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# Bugs R All

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Photo: C. Sunil Kumar

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# Authentic report of *Ceresium leucosticticum* White (Coleoptera: Cerambycidae: Callidiopini) from Pune and Satara in Maharashtra State

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A small, reddish black to black longicorn beetle, with a pattern of chalk-white spots on prothorax, elytra and underside was collected at two places in Maharashtra State, namely Satara and Pune (Talegaon). The Satara specimen was a female (coll: S. Gaikwad, vii.2014) and Pune specimen was a male (coll: S. Paripatyadar, 6.vii. 2014).

The keys provided in Gahan (1906) showed this cerambycid beetle to be *Ceresium leucosticticum* White. The beetle was originally described and illustrated by White (1855) [from E. India]; Gahan (1906) again gave description, along with a drawing, and added additional localities, within the then British India, such as 'Assam, Burma, Siam and Sumatra', of which only Assam is in Indian Territory now. Duffy (1968), who studied immature stages of the Oriental Cerambycidae, stated this species to be distributed in 'Assam, Bihar, Madras, Maharashtra and Uttar Pradesh'. Gressitt, Rondon and Breuning (1970) reported this species from Laos (as well as Burma, Hainan, Thailand, Sumatra, and in Laos: Throughout Mekong Valley and adjacent plateau) and stated that the pattern of white spots was variable, and sometimes the elytral spots may be absent or indistinct. In some images available on the internet the posterior pair of spots on prothorax is in the form of thin, somewhat oblique line (http://catalog.digitalarchives.tw/item/00/65/a3/d8.html). Similar colouration is shown in this species found in China (Hua Li-Zhong et al 2009) and the stated distribution is: 'Taiwan, Hainan, Yunnan, India, Myanmar, Thailand, Laos and Indonesia'. Mukhopadhyay and Biswas (2000) also mentioned the presence of this species in Meghalaya, based on old collection made by Kemp in 1917; apparently no new collection was at hand.

Most of the records of this species in India are thus from north-east and we are not aware of any publication reporting this species from Maharashtra or Western India, except that of Duffy (1968), where exact locality in Maharashtra is not given. Ghate (2012) presented a list of the known and personally checked Cerambycidae of Maharashtra, but till then this species was not collected in this State and Duffy's record was overlooked. This report is therefore a definite collection record of *Ceresium leucosticticum* from Maharashtra State. This report highlights the fact that true distribution of many Cerambycidae (and many other insect groups) in India is not known or is obscure. Presence of this species in two different localities indicates that it has viable population in Maharashtra, and perhaps elsewhere in Western India.

**Fig 1. Male *Ceresium leuco* - live, Talegaon. Photo Shruti**

**Fig 2. Dorsal view of female - full gray back**

**Fig 3. Dorsal view of head & prothorax**

As both earlier workers, White (1855) and later Gahan (1906), have given adequate description of this beetle, and a habitus drawing, this note only intends to illustrate salient features of this species with digital images. A few characters will only be mentioned.

Male and female are of the same coloration and size (about 11 mm long): black on head, prothorax and elytra, but with antennae, a narrow area around elytral suture and legs distinctly reddish brown. Antennae in male are longer than body (last three segments projecting beyond elytral tip), while in the female only slightly longer than body. All body is covered with white, decumbent hairs and there is a

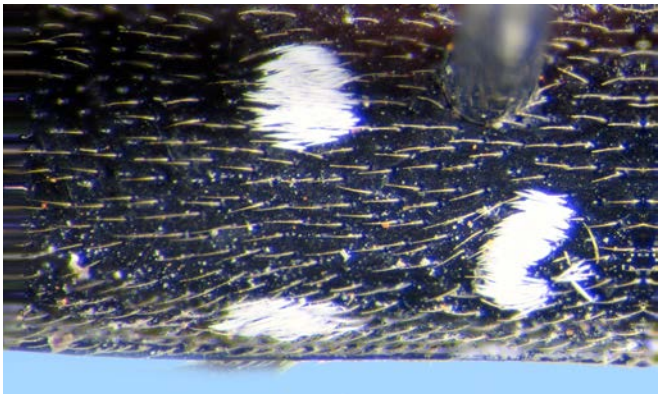

**Fig 4. Triplet of spots**

**Fig 5. Lateral view of *Ceresium leuco***

**Fig 6. Ventral view of *Ceresium leuco***

pattern of chalk-white spots on prothorax and elytra as seen from dorsal side (Figs. 1, 2). In the female examined here the spots at the apical region appear as two separate spots per elytron while in the male these are almost confluent forming one spot per elytron. Eyes are large and coarsely facetted. Prothorax is longer than broad, slightly rounded at the sides, coarsely punctured all over except the median longitudinal line which is smooth and glossy, with all 4 chalk-white spots visible from dorsal side (Fig. 3).

Elytra with a total of nine spots: one sutural spot just behind the scutellum (which is also white), a triplet of spots behind the sutural spot, but in front of the middle of each elytron (Fig. 4), and a pair of spots anterior to the apex (this pair may be very close or in the form of a single transverse spot). Elytral punctures are distinct in the proximal one third but fine in the distal part and each puncture has a white short seta. Ventrally again the insect is predominantly black with white pubescence near prosternum, on lateral part of mesoventrite and metaventrite. Abdominal segments also have chalk-white small patches at the sides but these may not be fully seen in ventral view (especially in female) but in lateral view only (Fig. 5). Legs of moderate length, all femora swollen in the middle, hind femur not extending the tip of abdomen, tibia carinate. Full ventral view of the same female is also shown (Fig. 6).

There are many interesting species of insects in the Western Ghats and adjacent areas but invertebrates in general are often ignored. It is essential that more attention is paid to invertebrates because the hotspots are still recognized on the basis of vertebrates only.

**Acknowledgements**

Authors are grateful to the authorities of Modern College, Pune 5, for facilities and encouragement. HVG also thanks BCUD, University of Pune, for providing funding during 2007-08, helping him to carry further work on these beetles. Ms. S.A. Gaikwad thanks Dr. S. Nalawade for help and encouragement provided in Satara.

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# First sighting of the Apefly *Spalgis epeus epeus* Westwood, 1851 (Lepidoptera: Lycaenidae: Miletinae: Spalgini) from the Garhwal Himalaya

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**Introduction**

The butterflies of Uttarakhand have been well studied by lepidopterists in the last 150 years. Amongst the earliest publications with a checklist of the area was a list of butterflies from Kumaon (Doherty 1886), who recorded 271 species. Subsequently, a checklist of 323 butterfly species from the Dehradun and Mussoorie area was published in 1899 (Mackinnon and de Nicéville 1899). Hannyngton followed up Doherty's paper by listing 378 species from Kumaon (Hannyngton 1910, 1911 & 1915). In the next few decades, numerous other publications studying the butterflies of the Dehradun and Mussoorie area followed (Ollenbach 1930, Shull 1958, 1962). In more recent years, Smetacek (2012) has done significant work in the Kumaon region and listed the butterfly species recorded in the Bhimtal area while Singh and Bhandari have extensively studied the butterflies in the Garhwal region (Singh 1999, 2009, Singh and Bhandari 2003, 2006). Uniyal (2004) added to the knowledge of the butterfly fauna in the Nanda Devi landscape and the Gangotri landscape (Uniyal *et al*. 2013) in the Garhwal region. Despite the wealth of information of butterfly fauna of the region, new records and range extensions of species continue to be reported in the last few decades. This paper discusses the sighting of the Apefly *Spalgis epeus epeus* from Dehradun, the first record of this species from the Garhwal Himalaya.

**Discussion and conclusions**

The Genus *Spalgis* is represented by two species from India *Spalgis epeus epeus* Westwood 1852 and *Spalgis baiongus* Cantlie and Norman 1960. The distribution of *Spalgis epeus epeus* (often stated as *Spalgis epius epius* in older literature) is stated as Sri Lanka, S. India to Paschimbanga; Kumaon east to Myanmar (Evans 1932). *Spalgis baiongus* is known from foothill forests of Sibsagar district in Assam, from Ghaspani in the Naga Hills and from the Great Nicobar Islands (Cantlie and Norman 1960). *A. baiongus*, to quote from its original description has "Underside: Both wings have rows of slender curved brown strigae similar to but more irregular than those of *epeus*. The strigae are outwardly lined with whitish; inwardly each shades into a brown area, thus giving the effect of a spot and making the wing look blotched and glazed. The sub-marginal area of both wings is diffusely whitish". Hence, it is possible to separate the *S. epeus* and *A. baiongus* based on external morphology alone.

On 10 November 2013 at 1130 hours, a single individual of the Apefly *Spalgis epeus epeus* (Fig. 1) was recorded from scrub forest on the banks of the River Song near Maldevta, on the outskirts of Dehradun (Fig. 2). This represents the first record of this species from Garhwal extending its known range westwards by 250 km. The earliest known record of this species from what is now the state of Uttarakhand is a mention by Hannyngton (1910) who states that it is "not common" from Haldwani in December. It is possibly on the basis of these records from Hannyngton that Evans (1932) and Wynter-Blyth (1957) listed its distribution as Kumaon eastwards. While recent literature (Kehimkar 2008) has listed the presence of this species from Uttarakhand, this is probably based on its presence in Kumaon from early literature. There are no published records of this species from Garhwal and neither are there any specimens of this species from Uttarakhand in the collection of the Forest Research Institute in Dehradun. In fact, there are no recent published records of *Spalgis epeus* from Kumaon either and Smetacek did not record it from his listing of butterflies the Jones Estate in Bhimtal. There are no records of this species from Uttarakhand on the website of Indian Foundation of Butterflies (http://www.ifoundbutterflies.org/#!/sp/490/Spalgis-epeus). Recent publications on this genus from India (Charn 2013) also do not make any mention of records of this species from Garhwal Himalaya.

With this record, this species is the only member of the subfamily Miletinae that is known from the Garhwal Himalaya. The life cycle of this species is well studied; its larvae are entomophagous and it known to feed on scaly

**Fig. 1** ***Apefly Spalgis epeus epeus*** **from Maldevta, Dehradun, Garhwal**

coccids such as aphids on plants (Dinesh *et al.* 2010), hence its presence in Garhwal is not dependent on any larval food plant. As the species is quite common throughout peninsular India (though less common east of Kumaon), its presence in Garhwal Himalaya is not surprising.

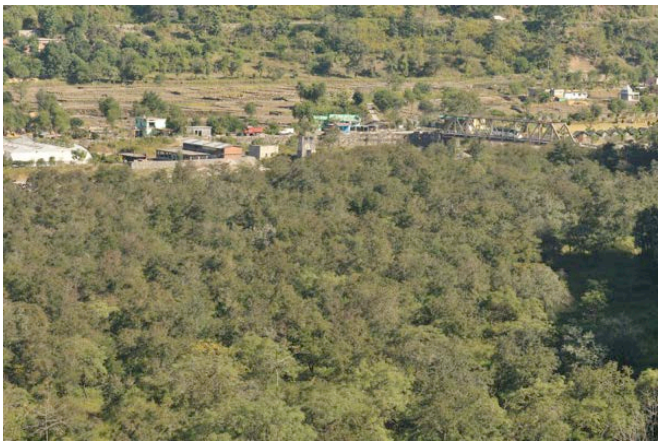

**Fig. 2 Maldevta habitat**

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# On a collection of Odonata (Insecta) from Lonar (Crater) Lake and its environs, Buldhana District, Maharashtra, India

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Lonar Crater (19°59' N, 76°31' E) is a bowl shaped depression (with a circumference of 7 km and a diameter of 1.8 km) in the basaltic flows of the Deccan traps in southern India, formed by the impact of a huge meteor that descended on earth from space around 52,000 years ago. It is one of the largest and oldest meteoritic craters in the world. This is the only crater in the world created by hyper velocity meteoritic impact on basaltic rock. The stone mass, which struck the earth, was approximately 60m in diameter weighing about a million tones. The force of impact is estimated to have generated energy equivalent to six megatons of explosion.

Lonar Crater, 165km from Auranghabad, is situated within Parbhani quadrangle in Buldhana district of Maharashtra. It is nearly 150m deep and a shallow saline lake occupies most of the crater interior and covers about 100m of sedimentary fill. The crater rim is elevated about 20m above the surrounding plain. The maximum elevation in the area is 669m above msl and the minimum is 370m.

