to the head and the apex of the gaster with long tail-like spiracular process of the 8th tergum.

KEY TO SPECIES OF *SYCOPHAGA*, MODIFIED FROM PRIYADARSANAN, 2000

1 Female ---------- 2

− Male ---------- 3

2 Antenna with 1 anellus; labial palpus unisegmented ---------- ***S. agraensis***

− Antenna with 2 anellus; labial palpus 2 segmented ---------- ***S. brevitarsus***

3 Spiracular process of the 8th segment 0.8x the length of the abdomen, 10 times its own width and wide at base and converging anterior ---------- ***S. agraensis***

− Spiracular process of 8th segment 0.66x the length of abdomen, 5 times its own width and broad at middle converging to both ends ---------- ***S. brevitarsus***

***Sycophaga agraensis* (Joseph, 1953)**

(Figure 318 - 323)

Synonyms: *Apocryptophagus agraensis* (Joseph, 1953); *Eukoebelea agraensis* (Joseph, 1953); *Idarnes agraensis* (Joseph, 1953); *Sycophagella agraensis* Joseph, 1953

Materials Examined

INDIA, Wayanad, Kerala, 11.7458N 76.2416E; 11.6689N 76.2783E; 11.5961N 76.3508E; 11.8692N 76.073E; 11.9552N 76.0851E; 11°32.962′N, 76°02.329′E; 11°33.398′N, 75°58.711′E, collected by Shilpa K. Satheesan, ex *Ficus racemosa* L.

Diagnosis: ***Female***. Length 1.65 mm excluding ovipositor valve. Head, abdomen, ovipositor valves and all antennal segments, except scape and pedicel sooty brown, reinforced by a slight iridescent sheen in the head, scuto-scapular region of mesonotum and abdomen; thorax, scape and pedicle of Antenna and ovipositor yellowish brown, legs pale yellow; wings hyaline, eyes and ocelli pinkish. Head rugulose with pubescence; Head width 1.5x distance between front ocellus and clypeal margin. Eyes large. Gena

0.7x eye length. Antenna with 12 segments, Antennal formula 11153; Scape 3x as long as wide; club 2.75x as long as wide. Mandible longer than wide, tridentate. Mesosoma smooth with little pubescence. Pronotum much wider than long, narrower than propodeum. Mesoscutum with recticulate punctation, as long as wide. Notauli complete and distinct. Scutellum as wide as long. Propodeum wide anteriorly, converging posteriorly, posterior margin emarginate. Wings: Fore wing hyaline, 2.2× as long as wide; SMV 3.7x MV; PMV 2x STV; Stigmal vein has three sensilla. Metasoma longer than wide; ovipositor very long, over 8x as long as abdomen.

Male: Length 2.4 mm. Uniformly yellowish brown; mandibles, tibia and certain margins of body ferrugineous; eyes black. Head depressed, 2x as long as wide, subrectangular; frons with fine engraved striation; eye long as long as wide; Antenna four segmented. Scape as long as wide, flattened. Mandible 1.5x as long as wide, Tridentate. Mesosoma large. Pronotum subquadrangular, about 2× as long as wide; mesonotum little longer than maximum width; metanotum and propodeum combined 1.5x as long as wide. Fore wing vestigial, nearly invisible, punctiform. Metasoma large, narrow at base, widening towards apex. 3x as long as wide; dorsum of abdomen with linear striations.

Host: Syconia galls of *Ficus racemosa* L.

***Sycophaga brevitarsus* Grandi, 1916**

(Figure 324 - 328)

Synonyms: *Apocryptophagus brevitarsus* (Grandi, 1916); *Eukoebelea brevitarsus* (Grandi, 1916)

Materials Examined

INDIA, Wayanad, Kerala, 11.7458N 76.2416E; 11.6689N 76.2783E; 11.5961N 76.3508E; 11.8692N 76.073E; 11.9552N 76.0851E; 11°32.962′N, 76°02.329′E; 11°33.398′N, 75°58.711′E, collected by Shilpa K. Satheesan, ex *Ficus racemosa* L.

Diagnosis: ***Female***. Length 2.21mm including ovipositor valve. General yellowish brown, T4-T8 with broad patches of brownish black anteriorly, legs yellow, antennal segments smoky brown, Eyes brownish black; Wings hyalin; Ovipositor yellowish brown, valves black; Head with pubescence; Head wider than distance between front ocellus and clypeal margin. Eyes as long as wide. Gena 0.6x eye length. Antennal formula 11263; Mesosoma smooth with little pubescence. Pronotum narrower than propodeum,

smooth, with few setae. Mesoscutum as wide as long. Notauli complete. Scutellum as long as wide. Propodeum smooth 2.5x as wide as long. Wings: Fore wing hyaline, 2.3× as long as wide; SMV 4x MV; PMV 1.4x STV; MV shorter than PM; Metasoma smooth and shiny. Gaster longer than thorax; 1.4x as long as wide. Ovipositor about 6x as long as abdomen.

Male: Length 2.8 mm. Head, mesosoma, metasoma, wing remnants and all legs yellow; Eyes black; Head 2x as long as width, subrectangular; frons with minute; eye long, 1.66× as long as wide; Antennal with four segments; Mandible longer than wide, tridentate; Mesosoma large. Pronotum subquadrangular, length less than 2x it's width; mesonotum as wide as long; metanotum and propodeum combined longer than wide, longitudinal striations. Fore wing vestigial, nearly invisible, punctiform. Metasoma large. Narrow at base, widening towards posterior end.

Host: Syconia galls of *Ficus racemosa* L.

