STUDY ON THE DIVERSITY OF WASP OF TKM COLLEGE CAMPUS AND MANDROTHURUTHU

PROJECT REPORT

Dissertation submitted to the University of Kerala in partial fulfillment of the requirements for the award of the degree of

BACHELOR OF SCIENCE

in

ZOOLOGY

DEPARTMENT OF ZOOLOGY

TKM COLLEGE OF ARTS AND SCIENCE

KOLLAM-5

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Submitted by

Name of candidates	Candidate Code
THAQMEELA.K	25017142038

DEPARTMENT OF ZOOLOGY

TKM COLLEGE OF ARTS AND SCIENCE

KOLLAM-5

2020

CERTIFICATE

This is to certify that the dissertation entitled "**Study on the diversity of wasp of TKM College Campus and Mandrothuruthu**" is an authentic record of the work done by Thaqmeela-K with Reg. No. 250171A2038 under my supervision as partial fulfillment of the requirements for the Degree of Bachelor of Science in Zoology and this report has not been submitted earlier for the award of any degree or diploma or any other similar titles anywhere.

Aseeb A K
(Supervisor)
Asst. Professor
Dept. of Zoology

Certified bonafide

Head of the Department

DEPARTMENT OF ZOOLOGY ★ TKM COLLEGE OF ARTS&SCIENCE ★ KOLLAM-5

EXAMINERS

1.

2.

DECLARATION

I do hereby declare that this dissertation titles **"Study on the Diversity of Wasp of TKM College Campus and Mandrothuruthu"** is a bonafide report of the project work carried out by me, under the supervision and guidance of **Aseeb A K,** Asst. Professor, Department of Zoology, TKM College of Arts and Science, Kollam as partial fulfillment of the requirements for the award of the Degree of Bachelor of Science in Zoology.

THAQMEELA .K

Karicode

ACKNOWLEDGEMENT

I have got many people to thank for their encouragement and support to accomplish the objectives of my work.

Primarily I would thank the God Almighty for his blessings upon me to complete this project with success. Then I am indebted to the Teacher-in-charge **Aseeb A K,** Assistant Professor, Department of Zoology for his valuable guidance, constant encouragement and immense motivation which his sustained my efforts at all the stages of this project work.

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Finally but immensely I remember with sincere gratitude, all my classmates and parents for their cooperation, love and concern without which this work would not have been materialized.

THAQMEELA.K

CONTENTS

dedicated to

my parents & teachers...

INTRODUCTION

Wasps are hunters and scavengers that prey on a variety of arthropod and animal protein sources. They are well equipped for this role, possessing large, powerful cutting mandibles for capturing, subduing, and processing prey, large eyes for detecting potential prey, and the ability to fly and hover in pursuit of food. Although well known for their stinging ability, wasps do not capture or subdue prey with the sting. Their venom is used entirely for defense, primarily against vertebrate potential predators. Indeed, all investigated wasp venoms are toxic, painful, and effective against vertebrates, but are rather weakly active and slow in affecting insects unless the sting is delivered near a ganglionic center of the nervous system. Moreover, wasps have little need to sting prey because they are equipped with powerful mandibles that are used to chew wood fibers from dead trees and can cut through tough insect nets in a matter of minutes.

Like all insects wasps have a hard exoskeleton which protects three main body parts, the head, the mesosoma and the metasoma. There is a narrow waist, the petiole, joining the first and second segments of the abdomen. The two pairs of membranous wings are held together by small hooks and the forewings are larger than the hind ones. In females there is usually a rigid ovipositor, which may be modified for injecting venom, piercing or a swing. In addition to their large compound eyes, wasps have several simple eyes known as ocelli. Wasps possess mandibles adapted for biting and cutting, other mouthparts are formed into a suctorial proboscis, which enables them to drink nectar.

Adult wasps usually obtain energy for flight and general metabolism from sugar sources. Nectar from flowers, honeydew from aphids and other homopterous insects, and sweet fluids from fruit all can be food sources. In most species, these sugars are supplemented by the sugary trophallactic secretions produced by larvae in response to solicitation by adults.

All wasps construct multicell nests from plantfibers. The most common materials for making nests are wood fibers scraped from the weathered dead wood of trees or twigs, but other materials including rotten wood and fibers from living plant leaves and stems are sometimes used. In most cases, these fibers are strengthened with salivary secretions during preparation and application to the nest. After application of the fibers, abdominal secretions may be added to further strengthen the material and help repel ants.

Wasps fall into two categories solitary or social. The majorities is solitary and live and operate alone. Examples of solitary wasps are parasitic wasps, which are beneficial insects used in agricultural pest control, and hunting wasps, which hunts spiders and other insects. Some solitary wasps nest in small groups alongside others of their species, but each is involved in caring for its own offspring. Many of the solitary wasps are parasitoidal, meaning they lay egg on in other insects and often provision their own nests with such hosts. Many, notably the cuckoo wasps are kleptoparasites, laying eggs in the nests of other wasps.

There are more than 30,000 identified species of wasps. There are only about 1,000 wasps species are identified as social. Social species are hornets, yellow jackets, and paper wasps, live and work together in colonies. Only the family Vespidae contains social species, primarily in the subfamilies Vespinae and Polistinae.

A wasp is any insect of the order *Hymenoptera* and suborder *Apocrita* that is neither a bee nor an ant. The most commonly known wasps, such as yellow jackets and hornets are in the family Vespidae and are eusocial. Prey of wasps is varied. Paper wasps (*Polisets*) are specialists on caterpillars, which they locate by visually and olfactorally searching vegetation likely to harbor them. Once located, the prey is quickly subdued, cut into manageable pieces that are chewed into a "meatball," and carried back to the nest to be fed to the larvae. Yellowjackets and hornets tend to have a broader diet than paper wasps and will capture a variety of arthropod prey including flies, spiders, caterpillars, and an assortment of other groups. House flies (*Musca domestica*) and other flies comprise major prey items of some species. Some species also scavenge for prey, removing insects captured in spider webs, carving flesh from dead animals such as rodents, and even removing insects freshly smashed on radiators and grilles of cars. The scavenging habits of some species have earned them the distinction of being considered to be pests at picnics, outdoor events, and around garbage cans.

Colony founding can be independent, or by swarm founding. In independent founding, the colony is initiated by one or more queens without the aid of workers; in swarm founding, colony initiation is accomplished by a swarm of many workers plus reproductive queens. Independent founding can be by a single queen (haplometrosis) or by several queens joining their efforts to initiate the colony (pleometrosis). Most yellowjackets and hornets are haplometrotic, though *Vespa affinis* sometimes is pleometrotic with multiple foundresses in a colony, and *Provespa*, departs entirely from the rule and reproduces by

swarming. *Polistes* and *Mischocyttarus* independently found colonies with a mix of both pleometrotic and haplometrotic colony founding. Single founding queens have the advantages of absence of competition for egg laying from other queens and a greater potential number of reproductive offsprings per foundress. Disadvantages include greater risks from ants and other predators or parasites attacking the unattended nest when the foundress is foraging, and an often lower success rate in establishing a nest. In addition to better protection of the nest, advantages for multiple foundresses include faster construction of the nest, more reliable prey capture for the larvae, and increased colony survival in the event of the loss of a foundress. These trade-offs of better survival and growth often prove advantageous for foundresses to join others. Both within individual species and across the genus as a whole, pleometrotic founding tends to be more prevalent at lower latitudes than haplometrotic founding, perhaps in part because of the more intense pressure from predators and parasites in warmer environments.

In wasps, as in other Hymenoptera, sex is determined by a haplodiploid system, which means that females are unusually closely related to their sisters, enabling kin selection to favor the evolution of eusocial behavior. Females are diploid and males called drones have haploid number of chromosomes and develop from an unfertilized egg. Wasps store sperm inside their body and control its release for each individual eggs as it is laid. Therefore under most conditions in most species, wasps have complete voluntary control over the sex of their offspring.

Reproduction and colony founding by swarms occurs in all epiponine wasps plus *Provespa* and some *Ropalidia*. During swarm founding, hundreds, or even thousands, of workers with young queens leave the parent nest and move to a new location to construct a new nest and reproductive unit. Clear advantages of swarm founding over independent founding are the availability of a large worker force to construct the nest quickly, and the opportunity for task specialization by individuals within the swarm. Reproductive individuals in the swarm need not forage as must their independent founding counterparts, and individual workers can specialize in different tasks such as collecting nectar, prey, fiber for nest construction, or water for cooling and mixing with fiber for nest construction. Multiple workers also ensure that a large defending force is always available, should intruders appear.

Wasps play many ecological roles. Some are predators or pollinators, whether to feed themselves or to provision their nests. Some species can effectively transport pollen

and pollinate several plant species. Pollen wasp in the subfamily Masarinae gathers nectar and pollen in a crop inside their bodies, and pollinates flowers of Penstemon and the water leaf family, Hydrophyllaceae. The Agaonidae or fig wasps are the only pollinators of nearly 1000 species of figs. Since the wasps are equally dependent in their fig trees for survival, the coevolved relation is fully mutualistic. Social wasps are considered pests when they become excessively common, or nest close to buildings. People are most often stung in late summer, when wasp colonies stop breeding. Stings are usually painful rather than dangerous, but in rare cases, people may suffer life threatening anaphylactic shock.