**Vegetation**

Principal vegetation is dry deciduous type at the crater, dry bushy vegetation on the rim and slopes, moist deciduous ecosystem in the basin with semi evergreen components. Moist deciduous component along the bank of perennial streams and the lake shore is covered with salt tolerant vegetation.

Based on the eco-climatic factors, and unique setting of the crater, varying microhabitats existed within the localized area, which are as follows.

**Wetlands/Microhabitats**

**1. Brackish water Lake:** The Lake covers an area of about that of the crater. It is circular in shape interconnected with many springs flowing from the slopes. The littoral zone of the lake is covered with aquatic vegetation and dried logs of trees located on the margin of the lake supported perching place for dragonflies. Average depth of the lake varies from 2m in summer to 4m in rainy season. The salinity of the lake water is higher than that of the sea and the high pH value (10-11) has resulted in the creation of unique micro-ecosystem. More than 14 species of algae are found here.

**2. Marshes:** Marshes are formed at lake beds where inflow of freshwater stream meets saline lake. Northwestern area of the crater slope is endowed with a subterranean perennial spring - Dhaar. Its outflow into crater base irrigates the horticultural fields at the crater bed and the influx of freshwater in to the saline lake is marked by the formation of small marshes with aquatic vegetations like *Typha angustata, Ipomoea aquatica, I. carica, Ageratum conyzoides, Parthenium* sp. etc. Marshy area extends from Bolanath Temple to Dhargha along the western edge, up to Mahadevi Temple. The rich supply of guano from the bird roosts and the uses of fertilizers in the agricultural fields further enriched the marshy area, and it is the one of the nutrient rich areas of the Crater.

**3. Subterranean Perennial Spring:** Northwest rim is endowed with a perennial subterranean spring Dhaar, springing out from Dhaar Temple complex. Local inhabitants depend on this spring for drinking, bathing and washing. The pools and puddles formed from the outlet of the underground spring amidst rocky terrain provides suitable ecosystem for stream fauna. Southwest bed is with another small freshwater spring originating near Ramgaii Temple. It flows through western side int o agricultural fields. This is not perennial.

**4. Temple Pond:** Dhaar temple complex at northwest rim includes an artificial cement tank with no outlets. This square shaped pond is undisturbed and endowed with thick growth of algal mat.

**5. Artificial Reservoirs:**

a. Little Lonar or Ambar Lake: located north of the original Crater Lake, spread over an area of 1ha. with a bowl shaped basin and about three major inlets opening in to it. The shallow lake basin has about one small embankment, resembling an island at the northern end.

b. Kalapaani: an artificial reservoir build for irrigating agriculture fields situated at south west of Lonar Crater, towards Kinny village. The littoral zone of the lake is covered with *Ipomoea fistulosa*, *Polygonum glabrum* and other aquatic plants.

6. **Crater rim:** is dry with scanty vegetation dominated with *Parthenium*. The elevated rim is about 7 km in circumference with great human disturbances.

This complex ecosystem with varying microhabitats supports interesting faunal and floral elements. Detailed

study on the faunal diversity of the lake has not been done. Some preliminary observations carried out by researchers (Anonymous 1996, Badve *et al.*, 1993, Jafer and Soniya 2003, Jha 2003, Jafer 2007, ZSI 2008) reveal presence of variety of fauna and flora on this lake including nine species of dragonflies from the Lake area (Kulkarni and Talmale, 2008). The other important aquatic fauna observed by the exploration of ZSI was two each species of cladocerans and rotifers and a single ostracod species. Due to high alkalinity, pH and salinity no crustaceans, decapods and fishes were recorded from the lake area.

**Material and Methods**

Crater Lake, crater bed, crater slopes, crater rim, '*ejecta blanket*' and neighbouring artificial lakes were surveyed for Odonata samples from 1-7th November 2000 using insect net. Only adults were collected and studied. The odonata specimens were identified with the help of Fraser (1933, 1934 & 1936). The nomenclature followed here is after Subramanian (2009).

**Results**

Altogether 21 species of Odonata under 18 genera of 5 families were recorded from the Lonar Crater Lake and its environs. The suborder Zygoptera (Damselflies) represented by 5 species and the suborder Anisoptera (Dragonflies) with 16 species. The extreme salinity and high alkalinity (the pH higher than 10.5) of the Lake does not influence the odonata diversity of the area. The lake is known to support blue-green algae and certain micro-organisms. There is no previous record of higher aquatic organisms and fishes inhabiting this saline lake. The present report provides breeding records of 3 species of dragonflies (*Diplacodes trivialis, Orthetrum sabina, Brachythemis contaminata*) and two species of damselflies (*Ischnura senegalensis* and *Agriocnemis pygmaea*) within the Lonar Lake. *Tramea basiliaris* and *Trithemis pallidinervis* were sighted near Kalapaani and never within Lonar lake. The perennial stream flowing through the rim and marshes attracted many of the hill stream - loving species such as *Trithemis festiva, T. aurora and Orthetrum pruinosum*. The detailed species account and ecological observations are given below.

**Systematic Species Account**
**Order: Odonata**
**Suborder: Anisoptera**

**Family: Aeshnidae**

1. *Anax immaculifrons* Rambur
Material examined: 1M. 1.11.2000 Dhaar temple pond 1M. 7.11.2000 Dargha, 3M. 4.11.2000 Sitarani, Marshes
Common throughout the survey, seen in all kind of microhabitats. Observed many times perched under rock boulders bordering perennial stream at Sitarani during midday. Also seen among human inhabitations near Lonar village. According to Fraser (1936) the species is distributed only in dry zones of North West provinces and Deccan. Once seen chasing a male *Orthetrum pruinosum neglectum*. A dead specimen was observed floating on the stream near Dhaar temple pond.

2. *Hemianax ephippiger* (Burmeister)
Material examined: 1M. 7.11.2000. Deshmukh ka kopra.
A single male was caught while flying with a swarm of *Pantala flavescens* over the agricultural field near Lonar lake basin.

**Family: Gomphidae**

3. *Ictinogomphus rapax* ( Rambur)
Only seen at Kalapaani lake area. Frequently patrolling along the littoral zone of the lake along with *Anax immaculifrons*.

**Family: Libellulidae**

4. *Orthetrum sabina sabina* (Drury)
Material examined: 2M,1F. 4.11.2000 at Marsh.
Common throughout the circumference of the inland saline lake, also at artificial reservoirs like Kalapaani and Little Lonar. Stray specimens were found away from water. Swarms in tandem were observed over marshes at Northwestern part of the lake bed, also observed ovipositing over algal mats. Many exuviae were found on the *Typha* grasses indicating their breeding activities.

5. *Orthetrum pruinosum neglectum* (Rambur)
Frequently seen near freshwater stream resting on dried up twigs of *Prosopis juliflora* or *Lantana camara*. Territorially active red males frequently seen perched on the rock boulders.

6. *Diplacodes trivialis* (Rambur)
Material examined: 2M,1F. 4.11.2000. at Marsh
Abundant along the marshes at northwestern edge of the lake. Observed in tandem, ovipositing over floating algal mat. Also found throughout the circumference of Saline Lake even in barren areas, perching on ground or low on vegetation, or flying very close to the ground.

7. *Bradinopyga geminata* (Rambur)
Material examined: 1F. 7.11.2000.
Frequently seen resting on the granite wall of the Taluk Office building, a little away from the lake rim.

8. *Brachythemis contaminata* (Fabricius)
Material examined: 2M. 6.11.2000. Kalapaani Reservoir; 2M, IF. 2.11.2000. Baagh.
This species is very common throughout the circumference of inland saline lake and also at most contaminated areas along the eastern edge of the lake where water surface is

**Table.1: Odonata species distribution across different micro habitats at Lonar Lake and its environs.**

| S. No. | Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| 1 | *Hemianax ephippiger* | A | P | A | A | A | A | A |
| 2 | *Anax immaculiforns* | P | P | P | P | P | P | P |
| 3 | *Ictinogomphus rapax* | A | A | A | A | P | A | A |
| 4 | *Orthetrum sabina sabina* | P* | P* | P | A | P | A | P |
| 5 | *O. pruinosum neglecturm* | A | A | P | A | A | A | A |
| 6 | *Diplacodes trrivialis* | P* | P* | A | A | A | P | P |
| 7 | *Bradinopyga geminata* | A | A | A | P | A | A | P |
| 8 | *Brachythemis contaminata* | P* | P | A | A | P | P | A |
| 9 | *Trithemis aurora* | A | A | P | A | P | A | A |
| 10 | *T. festiva* | A | A | P | A |  | A | A |
| 11 | *T. pallidinervis* | A | A | A | A | P* | A | A |
| 12 | *Tholymis tillarga* | P | P | A | A | P | P | A |
| 13 | *Tramea basilaris burmeisteri* | A | A | A | A | P | A | A |
| 14 | *Zyxomma peteolatum* | A | A | A | P* | A | A | A |
| 15 | *Pantala flavescens* | A | P | A | A | A | A | P |
| 16 | *Crocothemis servilia servilia* | A | P | A | A | A | A | P |
| 17 | *Ceriagrion coromandelianum* | P | P* | A | A | A | A | P |
| 18 | *Pseudagrion rubriceps* | A | A | A | A | P | A | A |
| 19 | *Ischnura senegalensis* | P* | P* | A | A | A | A | A |
| 20 | *Agriocnemis pygmaea* | P* | P* | A | A | A | A | A |
| 21 | *Copera marginipes* | A | A | P* | A | A | A | A |

**Key: 1). Crater Lake 2). Marshes 3). Spring 4). Pond 5). Kalapaani 6). Amber Lake 7). Crater rim. P= Present, A= Absent, * Breeding**

covered with thick algal mat. Abundant at Kalapaani Lake, many swarms were observed under a shady area near lake bed. Also observed at Little Lonar Lake. Much reproductive activity observed around the Lonar lake, hovering females oviposited on the thick algal mat floating on the lake water

9. *Trithemis aurora* (Burmeister)
Material examined: 3M, 2F. Sitarani (Perennial spring) 4.11.2000; 1M Kalapaani 6.11.2000.
Commonly seen over midstream vegetation and partly resting on the rocks. At Kalapaani, brilliant crimson coloured males were observed perching on the *Ipomoea fistulosa* plant.

10. *Trithemis festiva* (Rambur)
Material examined: 4 M. Sitarani. 4.11.2000.
Common at streams near Sitarani, frequently perching on the rock boulders or twigs hanging over the stream.

11. *Trithemis pallidinervis* (Kirby)
Material examined: 2M. 6.11.2000.
Very common at Kalapaani lake. Tenerals and adults swarms over lake bed vegetation. Not observed in Lonar lake.

12. *Tholymis tillarga* (Fabricius)
Material examined: 2F. Baagh. 1.11.2000; 1M. Sitarani. 4.11.2000.
Roosting population observed at Baagh on *Lantana camara*, *Annona* sp., *Phyllanthus* sp., many perched by hanging vertically among bushes in shade, 10-20m away from the lake. Males dominate the roosting population. Towards evening large numbers found patrolling over the saline lake for foraging.

13. *Tramea basiliaris burmeisteri* Kirby
Material examined: 1M. 6.11.2000. Dhaar Temple Pond.
Frequently seen soaring over with swarms of *Pantala flavescens* near the agricultural field.

14. *Zyxomma petiolatum* Rambur
Material examined: 2M. 1.11.2000. Dhaar temple pond.
Collected from a temple pond, infested with thick mass of algae and other aquatic macrophytes. At twilight this species were performing territorial flight chasing and fighting over a small area of the water body.

15. *Pantala flavescens* (Fabricius)
Mostly seen in open areas. Smaller swarms (4-5) observed flying over the agricultural field along with *Tramea basilaris*. Large feeding swarms (30-40) gathered close to the agricultural field near the lake basin.

16. *Crocothemis servilia servilia* (Drury)
Rarely seen. A mature red male was observed once at Deshmukh ka Kopra agricultural field, near the lake basin.

**Suborder: Zygoptera**
**Family: Coenagrionidae**
17. *Ceriagrion coromandelianum* (Fabricius)
Material examined: 1. 4.11.2000. Ramgayii
Common around Baagh, Dargha, marshlands among aquatic grasses, mudflats and at agricultural fields. Occasionally females found wandering into dry scrub jungles at lake bed. Breeding pairs also observed at Baagh among vegetation.