5.3. FIG & FIG WASP INTERACTIONS

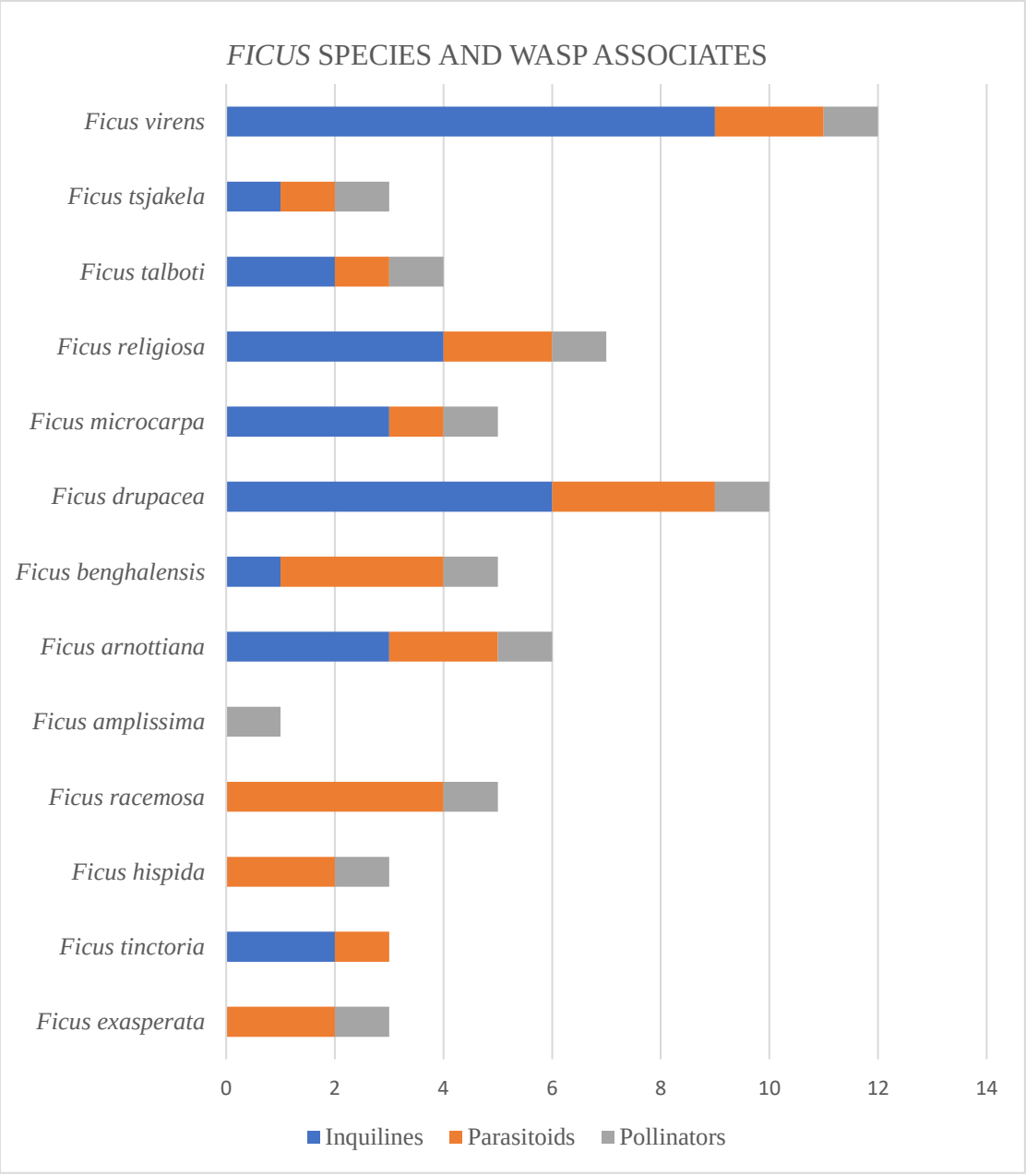
Fig wasps are collected from 13 different species of fig trees – *Ficus amplissima*, *Ficus arnottiana*, *Ficus benghalensis*, *Ficus drupacea*, *Ficus exasperata*, *Ficus hispida*, *Ficus microcarpa*, *Ficus racemose*, *Ficus religiosa*, *Ficus talboti*, *Ficus tinctoria*, *Ficus tsjahela*, *Ficus virens* from the Wayanad regions. Wasp species belonging to pollinators, parasitoids and inquilines are represented in the collection. Different species of *Ficus* species have different fruit or syconia size similar to their diverse wasp species associates. In the present study 13 *Ficus* species with syconium size ranging from 0.55mm to 4.75mm are studied for their wasp associates. Smallest syconia is of *Ficus tsjakela* and the largest is of *Ficus racemosa*.

Pollinator of all the studied *Ficus* species except *Ficus tinctoria* are recorded in the collection. At least one parasitoid species was found to be associated in all the studied *Ficus* species. Highest parasitoid number is recorded from *F. racemosa* followed by *F. arnottiana* and *F. benghalensis* whereas single species of parasitoid is reported from *F. microcarpa*, *F. talboti*, *F. tinctoria* and *F. tsjakela*. Inquilines are not reported from all the 13 studied *Ficus* species. Nine species of inquilines are reported from *F. virens*, six from *F. drupacea*, four from *F. religiosa*, three from *F. microcarpa*, *F. arnottiana*, two and from *F. tinctoria*, *F. talboti* and one each from *F. benghalensis*, *F. tsjahela*. Inquilines are not reported from three *Ficus* species *F. exasperata*, *F. hispida* and *F. racemosa*.

Highest number of fig wasps are reported from *Ficus virens*, which includes nine inquilines – single species from genera *Camarothorax*, *Sycobiomorphella*, *Ormyrus*, two species from genus *Otitesella* and four species from genus *Sycophila*; two parasitoids – single species from genera *Philotrypesis* and *Sycoscapter* each and the pollinator species, *Platyscapa sahiana* from the study area.

Least number of associated wasps are recorded from *Ficus amplissima i.e.*, only a single species, *Eupristina dalheiensis* which is the pollinator is the sole representative of the fig wasp with this *Ficus* species.

FIGURE 5: *FICUS* SPECIES AND WASP ASSOCIATES



Ficus drupacea is represented with the pollinator species *Eupristina belgaumensis*; the inquilines - a *Sycobia mathewi*, *Sycophila drupacea* sp. nov., *Sycophila mysurensis* sp. nov, *Micranisa claviscapa*, *Rahimaniella* gen. nov. and parasitoids - *Arachonia plumosa*, *Philotrypesis longispinosa* and *Sycoscapter triformis*.

Platyscapa quadraticeps the pollinator species of *Ficus religiosa* together with inquilines - *Sycobiomorphella religiosa* sp. nov., *Sycophila religiosa* sp. nov., *Marginalia religiosa*, *Otitesella digitata* and parasitoids - *Philotrypesis anguliceps*, *Sycoscapter religiosa* were recorded from the study area.

From the study area five wasp associates of *Ficus microcarpa* were reported. These included *Eupristina verticillate* the pollinator species, the inquilines - *Odontofroggatia corneri*, *Micranisa microcarpae* sp. nov., *Walkerella kurandensis* and a single species of parasitoid from the genus *Apocrypta microcarpae* sp. nov. *Odontofroggatia corneri* is a new report of this genus to India.