Among insects, wasps (social, solitary or parasitoids) exhibit great variations in structure, physiology and behavior and are of special interest for conservation, as they are considered predominant predators in terrestrial ecosystems, as they control the populations of several other organisms.

This work aimed to determine the richness and abundance of the wasp in TKM college campus, Munroe Island and nearby vicinities.

ECOLOGICAL IMPORTANCE OF WASPS

Despite the fear they sometimes evoke, wasps are extremely beneficial to humans. Wasps are essential for ecosystem functioning and carry out a variety of important jobs called ecosystem services which help us to lead a healthy and happy life. The most important ecosystem service provided by wasp is pest control. Wasp also play a significant role in pollination.

ROLE AS PREDATORS

Many wasp lineages, including those in the families Vespidae, Crabronidae, Sphecidae and pompilidae, attack and sting prey items that they use as food for their larvae; while Vespidae usually maculate their prey and feed the resulting bits directly to their blood.

Some species of parasitic wasp, especially in Trichogeammatidae, are exploited commercially to provide biological control of insect pest.

ROLE AS PARASITOIDS

Most solitary wasps are parasitoids. As adults those that do feel typically only take nectar from flowers. Parasitoid wasps are extremely diverse in habits many laying their eggs in inert stages of their host (egg or pupa) sometimes paralyzing their prey by injecting with venom through their ovipositor.

AS POLLINATORS

Eventhough in the absence of a far-like covering of soft hairs and pollen basket, a few species of wasp can effectively transport pollen and pollinate several plant species.

Pollen wasps in the subfamily, Masarinae gather nectar and pollen in a crop inside their bodies and pollinate flowers of penstemon and water leaf family, Hydrophyllaceae.

The Agaonide (fig wasps) are the only pollinators of nearly 1000 species of figs, and thus are crucial to the survival of their host plant.

EXPERT WINE MAKERS

Wasps are amazing wine makers. They contribute to the yeast content found in grapes. A study shown that wasps provide a suitable nesting area inside their stomachs during winter, specifically the saccharomyces cerevisiae fengus used to make wine, beer and bread. This is done by wasp feeding one of their favourite snacks, late season grapes, which are naturally rich in yeast.

REVIEW OF LITERATURE

The taxonomy and systematic of aculeate families were well studied by the enthusiasts and taxonomists. Most of the research has been inclined towards the taxonomy and behavioral studies, however, in recent time molecular study also contributing to substantial extent so as to understand the taxonomy, evolution and behavior of aculeate wasps. The first contributions to the study of aculeate wasp fauna in the World date back to the late eighteenth century and early nineteenth century. Fabricius (1775) in his first volume on Systema Entomologiae described 12 species of true scoliids, 18 species of vespids and 6 species of spider wasps. After a period of 25 years of complete neglect, the study of aculeate wasps began to attract naturalists and taxonomists across the world, which significantly increased the knowledge of this species rich group. Latrielle (1802) studied the wasps of Hawaiian Islands. This work on Hawaiian was pursued by Williams (1921, 1927), Weber (1948), Yoshimoto (1959), Willink (1972) and Yamane et al. (1996). Smith (1858) in his catalog of hymenopteran insects had given good coverage on wasps of Borneo, Malacca and Singapore region. The most comprehensive monographic work on wasps of France was carried out by Saussure (1853-1858). Noteworthy contributions to the taxonomic studies on aculeate wasps were given by Gribodo (1982), Dalla Torre (1889, 1894, 1904), and Cameron (1898, 1900). Ashmead (1902) focused the outline classification of the fossorial, predaceous and parasitic wasps of the superfamily Vespoidea. Brethes (1903), Ducke (1904, 1905, 1907).and William and Ashmead (1904) contributed to the taxonomy of aculeate wasps of South America. Neotropical Polistinae species were studied by many workers in the lights of taxonomy, phylogeny and biology and behavior. Noteworthy contributors are Bequaert (1933, 1937, 1943); Zikan (1935, 1949); Windsor (1972); Richards (1941, 1943, 1945, 1971, 1978); Gorton (1978); Silva & Rodriguez (1987); Carpenter & Wenzel (1988); Silva (1988); Starr (1988); Silva & Oliveira (1989); Queller et al. (1992); O'Donnell (1992, 1999); London & Jeanne (1996); Cooper (1996a, 1996b). Zalat et al. (1992) studied eumenine of Egypt and accounted 35 species and furnished the keys for genera and species. Yamane and Yamane (1979) has given an account of 16 polistine species from Nepal. Baltazar (1966) in his catalogue of Philippine Hymenoptera had given detailed information on synonyms and distribution of species across the Philippine Islands. Carpenter and Cumming (1985) explained the character analysis of potter wasps. Carpenter (1986) had given the synonymic generic checklist of the Eumeninae. Carpenter and Day (1988) supervised nomenclature of

Polistinae of the World and supplied for certain genus-group names for paper wasps. Yamane (1990) reviewed the Eumenine fauna of Japan enumerating 54 species with description of new 5 species. Carpenter (1996, 2001, & 2004) in his work on aculeate wasps: cataloged the species of genus Polistes, proposed the generic synonymy of Stenogastrinae mentioning seven genera worldwide, and described one new species of hover wasp, from northern Vietnam. Carpenter et al. (1996) synonymised the genus Occipitalia Richards, 1978 and merged it to the Clypearia Saussure, 1854. Carpenter (1999) documented taxonomic details on paper wasps of the world. Kojima and Carpenter (1997) had given a catalog of species in the polistine tribe Ropalidiini, which comprises 225 species of Old World. They have also designated lectotypes of 14 species described by Cameron (1900) in the Zoologisch Museum. Carpenter (2004) Synonymised the genus Marimbonda Richards, 1978, with Leipomeles Möbius, 1856. Among important works on aculeate diversity and taxonomy in recent past were that of Jun-ichi Kojima (2001) studied Ropalidia wasps of New Guinea, Carpenter and Christopher (2000) described new genus Chalogaster using cladistic analysis. Carpenter and Nguyen (2003) given illustrated keys to genera of social wasps of south-east Asia, Bartalucci (2004, 2006, 2008) and Brown (2005) contributed to the knowledge of family Tiphiidae. Libor (2006) on range extension of Vespa orientalis in Mexico. Saito and Nguyen (2006) on hover wasps, Buck et al. (2008) furnished comprehensive information in atlas of vespidae from the northeastern Nearctic region, Ebrahim and Carpenter (2008) compiled a catalog of Iranian vespoid wasps with illustrated keys to all species. Gusenleitner and Gusenleitner (2010) invented two eumenine species and enlisted 116 species from Kenya. Landolt et al. (2010) described new species of genus Vespula and also 16 reported Vespa crabo first time from Guatemala (USA), Nguyen et al. (2011) studied the species group of genus Polistes Latreille 1802 from the mountainous areas of northern Vietnam. Gusenleitner and Mad (2012) specified taxonomic account on Ethiopia vespidae. Khalid et al. (2012) studied the vespidae fauna of Pakistan; Nugroho et al. (2013) dealt with eumenine fauna of Indonesia. Effective use of vespoid wasps as bio-control agents in agriculture has been discussed by Lee (1984), Lee et al. (1986) and Grissel (2007). Social wasps are used to study the evolution of multifaceted phenomenon of social life in animals. Gadagkar et al. (1982) and Chandrashekara and Gadagkar (1990) studied the division of labour, communication among colony members. Similar work of the kind was that of Carpenter (1991). Robert and Hunt (1992), Hunt et al. (1995), Carpenter et al. (1996), London (1996), Hunt (1999), London and Jeanne (2000), Adam et al. (2001), Robert and Gonzalez (2004) and Buschini

and Buss (2010). 2.2 National The Fauna of British India series on Hymenoptera by Bingham (1897) has been a first consolidated record of aculeate hymenoptera besides mentioning some other hymenoptera groups also. A few years later Bingham (1903) yet again contributed to taxonomy of Ants and Cuckoo wasps through his second volume of Fauna of British India series on Hymenoptera. However, prior to Bingham's laudable contributions, Horne (1870) had studied the Vespidae and Apidae of north-east India. Studies on systematics and diversity of Vespoidea group have long been pursued by researchers of India and overseas. Betrem (1928) brought out a monograph on Indo-Australian Scoliidae. Van der Vetch (1968) while describing the Rhynchium species of Philippines discussed the taxonomy of Indian eumenine taxa. Later, Chhotani & Ray (1975) studied the aculeate fauna of Rajasthan. The monograph of Krombein (1978) on the Scoliidae of southern India and Ceylonese (now Sri Lanka) can be considered as the key-stone in the taxonomy of hairy wasps. This commendable and comprehensive biosystematics work has given detailed taxonomic information on true scoliids, raising several new taxa, re-describing and synonymysing the existing ones. Roy and Kundu (1985) has studied the wasps of 17 Namdhapa Wildlife Sanctuary, Arunachal Pradesh and contributed about 'a gap of hundred years' to aculeate systematic of north east India. Krombein (1991) in his notes on Ceylonese wasps (now Sri Lanka) has given valuable inputs on natural history of families like Vespidae, Pompilidae and Crabonidae of south India. A preliminary study of the hymenopteran fauna of Silent valley national park, Kerala has been carried out by Binoy et al. (1999). Das and Gupta (1983) put forth a detailed Catalogue of subfamilies Stenogastrinae and Vespinae for Indian subcontinent. Das and Gupta (1989) contributed immensely to the comprehension of Indian vespids through a monograph on social wasps of India and adjacent countries. This monograph furnished the detail account on diversity, taxonomy of social wasps with new descriptions and synonymy of existing taxa of Indian subregion. Jonathan and Gupta (1999a, b) studied the hairy wasps of family Scoliidae in the state fauna series of West Bengal and Meghalaya state respectively. Ray (2000, 2003) has studied the diversity of aculeate wasps of Tripura and Sikkim respectively as a result highlighted the diversity of aculeate wasps in northern India. A consolidated account on Scoliidae fauna of India and adjacent countries has given by Jonathan and Gupta (2003a) in fauna of India series of Zoological Survey of India. They have accounted total 79 species under 13 genera, among them 8 species and 5 subspecies were new to science. Jonathan and Gupta (2003b) further studied the scoliids of Sikkim. Lambert and Narendran (2002) and Lambert (2004) described two