18. *Pseudagrion rubriceps* (Selys)
Material examined: 1M. 6.11.2000. Kalapaani reservoir. A pair among bushes little away from water.

19. *Ischnura senegalensis* (Rambur)
Material examined: 1M, 2F. 7.11.2000. Dargha; 2F, 2M 2.11.2000 Baagh; 1M 5.11.2000 Marsh; 2F 4.11.2000. Mahadevi Temple.
Very common at Baagh and marshes over aquatic grasses. In copula among grasslands within the lake marshes indicate breeding. Teneral (red form) and females abundant over the sedges along the lake bed.

20. *Agriocnemis pygmaea* (Rambur)
Material examined: 1 F (Teneral). 4.11.2000 at Marsh. Uncommon among marshes. Mostly found associated with *Ischnura senegalensis*. Many tenerals were seen among the sedges within the lake.

**Family: Platycnemididae**
21. *Copera marginipes* (Rambur)
Material examined: 2M, 2F. 4.11.2000 Sitarani; 1M. 7.11.2000 Dargha.
Very common throughout the course of perennial stream at northwestern edge from Sitarani to Bholanath Temple. Many pairs observed in tandem over stream beds. At times, the species found resting on *Lantana* twigs slanting towards the stream.

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# Occurrence of *Phyllodes consobrina* Westwood 1848 (Noctuidae: Lepidoptera) from Southern Western Ghats, India and a review of distributional records

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The present note is to report the records of a rare moth *Phyllodes consobrina* (Noctuidae: Lepidoptera) from different parts of southern Western Ghats. As per the fauna volume of British India on moths (Hampson 1894), the earlier distribution of this species was restricted to Andaman Islands, North eastern India, Myanmar and Sri Lanka. Later, this species is recorded from Thailand, Bangladesh and Bhutan (Zaspel, 2008). Recently the species was reported from Maharashtra part of Western Ghats (Subhalaxmi *et al.*, 2011) and from Kodaikanal hills (Sivasankaran *et al*., 2012).

**Fig. 1. *Phyllodes consobrina* recorded from Kottiyur WLS, Kannur Dt, Kerala**

As a part of a project on 'insects as bio-indicators' we have conducted research on insects and its habitat preferences in tropical rain forests of Silent Valley National Park (SVNP), Palakkad district, Kerala. This region is classified as west coast tropical wet evergreen forest, which forms a part of Nilgiri Biosphere Reserve. Fruit bait traps (modified Van Someren-Rydon Trap) have used for collection of lepidopterans during the study. The trap was baited with rotting or squashed fruit with a dose of alcohol (Das and Vijayan 2007). On 20 May 2014 we collected one specimen of *Phyllodes consobrina* from the fruit-bait trap, kept in Sairandhri ($11^0$03' - $11^0$13' N & $76^0$21' – $76^0$35' E). Later on 19 March 2015, another specimen was also observed from the region. The specimen measured, wingspans such as forewing 6 cm and hindwing 4.3 cm. *Phyllodes consobrina* is a fruit feeding moth, the large crimson patch with white centre on the upper side of hindwing is the distinct characteristic for the identification of the species (Banziger 1968, Zaspel 2008). They are very sensitive against the disturbance and highly camouflaged with the surroundings.

While discussing the identification of the moth species, MJP recalled the sighting of *Phyllodes consobrina* from northern Kerala way back in 1994. He recorded a specimen from Kelakam (11.8917° N, 75.8083° E), very close to Aralam WLS in Kannur district in May 1994. Further, on a visit to Nirmalagiri College, Kuthuparmba, Kannur district on February 2012, he chanced upon a preserved specimen of *Phyllodes consobrina* from the entomological collection of the college museum. The specimen was collected by students from the Kannavam forest area (11.8333° N, 75.6667° E). Very recently on 11th November 2013, a specimen was photographed from Kottiyur WLS (11.8764° N, 75.8542° E), Kannur district (Fig.1) by a press photographer. Interestingly, all the records were from the foothills of Western Ghats in Kannur district.

Considering the fewer distributional records, the present observation is worth reporting as a first few reports from southern Western Ghats with a range extension for this species. More studies are envisaged to have a better understanding of these least known moth species from the region.

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# First Record of *Gerosis bhagava* Moore 1866 (Lepidoptera: Hesperiidae) from Bangladesh

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Common yellow-breasted flat *Gerosis bhagava* (Moore, 1866) is the member of family Hesperiidae and subfamily Pyrginae. It is a widely distributed butterfly in India, Nepal, Bhutan and Myanmar (Kehimkar 2008).

A single specimen was observed and photographed on 24th December, 2013 at Banshkhali Eco-park (21º59.497´N 91º58.931´E), Chittagong, Bangladesh. It was sitting on bird droppings near a rocky stream. It had a dark olive brown upper forewing with a triangular patch made up of three discal semi-transparent white spots, of which two are large; beneath there are small black spots bordering a brownish white streak. Upper hindwing with a broad, transverse band, pale yellow in male and white in female. Abdomen has a white band (Kehimkar 2008).

The occurrence of Common yellow-breasted flat from Bangladesh has no records in any of the recent publications (Chowdhury & Hossain 2011, 2013) and other available literatures. However, Larsen (2004) suspected it presence in Chittagong Hill tracts.

The present documentation is the first confirmed record of Common yellow-breasted flat from Bangladesh. This finding is important to update the status and distribution of Butterflies in Bangladesh.

**Common yellow breasted flat**

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# Present status on some common butterflies in Rahara area, West Bengal

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**Introduction**

Insects, especially butterflies are one of the good indicators of environmental quality of any ecosystem. Butterflies have specific habitat requirement depending upon their feeding and reproduction requirements, loss of which may cause local extinction (Öckinger *et al.*, 2006). Due to differences between the needs of adults and larvae, it is often difficult to determine the 'optimal' level of habitat variables needed for the species as a whole (Melanie *et al*., 2011). Thus the conservation value of a habitat could be assessed by the presence of various species of butterflies in an area. The aim of the present study is to report the species of butterflies observed over short period and hence random observations were conducted first time in Rahara area.

**Materials and methods**

The study sites at R.K. Mission V.C. College, Rahara within a radius of 1km was chosen. In all, four sites were chosen on the basis of their contrasting vegetation types and levels of disturbance. The diversity of butterfly species and their host plants were also investigated. The foraging plants species of these insects mainly comprise *Lantana camara, Hibiscus* sp., *Ixora* sp., *Bougainvillea* sp., *Tridex* sp., *Zizyphus* sp., *Cassia* sp., *Anthocephalus* sp., *Senecio confusus, Caesalpinia pulcherrima, Mussaenda erythrophylla* etc. Observation on butterflies at all of the sampling locations were conducted in the pre-winter months i.e. October-November 2011. The number of individuals of each species observed and captured by sweep nets were done when weather conditions were suitable for butterfly activity. The time of observation was from morning 10:30 am to afternoon 4.00 pm. Observations were made by direct visual methods. For photography HD Digital camera model Canon Power Shot SX130 IS of 12 X optical zoom and Nikon Coolpix L23 were used. Flash was kept off to capture natural colour of the butterflies. Then they were collected and brought to Zoology Laboratory of R.K.M.V.C. College, Rahara for primary identification with the help of some available books on butterflies ( Singh 2011, Ghosh 2009, Balmer 2007, Kunte 2000 and Bhattacharya 1997) and for taking their snaps. Later in the process, the snaps taken and a few collected specimens were taken to Zoological Survey of India, New Alipore, Kolkata for identification and further information. The temperature and humidity were recorded during study hours. The status recording (Wadatkar and Kasambe 2008) was as follows - VC or very common (>30 sightings), C or common (20-30 sightings), NR or not rare (15-19 sightings), R or rare (<10 sightings), VR or very rare (1-2 sightings).


**Fig. 1. A part of Rahara area showing butterfly collection localities. Note patchy areas of greeneries, ponds and buildings.**

**Observations**

In our observation on the butterfly species diversity in Rahara area during October-November, 2011 ie., pre-winter months 35 species belonging to 5 families were recorded.

**Table 1. Species composition of Butterfly found in Rahara Area, Kolkata.**

| Family | Common name | Scientific name | Status |
|---|---|---|---|
| Nymphalidae | Plain Tiger | *Danaus chrysippus* | VC |
| | Common Evening Brown | *Melanitis leda* | VC |
| | Common Bush Brown | *Mycalesis perseus* | VC |
| | Peacock Pansy | *Junonia almana* | VC |
| | Chocolate Pansy | *Junonia iphita* | NR |
| | Grey Pansy | *Junonia atlites* | VC |
| | Studded Sergeant | *Athyma asura* | R |
| | Commander | *Moduza procris* | NR |
| | Stripped Tiger | *Danaus genutia* | C |
| | Common Crow | *Euploea core* | VC |
| | Blue Tiger | *Tirumala limniace* | R |
| Pieridae | Indian Cabbage White | *Pieris canidia* | C |
| | Common Gull | *Cepora nerissa* | C |
| | Mottled Emmigrant | *Catopsilia pyranthe* | C |
| | Small Grass Yellow | *Eurema* sp. | VC |
| | Spotted Grass Yellow | *Eurema* sp. | VC |
| | Spotless Grass Yellow | *Eurema laeta* sp. | R |
| | Three Spot Grass Yellow | *Eurema blanda* | NR |
| | Common Grass Yellow | *Eurema hecabe* | NR |
| | Psyche | *Leptosia nina* | VC |
| | Common Jezebel | *Delias eucharis* | C |
| Papillionidae | Lime Butterfly | *Papilio demoleus* | C |
| | Tailed Jay | *Graphium agamemnon* | C |
| | Unidentified Swallow Tail | | NR |
| | Common Jay | *Graphium doson* | R |
| Lycaenidae | Forget-Me-Not | *Catochrysops strabo* | VC |
| | Rounded Peirrot | *Tarucus nara* | VC |
| | Striped Peirrot | *Tarucus* sp. | C |
| | Common Pierrot | *Castalius rosimon* | C |
| | Quaker | *Neopithecops zalmora* | C |
| | Common Silver Line | *Spindasis vulcanus* | NR |
| | Grass jewel | *Chilades trochylus* | R |
| Hesperiidae | Straight Swift | *Parnara guttatus* | VR |
| | Bevan's Swift | *Pseudoborbo bevani* | VR |
| | Tree Flitter | *Hyarotis adrastus* | |

(Table 1). Species belonging to the family Nymphalidae (40%) were most dominant followed by Peiridae (25%), Lycaenidae (10%), Hesperiidae (5%), Papilionidae (20%). Only three species of Hesperiidae were recorded out of 35 butterfly species throughout our study period. A mutual association between butterflies and different species of flowers is noticed in the surrounding areas. Sometimes adult butterflies feed on nectar or pollen or both. Imai (1993) showed that in the time course of urbanization, the species richness of Hesperiidae declines first followed by Pieridae in delayed order. Due to establishment of the nearby Titagarh Power Plant, construction of several civil structures, roads, movement of heavy vehicles around our study areas would sure seriously affect the future life activities of butterflies.

**Discussion**

Butterfly visitation records during two pre-winter months were conducted due to luxuriant growth of host plants of butterflies in moist post-rainy season. Visitation pattern includes a variety of plants including host-plants. The study shows that Pieridae and Nymphalidae exhibited the maximum species diversity. The simple reason for this abundance of Pieridae and Nymphalidae butterflies in the study area can be ascribed to the dominance of their larval food plants. Similar situation was reported in Tamil Nadu by Rajagopal *et al.* (2011). The reason for high diversity of nymphalids could be that the caterpillars of nymphalids feed on wide range of food preference and most larvae are fiercely spined, so these butterflies successfully exploit the resources and also protected. Many members of nymphalids feed on plant sap, juice of rotting fruit, fresh dung and other decaying organic matter (Krenn, *et al*., 2001). Imai (1993) also suggests that this butterfly family is most tolerant to the effect of urbanization. Reasons for few hesperiid species that these prefer woodland, moist meadows and such habitat are very scarce in Rahara area. Moreover, the hesperiids exhibits crepuscular habit. Therefore, these butterflies might have skipped from our day time survey. Kunte (2000) reported that they are also seen active in day time under the shade of jungle or out in the open during cloudy weather.