Ficus racemosa, the cluster fig is represented with pollinator species *Ceratosolen fusciceps* and parasitoid species - *Sycophaga brevitarsus*, *Apocrypta westwoodi*, *Sycoscapter racemosa* sp. nov. and *Sycophaga agraensis*.

Six species of wasp associates are recorded from *Ficus arnottiana* including its pollinator *Platyscapa arnottiana* and other inquilines – *Ornatapedicellum* gen. nov., *Sycophila arnottiana* sp. nov., *Philosycella wiebesina* and two parasitoids - *Philotrypesis indica* and *Sycoscapter arnottianus* from the study area.

Banyan tree, *Ficus benghalensis* was found to be associated with *Eupristina masoni* as its pollinator species, *Sycobia bethyloides* as an inquiline associate and *Philotrypesis affinis* and *Sycoscapter stabilis* as parasitoid associate from the study area.

Ficus talboti was found associated with four wasp species, represented by *Eupristina keralensis*, the pollinator, *Micranisa ashtamudiensis* and *Walkerella talboti*, the inquiline associates and *Philotrypesis talboti* sp. nov., the parasitoid associate, from the study area.

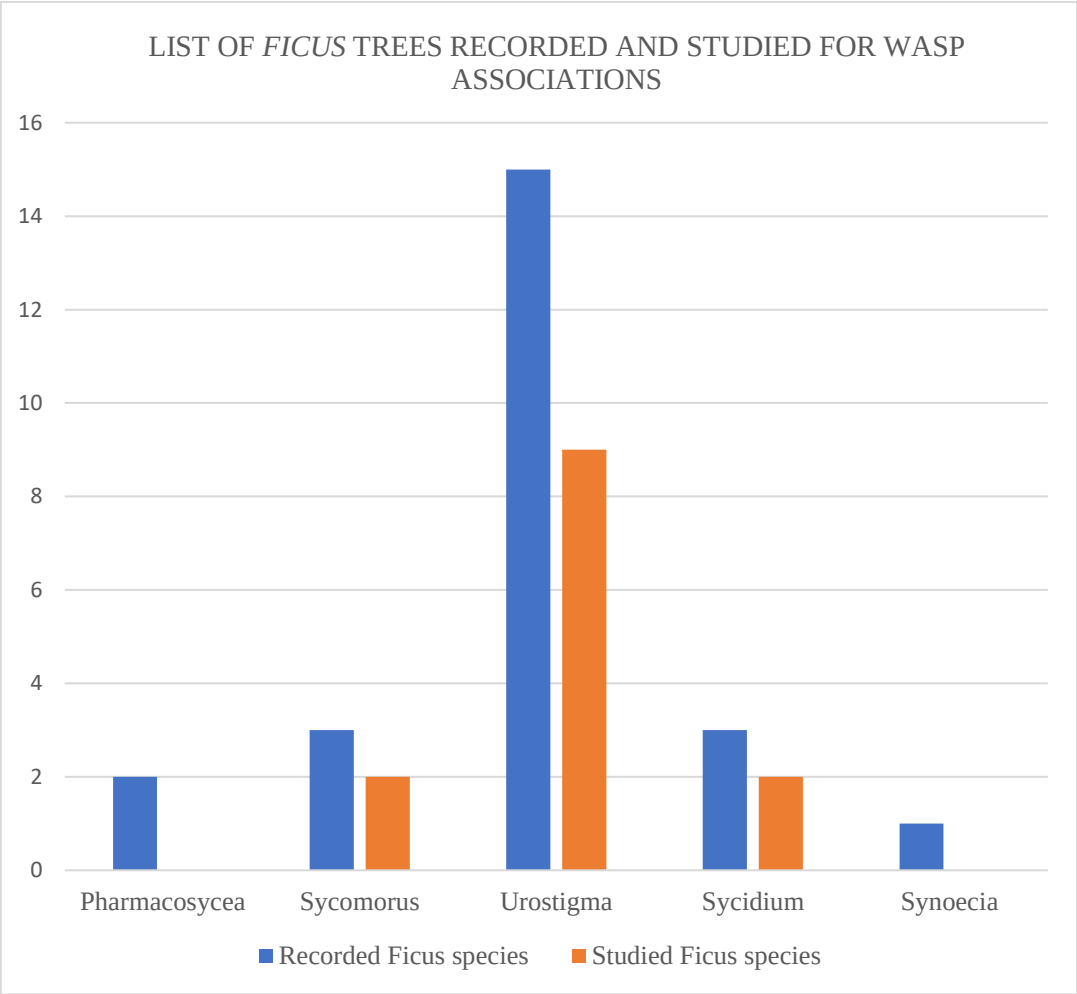
Ficus exasperata and *Ficus hispida* are represented by three species of fig wasps each. The pollinator species *Kradibia gestroi* and *Ceratosolen solmsi* of *Ficus exasperata* and *Ficus hispida* respectively and their parasitoid associates *Philotrypesis quadrisetosa*, *Sycoscapter longipalpus* and *Apocrypta bakeri*, *Philotrypesis pilosa*, respectively.

Platyscapa tjahela, *Otitesella tsjahela* and *Sycoscapter tsjahela* sp. nov. are fig wasp associates recorded from *Ficus tsjakela*. They are the pollinator, inquiline associate and parasitoid associate respectively of the *Ficus* species.

Ficus tinctoria has found to have associated with two inquilines belonging to genera *Neosycophila tinctoria* sp. nov., *Sycophila tinctoria* sp. nov and *Sycophila gibbosa* sp. nov. Together with this, a parasitoid associate of genus *Syntomernus codonatus* is also recorded. *Neosycophila* genus and *Syntomernus codonatus* species is a new record to India. Pollinator species is not recorded from this species of *Ficus* from the study area.

Although 24 species of *Ficus* species are recorded from the study area only 13 species of *Ficus* are studied for wasp associations. These recorded *Ficus* species belong to five subgenera – Pharmacosycea, Sycomorus, Urostigma, Sycidium and Synoecia, out of which only three subgenus – Sycomorus, Urostigma and Sycidium are studied for wasp associations. Out of the three species of *Ficus* recoded from the subgenus Sycomorus and Sycidium, two are studied for wasp associations, likewise within 15 species of *Ficus* recorded from Urostigma, nine are studied for wasp associations. Most number of *Ficus* species that were recorded and studied for wasp association were from the subgenus Urostigma.