new species of eumenine genus, Antepipona Saussure from South India. Subsequent additions to the knowledge of Vespidae of India is enriched by Lambert (2005) on three new species of genus Ropalidia from south India and Lambert et al. (2007, 2008) on potter wasps India. Later, Gupta (2007) studied the diversity of aculeates from western Doon Shivaliks. Gusenleitner (1987, 1988, 1996, 2001, 2006, 2007, 2008, 2010, and 2011) contributed immeasurably to the taxonomy of family Vespidae in general and potter wasps in particular from of Indian subregion and world as well. Kundu et al. (2010) first time studied the vespidae of Uttarakhand and given taxonomic account on 34 species along with key and diagnosis for each species. The systematic study of scoliids wasps of Jaldapara Wildlife Sanctuary, West Bengal has been documented by Bhattacharjee et al. (2010). 18 Furthermore the knowledge on Indian Vespoids is highlighted by many workers like Srinivasan and Girish (2009a, 2009b, 2010, and 2013). Several workers contributed to range extension of Vespoids throughout the country. Shareef et al. (2013a, b) given the new distributional record of potter wasp, *Pseudozumia indica* from Peninsular India and paper wasp, *Polistes (Gyrostoma) rothneyi krombeini* from Malabar Wildlife Sanctuary, Kerala. Lambert et al. (2012) reported *Polistes (Polistella) strigosus Bequaert* first time from south India. Recently, Lambert et al. (2014) described the new species *Ropalidia narendrani* Lambert Kishore, Mohammed Shareef and Girish Kumar, 2014 from Southern Western Ghats, Kerala, India. Works on Vespoidea taxonomy owed much to the contributions by Girish Kumar. His numerous papers on range extension, re-description and descriptions of new taxa which dealt mainly with Vespidae and Scoliidae thoroughly documented the diversity of Indian Vespoids. Of his several notable contributions in this regards are: Girish Kumar and Kazmi (2008) on range extension of *Megacampsomeris prismatica*; Girish Kumar (2009a, b, c) a checklist of Scoliidae of India, range extension of *Megascolia azuria christiana* in north India; scoliids of Andhra Pradesh respectively. Moreover the other contributions are, Girish Kumar (2010) on distribution of *Polistes (Gyrostoma)* in Indian subcontinent, Girish Kumar and Srinivasan (2010) on hornet wasps of India, Girish and Kishore (2010) on new records of *Polistes (Polistes)* from Indian subregion, Girish Kumar and Nguyen (2010) on nocturnal wasp from India, Girish and Kishore (2011) on redescription of *Xenorhynchium nitidulum* from India, Girish Kumar (2011a, b) on distribution of *Scolia (Discolia) binotata binotata* in north India and on re-description of *Orumenoides edwardsii* from India. In addition Girish Kumar (2012a, b, c, d) contributed to scoliid wasps of India in ENVIS newsletter, redescription of genus *Omiocroides* from India, review on Delta dimidiatipenne and re-description of *Delta*

esuriens from India respectively. *Girish Kumar and Sharma* (2012) have given a review of genus *Orancistrocerus* from Indian subcontinent. Important contributions made by Girish Kumar are: Girish and Kishore (2012), Girish Kumar et al. (2012a, b), Girish Kumar (2013a, b, c), Girish Kumar et al. (2013a, b, c, d), Girish Kumar and Sharma (2013a, b), Girish Kumar and Carpenter (2013). In recent times, Girish Kumar and Sharma (2014a) studied the 19 aculeate wasps of Nayachar Island of west Bengal; Girish Kumar and Sharma (2014b) studied Vespidae of Rajasthan; Girish Kumar et al. (2014a, b, c) gave the additional information on eumenine genus *Apodynerus* from Indian subcontinent, review of the genus *Paraleptomenes* from Indian subcontinent and review of the genus *Epsilon* from India respectively. As regards systematic and diversity studies on Vespoidea fauna of Maharashtra state, is inadequately known. Important early attempt is by Girish Kumar and Kazmi (2012), with enumeration of 10 species of scoliids from Maharashtra. Recently, Jadhav et al. (2014) reported a scoliid wasp, *Scolia (Discolia) fasciatopunctata dunensis* Betrem, 1928 first time from Western Ghats of India as well as peninsular India. Earlier, the distribution of this species was restricted to states of north-east India. Subsequently, Jadhav and Gaikwad (2014) documented the range extension of scoliid wasp, *Megacampsomeris cochinensis* Betrem, 1928 from the Northern Western Ghats. Both these reports constitute as a new report for the state Maharashtra.

REVIEWS ON MOLECULAR PHYLOGENY

The spider wasps across the world are well studied as regard of their diversity and complex taxonomy. The multifarious taxonomy of this diverse family is studied by many workers in neartic region. Earlier phenomenal attempts were made by Brothers (1975). He studied the phylogeny of Mutillidae. Later, Brothers (1999) studied the phylogenetic aspects of Vespoidea and Apoidea. Brother and Carpenter (1993) experimented on the interrelation among aculeate families using phylogenetic analysis. Shimizua (1994) studied classification of Pompilidae exclusively based upon molecular phylogenetics. Noteworthy contribution of Pitts et al. (2007) on preliminary morphogenesis analysis on spider wasps revealed the relationship among families of spider wasps. A phylogenetic study on spider wasps of Fiji has been studied in detail by Pitts and Wilson (2007). The inputs on family level divergence of spider wasps of USA have been contributed by Wilson et al. (2012).

De Saussure (1853) provided the higher classification of the super family Vespoidea. He divided vespid wasps often called as diplopterus wasps (doubled wings =

wings folded longitudinally at rest) into three tribes viz., Masarien, Eumenienes and Vespiens. Smith (1857) divided Diploptera into three families Masaridae, Eumenidae and Vespidae. Dalla Torre (1894, 1904) also considered Vespidae as a family of Diploptera. Bingham (1897) classified Diploptera as a tribe under Aculeata and recognized two families (Eumenidae and Vespidae). Bingham (1897) studied extensively on the fauna of British India. Later Eumenidae considered as a subfamily known as Eumeninae under the family Vespidae. Das & Gupta (1989) published a monograph on social vespids of Indian region namely "The social wasp of India and the adjacent countries".

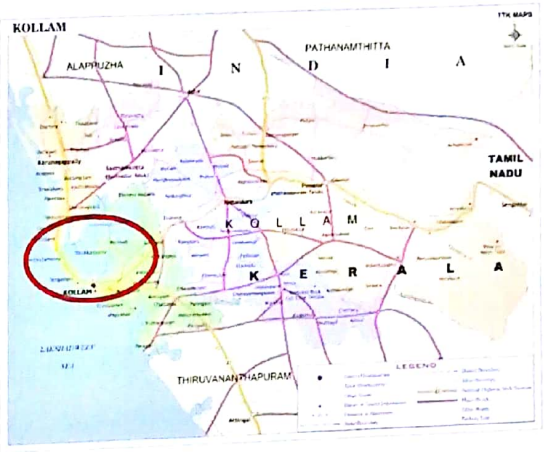
STUDY AREA

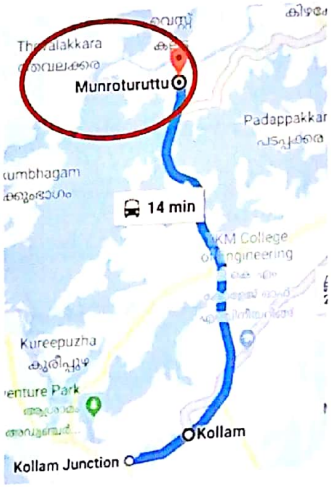
Study area selected for this project work were TKMCAS campus at Karicode and Mandrothuruthu (Munroe Island). Karicode is a neighbourhood of Kollam city in Kerala, India. It is about 5 kilometers away from Kollam City Centre. It is the 23rd ward in Kollam Municipal Corporation Council. Mundrothuruthu is an inland island group located at the confluence of Ashtamudi Lake and the Kallada River, in Kollam district, Kerala. It is a group of eight small islets comprising a total area of about 13.4 sqkm. The island, accessible by road, rail and inland water navigation, is about 25 kilometres from Kollam by road, 38 kilometres north from Paravur, 12 kilometres west from Kundara and about 25 kilometres from Karunagapally. TKMCAS Campus is at latitude 8.9153° N, and longitude 76.6326° E. and Mandrothuruthu is at latitude 8.9952° N and longitude 76.6105° E.