Biological diversity is a good environmental indicator of habitat health. By studying the diversity of butterflies, it may be possible to establish a relationship between the health levels of the habitat with the presence of butterflies. The presence of adult butterflies in our study area typically indicates that a breeding population occurs in the surrounding area. However, the growing trends in habitat depletion must have marked change in butterfly diversity. Monitoring species diversity in conjunction with alterations in habitat can provide greater insight into the ecological requirements for such semi-urban butterfly populations and enable us to conserve and manage.

**Plate 1. List of adult host plants**

*Bougainvillea spectabilis*

*Ixora coccinea*

*Calliandra brevipes*

*Lantana camara*

*Caesalpinia pulcherrima*

*Tridax procumbens*

*Zizyphus* sp.

*Hibiscus* sp.

*Senecio confusus*

*Mussaenda erythrophylla*

*Anthocephalus* sp.


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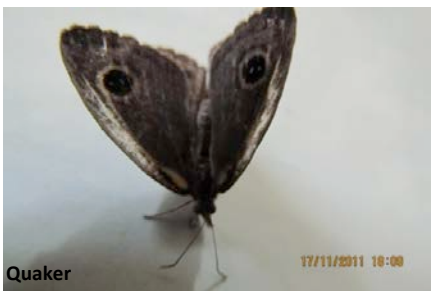
## Plate 2: List of butterflies

Common Evening brown

Common Silverline

Common Gull

Psyche



Quaker

Quaker

Forget-me-not

Common Crow

Common Tiger

Common Gull

Common Grass yellow

Dark Evening Brown

Unidentified sp.

Common Crow

Common Tiger

Yellow Orange Tip (White form)

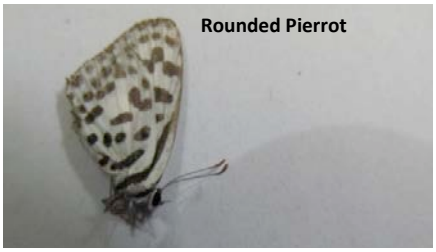
Three Spot Grass yellow

Common jezebel

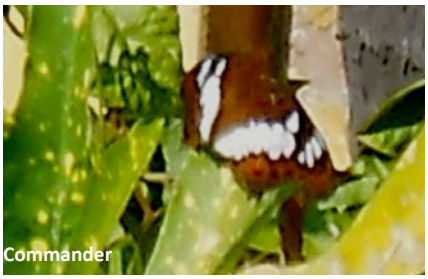
Common Mormon (♂)

Peacock Pansy

Common Evening brown






Dark Evening Brown

Tree Flitter


Mottled Emmigrant






Chocolate pansy

Common Brimstone




# Additions to the Butterfly fauna of Sundarbans Mangrove Forest, Bangladesh

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The Sundarbans is the largest mangrove forest of the world, overlapping two neighbouring countries - Bangladesh and India. Sundarban is one of the unique ecosystems with diverse mangrove vegetation namely Sundari (*Heritiera fomes*), Gewa (*Excoecaria agallocha*), Goran (*Ceriops decandra*), Keora (*Sonneratia apetala*), Baen (*Avicennia Officinalis*), Passur (*Xylocarpus moluccensis*), Kankra (*Bruguiera gymnorrhiza*), Hargoza (*Acanthus ilicifolius*) many other herbs and shrubs. The faunal composition of the Sundarbans consists of a variety of wild animals namely the tigers, deer, wild boars, monkeys, otters, variety of birds, crocodiles, various snakes including python, lizards, amphibians, mollusks, crabs and so on. Besides, it has been an important habitat for many invertebrate fauna including butterflies. But the research on butterflies is scanty here. So far 37 species of butterfly have been documented (Hossain 2013).

The record presented here was conducted between 26 June - 18 July 2014 and random sampling was followed in Sundarban East Wildlife Sanctuary. The species were confirmed based on photographic evidences. The following four species were recorded for the first time from the Bangladeshi Sundarbans, increasing the total number to 41 species.

**Painted Lady *Vanessa cardui* (Linnaeus, 1758)**
The Painted lady is the world's most widely distributed butterfly, missing only from the Neotropical forest zone, Australia, and the Arctics. As a strong migrant it should be found anywhere from time to time, and in winter could well breed in numbers (Larsen 2004). This butterfly was first observed on gewa (*Excoecaria agallocha*) tree (Fig. 1).

**Indian Sunbeam *Curetis thetis* (Drury, 1773)**
During the study period Indian Sunbeam was seen very frequently. It is a very common butterfly in Sundarbans (Fig. 2). This is a very common species in other parts of the country

**Veined Pierrot *Tarucus venosus* (Moore, 1882)**
Only four individuals were seen during the study period. This species is more or less common in other parts of the country (Fig. 3).

**Gram Blue *Euchrysops cnejus* (Fabricius, 1798)**
Several sightings were encountered at Katka meadows of Sundarbans and near Katka forest office area (Fig. 4). They usually prefer open drier places .

The presence of four additional species records indicate that intensive study is required further to understand the diversity of butterflies in Sundarbans, Bangladesh.

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**Fig. 1 Painted lady**


**Fig. 2 Indian Sunbeam**


**Fig. 3 Veined Pierrot**


**Fig. 4 Gram Blue**

# Study on butterfly (Papilionoidea) diversity of Bilaspur city

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**Introduction**

Biological diversity plays a significant role in enrichment of soil and maintaining water and nutrient cycles. It is now increasingly recognized as a vital parameter to assess global and local environmental changes and sustainability of developmental activities (Lovejoy 1995). Compared with other insect groups, the high abundance of butterflies, together with their relatively known taxonomy, has resulted in this group receiving a reasonable amount of attention.

According to Kehimkar (2008) India has 1,501 species, of which 321 are skippers, 107 swallowtails, 109 whites and yellows, 521 Brush footed butterflies and 443 Blues.

State of Chhattisgarh, being placed in Deccan peninsular bio-geographical zone, houses an important part of rich and unique biological diversity. The forests of the state fall under two major forest types, viz., tropical moist deciduous forest and the tropical dry deciduous forest. The total geographical area of the state being 1,35,191 km2, a mere 4.1% of the country, 44.81% of state's geographical area being recorded as forest area. Because of nectar feeding, many species of butterflies are found within city boundary and their diversity speaks about ecological health of the city. Bilaspur city, the study site of present investigation is only 56 km from Achanakmar Tiger Reserve; Tiple (2012) reported 104 butterflies in Achanakmar Tiger Reserve. Chandra (2007) reported 174 butterflies from Madhya Pradesh and Chhattisgarh. In the year 2000 Chhattisgarh state was formed and after that rapid urbanization has started in this region. This has caused shrinking of green pockets within the city. By this study we have tried to find out butterfly diversity of the city to compare with the diversity of Achanakmar tiger reserve, so as to find out effect of urbanization.

**Material and Methods**

The observations of the present investigation were conducted during June 2009 to May 2011 in Bilaspur. Three different areas that represented the habitat types within the city, were selected for sampling of butterfly and collection of data.

The study areas were as follows:

Area - I: Man-made garden area within the cities surrounded by trees. 1). Deendayal Garden 2). Paryavaran Nursery.

Vegetation in the Area I was as follows: ornamental garden plants like *Hibiscus* spp., *Ixora coccinea*, *Dahlia* spp., *Tabernaemontana divaricata*, *Euphorbia pulcherrima*, *Hymenocallis littoralis*, *Catharanthus roseus*, *Bougainvillea* spp., *Salvia* sp., *Thevetia peruviana*. The trees surrounding the garden were *Cassia fistula, Terminalia arjuna, Acacia* spp., *Delonix regia, Bauhinia purpurea, Anthocephalus indicus, Polyalthia longifolia*.

Area - II: Grove

1). Smriti Van 2). Near Railway station, Golf Club

Trees like *Mangifera indica, Anthocephalus indicus, Tamarindus indica, Annona* sp., *Ficus religiosa, Azadirachta*

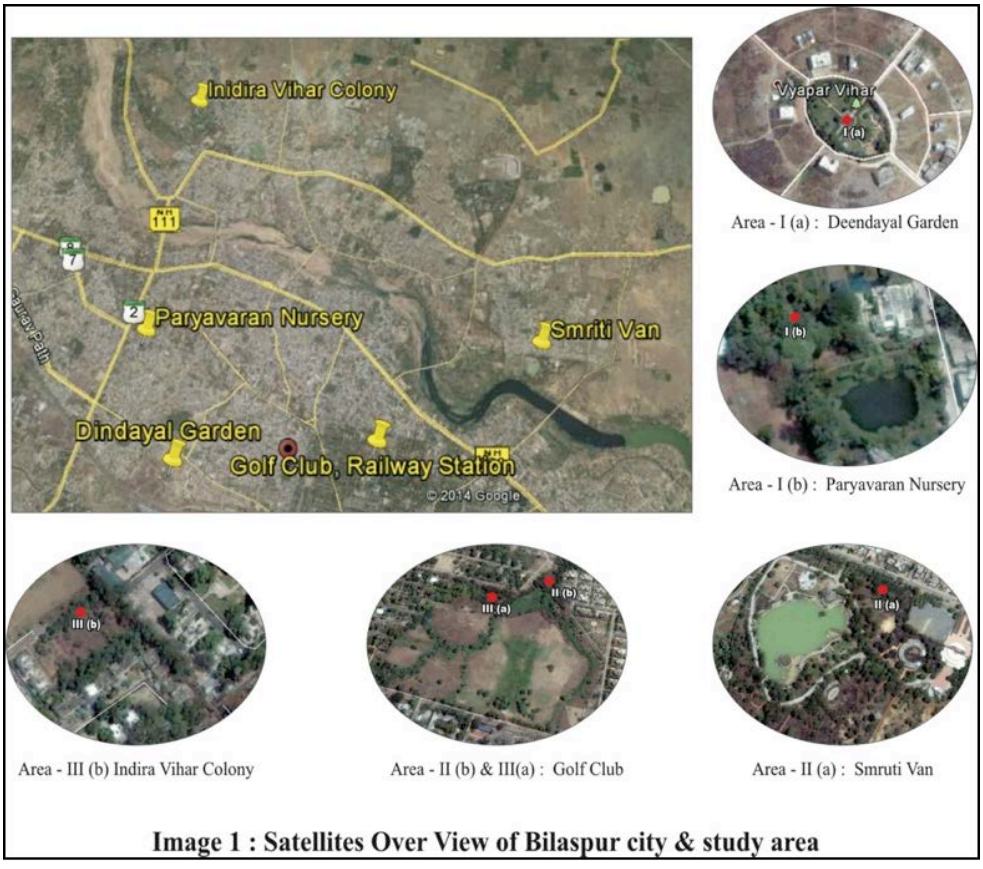



**Image 1 : Satellites Over View of Bilaspur city & study area**

*indica, Butea monosperma, Terminalia eliptica* were prevalent in Area II. C*alotropis procera, Argemone mexicana, Cassia tora* and *Parthenium* were dominant herbs and shrubs in the area.

Area - III: Shrubby area along with trees.
1). Near Railway station, Golf Club 2). Indiravihar Colony
*Peltophorum pterocarpum, Acacia* sp*., Annona* sp*., Thevetia peruviana, Calotropis procera, Argemone mexicana, Cassia tora, Parthenium, Solanum virginianum, Ziziphus* sp*., Lantana camara*, and *Nerium oleander* were found.

These sampling areas were selected so as to cover maximum possible habitats within the city. The study sites were sampled quarterly, to fulfill objectives of present investigation. Altogether 48 transects were covered during the study period (Image 1).

**Butterfly sampling**
Transect-walk method was adapted to sample the butterflies. Transects were walked between 8:00 am to 11:00 am which roughly corresponded to the peak activity period for most butterflies. As the sampling areas were small pockets within the city, transect of 200 meters in every area was set. The duration of sampling for each transect was between 45 and 60 min.

All the butterflies at the distance of 5m from the observer were recorded during the counts.