FIGURE 6: LIST OF *FICUS* TREES RECORDED AND STUDIED FOR WASP ASSOCIATIONS



Since, highest number of *Ficus* recorded in this investigation is from subgenus Urostigma a greater number of wasp species associates were also studied from it. Most number of fig wasp species are found to be associated with Urostigma, followed by Sycomorus and

then Sycidium. The number of species of parasitoid wasps associated with Urostigma (around 15 species) are much higher than those associated with Sycomorus and Sycidium. Even though the number of *Ficus* species studied from the subgenera Sycomorus and Sycidium are the same, the number of parasitoids associated with Sycomorus is double the number of associated with Sycidium. Inquilines are only seen associated with subgenus Urostigma and Sycidium and not with any *Ficus* species from Sycomorus.

FIGURE 7: COMPARISON OF WASP ASSOCIATION WITH FICUS SUBGENUS

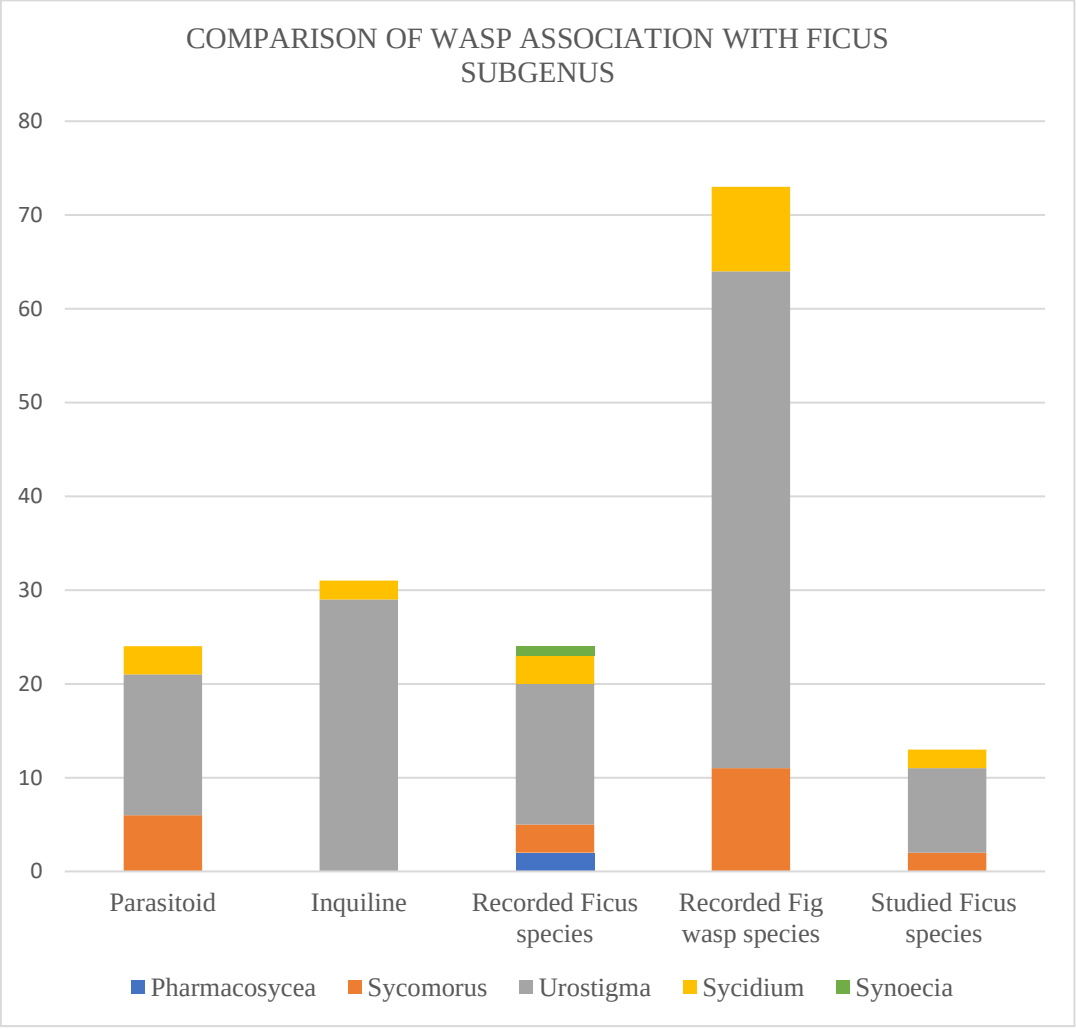
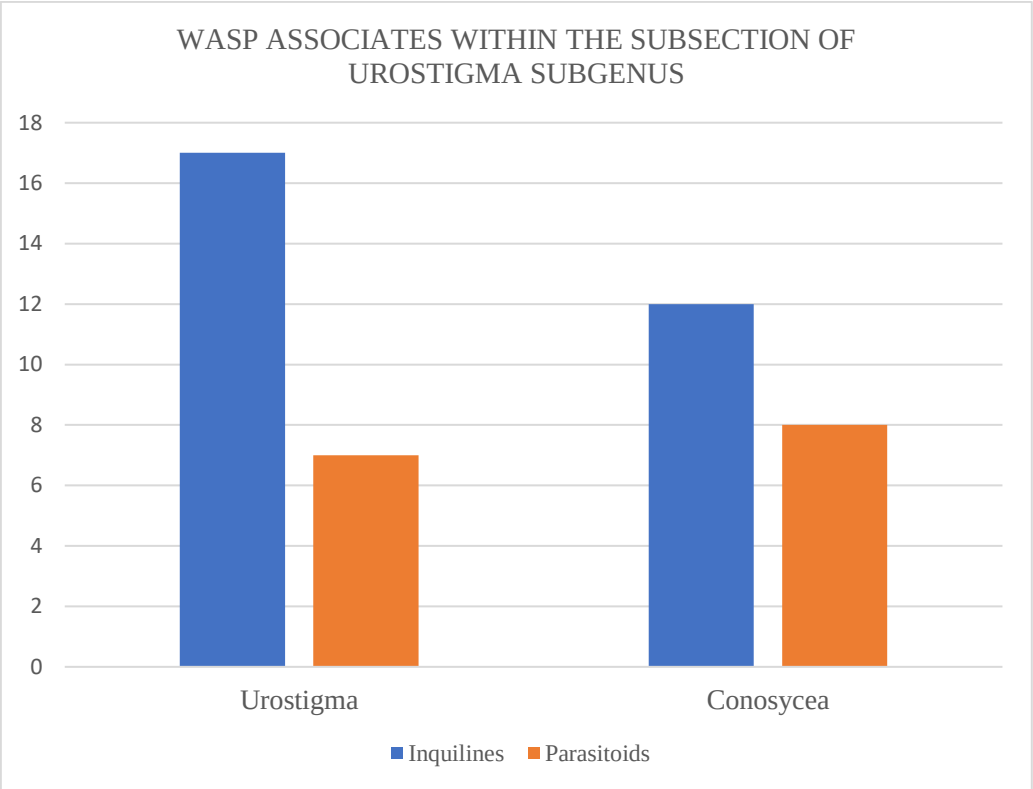