OBJECTIVES

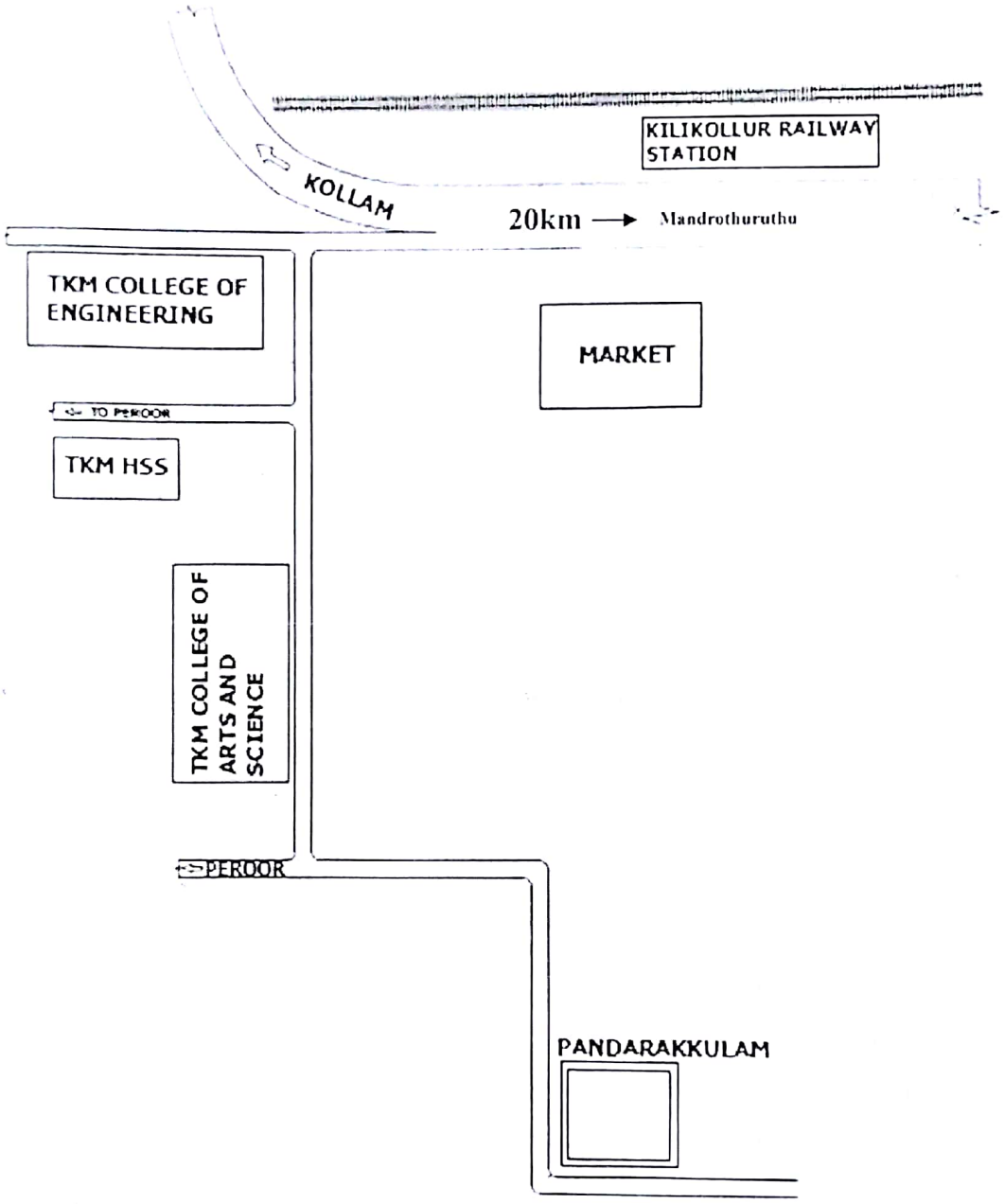
1. To study the diversity of wasps in Karicode and Munroe Island.
2. To identity the common, uncommon and rare species of Karicode and Munroe Island.

STUDY AREA





STUDY AREA



MATERIAL AND METHODS

The specimens were collected from TKM college campus and Mandrothuruthu. The collected specimens were studied and photographed by using a Leica Stereo microscope with LAS software version 3.6.0. All the studied specimens were registered and kept at ZSIK(Zoological Survey of India, Kozhikode.)

THE STUDY AREA

TKM college campus and Mandrothuruthu is taken for studying the diversity of wasps.

COLLECTION AND PRESERVATION OF SPECIMENS

Specimens for this study is collected by employing various standard insect collecting gadgets as mentioned below

Sweep Net: The main advantage of net sweeping is that we get plenty of specimens with high diversity in a short period of time while comparing with other techniques for collection. The insect net used for collection is a modified type of Noyes, 1982

Malaise Trap: It is a tent like device made with terelene cloth, which work on the basis of the positive phototactic and negatively geotropic behaviour of insects.

Yellow Pan Trap: It works on the principle that insects get attracted to yellow color. These are yellow coloured plastic pans filled with water, along with a few drops of surfactant.

The specimens collected is narcotized in killing jars with ethyl acetate and later stored in vials containing 70% alcohol. The specimens is pinned by standard entomological pins and observed under high resolution stereoscopic binocular microscope (Model Leica M205 A). Multi focal stacking Imaging of the specimens is done with camera (Model DFC 500) attached with the same microscope.

The following abbreviations used in the text for the terms:

H = Head; M = Mesosoma; S = Abdominal sterna; T = Abdominal terga.

SYSTEMATIC LIST

Family VESPIDAE

Genus ***Ropalidia*** Guérin-Méneville, 1831

1. *Ropalidia brevita* Das & Gupta, 1989

2. *Ropalidia jacobsoni* (du Buysson, 1908)

Genus ***Antepipona***(de Saussure, 1867)

3. *Antepipona ceylonica*(de Saussure)

Genus ***Subancistrocerus*** Saussure, 1855

4. *Subancistrocerus sichelii*(de Saussure, 1856)

Family SCOLIIDAE

Genus ***Campsomeriella*** Betrem, 1941

5. *Campsomeriella (Campsomeriella) collaris collaris* (Fabricius)

Genus ***Scolia*** Fabricius, 1775

6. Scolia (Discolia) binotata binotata Fabricius

Family SPHECIDAE

Genus ***Chalybion*** Dahlbom, 1843

7. *Chalybion bengalense* (Dahlbom)

Genus ***Sceliphron*** Klug, 1801

8. *Sceliphron coromandelicum* (Lepeletier)

Family CRABRONIDAE

Genus ***Carinostigmus*** Tsuneki, 1954

9. *Carinostigmus costatus* Krombein

Genus ***Liris*** Fabricius, 1804

10. ***Liris*** sp.

Genus ***Pison*** Spinola, 1808

11. *Pison* sp.

Family EUCHARITIDAE

Genus ***Schizaspidia*** Westwood (1835)

12. *Schizaspidia brevifuniculata* Narendran

Family TIPHIIDAE

Genus ***Tiphia*** Fabricius, 1775

13. *Tiphia* sp.

RESULT

1. ***Ropalidia brevita* Das & Gupta, 1989**

Family: Vespidae

Genus: *Ropalidia* Guerin-Meneville

(Figure. 1)

1989-*Ropalidia brevita* Das and Gupta, 121.

Holotype male, Delhi university ridge (NZC)

Diagnosis: Female. T_1 proportionally wider with its maximum width in dorsal view nearly half as wide as that of T2 . Propodeum with paired, longitudinal basal carinae with weak transverse striations and scattered shallow punctures between basal carinae.

Colour description:

Female: Body red with following yellow portions, antennal scape below, band on clypeus at apex, mandible (except at tip) inner orbit below ocular sinus, prenotum anterioly, two marks on metanotum, two enlarged marks on apical half of propodeum, faint mark on sides of mesosternam, tarsal segments of all legs. In some portions black patches are mixed with redolish body.

Male: Similar to female in size and general appearance clypeus, sypraclypeal area, inter antennal space, inner orbit below ocular sinus are completely yellow. Male terminal antennal flagellomeres less strongly curved and bluntly pointed at apex.

Body length: Female and male, 12mm

Material examined INDIA: Kerala, Kollam district, TKMCAS Campus, 1♀, 1.iii.2020, Coll. A.K. Aseeb; Munroe Island, 1♂, 1.ix.2019-1.ii.2020, Coll. A.K. Aseeb& Party..

Distribution: In India: Assam, Chhattisgarh, Delhi, Goa, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Odisha, Rajasthan, Sikkim, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal

Elsewhere: Pakistan.

2. ***Ropalidia jacobsoni* (du Buysson, 1908)**

Family: Vespidae

Genus: *Ropalidia* Guerin-Meneville

(Figure. 2)

1908-Icaria Jacobseni du Buysson, 123. Type female, Java

Diagnosis: Female. Median furrow of propodeum distinct, T_1 in lateral view with dorsal margin more strongly convex in posterior half, highest slightly posterior to level of posterior margin of the sternum.

Colour description: Female- Body reddish brown with yellow and black markings. Yellow markings are present at mandible except at tip and at base brown, clypeus except the characteristic black mark, mark on inter antennal space ventral side of antennae, two large marks on metanotum, two broad marks on propodeum separated by broad black line along median groove.