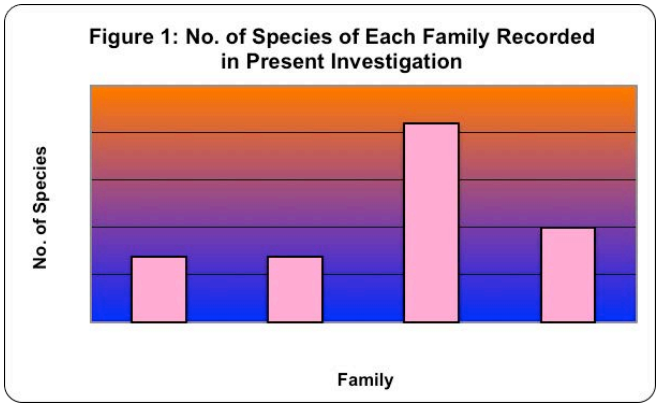
**Butterfly identification**
Butterflies which could be identified during the transect study were noted down. The unidentified butterflies first observed were once caught using butterfly net and released after identification. Butterflies observed in present study were photo documented.

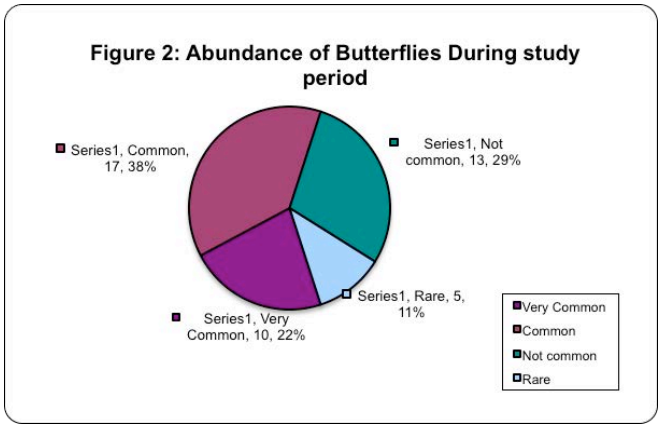
Butterflies of the super families, Papilionoidea were identified using *The Fauna of British India* by Telbot (1986), *Butterflies of the Indian region* by Wynter & Blyth (2009 reprint) and *Indian Butterflies* by Kehimkar (2008). Data were tabulated and analyzed.

**Result and Discussion**
Butterflies are significant indirect indicator of environmental changes because of their sensitivity to local weather, climate and light levels. The richness of Butterfly community also indicates diverse plant communities in any habitat, as these insects are directly dependent on plants. Butterflies got the major attention of scientific community for its ecological role, abundance and alluring color pattern. However, very little work has been done in this region. During the study period, 1766 butterfly specimens were recorded, 41 species were recorded from Area I, 28 species from area II, and 30 species were recorded from area III.

Out of the 45 butterfly species (Table 1) observed in present investigation, there were seven species belonging to family Papilionidae; twenty one species belonging to Nymphalidae; seven species belonging to family Pieridae, and ten species of Lycaenidae. Nymphalidae formed the largest group (21 species).

Joshi (2007), in his study on community structure and habitat selection of butterflies in Rajaji National Park, Uttaranchal, India recorded a total of 1857 individuals belonging to 40 species. Arun (2003) also found similar results. He studied 53 butterflies belonging to three major families. Among the three, Nymphalidae accounted for



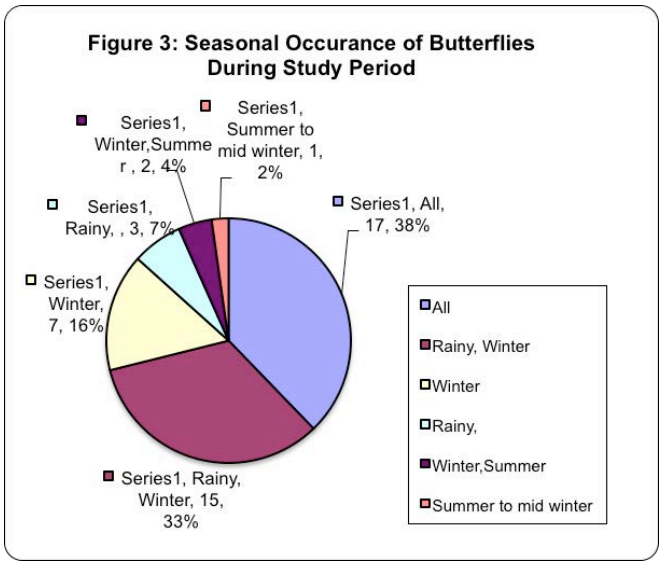



**Table 1: Butterfly Species found in the region**

| Family | Common Name | Species | Abundance | Area* | | | Seasonality** |
|---|---|---|---|---|---|---|---|
| | | | | I | II | III | |
| Papilionidae | Common Mormon | *Papilio polytes* (Linnaeus) | Very Common | + | + | + | A |
| | Blue Mormon | *Papilio polymnester* (Cramer) | Not common | + | - | - | W |
| | Common Rose | *Atrophaneura aristolochiae* (Fabricius) | Common | + | - | - | R,W |
| | Lime Butterfly | *Papilio demoleus* (Linnaeus) | Very Common | + | + | + | A |
| | Common Jay | *Graphium doson* (Frühstorfer) | Very Common | + | + | - | A |
| | Tailed Jay | *Graphium* agamemnon (Frühstorfer) | Not common | + | + | - | R,W |
| | Spot Sword Tail | *Graphium nominus* (Esper) | Not common | + | - | - | LW,MS |
| Pieridae | Common Grass Yellow | *Eurema hebaca* (Linnaeus) | Very Common | + | + | + | A |
| | Three spot Grass Yellow | *Eurema blenda* (Biosduval) | Common | + | - | + | W |
| | Spotless Grass Yellow | *Euremm laeta* (Biosduval) | Not common | - | - | + | R,W |
| | Common Emigrant | *Catopsilia pomona* (Fabricius) | Very Common | + | + | + | A |
| | Mottled Emigrant | *Catopsilia pyranthe* (Linnaeus) | Very Common | + | + | + | A |
| | Common Wonderer | *Pareronia valeria* (Fabricius) | Not common | + | - | + | R,W |
| | Common Gull | *Cepora nerissa* (Fabricius) | Common | + | - | + | R,W |
| Nymphalidae | Evening Brown | *Melanitis leda* (Linnaeus) | Very Common | + | + | + | A |
| | Common Bushbrown | *Mycalesis perseus* (Fabricius) | Common | - | + | + | W,S |
| | Plain Tiger | *Danus chrisippus* (Linnaeus) | Very Common | + | + | + | A |
| | Stripped Tiger | *Danus genutia* (Cramer) | Common | + | - | + | R,W |
| | Common Crow | *Euploea core* (Cramer) | Very Common | + | + | + | A |
| | Blue Tiger | *Tirumala limniace* (Cramer) | Common | + | + | - | A |
| | Great Eggfly | *Hypolimnas bolina* (Linnaeus) | Common | + | + | - | R,W |
| | Danin Eggfly | *hypolimnas misipus* (Linnaeus) | Not common | + | + | - | R |
| | Gray Pancy | *Junonia atlites* (Linnaeus) | Common | + | + | + | A |
| | Pecock Pancy | *Junonia almana* (Linnaeus) | Not common | + | - | + | W |
| | Lemon Pansy | *Junonia lamonias* (Linnaeus) | Common | + | + | + | A |
| | Blue Pancy | *Junonia orithiya* (Linnaeus) | Rare | - | - | + | W |
| | Chocolate Pancy | *Junonia iphita* (Cramer) | Rare | + | + | - | R,W |
| | Yellow Pancy | *Junonia hierta* (Fabricius) | Rare | - | - | + | W |
| | Tawny Caster | *Acraea violae* (Fabricius) | Very Common | + | + | + | A |
| | Sailer | *Neptis hylas* (Linnaeus) | Common | + | + | - | R,W |
| | Common Baron | *Euthalia aconthea* (Cramer) | Common | + | + | + | R,W |
| | Common castor | *Ariadne merione* (Cramer) | Common | + | - | + | R |
| | Black Raja | *Charaxes solon* (Fabricius) | Rare | + | + | - | R |
| | Baronet | *Euthalia nais* (Forster) | Not common | + | + | - | A |
| | Commander | *Moduza procris* (Cramer) | Not common | + | + | - | R,W |
| Lycaenidae | Common Line Blue | *Prosotus nora* (C.Felder) | Not common | + | - | + | R,W |
| | Pea Blue | *Lampides boeticus* (Linnaeus) | Not common | + | - | + | R,W |
| | Zebra Blue | *Leptotes plinius* (Fabricius) | Common | + | + | + | A |
| | Pale Grass Blue | *Pseudozizeeria maha* | Common | + | + | + | A |
| | Tiny Grass Blue | *Zizula hylax* (Fabricius) | Not common | + | - | + | W |
| | Dark Grass Blue | *Zizeeria karsandra* (Moore) | Common | + | + | + | A |
| | Common Pierrot | *Castalius rosimon* (Fabricius) | Common | + | + | + | W |
| | Dark Cerulean | *Jamides bochus* (Stoll) | Not common | + | - | - | R,W |
| | Gram Blue | *Euchrysops cnejus* (Fabricius) | Common | + | + | + | S, MW |
| | Large Oak Blue | *Arhopala amantes* (Hewitson) | Rare | + | - | - | R,W |

*= Presence /Absence of butterflies from area I, II, III; **= R- Rainy, W- Winter, A- All, S- Summer, MW- Mid winter, LW- Late winter, MS- Mid summer

**Fig. 1** ***Euthalia aconthea***

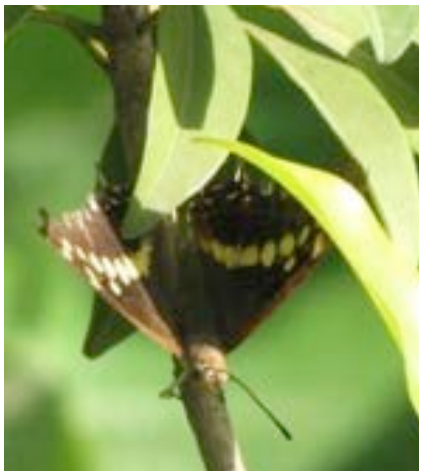


**Fig. 2** ***Charaxes solon***

**Fig. 4** ***Moduza procris***

**Fig. 5** ***Ariadne merione***

**Fig. 6** ***Hypolimnas bolina***

**Fig. 7** ***Neptis hyla***

**Fig. 8** ***Graphium agamemnon***

**Fig. 9** ***Papilio polymnestor***

**Fig. 10** ***Cepora nerissa***

**Fig. 11** ***Arhopala amantes***

around 58% of the species richness, Papilionidae was represented by 13 species and Pieridae by 9 species. Sudhendra Kumar *et al*. (2000) studied butterflies of Prambikulam wildlife sanctuary, Kerala and reported 124 species of butterflies, belonging to 75 genera and 9 families. He collected 28 species of butterflies of family Nymphalidae, 22 species of Pieridae, 20 species of Lycaenidae, 16 species of Satyridae and 15 species of Papilionidae. Tipley (2012) studied butterflies of Achanakmar Amarkantak Biosphere reserve and reported 104 butterflies from this region. As Bilaspur city is only 56 km from Achanakmar, we compared our findings with their records. Three butterflies (*Graphium dorson, Pseudozizeeria maha, Arphopala amantes*) recorded from Bilaspur city by us were not reported from Achanakmar Amarkantak region, however the three were reported from Madhya Pradesh and Vidarbha. Kaneria *et al*. (2013) also studied butterflies of Bilaspur District, and found 50 species. In our study we found 10 species of butterflies which were not listed by them.

Seasonal occurrence of butterfly species was also recorded in the study period. Seventeen species were observed in all seasons and rest of the butterflies showed seasonal occurrence.

In the present investigation, *Euplea core, Danaus chrysippus, Acraea violae, Papilio demoleus, Graphium doson, Eurema hecabe, Catopsila pomona* and *C. pyranthe* were the abundant species during the study period. Some other scientists have also reported abundant species from their respective study areas, such as, Shrikumar & Balakrishnan (2001) reported *Eurema hecabe* as most abundant butterflies in all elevations, followed by *Jomides celeno, Troides minos, Caleta caleta* in Aralam wildlife sanctuary, Kerala. Joshi (2007) found *E. hecabe*, constituting 16.5% of the total, second most abundant species *Melanitis leda* (16.2%) in Rajaji National Park, Uttaranchal.