FIGURE 8: WASP ASSOCIATES WITHIN THE SUBSECTION OF UROSTIGMA SUBGENUS



Ficus species studied from the subgenus Urostigma belongs to two subsections – Conosycea and Urostigma. Comparison of the parasitoid and inquiline associates within the four *Ficus* species belonging to these two subsections, showed that the number of species of inquilines associated with subsection Urostigma is more than those associated with Conosycea subsection. On the other hand, the number of species of parasitoid associates of these *Ficus* species is found to be more within the Conosycea subsection than with the Urostigma subsection.

5.4. DISTRIBUTION OF *FICUS* SPECIES IN THE PROTECTED AREAS OF WAYANAD REGION

Wayanad Wildlife Sanctuary (WWS), the second largest protected area in Kerala, with an area of 344.53 km^2, comprising contiguous stretch of forested landscape, mostly occupied by South Indian moist mixed deciduous forests and Southern dry mixed deciduous forests is the only protected area in the study area. With its moist climate and better water regime it supports the world's largest population of Asian elephants and also serves as an important habitat for the Bengal tiger population in the country (Management Plan, Wayanad Wildlife Sanctuary 2012-2022). As a keystone species of the tropical forests and as one of the pioneer species used for habitat restoration with a more effective restoration nuclei (Slocum, 2001) documenting *Ficus* species distribution in protected forest areas, in addition to be used as biodiversity report, plays an important role as a baseline data for the restoration projects. Sampling was conducted along the trek paths covering most of the habitats of the protected area, in four different ranges i.e., Muthanga, Kurichiat, Sulthan Bathery and Tholpetty, of the sanctuary.

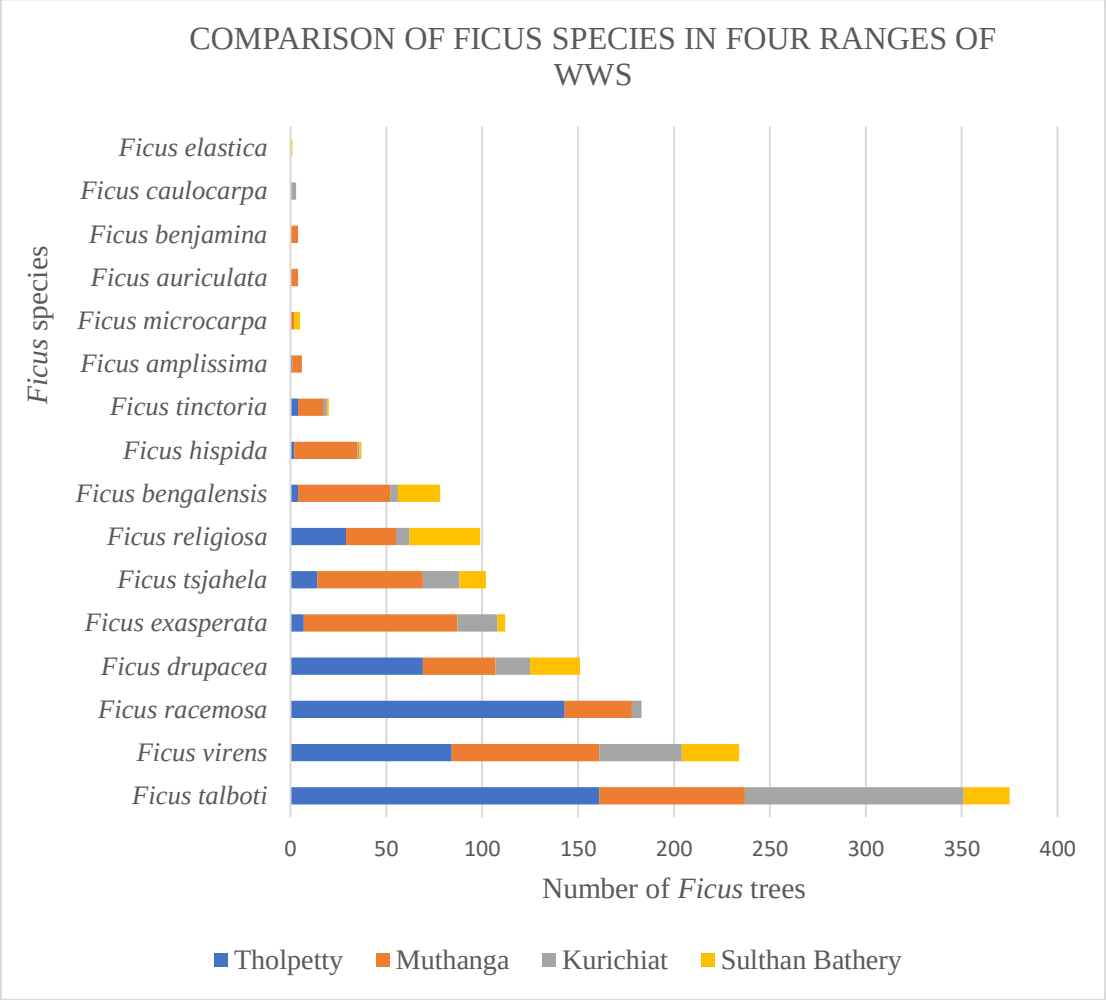
A total of 1415 individual *Ficus* trees belonging to 16 species are recorded from Wayanad Wildlife Sanctuary. The most abundant *Ficus* in the sanctuary is found to be *Ficus talbotii*, followed by *Ficus virens*, *Ficus racemosa* and *Ficus drupacea*. More than 100 individual trees of six *Ficus* species are reported from the Sanctuary.