Black marks are present on clypeus at base suprachypeal area, large circular spot above each antennal socket, mark around each ocellus occiput, propleuron, dorsal metapleuron, ventral metapleuron apically towards mesopleuron. Wings transparent with apical half of radial cell brown, stigma is yellow.

Size : ($H+M+T_1+T_2$): Female 6-7 mm

***Material* examined:** India, Kerala, Kollam ditrict, Munro island, 4 female, 2 male, 1-ix-2019 to 1-ii-2020, coll.A.K.Aseeb & party.

Distribution: In India–Arunachal Pradesh, Assam, Chattisgarh, Delhi, Gujarat, Karnataka, Kerala, Maharastra, Meghalaya, Nagaland, Rajasthan, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal.

Elsewhere: Indonesia, Bangka, Java, Lombok, Sulawesi, Sumatra, Myanmar.

3. ***Antepipona ceylonica* (de Saussure, 1867)**

Family: Vespidae

Genus: *Antepipona* (de Saussure, 1867)

(Figure. 3)

Diagnosis: Female: Pronotal carrina well developed on lateral sides, doesnot reach dorsal side, it bends inwards before reaching dorsal side dorsal side completely rounded; colouration of metastoma characteristic

Colour: Body black, with yellow markings. Yellow are basal half of mandibles except a basal black spot, mark at apex sometimes absent. A large line on temple, two large spots on dorsal surface of prontum. T_1 apically on a band narrow at the sides, sometimes joins two speeks. T_2 with two large round spots at base. Minute speeks on lateral margins of T_3; a thin band, sinous on T_4 a round spot on T_6; S_2& S_3 with an apical band slightly enlarged at middle and on sides.

Ventral surface of pedicel and flagellar segments yellowish brown. Wings sub hyaline, infumated along apical half of marginal vein.

Male: Clypeus slightly wider than long rather strongly convex, with short teeth but very sharp densily punctured. Punctures stronger than those in female colour similar to female expect clypeus, supraclypeal area and interantennal space entirely yellow. Mandible almost entirely yellow except brown apex: apex of T_5 with a yellow band; T_7 without yellow markings.

Size ($H+M+T_1+T_2$) Female 6.5-7mm male, 6-7mm.

Material examined:

INDIA: Kerala, Kollam district, Munroe Island, 1♂, 1.ix.2019-1.ii.2020, Coll. A.K. Aseeb& Party.

Distribution- India: Andhrapradesh, Chattisgarh, Goa, Gujarat, Jharkhand, Karnataka, Kerala, Maharashtra, Nagaland (New record) Odisha, Rajasthan, Sikkim, Tamil Nadu, Telangana, Uttarakhand, Uttar Pradesh, West Bengal.

Elsewhere: Maynmar: Sri Lanka

4. ***Subancistrocerus sichelii*** **(de Saussure, 1856)**

Family: Vespidae

Genus: ***Subancistrocerus*** **Saussure, 1855**

(Figure. 4)

Subancistrocerus sichelii**:** Iwata, 1965; 105; Van der Veeht, 1967: 31 (Proposal to place on official List) ICZN opinion 893, 1970: 189(placed on official list)

Redescription- Female: Body length ($H+M+T_1+T_2$) 6.76mm; Fore wing length 5.6mm. body black with pale yellowish white and brown colouration pale yellowish white colouration as follows: mandible towards base, a curved line on the clypeus at base and rarely two spots towards apex. Brown colouration as follows: mandible except basal area. Wings hyaline with veins and pterostigma dark brown, body with rather sparsely to moderately dense silvery pubesena.

Head 0.97 x as wide as long in front view, clypeus median area flat, slightly projecting teeth. In between two teeth width 1.9 x length, moderaley deep puncture. Lower part with scattered puncture; POL 1.5 x 001 diameter of anterior ocillus 0.92 x Antenna 2.05 x farther from each other them from eyes.

Mesosoma: Anterior face of pronatum with two close set but well separated deeply impressed fovea at middle. Posterior face and lateral sides of pronotum, mesoscutem,

scutellum and metanotum, strongly, closely and rugosely punctuate; mid tibia with one supul; hind coxa with a spine at its base.

Metasoma: Sessile, lenth of T_1 + T_2 slightly greater than the length of mesosoma in profile (1.06 x). T_1 compressed, narrowed, companulate 1.32X as wide as long. T_2, T_3, T_4, and S_2, S_3 with moderately strong punctures.

Male: Body length (H+M+T_1+T_2) 6 – 6.2mm. fore wing length 5-5.5mm colour pattern is almost same as that of female except clypeus. Body more deeply sculptured than female. 4.03X as wide as long in front view . Clypoeus more elongate and apex between two teeth deeply emarginate width 1.04X length.

.

***Material examined*:** *Material examined*: INDIA: Kerala, Kollam district, TKMCAS Campus, 1♀, 1.iii.2020, Coll. A.K. Aseeb& Party

Distribution: India: Andaman & Nicobar Islands (new record), Arunachal Pradesh (new record), Assam (new record), Bihar (new record), Karnataka, Maharashtra, Meghalaya (new record), Odisha (new record), Sikkim, Tripura (new record), Uttarakhand, West Bengal.

Elsewhere: Bangladesh (new record), Myanmar,Sri Lanka, Thailand (new record).

Remarks: It is the only species of the Genus *Subancistrocerus* de Saussure which is widely distributed in India, both mainland and islands, occurring in all the ecosystems and in areas of low to very heavy rainfall from sea level to high elevations.

5. *Campsomeriella (Campsomeriella) collaris collaris* (Fabricius, 1775)

Family: Scolidae

Genus: *Campsomeriella* Betrem, 1941

(Figure. 5)

Diagnosis: *Female*: Length 14-27 mm. Integument black; vestiture black, except clypeus and front usually with intermixed cinereous setae, occiput and scapula with dense erect and mesoscutum with decumbent white setae. Wings dark brown with deep blue reflections. Upper front and vertex impunctate except for a few scattered punctures; upper plate of metapleuron impunctate except for a few fine, scattered punctures along upper margin; longer spur of hind tibia black and obtuse apically.

Male: Length 11-19 mm. Integument black. The following parts are yellow: clypeus except for a median triangular black mark; mandibles at basal half; pronotum anteriorly in the middle; a narrow stripe adjacent to tegula; two large spots on scutellum anteriorly; a small anteromedian spot on metanotum; a spot on each callosity; stripe on apical half of all femora; outer surface of all tibiae; almost entire surface of T1, about apical two- thirds of T2, apical half of T3 and T4, S2 and S3 with paired minute posterolateral spots. Vestiture white except black on T5-T7; S6 and S7 with long dense black setae.Wings hyaline, with weak yellowish reflections.

***Material examined*:**

INDIA: Kerala, Kollam district, Munroe Island, 1♂, 1.ix.2019-1.ii.2020, Coll. A.K. Aseeb & Party.

Distribution: India (Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Goa, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Lakshadweep, Madhya Pradesh, Maharashtra, Meghalaya, Odisha, Rajasthan, Sikkim, Tamil Nadu, Telangana, Tripura, Uttarakhand, Uttar Pradesh, West Bengal).

Elsewhere: Bhutan, Nepal, Sri Lanka.

6. *Scolia (Discolia) binotata binotata* Fabricius, 1804

Family: Scolidae

Genus: *Scolia* Fabricius, 1775

(Figure. 6)

1804. *Scolia binotata* Fabricius, 244. Male, Tranquebar (ZMUC).

1978. *Scolia (Discolia) binotata binotata*; Krombein, 41- 43.

Diagnosis: *Female*: Length 14-15 mm. Integument black, T3 and T4 with paired, large rounded red spots. Vestiture black, except white on the occiput.Wings medium to dark brown, forewing anteriorly darker with bluish reflections. Dorsomedian area of propodeum with moderately large, deep punctures, dorsolateral area impunctate at its inner half; T1 with a prominent anteromedian tubercle; S2 with a weak basal tubercle.

Male: Length 14-15 mm. Integument black, T3 and T4 with paired, rounded, light red spots. Vestiture black mixed with white. Wings dark brown at base and paler at apices with bluish purple reflections; forewing membrane beyond cells devoid of microtrichiae except for a small patch adjacent to apex of marginal cell; flagellum clavate towards apex.

***Material examined*:**

INDIA: Kerala, Kollam district, Munroe Island, 3♀, 1.ix.2019-1.ii.2020, Coll. A.K. Aseeb& Party.

Distribution: India (Andhra Pradesh, Arunachal Pradesh, Assam, Delhi, Diu, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, West Bengal).

Elsewhere: Bhutan, Sri Lanka.

7.*Chalybion bengalense* (Dahlbom, 1845)

Family: Sphecidae

Genus: *Chalybion* Dahlbom, 1843

(Figure. 7)

1949. *Chalybion bengalense*; Krombein, 3869, Gilbert Is.

Diagnosis: *Female:*Length: 15-22 mm. Body and legs shining metallic blue, abdomen sometimes purplish, mid and hind femora light red, antennae and mandible black, wings slightly infumated, vestiture whitish.