**Acknowledgement**

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# Bio-ecology of Swallowtail (Lepidoptera: Papilionidae) Butterflies in Gautala Wildlife Sanctuary of Maharashtra, India

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**Introduction**

Swallowtail butterflies are large and colourful that form the family Papilionidae. In Lepidoptera, butterflies are typically active during day time due to their skill of flight, butterflies achieved an almost world-wide distribution, though as with most animal groups (particularly cold blooded ones) there is a greater diversity to be found in the tropics (Mathew, 2001). Unfortunately, butterflies are threatened by habitat destruction and fragmentation almost everywhere (Mathew, 2001).

Gautala Widlife Sanctuary is situated in Aurangabad District of Maharashtra and lies in the Satmala and Ajantha hill ranges of *Sahyadri*. The vegetation found here is southern tropical dry deciduous forest. Wildlife population includes chinkara, sloth bears, bats, wild boar, jungle cat, civet cat, monkey, barking deer, fox, jackal, langur, leopard, nilgai and wolf. Cranes, spoonbills, storks, ibis, pochards, peafowl, quail, partridges, and various species of waders are some of the bird species found here. Reptiles include cobra, krait, keel, backviper, python, rat snake, and monitor lizard. Large scales of lapidarian species are also occurring in this fauna.

**Materials and Methods**

The present study is an attempt to study the bio-ecology of selected species of *Papilionidae* in Gautala Wildlife Sanctuary of Maharashtra, India. For the counting of the butterflies we choose five forest types; dry deciduous, moist deciduous, evergreen, scrub and thorny forest and teak plantation. To cover habitat of all forest, two transects of 2 km each were laid in each forest type. The observation of the butterflies was made on both the sides of the transect up to 20 meters. Counting and ocular observation of eight selected *Papilionidae* species was done. During this study, the interaction of the butterflies with larval and adult host plants was also observed. The study observations was done in morning, 0700 to 1000 hrs for the period of two years, from June 2008 to May 2010, in three seasons, i.e. monsoon season (June to September), winter season (October to January) and summer season (February to May). In this study, selected seven species of *Papilionidae* butterflies, counted in different seasons, during the counts; date, time, and general weather conditions were recorded and the density of *Pachliopta aristolochiae*, *Pachliopta hector, Papilio demoles, Papilio helenus*, *Papilio polytes, Papilio polymenstor, Papilio crino* were calculated.

**Observations and results**

In evergreen forest of Gautala Wildlife Sanctuary, *P. demoles, P. polytus, P. polymnestor, P. crino*, were found in all the seasons. During the monsoon *P. aristolochiae* was found (Table 1). In the moist deciduous forest *P. aristolochiae, P. hector, P. polytes, P. polymnestor* and *P. crino* were found in all the seasons (Table 2). In dry deciduous forest *P. aristolochiae, P. polytes*, and *P. polymnestor* were found in all the seasons. *P. demoles* was found in the summer. *P. helenus* was not found in winter. *P. crino* was not found in summer (Table 3). In the scrub jungle *P. aristolochiae, P. hector* and *P. polytes* was found in all seasons. (Table 4) In the teak plantation *P. aristolochiae, G. sarpendon, P. polymnestor, P. crino* and *P. hector* was found in all seasons. (Table 5) There was a correlation between the vegetation characteristics features in different habitats of of the sanctuary. Host plant density and diversity were found to be more important variables that influence on the butterfly densities significantly ($p < 0.05$).

**Discussion**

In present study, the diversity of *Pachilopta aristolochea* is high in dry deciduous forest and scrub jungle, this species is found in all habitats average in moist deciduous and teak forests and poor in evergreen forest. In dry deciduous forest, the diversity of *Pachiliopta hector* was average, in scrub forest, moist deciduous and teak plantation it was good. In evergreen forest the diversity of *Pachiliopta hector* was little less. *Papilio demoles* found in evergreen forest during monsoon and post monsoon seasons and having good diversity in the evergreen forest, comparatively it had poor diversity in dry deciduous forest, scrub jungle, moist deciduous forest and teak plantation. *Papilio helenus* had a poor diversity in evergreen, scrub, moist deciduous and teak plantation, while in dry deciduous it had higher diversity. *Papilio polytes* found in dry deciduous forest, evergreen and semi-evergreen forest. It had an average diversity in dry deciduous forest, evergreen forest and teak plantation, while its diversity was high in scrub and moist deciduous forest. In the present study, *Papilio polymnestor* which is a butterfly of the thicker forest and found along ecotones and edges. It had an average diversity in all the forest types. *Papilio crino* had an average diversity in evergreen and dry deciduous forest; comparatively it had poor diversity in moist deciduous forest, teak plantation and scrub forest.

**Table 1. Seasonal variations in the butterfly density (No./km$^2$) diversity (H') in the evergreen forest of Gautala Wildlife Sanctuary of Maharashtra, India**

| S.No | Species Name | Seasons* | | |
|---|---|---|---|---|
| | | Monsoon | Winter | Summer |
| 1 | *Pachliopta aristolochiae* | 65 | 0 | 0 |
| 2 | *Pachliopta hector* | 0 | 0 | 0 |
| 3 | *Papilio demoles* | 6 | 9 | 1 |
| 4 | *Papilio helenus* | 3 | 0 | 0 |
| 5 | *Papilio polytes* | 14 | 3 | 3 |
| 6 | *Papilio polymenstor* | 19 | 9 | 6 |
| 7 | *Papilio crino* | 20 | 12 | 6 |
| | **Total** | 127 | 33 | 16 |
| | **Diversity (H')** | 1.35302 | 1.16966 | 1.213214 |

**Table 2. Seasonal variations in the butterflies density (No./km$^2$) diversity (H') in the moist deciduous forest of Gautala Wildlife Sanctuary of Maharashtra India**

| S.No | Species Name | Seasons* | | |
|---|---|---|---|---|
| | | Monsoon | Winter | Summer |
| 1 | *Pachliopta aristolochiae* | 59 | 19 | 2 |
| 2 | *Pachliopta hector* | 74 | 50 | 20 |
| 3 | *Papilio demoles* | 0 | 0 | 0 |
| 4 | *Papilio helenus* | 0 | 0 | 0 |
| 5 | *Papilio polytes* | 68 | 45 | 29 |
| 6 | *Papilio polymenstor* | 25 | 19 | 15 |
| 7 | *Papilio crino* | 17 | 12 | 2 |
| | **Total** | 243 | 145 | 68 |
| | **Diversity (H')** | 1.4504 | 1.4585 | 1.2065 |

In the present study, even though vegetation structure is important for *Papilionidae* species diversity and density, climate also play an important role in deciding the density diversity of butterflies. The butterfly density and diversity is also depends upon the availability and composition of host plants in forest. Study also reports that in teak forest the highest diversity was in summer, followed by the monsoon. In dry deciduous forest, winter had the highest diversity. In evergreen forest, diversity of swallowtails butterflies were highest during the monsoon, followed by winter. In scrub forest, the monsoon had the highest diversity, followed by winter. In moist deciduous forest, the diversity of these butterflies was highest during the monsoon. The studies show that butterfly diversity patterns do not show any season-wise fixed pattern in the various forest types. During the study in the teak plantation P. *aristolochiae, G.sarpendon, P. polymnestor, P. crino* and *P. hector* shows the correlation with host plant diversity. Kunte (1999) reports the correlation between foliage height diversity, plant species diversity and butterfly diversity increase in butterfly diversity was not linear with vegetation diversity. It increased from high elevation grassland through shrub savannah, teak plantation and deciduous forest and then dipped down in the Shola evergreen forest.

**Table 3. Seasonal variations in the butterflies density (No./km$^2$) diversity (H') in the dry deciduous forest of Gautala Wildlife Sanctuary of Maharashtra India**

| S.No | Species Name | Seasons* | | |
|---|---|---|---|---|
| | | Monsoon | Winter | Summer |
| 1 | *Pachliopta aristolochiae* | 206 | 133 | 76 |
| 2 | *Pachliopta hector* | 18 | 58 | 0 |
| 3 | *Papilio demoles* | 0 | 0 | 8 |
| 4 | *Papilio helenus* | 25 | 0 | 21 |
| 5 | *Papilio polytes* | 51 | 16 | 18 |
| 6 | *Papilio polymenstor* | 17 | 8 | 18 |
| 7 | *Papilio crino* | 67 | 8 | 0 |
| | **Total** | 384 | 223 | 141 |
| | **Diversity (H')** | 1.393255 | 1.09991 | 1.311206 |

**Table 4. Seasonal variations in the butterflies density (No./km$^2$) diversity (H') in the scrub jungle of Gautala Wildlife Sanctuary of Maharashtra India**

| S.No | Species Name | Seasons* | | |
|---|---|---|---|---|
| | | Monsoon | Winter | Summer |
| 1 | *Pachliopta aristolochiae* | 172 | 75 | 88 |
| 2 | *Pachliopta hector* | 80 | 63 | 45 |
| 3 | *Papilio demoles* | 0 | 0 | 0 |
| 4 | *Papilio helenus* | 0 | 0 | 0 |
| 5 | *Papilio polytes* | 60 | 69 | 44 |
| 6 | *Papilio polymenstor* | 8 | 6 | 8 |
| 7 | *Papilio crino* | 6 | 6 | 2 |
| | **Total** | 326 | 219 | 187 |
| | **Diversity (H')** | 1.176196 | 1.268082 | 1.224706 |

**Table 5. Seasonal variations in the butterfly density (No./km$^2$) diversity (H') in the teak plantation of Gautala Wildlife Sanctuary of Maharashtra India**

| S.No | Species Name | Seasons* | | |
|---|---|---|---|---|
| | | Monsoon | Winter | Summer |
| 1 | *Pachliopta aristolochiae* | 123 | 68 | 82 |
| 2 | *Pachliopta hector* | 76 | 21 | 21 |
| 3 | *Papilio demoles* | 0 | 0 | 0 |
| 4 | *Papilio helenus* | 8 | 4 | 4 |
| 5 | *Papilio polytes* | 0 | 0 | 0 |
| 6 | *Papilio polymenstor* | 14 | 16 | 14 |
| 7 | *Papilio crino* | 9 | 4 | 2 |
| | **Total** | 230 | 113 | 123 |
| | **Diversity (H')** | 1.118783 | 2.534071 | 1.014553 |

** Monsoon= Monsoon Season (June – September); Winter = Winter Season (October – January); Summer = Summer Season (February – May)*

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# New report of midge gall (Diptera: Cecidomyiidae) on *Ziziphus xylopyrus* (Retz.) Willd. (Rhamnaceae) from Northern Western Ghats

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Plant galls or plant tumours are structural abnormalities, which arise mostly by overgrowth and excessive cell division of tissues in response to the feeding activity of a parasite on the host plant. Among gall makers, Cecidomyiids or gall midges as they are popularly called are well known on a variety of plants.

During floristic explorations in Katraj hills, Pune district, an interesting colourful leaf gall was observed on *Ziziphus xylopyrus* (Retz.) Willd. Katraj hills are the eastern spur of magnificent Western Ghats and treated as one of the 34 biodiversity hot spots. (Roach, 2005). It supports dry deciduous vegetation with many endemic species. The area is type locality of two species of flowering plants viz. *Pimpinella katrajensis* and *Euphorbia katrajensis* (Datar & Ghate, 2006).

**Material examined:** Leaf gall on *Ziziphus xylopyrus* collected on 11.06.2014; GPS location: 18.408592, 73.854702. *Ziziphus xylopyrus* (Retz.) Willd. (Plate 1 a) is a straggling shrub or occasionally tree, growing between 3–6 m tall. The species is armed or sometimes spines are not present. Leaves are 3.5–7.5 cm long, occasionally elliptic–oblong or suborbicular, obliquely cordate at base. Flowers appear in pubesecent, paniculate cymes. Fruits are 2.5 cm across, globose, hard and woody. 2–3 seeded (Singh & Karthikeyan, 2000). The species is not preferred as edible unlike other species of this genus. It is locally known as *Hadkibor, Ghatbor* or *Guti* and flowers between April and July. The plant species was identified using flora (Singh & Karthikeyan, 2000) and was confirmed by comparing with authentic specimen deposited at herbarium of Agharkar Research Institute, Pune (AHMA).