We recorded 163 individual trees belonging to 11 species from Sulthan Bathery range, 237 individual trees belonging to 10 species from Kurichiat range, 518 individual trees belonging to 11 species from Tholpetty range and 496 individual trees belonging to 14 species from Muthanga range. This included two exotic species, one from Muthanga range (*F. auriculata*) and one from Kurichiat Range (*F. elastica*) each.

Most abundant *Ficus* species in Tholpetty and Kurichiat range is *Ficus talbotii* whereas in Sulthan Bathery range it is *Ficus religiosa* and in Muthanga range its *Ficus exasperata*. In Muthanga range, *Ficus talbotii* and *Ficus virens* are also abundant, although the number of *Ficus exasperata* is slightly higher. *Ficus exasperata* is a tree which was mostly (almost entirely) found along public road sides along the sanctuary. Very few trees of *Ficus amplissima* (six), *Ficus benjamina* (three), *Ficus caulocarpa* (three) and *Ficus*

microcarpa (five) are recorded during the survey. In this, all the three *Ficus caulocarpa* are found in the same location at Kurichiat range.

FIGURE 9: COMPARISON OF FICUS SPECIES IN FOUR RANGES OF WWS



From the study, 631 *Ficus* trees are found to be stranglers, these were associated with around 50 different species of trees. Out of the 631 stranglers reported, 121 are found to be on *Terminalia tomentosa*, 77 found strangling *Tectona grandis*, 57 on *Pterocarpus marsupium*, 51 strangling on *Grewia tiliifolia*, 38 are found strangling eight different *Ficus* species, 34 on *Lagerstroemia lanceolata* 25 on *Terminalia bellirica*, 22 each on *Syzygium cumini* and *Terminalia arjuna*, 17 each on *Stereospermum chelonoides* and *Aporosa cardiosperma* and 14 on *Schleichera oleosa*. We recorded one incidence each of *Ficus hispida* and *Ficus exasperata* growing on *Grewia tiliifolia*. Both of these plants, generally, have not been recorded or seen growing on other trees.

6. DISCUSSION

The study reported 24 species of *Ficus* from the study area. Among these, three - *F.auriculata, F. elastica* and *F. pumila,* are exotic cultivated species. Other 21 species are native species of the study area. Some of the species of *Ficus* are preferentially seen in particular forest types (Satheesan, 2016), e.g. *Ficus callosa, Ficus beddomei, F.nervosa* preferred only evergreen or semi evergreen forest over the others. *Ficus beddomei* is endemic to Western Ghats. Higher number of *Ficus drupacea, F. tinctoria, F. exasperata, F. virens, F. benghalensis* and *F. religiosa* are recorded in the moist deciduous parts of the study area. Eight species of *Ficus* species are new record to the study area, according to Sasidharan, 2006. Most of *Ficus* species show strangling nature, in our observation around 50 per cent of *Ficus* trees observed are stranglers on other trees. Interestingly, we observed *Ficus hispida* growing on a large branch of *Grewia tiliifolia*. It is generally a medium sized tree up to 10m growing on ground, mostly near any water source. We also observed a free-standing trees of *Ficus tinctoria* growing on rocks, which mostly were seen growing as shrubs on other plants, preferring *Ficus* species. *Ficus virens* was observed to have two types of fruits – one with pink spots or colouration on white coloured fruits and other a fully light green coloured fruit. A variety of birds – white cheeked barbet, Malabar grey hornbill, orange minivets, babblers etc and animals like Bonnet macaque, Sambar deer, spotted dear, barking deer, elephants, civets and even fishes are observed feeding on fig fruits or leaves.

Fig wasp communities are reared from 13 species of *Ficus* for the study. The study reported two new genus - *Ornatopedicellum* gen. nov. closest to *Camarothorax* but differs in notauli and delimited supraclypeal area and *Rahimaniella* gen. nov. closest to *Odontofroggatia* but differs from it in having different antennal segments, tarsi and axilla. Twenty-two new species of fig wasps into families, Epichrysomalidae, Eurytomidae and Pteromalidae are also reported in this study.

The new species to Epichrysomalidae are *Neosycophila tinctoria* sp. nov., *Ornatapedicelum virens* sp. nov., *Rahimaniella drupacea* sp. nov. and *Sycobiomorphella religiosa* sp. nov. Here, *Neosycophila tinctoria* sp. nov. differs from *N. omeomorpha* Grandi in not having sublateral furrow in mesoplueral region (with one anterior longitudinal and one posterior oblique sublateral furrow in *N. omeomorpha*) while *Sycobiomorphella religiosa* sp. nov. differs from *S. lacorensis* Abdurahiman and Joseph

in having supra clypeal area completely delimited (Supra clypeal area not delimited in *S. lacorensis* Abdurahiman and Joseph); Eyes as long as wide (Eye 2× longer than wide in *S. lacorensis* Abdurahiman and Joseph); Mandible tridentate (Mandible bidentate *S. lacorensis* Abdurahiman and Joseph).

The new species to Eurytomidae are *Sycophila drupacea* sp. nov., *Sycophila mysurensis* sp. nov., *Sycophila arnottiana* sp. nov., *Sycophila religiosa* sp. nov., *Sycophila virens* sp. nov., *Sycophila infectoria* sp. nov., *Sycophila wayanadensis* sp. nov., *Sycophila batheri* sp. nov., *Sycophila tinctoria* sp. nov. and *Sycophila gibbosa* sp. nov. All these *Sycophila* differs from each other and the other described species in various combinations of characters. They form to clusters of species based on their pedicel to F1 length. *Sycophila tinctoria* sp. nov., *Sycophila gibbosa* sp. nov., *Sycophila drupacea* sp. nov., and *Sycophila virens* sp. nov. forms one cluster while others form the second cluster. Within each cluster they can be easily distinguished based on the pronotum length to with, POL OOL ration and head length to width ratios.