Head with temple narrow, not thickened and angulate beneath posteriorly, eyes converging above, least interocular distance equal to length of second flagellar segments; face with narrow median area delimited below by a strong carina from antennal tubercle extending upward, becoming evanescent above where it passes behind fore ocellus; frontal punctures moderately large, more separated on median area than laterally; vertex with moderately large, subcontiguous punctures and a short median grove; occiput with fine, close punctuation; first flagellar segment 0.9 times combined length of second and third segments.

Pronotal disk with a median furrow, some delicate transverse rugulae on anterior two-thirds, a low, rounded anterolateral tubercle and a stronger narrower median tubercle on posterior margin; mesopleuron without sternaulus; forwing with three submarginal cells.

Abdominal petiole short, extending two-thirds distance to apex of hind coxa; most of disk of second tergum with scattered small punctures, dense fine punctures only on narrow lateral strip.

Colour description: Integument blue to greenish blue; antennae black; legs largely violaceous; wings light brownish hyaline with apical third lightly infuscated. Propodeum with apico-lateral spots of white tomentum.

Length (H+M+T1+T2):14-18 mm

Male: (Figures 5, 6). Clypeus apically with three smallteeth; antenna with placoids on fifth or sixth to ninth flagellomere; S8 with slender apical process; aedeagus with teeth along outer ventral margin. Length (H+M+T1+T2): 10.5-16 mm.

Variations: All the specimens examined properly. Though Body length, wings length and colour differ somewhat in one or two specimens.

***Material examined*:**

INDIA: Kerala, Kollam district, TKMCAS Campus, 2♀, 1.iii.2020, Coll. A.K. Aseeb& Party.

Distribution: India: Andhra Pradesh (New Record),Arunachal Pradesh (New Record), Assam , Chhattisgarh (New Record), Delhi , Gujarat (New Record), Jharkhand (New Record), Karnataka, Kerala, Maharashtra, Madhya Pradesh (New Record), Meghalaya, Odisha, Punjab (New Record), Sikkim, Tamil Nadu, Tripura,Uttarakhand, Uttar Pradesh, West Bengal.

Elsewhere: Widely distributed.

Remarks: Though this species predatory in nature and mostly found in proximity of dry wooden areas (Maurizio Mei*et.al.*2012. The species is reported with additional distributional areas recorded from India, with first time report from 7 states of the country. The occurrence of the species, *Chalybion bengalense* (Dahlbom, 1845) from 7 states *viz*. It is having global, wider distribution. This species has also been recorded from Sinai Peninsula, Oman, Iraq, India, China, Japan, Indonessia and Philipines (Maurizio Mei *et al*. 2012). It is also found in New World in the vicinity of of Opa Locka Airport, Florida (Anderson, 2009).

Although *Chalybion bengalense* (Dahlbom, 1845) is considered to be an oriental species, later studies have shown that its zoogeographic distribution is not restricted to the Oriental

Region alone but also to the Palearctic Realm, some parts of Ethiopian, Australian and Nearctic Region.

8. *Sceliphron coromandelicum* (Lepeletier, 1845)

Family: Sphecidae

Genus: *Sceliphron* Klug, 1801

(Figure. 8)

Pelopaeus coromandelicus Lepeletier, 1845: 306, ♀(as *Coromandelicus*, incorrect original capitalization). Holotype or Syntypes: ♀, India: Coromandel Coast: no specific locality (M. Spinola coll. TORINO).

Sceliphron coromandelicum Bingham, 1897: 238 (new combination, redescription).

Diagnosis: Mandibles without tooth on the inner side; clypeus of female with small lateral incisions ; clypeus of male evenly rounded, with small, triangular apical lobes; post antennal tubercles very small; lower half of inner eye margins almost parallel; hypostomal carina not reach to the base of mandibles; mesosoma dull, finely sculptured; mesoscutum regularly transversely striate, only laterally with some shallow punctures; metapleuron weakly strigose; dorsal margin of propodeal orifice narrow, but not evenly rounded; second submarginal cell of forewing anteriorly wider than the third; petiole distinctly curved in lateral view, apically not compressed; apical tergite of male with pygostyles; apical sternite of female rather sharply keeled. Long,erect pubescence of head and mesosoma dark brown to black; short pubescence usually white; tomentum of face silvery.

Colour: Body Black with the following yellow portions: a coalescent spot on the clypeus (rarely absent); ventral side of scape; a band on pronotum; tegula; small subtegular spots on mesepisternum; rarely a small spot on scutellum and at apex of propodeum; petiole. Legs reddish yellow, except coxae, trochanters, base of fore and mid femora and terminal tarsomeres (outer side of hind tibiae brownish black to black).

Size: Female 17-21 mm. Male 16-20 mm.

Material examined:

INDIA: Kerala, Kollam district, TKMCAS Campus, 2♀, 1.iii.2020, Coll. A.K. Aseeb& Party.

Distribution: India: Bihar, Karnataka, Kerala,Maharashtra, Meghalaya, Odisha, Pondicherry, Tamil Nadu, West Bengal.

Elsewhere: Bangladesh (Chittagong); Burma (Rangoon); Sri Lanka (Puwakpitiya). Combodia,Thailand, Malaysia (Bingham, 1897; Dutt, 1912; Hensen, 1987; Smith, 1856; Rothney, 1923).

9.*Carinostigmus costatus* Krombein

Family: Crabronidae

Genus : *Carinostigmus* Tsuneki, 1954

(Figure. 9)

Female: Length 5.5 mm. Black, integumentshiny except vertical aspect of face, which is dull from delicate shagreening, the following are testaceous: palpi, mandible except extreme base, apical teeth and narrow ivory streak near base, underside of scape, underside of pedicel and first two flagellar segments, tegula, fore tibia, mid tibia except beneath and hind tarsi; pronotal lobe white. Wings clear, stigma black, veins dark brown. Head in frontal view ; viewed from above head moderately narrowed behind eyes, width at occiput 0.5 times greatest width; clypeus with median lobe narrow, strongly produced, apex slightly emarginate, clypeal margin laterad of lobe gently incurved; labrum (paratype) narrow, pentagonal, sides near apex gently emarginate; frontal ridge strong, near middle with a narrow, erect T-shaped projection; ocular groove crenulate and moderately broad along vertical section of inner eye margin; vertical section of front delicately shagreened; upper horizontal part of front and vertex with sparse, tiny punctures, a weak groove before anterior ocellus; occipital groove narrow, weakly crenulate; underside of head with strong longitudinal costae except a narrow median area with delicate longitudinal lineolations. Anterior pronotal ridge strong, narrowly emarginate in middle, lateral angles spicate; notauli strongly impressed, crenulate, parapsidal lines weakly impressed; scutum with scattered punctures, a bit stronger and denser than on head, posterior area with several strong parallel ridges, longer in middle than laterally; scutellum with strongly depressed crenulate groove anteriorly, discally with a few scattered punctures; metanotum delicately shagreened in middle, obliquely rugulose laterally; stigmal fovea small, circular; propodeal enclosure with radiating rugae on basal section, elsewhere rugosoreticulate ; area adjacent

to enclosure and posterior propodeal surface coarsely rugosoreticulate; lateral surface obliquely rugose.

Abdominal petiole slender , 5.0 times as long as median width, lateral surfacewith a few weak carinae; pygidium depressed, shiny, ellipsoidal, more elongate than in C. congruus.

Male: Length 5.2 mm. Color as in female except flagellum brown beneath. Sculpture of head as noted for female except as follows: maxillary palpi very elongate, extending to apex of fore coxae, flattened and widened, inner margin with a fringe of long, close curled setae; apex of labrum broadly rounded; projection near middle of frontal ridge narrow, not T shaped; first four flagellar segments subequal in length; occipital groove more strongly crenulate; and narrow median area of head beneath irregularly rugulose.Thorax as in female except stigmal fovea small, oval, and lateral propodeal surface finely obliquely rugulose. Petiole of abdomen six times as long as median width, lateral surface not carinate; edge of seventh tergum with narrow strip bearing a brush of many short erect setae.

Material examined: INDIA: Kerala, Kollam district, TKMCAS Campus, 1♀, 1.iii.2020, Coll. A.K. Aseeb & Party.

10. ***Liris*** sp.

Family: Crabronidae

Genus: *Liris* Fabricius, 1804

(Figure. 10)

The *Liris* Fabricius belong to tribe Lirrini, in the largest familyCrabronidae, and has over 1100 species; the forms of lirrini with hind ocellar deformation, represents a high degree of specialization. These wasps are usually of medium size; nearly all of the Lirrini are fossorial and can truly be called "digger wasps" or " sand loving wasps; although Orthoptera are the predominant prey, Hemiptera, Homoptera and Lepidoptera larvae are used in some forms .

Diagnosis: lateral ocellus reduced, flat and small; frons just below median ocellus with a transverse swelling extending from eye to eye and interrupted by median frontal line, and a linear swelling along inner orbit which joins transverse swelling to form an M shape; mandible simple, most species with a conspicuous notch on outer margin, mostly with one or two teeth on inner margin; pronotal collar, scutum,

scutellum and metanotum punctuate, punctures longer than one to less than one diameter apart; forewing with three submarginal cells; pronotum is angular in dorsal view, and gaster without petiole. Liris can be distinguished from Larra Fabricius by the following combination of the following characters: in female, last tarsomere angled in lateral view and sides parallel on apical half, pygidial plate mostly with setae and in most species with apically a transverse row of stout apical spinules; in male, propodeal side impunctate and dull or if shiny, then at most with sparse pinprick punctures, fore and hind femur excavate ventrally in some species

Material examined: INDIA: Kerala, Kollam district, TKMCAS Campus, 1♀& 1♂, 1.iii.2020, Coll. A.K. Aseeb.