**Leaf- gall**. (Plate 1) Epi-hyophyllous (visible on both sides of blade), deep reddish brown to rusty brown, globose smooth, indehiscent, persistent covering gall. Solitary, free jointed or agglomerate, non localized and unilocular. Size of each gall 1- 2 mm in diameter. Profuse galling was seen on many leaves, each leaf having 2-32 galls. The galls were cut open in the laboratory to confirm the identity of the causative agent. Each gall having one chamber was found to contain one orange coloured larva. The presence of sclerotized organ on ventral side of prothorax (Plate 1, d) confirmed the identity of the gall maker as Cecidomyiid. In the absence of the adults the specific identity is kept pending. This communication forms the first report of

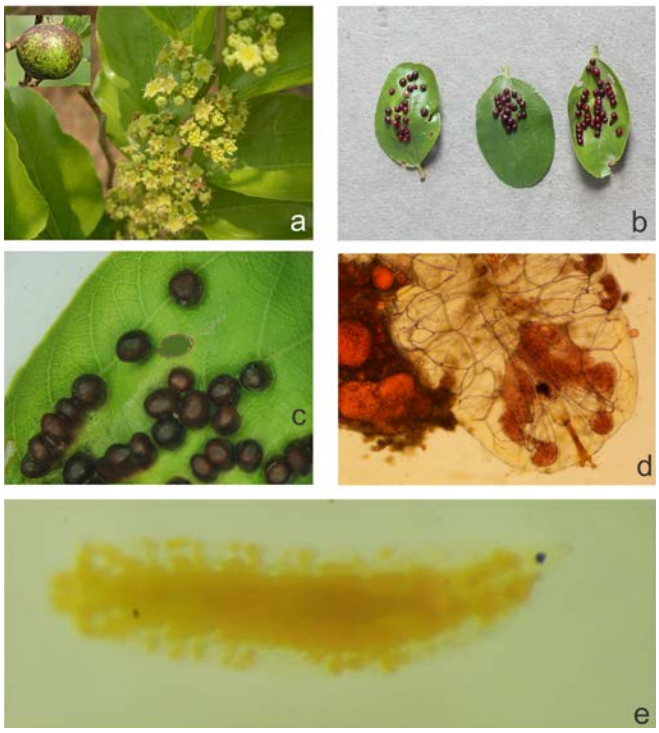


**Plate 1. Midge gall on *Ziziphus xylopyrus* (Retz.) Wild. a. Host plant (inset fruit); b. Galls on the leaves; c. Galls close up; d. Larva showing sclerotized sternal spatula; e. Larva**

Cecidomyiid galls on *Ziziphus xylopyrus* (Retz.) Willd. Mani (1973) mentions identical galls (Gall No 300) on *Ziziphus* sp. from South India without exact locality, identification of the causative agent and the plant species. Thus the present report of gall and the gall maker stands as the first from Northern Western Ghats of Maharashtra.

**Acknowledgements**

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# Rapid assessment of butterfly diversity in a ecotone adjoining Bannerghatta National Park, Bengaluru

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**Introduction**

The tropical regions, being the evolutionary origins of butterfly diversity, show high abundance and species diversity compared to temperate regions exhibit relatively stable population dynamics, longer-lived adult stages, and more continuous age-specific reproduction compared to temperate zone species and also due to complex species interactions like mimicry, parasitism and predation that significantly influence the ecological and evolutionary processes in tropical butterflies than in temperate ones (Bonebrake *et al*., 2010). Butterflies are an important component of the food chain (Aneesh *et al*., 2013), and are considered ideal subjects for ecological studies of landscapes and also act as indicators (Thomas and Malorie 1985, Kremen 1992, Kocher and Williams 2000). Plant diversity (shrubs and herbs) can be circuitously estimated depending on the species of butterflies available on the given area as caterpillars are purely depended on the host plant for their nutrition, some caterpillar are strictly plant species specific (Aneesh *et al.,* 2013).

In the present paper a preliminary field survey was undertaken to record the butterflies of Taralu estate and adjoining areas is reported.

**Materials and Methods**

Taralu estate (10°17'-10°19' N; 76°39'-76°44' E), a small settlement in Bengaluru South Taluk, Bengaluru Urban district has been selected as study area on the basis of following reasons viz., lack of literature on the butterfly fauna, proximity to the Bannerghatta National park and rich floral with mixed micro-habitat regimes. Field surveys were undertaken following earlier protocols (Kunte et al., 2012). Weekly field diurnal surveys were undertaken in the study area during April and May, 2014 by transect walks mostly during the early hours of the day. Individual species were photographed using Canon Powershot SX40. A sweep net was carried to collect species whose identity needed confirmation. Butterflies captured were released as soon as identification was confirmed. Online information websites were referenced for identification and confirmation of the species to reaffirm the species identification (http://www.ifoundbutterflies.org)/#!/tx/8-Nymphalidae-dp1.

**Results and Discussion**

Butterflies are charismatic and easy to find and measure in any ecosystem, the findings of the present survey report 16 species of butterflies belonging four families viz., Papilionidae (1), Pieridae (6), Lycaenidae (3) and Nymphalidae (6) (Plate 1), the highest in family Nymphalidae (Figure 1). Complex biodiversity within intricate food webs confers stability and equilibrium to the overall ecosystem. Lepidoptera are the primary defoliating herbivores in forest ecosystems converting plant biomass into animal biomass, and making it available to higher trophic levels in the food chain (Stamp and Casey 1993). Both adults and caterpillars represent the primary trophic level serving as food for herpetofauna and avifauna of the area. Thus, considering their aesthetic and ecological values attention to maintaining the butterfly species' habitat requirements is necessary to ensure that they are not impacted by anthropogenic pressures. The present list is from a short pilot survey during summer months, and is not a complete list.

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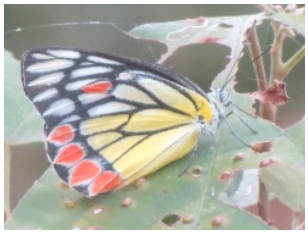
**Plate 1. List of species recorded in and around Taralu**

**Pieridae (Whites and Yellows)**

Common grass yellow
*Eurema hecabe*

Crimson Tip
*Colotis danae* - Male

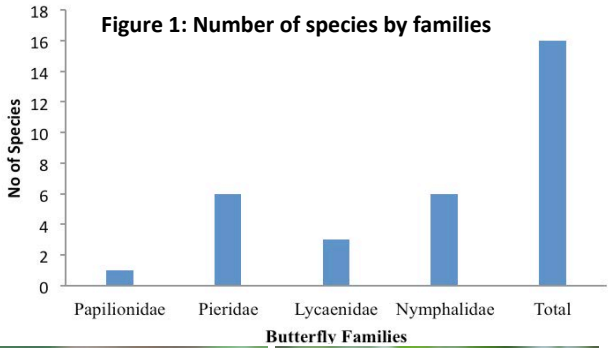
Plain Orange Tip
*Colotis aurora*



Common Jezebel
*Delias eucharis*

Common Gull
*Ceporanerissa* (Wet SF)

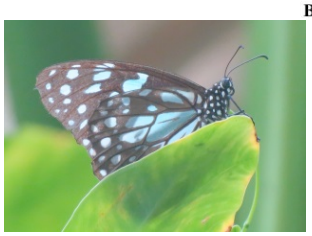
Mottled Emigrant
*Catopsila pyranthe*




**Nymphalidae (Brush Footed)**

Lemon Pansy
*Junonia lemonias*

Common evening brown
*Melanitis leda* (Wet SF)



Blue Tiger
*Tirumala liminace* - Female

Double Branded Crow
*Euploea sylvester*

Baronet
(*Symphaedra nais)*

Common Four-ring
*Ypthima huebneri* (Wet SF)

Common Four-ring
*Ypthima huebneri* (Dry SF)

**Papilionidae (Swallowtails)**

Crimson Rose
*Pachlipota hector*

**Lycaenidae (Blues)**

Gram Blue
*Euchrysops cnejus* - Female

Dark Grass blue
*Zizeeria karsandra* - Female

Common Cerulean
*Jamides celeno*

# Aquatic Insect Fauna and Diversity in five different sites of Loktak Lake of Manipur, North East India

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**Abstract**
The present study was conducted on the aquatic insect faunal diversity at the five different sites of the Loktak Lake, Manipur during March 2012 to February 2013. Fifty seven species belonging to 44 genera, 24 families and 6 orders were recorded belonging to the Orders Ephemeroptera, Odonata, Hemiptera, Coleoptera, Diptera, and Trichoptera. Within this Coleoptera is the dominant order with respect to species diversity (41.60% species) and abundance. Shannon index analysis was carried out to understand the species diversity eleven species are reported for the first time from the state.

**Introduction**
Aquatic insects are more abundant and diverse group that inhabits a variety of aquatic environment. These organisms are an important component of aquatic (and sometime terrestrial) food webs because they break down and process organic matters and provide food for invertebrates and vertebrates (Bouchard 2004). These insects are found in or on the surface of lentic as well as lotic waters. Fresh water makes up only about 0.01% of global total water body and it contains 8% species diversity out of 1.3 million scientifically described species (Dugeon 1999). Higher diversity and density of aquatic insects in more luxuriant vegetation wetland than in lentic which might have attracted more insect that looked for refuge, oviposition site and food, as their assemblage is strongly dependent on the composition, structure and greater surface area provided by vegetation types (Merritt *et al.* 2008). Aquatic insects are useful to study the water quality as indicator of pollution (Thani and Phalarakhsh 2008). Among the freshwater animal taxa, the aquatic insect may be considered model organisms in analyzing the structure and function of the inland waters because of their high abundance, high birth rate with short generation time, large biomass and rapid colonization of freshwater habitats (Sharma and Agrawal 2012). The presence /absence of certain families of aquatic insects can indicate the quality of the water body. Most insects are adapted to either a lentic or a lotic habitat, but overlaps are common such as in the floodplains of large rivers. The most controversial current issues are the building of the dams and blasting of rapid and various environmental disturbances tolerant levels (Arimoro and Ikomi 2000). Consequently, changes in physico - chemical properties (temperature, dissolved oxygen, carbonate, alkalinity, phosphates, nitrates and metal concentrations) can adversely affect the diversity, distribution and composition of aquatic insects (Odum 1971, Boyd 1979). The seasonality and aquatic vegetation affect the diversity of water beetles in tropical and temperate waters (Manivannan and Madani, 2012).

Water temperature is probably the most important environmental variable. It affects metabolic activities, growth, feeding, reproduction, distribution and migratory behaviors of aquatic organisms (Largler 1997, Clillet 2006, Suski 2006). India is one of the mega-biodiversity countries in the world and occupies the ninth position in terms of freshwater mega-biodiversity (Mittermeier 1997). In Manipur, however little is known about aquatic insects despite its potentials as a biodiversity hotspot as it lies on North-Eastern India. Although some preliminary surveys were reported on the aquatic insects of phumdis of Loktak Lake (Takhelmayum 2011) especially in the water, at the rim of water and littoral areas of surroundings information is lacking with regard to Loktak Lake. Therefore, the species diversity of the aquatic insects from these areas were studied to expand the database of aquatic insects in Loktak Lake of Manipur. In view of the importance role played by the aquatic insect in the ecosystem, the present work was conducted to determine the species richness and abundance of aquatic insects in the Loktak Lake of Manipur, North Eastern part of India.

**Materials and Methods**
**Study area**: The present study was conducted at 5 sites of Loktak Lake during March 2012 to February 2013. The Loktak Lake is the largest freshwater lake and swamp in the North East India. It lies in between 24°25' N to 24°40' N latitude and 93°45' E to 93°55' E longitude in the Southern part of the Imphal Valley of Manipur (Fig.1). The geo-coordinates and habitat profile of the five different sites of Loktak Lake are provided in Table 1.

**Field Methods**
Aquatic insects sampling was collected from the different microhabitats for one hour at each site to standardize sampling effort. Insects were collected using D-Frame net with a mesh size of 0.5mm. The numbers of individual were noted down. The large sized beetles were captured using bottle traps in horizontal position and also in vertical position. After two days the bottle traps were removed and trapped beetles were preserved in 70% alcohol( Hilsenhoff 1991) and brought back to the laboratory and identified with the help of standard identification manuals and

published literatures **(**Andersen *et al.* 2004, Bal and Basu 1994 a, b, Bouchard 2004, Epler 2010, Westfall *et al.* 1996).