The new species to Pteromalidae are *Micranisa microcarpae* sp. nov., *Otitesella virens* sp. nov., *Apocrypta microcarpae* sp. nov., *Philotrypesis virens* sp. nov., *Philotrypesis talboti* sp. nov., *Sycoscapter racemosa* sp. nov., *Sycoscapter tsjahela* sp. nov. and *Walkerella talboti* Shilpa and Santhosh. *Micranisa microcarpae* sp. nov. differs from *M. ashtamudiensis* Priyadarsanan in having scape 4 times its width; OOL 0.7x POL in *M. microcarpae* while scape 2 times its width; OOL 4x POL in *M. ashtamudiensis*. *O. virens* sp. nov. differs from *O. minima* Joseph in having a medially reduced propodeum which is 10x shorter than the propodeum width (propodeum 3x as wide as long in *O. minima*). *A. westwoodi* and *A. bakeri* differs from the new species in having POL 2.3x OOL (POL 1.7x OOL in *A. westwoodi* and POL 1.5x OOL *A. bakeri*); malar groove 0.4x eye length (Malar groove 0.5x eye length in *A. westwoodi* and malara groove 0.9x eye length *A. bakeri*). *P.talboti* sp. nov. is different from *P. pilosa* in having head width 1.5x length (length to gena length ratio; but different in having head width 1.5x length (1.9x in *P. pilosa*) while *P.virens* sp. nov. differs from *P. anguliceps* (Westwood) in having scape length 6.3x width (5.2x in *P. anguliceps*); pedicel length 1.5x width (2x in *P. anguliceps*). *S. racemosa* sp. nov. differ from *S. religiosa* Wiebes in having gena 0.35× eye length (gena 0.5× eye length in *S. religiosa*); SMV 1.6× MV (SMV 3× MV in *S. religiosa*) while *S. tsjahela* sp. nov. differs from *S. racemosa* sp. nov. in having SMV 1.9× MV (SMV 1.6× MV in *S. racemosa* sp. nov.); have four round sensilla at the end of STV (a pair of

setae on STV in *S. racemosa* sp. nov.); scape length 4.3× its width (scape length 4.6× its width in *S. racemosa* sp. nov.).

Two genera, *Neosycophila* and *Odontofroggatia* of Epichrysomalidae are new reports to India. Three species *Philotrypesis longispinosa*, *Sycoscapter infectorius*, *Otitesella minima* belonging to Pteromalidae, single species *Ormyrus bouceki* belonging to Ormyridae, *Syntomernus codonatus* from Braconidae and *Camarathorax bimasculinus*, *Sycobiomorphella lacorensis* and *Sycobia mathewi* from Epichrysomalidae are new reports to Kerala.

Other than the insect families reported in the result section, we recorded the presence of two other families – Eulophidae and Pirenidae from the study area. Only male specimen of Tetrastichinae sub family has been recorded from two species of *Ficus* whereas both male and female specimens of genus *Gastrancistrus* sp. of Perininae is reported from *Ficus* species from the study area.

Inflorescence of three *Ficus* species - *F. beddomei*, *F. callosa* and *F. heterophylla*, were collected, multiple times, for wasp emergence, but no fig wasps are reported from these *Ficus* species in this study. Trees, *F. beddomi* and *F. callosa* are pollinated by genus *Dolichoris*, which is not reported in this study from the study area. The three exotic species of *Ficus* - *F.auriculata*, *F. elastica* and *F. pumila*, does not harbour insects although the presence of *Sycophaga* sp. and *Apocrypta* sp. species on the surface of the figs of *F. auriculata* during a random observation outside the study area in Malappuram district was observed. The present investigation couldn't record any pollinator species from *Ficus tinctoria*, although four species of associated wasps is recorded from it. First report of an *Apocrypta* sp. is made from *Ficus microcarpa*. This genus was earlier reported from subgenus sycomorus only and now a host expansion to Urostigma subgenus is reported in this study.

Diverse species richness was recorded in different *Ficus* species in the study area. Some species like *Ficus virens* has around 12 associates whereas species like *F. amplissima* was found associated only with its pollinator. According to our field observations the latter species was found in very less number whereas the former was abundant in the study area. This high variation could be related to the abundance of the *Ficus* tree species in the study area as the accessibility and availability of resources increases the diversity of the animals associated with it. But further studies are need to confirm the same as no numeric

supportive data is available presently. The extreme values or number of wasps associated collected from *F. virens* could also be a result of a much larger collection of syconia from this species were studied compared to others.

Inquilines were not recorded from *F. racemosa*, *F. exasperata* and *F. hispida*. From our observations this could be because of the presence of high number of parasitoids and almost equal body size of pollinators and parasitoids would also be playing a role. One of our observations even found a parasitoid invaded syconia with dead parasitoid associates inside the syconia, as they could not dig a hole out of the syconia wall without the help of pollinators. This high number of parasitoid presences must have prevented the inquilines from ovipositing these *Ficus* species.

Induced gall size is different in different fig wasp species. In our observation the pollinator species and the parasitoid species have almost similar sized galls. But the inquiline species have larger galls mostly of different sizes according to their body size. The *Sycophila* sp. and the Epichrysomalidae species have larger sized galls compared to other inquiline species. The larger galls may be a result of their larger body size compared to others. This could be a reason that these insects oviposit and start induction of gall before the arrival of pollinator or parasitoid species as the space and resources for a large bodied insect would be absent in later stages of infestation.

The fruit size of different *Ficus* species is different as their wasp associates. The syconia size and some of the wasp associates showed significant dependency. The pollinators and the size of the syconia are independent of each other as irrespective of the syconia size they have evolved mechanism to enter the syconia and oviposit within their ovaries. The parasitoids were depended on the syconia size, this is because as the size of the fruit increases there will be more space available for oviposition in the syconia. The parasitoid number were influencing the presence and species richness of inquilines too. As the inquilines make larger galls, they need more space. In our observation, we found that the number of large sized inquilines will be always smaller than the number of parasitoids merging from a single syconia. If the number of parasitoids is high the presence of inquilines was found to be negligible and vice versa. There could be a direct role played by the oviposition time of the inquilines and the parasitoids in each *Ficus* species as the early oviposition of a large galling inquile would greatly reduce the space for the late coming parasitoid. Ghara and Borges, 2010 has observed in *F. racemose* that the different

Sycophaga sp. act both as inquilines or parasitoids, indicating the oviposition time of different species of even genus has to be separately evaluated in different *Ficus* species. Hence, these observations could only be confirmed by further studies considering the oviposition time of these insects.

The fruiting timing of the *Ficus* has changed due to the recent change in the weather patterns especially the rain patterns of the study area. Although the widely distributed species of the *Ficus* has not been largely affected by the same, the species, which are relatively less in number and show specific distribution patterns are found to have a disturbed massive flowering period. This disturbed flowering period hence would affect the wasp associates especially the non-pollinators, as they cannot maintain a good population on a limited flower supplies as the over exploitation of the host would adversely affect their survival. Any further confirmation of these observation needs a continuous monitoring of the weather and fruiting pattern and the community structure of the wasp associates, which would require a long-term monitoring work.