11. ***Pison*** sp.

Family: Crabronidae

Genus: *Pison* Spinola, 1808

(Figure. 11)

Pison is a genus of wasp coming under family Crabronidae, subfamily Crabroninae and Tribe Trypoxylini. Important characters of the genus are the following.

***Genus characters*:** Inner orbits usually convergingabove, infrequently parallel (converging below in someforms); eyescovered with short dense pile in subgenus krombeiniellum, frons simple or with a short medianlongitudinal line or carina; basal flagellomeres of malesometimes excavate or otherwise modified; clypeus variablebut usually about twice as wide as high, free marginusually with a truncate or V-shaped median lobe;labium quadrangular, apex sometimes bilobed; mandibleusually simple but witli an inner subapical or mesal toothin some species,

Females of all *Pison* species prey upon spiders, but their nesting behaviour varies greatly. Most species construct mud nests, either as free-standing, aerial structures or as groups or lines of cells in pre-existing cavities (Bohart and Menke 1976; Evans 1981). A few nest in tunnels in clay soils and construct mud partitions between their cells. In contrast, several Australian species do not appear to use mud in cell construction; these species nest in dry, sandy soil and have a psammophore to assist in nest excavation.

Material examined: INDIA: Kerala, Kollam district, TKMCAS Campus, 1♀, 1.iii.2020, Coll. A.K. Aseeb& Party.

12. *Schizaspidia brevifuniculata* Narendran, 1985

Family : Eucharitidae

Genus: *Schizaspidia* Westwood (1835)

(Figure. 12)

(Figure: 12)*Schizaspidia brevifuniculata* Narendran, 1985a. *Journal of the Bombay Natural History Society* 82(3): 606-607. Type data: India: Kerala, South Malabar, Chettiyarmad, Holotype Female (examined) (DZUC). Description of female, illustrated.

Diagnosis: Female: Head and Body blackish metallic green; antennae dark brown with scape and pedicel yellowish brown; coxae concolorous with mesosoma, femora and middle portions of tibiae brown; apices of femora, bases and apices of tibiae and tarsi pale yellow; wings hyaline without any distinct infumation; head width subequal to thoracic width; frons smooth, polished with very weak striations on dorsal half POL: 9, OOL 5; tentorial pits deep; antenna as in figure 155; scutellum sculptured; sculpture of mesopleuron; petiole a trifle longer than hind coxa, sides weakly carinte; gastral tergites smooth, shiny without distinct sculptures.

Male: Unknown.

Host: Unknown.

Distribution: India (Kerala, Karnataka)

Material examined: INDIA: Kerala, Kollam district, Munroe Island, 1♀, 1.ix.2019-1.ii.2020, Coll. A.K. Aseeb& Party.

Distribution: India: Kerala

13. *Tiphia* sp.

Family: Tiphiidae

Genus: *Tiphia* Fabricius, 1775

(Figure: 13)

The family Tiphiidae is a group of fossorial aculeate wasps. About 1,500 tiphiid species in seven subfamilies have been known worldwide (Brothers and Finnamore, 1993), among

which 19 South Korean Tiphia species of the subfamily Tiphiinae are currently recognized (Han et al., 2007; Kim and Han, 2008a; Kim and Han, 2008b). All the members of Tiphiidae are solitary, and their larvae are usually ectoparasitoids of soil-dwelling coleopteran larvae. Pupation usually occurs within the substrate occupied by the host (Brothers and Finnamore, 1993). Thus, some species have been positively used as valid natural controllers of harmful coleopteran larva such as larva of Popillia japonica introduced into America (Clausen et al., 1933; Ramoutar and Legrand, 2007). Tiphiidae can be diagnosed by the following combination of characteristics: mesosternum with laminate expansion on each side of midline covering base of contiguous mesocoxae in both sexes (the expansions rarely being reduced to small teeth); hind coxae contiguous in both sexes; hind wing with distinct claval and jugal lobes in both sexes; and male metasomal sternum VIII (hypopygium) forming a single strong acute upcurved hook (the hypopygium sometimes simple or with 2-5 spines) that is usually entirely exposed but sometimes partly concealed.

Tiphia is a genus of wasps belonging to the family Tiphiidae subfamily Tiphiinae.They feed on soil inhabiting scarab beetle larvae.

***Tiphia* sp. 1**

Material examined: INDIA: Kerala, Kollam district, Munroe Island, 1♂, 1.ix.2019-1.ii.2020, Coll. A.K. Aseeb & party

***Tiphia* sp. 2**

***Material examined*:** INDIA: Kerala, Kollam district, Munroe Island, 1♂, 1.ix.2019-1.ii.2020, Coll. A.K. Aseeb& Party

DISCUSSION

In the present study fourteen species of wasps in ten genera representing six families (Vespidae, Scolidae, Sphecidae, Crabronidae, Eucharitidae, Tiphiidae,) were recorded. Family Vespidae was represented by four species under three genera. We got two species under two genera of Family Scolidae. Family Sphecidae was also represented by two species under two genera. Family Crabronidae included three species under three genera. One species under one genera was identified from Family Eucharitidae. Family Tiphidae was represented by two species under one genera. Out of these fourteen species, further detailed studies are needed for four specimens. As it shows its own unique features, they couldn't be categorized well. Most probably some of them will be new species.

PLATE 1

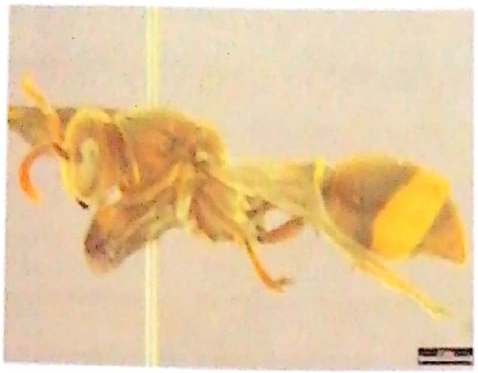


Fig. 1 Ropalidia brevita

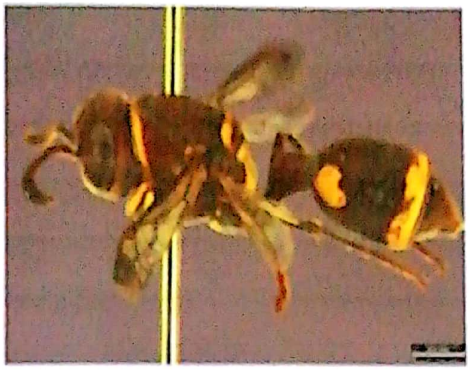


Fig. 2 Ropalidia jacobsoni

Fig 3. Antepipona ceylonica

Fig. 4 Subancistrocerus sichelii

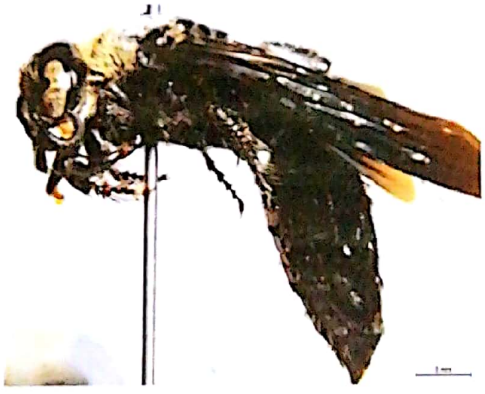


Fig. 5 Campsomeriella collaris collaris

PLATE 2

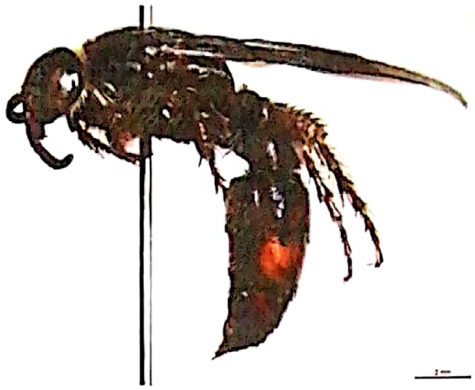


Fig. 6 Scolia binotata binotata

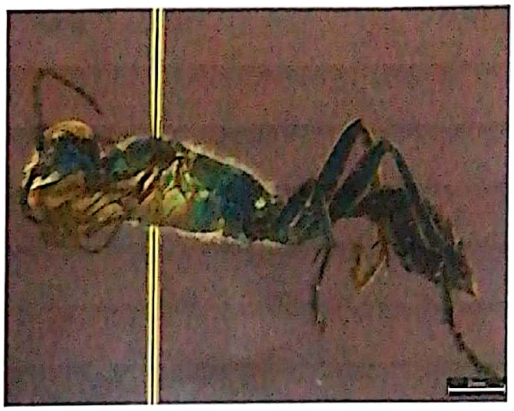


Fig. 7 Chalybion bengalense

Fig. 8 Sceliphron coromandelicum

Fig. 9 Carinostigmus costatus krombein

PLATE 3

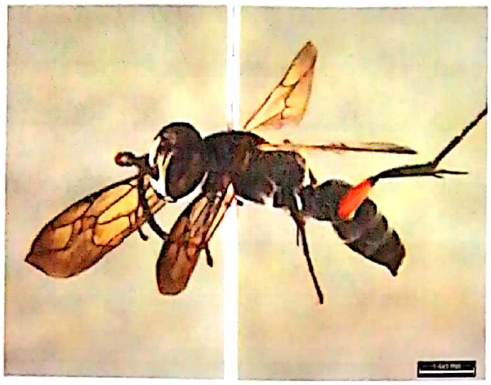


Fig. 10 Liris sp.

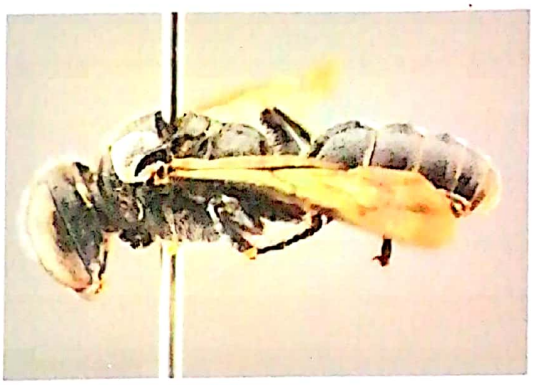


Fig. 11 Pison sp.

Fig. 12 Schizaspidia brevifuniculata

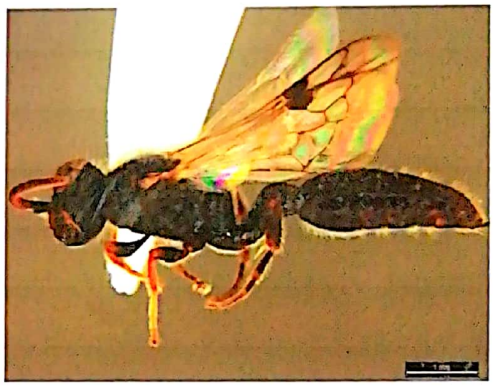
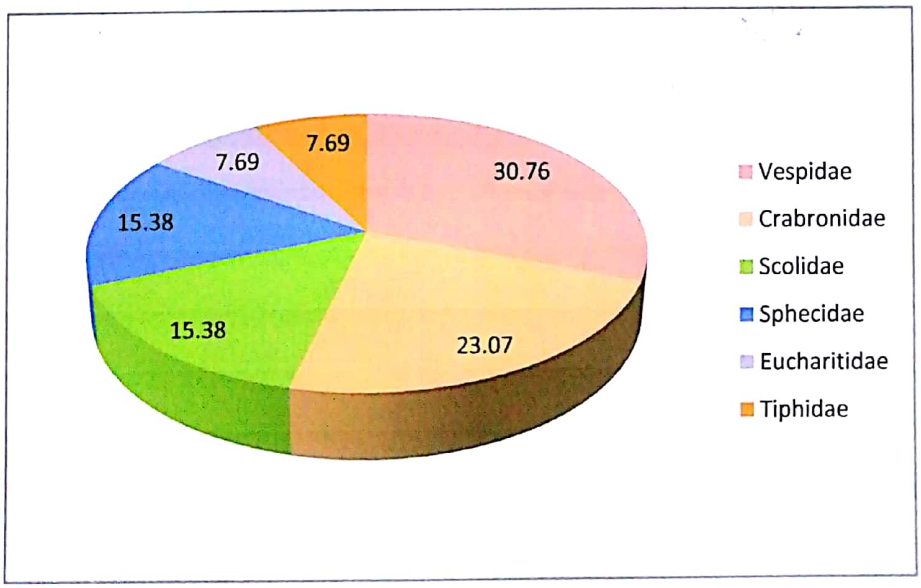


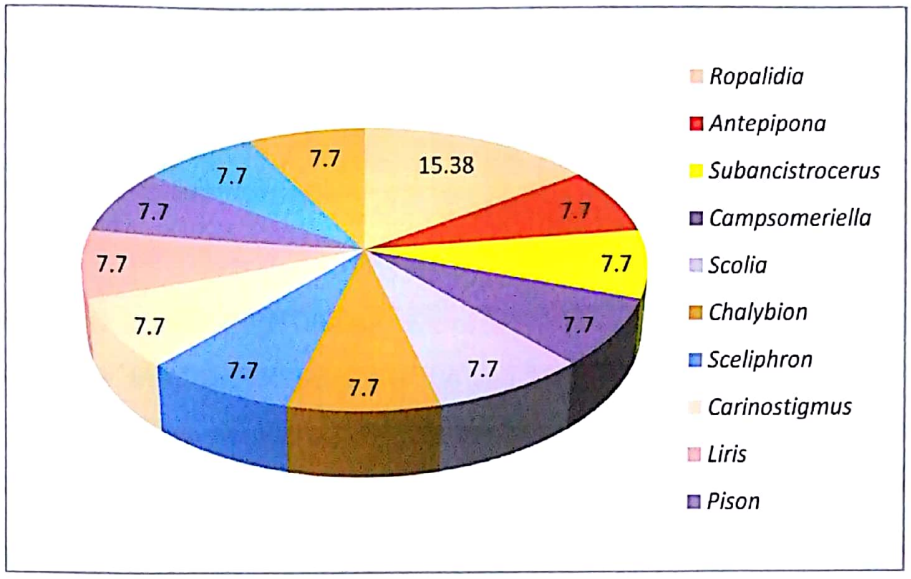
Fig. 13 Tiphia sp.

Sl. No.	Family	Genera	Species
1.	Vespidae	*Ropalidia*	*Ropalidia brevita* (Das & Gupta, 1908)
			Ropalidia jacobsoni (du Buysson, 1908)
		Antepipona	*Antepipona ceylonica* (de Saussure, 1867)
		Subancistrocerus	*Subancistrocerus sichelii* (de Saussure, 1856)
2.	Scolidae	*Campsomeriella*	*Campsomeriella collaris collaris*
		Scolia	*Scolia binotata binotata* fabricius
3.	Sphecidae	*Chalybion*	*Chalybion bengalense* (Dahlbom)
		Sceliphron	*Sceliphron coromandelicum* (Lepeletier)
4.	Crabronidae	*Carionostignus*	*Carinostigmus costatus* krombein
		Liris	*Liris sp.*
		Pison	*Pison sp.*
5.	Eucharitidae	*Schizaspidia*	*Schizaspidia brevifunilulata* (Narendren)
6.	Tiphildae	*Tiphia*	*Tiphia sp.*

In this present study a total of 13 species of wasps belonging to 12 genera under 6 families were recorded. Among these, 4 species wasps belonging to 3 genera under 1 family and 3 species under 3 genera under 1 family and 2 species under 2 genera under 1 family and 2 species under 2 genera under 1 family. Finally each of remaining 2 species belonging to 2 individual genera and 2 individual family respectively. Regarding the different wasp families the highest diversity of wasps were recorded belonging to the family Vespidae(30.76%).



The diagram shows the diversity of 6 families of wasps recorded from TKM Campus and Mandrothuruthu. The most represented is Vespidae including 4 species (30.76%). Then Crabronidae (23.07%) Scholidae (15.38%), Sphecidae (15.38%) Eucharitidae (7.69%) and Tiphidae (7.69%).



The diagram shows the diversity of a genera of wasps recorded form TKM College Campus and Mandrothoruthu. The most represented are genera Rophalida (15.38%) the remaining genera are, Antepipona, Subancistrocerus, Campsomeriella, Scolia, Chalybion, Sceliphron, Carinostigmus, Liris, Pison, Schizaspidia, Tiphia (7.7%)

CONCLUSION

The vast majority of wasp species are solitary insects they spend most of their life in preparing their nests and foraging for food for their young. Many of the solitary wasps are parasitodial. Wasps are a diverse group, estimated at over a hundred thousand described spaces around the world except for the polar regions and a great many more as yet under undescribed. Wasps play many ecological roles, some are predictors or pollinators, bio control agent's and biodiversity indicators. Stings are usually more painful rather than dangerous, but in rare cases people it may become life threatening. Present study has revealed valuable information on the wasps of TKM campus and Monroe Islands.

Monroe Island is the habitat diverse area of wasps species, since no significant study was done in this area, the survey, collection and identification of wasps in this area is relevant for estimating described and unidentified species of wasps. This study has revealed about some known and described species like,

(1) *Ropalidia brevita* Das & Gupta, 1989

(2) Ropalidia jacobsoni (du Buysson, 1908)

(3) Antepipona ceylonica (de Saussure)

(4) Subancistrocerus sichelii (de Saussure, 1856)

(5) Campsomeriella (Campsomeriella) collaris collaris (Fabricius)

(6) Scolia (Discolia) binotata binotata Fabricius

(7) Chalybion bengalense (Dahlbom)

(8) Sceliphron coromandelicum (Lepeletier)

(9) Carinostigmus costatus Krombein

(10 Schizaspidia brevifuniculata Narendran

Three more specimens seem to be unidentified yet were also included in the present study. These are

(1) *Tiphia sp.*

(2) *Liris sp.*

(3) *Pison sp.*

Further studies are needed for the identification of these specimens. There is a high probability for having these specimens new to science. But this can be only ensured by detailed study and verification under experts. This project work helped to provide immense knowledge about the wasps diversity of Munroe Island and TKM campus. Future studies may result in further elaboration of the diversity of wasp species.

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