7. CONCLUSION

The study reported 24 species of *Ficus* from the Wayanad regions, with their taxonomic key for identification. Together with these 66 species of fig wasps from 13 different *Ficus* species are also reported from the study area. The fig wasp species were also accompanied with taxonomic keys for the observed species from the study area. Eight species of *Ficus* reported from the study area are additional new record to the Wayanad district. One these species, *Ficus beddomei* is endemic to southern Western Ghats.

The study reported two new genera and 22 new species of fig wasps to the science. The two new genera are *Ornatopedicellum* gen. nov. and *Rahimaniella* gen. nov. to Epichrsomalidae. New species include 10 new species to the genus *Sycophila*, two new species each to genus *Philotrypesis* and *Sycoscapter*, one new species each to genus *Micranisa*, *Otitesella*, *Walkerella*, *Apocrypta*, *Neosycophila*, *Sycobiomorphella*, *Ornatopedicellum* gen. nov. and *Rahimaniella* gen. nov. Two genus *Neosycophila* and *Odontofroggatia* from family Epichysomalinae were new additional report to India from this study. Six species *Philotrypesis longispinosa*, *Sycoscapter infectorius*, *Ormyrus bouceki*, *Otitesella minima*, *Syntomernus codonatus*, *Camarathorax bimasculinus*, *Sycobiomorphella lacorensis* and *Sycobia mathewi* are new additional reports to Kerala.

The study recorded distribution pattern of 1415 individual *Ficus* trees belonging to 16 species from the Wayanad Wildlife Sanctuary. *Ficus talbotii* was found to be the most abandoned species in the whole sanctuary and in Tholpetty and Kurichiat ranges whereas *Ficus exasperata* and *Ficus religiosa* were found in maximum numbers in Muthanga and Sulthan Bathery ranges. Maximum number of *Ficus* trees were reported from Tholpetty range followed by Muthanga, Kurichiat and Sulthan Bathery respectively. The study also recorded 631 strangling *Ficus* trees associated with around 50 different species of trees.

The key for *Ficus* species were restricted to the study area with only observed species of *Ficus*, further elaborate study of whole Kerala is needed to generate a key for the whole Kerala landscape. Taxonomic keys were provided for those families, genera and species that were observed from the study area during the present study period. The keys for the fig wasp species were mentioned for those genera which were represented by more than one species for highly dimorphic groups and at least three species for other groups with similar males and females. An elaborate study on the fig wasp associations on all recorded

species of *Ficus* had to be done in order to prepare a full-fledged identifications key for all the species recorded from India or Kerala as most of the type materials (mostly damaged or unable to locate) and descriptions only served the purpose, partially.

The study of *Ficus* species, which is a keystone species that is depended on for food and shelter by large number of faunas (Shanahan et al., 2001) and also as an important plant genus with high restoration potential (Harrison, 2005), is highly relevant as an essential data resort for future works on restoration of essential forest patches and also for studying plant animal interactions. Fig and wasp interactions is considered as an excellent platform to learn the climate change studies too (Borges, 2021). The data provided by this work would be very essential as a baseline data for these afore mentioned extended studies.

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9. RECOMMENDATIONS

- This study can be used as a baseline data of checklist and distribution of figs and fig wasps of Wayand. An extended study for the same is recommended for Kerala, so as to understand the distribution of the keystone species.
- More studies on fig associated wasps and their interactions are recommended as there is a high possibility of new species awaiting discovery and also new inquiline and parasitoid interactions would also be possibly found.
- We also recommend future studies on the fig depended animals and their interaction with the plant. Studies on the effect of climate change on the fig insects, fig fruiting cycle and on other depended animals would be essential area of study.
- Conservation attention and community learning about figs, their species and value in forests, urban and village areas should be encouraged. This would indirectly benefit a whole community of species as *Ficus* being acting as a keystone resource.

10. ABSTRACT

Study on the genus *Ficus* - a keystone plant, depended up on by large number of fauna for food and shelter and an important plant genus with high restoration potential, and its associated fig wasp species is highly relevant as an essential data resort for studying plant animal interactions and also for future forest restorations. The data provided by this work would be essential baseline data to learn the climate change studies too, as the fig and wasp interactions is considered as an excellent platform for climate change studies.

The study reported 24 species of *Ficus* from the Wayanad regions, with their taxonomic key for identification. Sixty-six species of fig wasps from 13 different *Ficus* species are also reported from the study area, accompanied with taxonomic keys. Eight species of *Ficus* reported from the study area are new record to the Wayanad district. One these species, *Ficus beddomei* is endemic to southern Western Ghats.

The study reported two new genera, *Ornatopedicellum* gen. nov. and *Rahimaniella* gen. nov. to Epichrsomalidae. Twenty-two new species of fig wasps are contributions to science from the present study. These include *Neosycophila tinctoria* sp. nov., *Ornatapedicelum virens* sp. nov., *Rahimaniella drupacea* sp. nov., *Sycobiomorphella religiosa* sp. nov., *Sycophila drupacea* sp. nov., *Sycophila mysurensis* sp. nov., *Sycophila arnottiana* sp. nov., *Sycophila religiosa* sp. nov., *Sycophila virens* sp. nov., *Sycophila infectoria* sp. nov., *Sycophila wayanadensis* sp. nov., *Sycophila batheri* sp. nov., *Sycophila tinctoria* sp. nov., *Sycophila gibbosa* sp. nov., *Micranisa microcarpae* sp. nov., *Otitesella virens* sp. nov., *Walkerella talboti* Shilpa & Santhosh, *Apocrypta microcarpae* sp. nov., *Philotrypesis virens* sp. nov., *Philotrypesis talboti* sp. nov., *Sycoscapter racemosa* sp. nov. and *Sycoscapter tsjahela* sp. nov. Two genus *Neosycophila* and *Odontofroggatia* from family Epichysomalinae were new additional report to India from this study. Six species *Philotrypesis longispinosa*, *Sycoscapter infectorius*, *Ormyrus bouceki*, *Otitesella minima*, *Syntomernus codonatus*, *Camarathorax bimasculinus*, *Sycobiomorphella lacorensis* and *Sycobia mathewi* are new additional reports to Kerala.

The study recorded distribution pattern of 1415 individual *Ficus* trees belonging to 16 species from the Wayanad Wildlife Sanctuary. *Ficus talbotii* was found to be the most abandoned species in the whole sanctuary. The study also recorded 631 strangling *Ficus* trees associated with around 50 different species of trees.