**Data Analysis**

Data collected from the study were tested for normality. Data which failed normality were not used for further analysis. Species diversity (Shannon- Weiner index), component of dominance (Simpson dominance index) and Berger-Parker dominance were determined for each site. Comparison in species composition between different sites was estimated using single linkage cluster based on Bray-Curtis similarity. Species recorded in this study were ranked on the basis of relative abundance of individual species. Data of species richness counts of one year from the study area were pooled to get rarefaction curves for comparison of estimated species richness between the sites. The package of Biodiversity Professional version 2 was used to determine diversity indices, cluster analysis, rarefaction curves, species richness estimates and also used for rank abundance diagram (Neil Mc Aleece *et al*. 1997).

**Results**

**Insect fauna**

A total of 3079 individuals of aquatic insects representing 57 species belonging to 44 genera, 24 families and 6 orders were recorded. Maximum of 797 individual and 57 species of aquatic insects were recorded in Phubala (site I) followed by Thinungei (site III) with 695 individual and 56 species, Takmupat (site II) with 658 individual and 55 species, Ningthoukhong (site IV) with 471 individual and 56 species and minimum of 458 individual and 56 species were recorded in Oksoipat (site V). Eleven species are reported for the first time from the state. Out of 11 species, 3 species belongs to Hemiptera, 7 species belongs to Coleoptera and 1 from Trichoptera (Table.2).

**Species Diversity and Abundance Pattern**

The present studies reveal that Coleoptera is the dominant order with respect to species diversity (41.60 % species), followed by Hemiptera (40.47%), Odonata (9.16), Diptera (5.72 %), Ephemeroptera (2.5%) and Trichoptera (0.39%) (Table.3).

The sample size of the five different sites were compared and Shannon H with log base 10 indicated that the site I ($H_S$ =1.647) showed maximum diversity and least dominance ($D_S$ =0.026) followed by the site III ($H_S$=1.65 and $D_S$=0.025) site II ($H_S$=1.604 and $D_S$=0.031), site IV ($H_S$=1.622 $D_S$=0.028) and site V ($H_S$=1.75 $D_S$=0.033) species diversity in vegetation site I and site II were higher than vegetation poor site II, site IV and site V. Hills diversity index indicated that site I and site III was richest (15 species) followed by site IV (14 species), site II and site V (with 13 species each) (Table.4)

**Species Ranking**

The species were ranked according to their abundance. Abundance ranking showed that site I and site III had less number of rare species and had more number of common species as compared to other sites.

**Comparison of species turnover among different sites**

To examine the difference in species composition between the different sites (habitat) Bray Curtis cluster analysis (single link) was calculated based on the similarity richness and abundance of water beetle taxa. It showed that the population structure similarity was very close similar between the site I and site III which form a single cluster and site IV and site V formed another cluster. Site II stood apart as an out group of the cluster consisting of site IV and site V. The overall species composition and population structure at site I and site III were more similar compared to site IV and site V whereas site II was completely different from these two groups (Fig.4).

**Habitat preference species distribution**

Species distribution of water beetle fauna at different sites was assessed. Almost all the species showed random and aggregated distribution (Table 5).

**Discussion and Conclusions**

During the study, 57 species of aquatic insects were recorded. These belong to 6 orders – viz., Ephemeroptera, Odonata, Hemiptera, Coleoptera, Diptera, and Trichoptera. The aquatic insects constitute an important part of macrozoobenthos of freshwater habitats and have their greatest abundance and diversity in the temperate regions. Small and temporary or wetlands have more species than large and permanent water bodies. These insects are not selective in their choice of water bodies and occur in a wide variety of habitats, although many species may prefer certain types of water bodies. Insects belonging to Ephemeroptera, Odonata, Hemiptera, Coleoptera, Diptera and Trichoptera showed high richness and abundance. Eleven species*, Gerris* sp.*, Aquarius* sp.*, Paraplea litutrata, Hydrovatus acuminatus, Hydrovatus bonvouloire, Leiodyte nicobaricus, Hydrocanthus guignoti, Neohydrocoptus subvitulus, Donacia* sp.*, Notoides* sp. and *Phryganeid* sp. are reported here as new record for the state of Manipur.

Overall species abundance and richness revealed that insects of the Order Coleoptera were the most abundant and Trichoptera was the less abundant in the Loktak Lake of Manipur. Ephemeropteran were abundant in terms of individual but least in species diversity. This revealed that the water of Loktak Lake was not polluted and rich in vegetation. Family wise, member of the Dytiscidae was the most species rich insects followed by Hydrophilidae, Nepidae, Notonectidae, Gerridae and Libellulidae, Corixidae, Belostomatidae, Noteridae and Phrygaeidae was the minimum number of species and individuals. Many of

them, especially Dytiscids and many Hydrophilids are generally found in habitat of small water bodies or on the margin of lakes, river etc. and they occupy the zone of emergent vegetation, mats of plant debris, or flooded terrestrial vegetation along the shoreline.

Thakare and Zade (2011) studied the diversity, abundance and species composition of water beetles in Kolkas Region of Melghat Tiger Reserve, Central India and collected 13 species of water beetles. Kiyak *et al.* (2006) collected 31 aquatic beetles from the province Denizli, Aydin, Ispark and Antalya in South west Mediterranean region of Turkey. However Majumder *et al.* (2013) in Tripura reported Order Hemiptera was the most dominant insects in Urban Fresh Water of Tripura. In this study Diptera and Trichoptera was the least dominant order, which suggest that the Loktak lake of Manipur are less polluted and rich in aquatic vegetation (Mulli *et al.* 2000, Verma 2010 and Takhelmayum 2011).In the present study Coleoptera constitute 41.60 %, prevalence of Dytiscidae is indicative of the ecological health of studied lake, Dytiscidae and Noteridae generally prefer leaves of submerged aquatic vegetation in clear freshwater lake and are predacious in nature. In contrast Hydrophilidae inhabits shallower regions of water bodies with abundant macrophytes and feed on detritus, algae, decaying vegetative matter (Khan 2001). Among the insects Order Diptera and Trichoptera prefer lentic ecosystem (Blakely 2011), because many of the dipteran prefer lentic habitats are breeding ground and early life stages (Majumder 2013). The dipteran species were mostly represented by larvae of different mosquitoes and chironomid flies which was inversely proportional to dissolve oxygen of the lake and presence of these aquatic insects indicates that the presence of more organic decay which has resulted in good growth of macro-hydrophytes in the lake.

The present study reveals that the most abundant and diverse insects were found in site I and site III suggesting the presence of luxuriant aquatic vegetation which is necessary for shelters, oviposition sites and food (Korkeamaki 2002). The result indicated that the diversity of the aquatic insect fauna of Loktak Lake was relatively high (44 genera and 57 species). The aquatic insects fauna in the present investigation were dominated by the family Dytiscidae which comprised 10 species followed by Hydrophilidae (8 species) and Nepidae (5 species).

Freshwater provided habitat for many life forms and provide numerous benefits to human beings directly or indirectly. In the present study, a total of 57 species was recorded from 5 different sites of the Loktak Lake and the number of aquatic insect species and their abundance varied among the lakes. Dominance of Coleopteran and Hemipteran insects indicates that Loktak Lakes of Manipur is relatively less polluted.

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**Table 1: Coordinates (UTM) and altitudes (Alt.) of 5 collection sites of Loktak Lake of Manipur**

| Site No. | Locations | Habitat types | UTM | Alt |
|---|---|---|---|---|
| LL1 | Phubala | Wetland | N 24$^0$32.265' E 93$^0$45.755' | 861 |
| LL2 | Takmupat | Lentic | N 24$^0$29.221' E 93$^0$48.580' | 804 |
| LL3 | Thinungei | Wetland | N 24$^0$32.806' E 93$^0$46.174' | 864 |
| LL4 | Ningthoukhong | Wetland | N 24$^0$34.613' E 93$^0$46.704' | 870 |
| LL5 | Oksoipat | lentic | N 24$^0$28.005' E 91$^0$20.888' | 863 |

**Table 4: Diversity indices for 5 different sites at Loktak Lake of Manipur**

| Index | Phubala (Site I) | Takmupat (Site II) | Thinungei (Site III) | Ningthoukhong (Site IV) | Oksoipat (Site V) |
|---|---|---|---|---|---|
| Shannon H' Log Base 10 | 1.647 | 1.604 | 1.65 | 1.622 | 1.575 |
| Simpson Diversity (D) | 0.026 | 0.031 | 0.025 | 0.028 | 0.033 |
| Hill's Number | 56 | 53 | 56 | 55 | 55 |
| Berger-Parker Dominance(d) | 0.056 | 0.076 | 0.055 | 0.076 | 0.094 |
| Berger-Parker Dominance(1/d) | 17.77 | 13.16 | 18.21 | 13.08 | 10.61 |

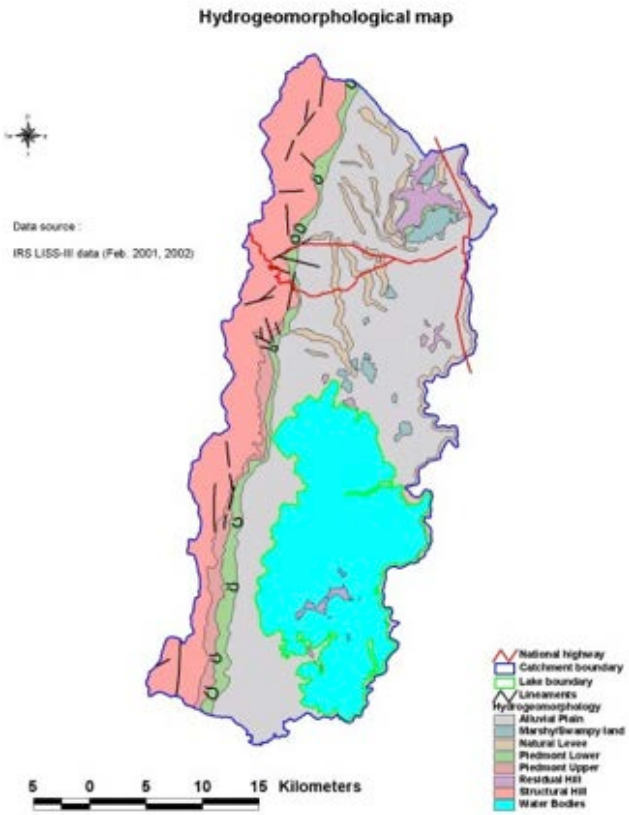
**Table 2: List of species, Number of individuals and relative abundance of aquatic insects recorded in five different sites of Loktak Lake of Manipur**

| Name of Species | Phubala (Site I) | Takmupat (Site II) | Thinungei (Site III) | Ningthoukhong (Site IV) | Oksoipat (Site V) | R A (%) |
|---|---|---|---|---|---|---|
| *Baetis* sp. | 28 | 4 | 21 | 8 | 16 | 2.50 |
| *Rhyothemis decoratus* | 10 | 10 | 8 | 4 | 3 | 1.14 |
| *Rhodothemis rufa* | 14 | 12 | 7 | 3 | 1 | 1.20 |
| *Pantala flavescens* | 12 | 9 | 7 | 5 | 4 | 1.20 |
| *Ischnura* sp. | 13 | 27 | 16 | 18 | 15 | 2.90 |
| *Tramea* sp. | 21 | 16 | 21 | 14 | 12 | 2.73 |
| *Diplonychus rusticus* | 38 | 50 | 35 | 25 | 20 | 5.46 |
| *Diplonychus molestus* | 28 | 36 | 22 | 18 | 15 | 3.86 |
| *Lethocerus indicus* | 5 | 3 | 2 | 1 | 1 | 0.39 |
| *Laccotrephes griseus* | 12 | 9 | 10 | 8 | 4 | 1.40 |
| *Laccotrephes ruber* | 21 | 18 | 15 | 6 | 2 | 2.01 |
| *Ranatra varipes* | 12 | 12 | 8 | 3 | 3 | 1.23 |
| *Ranatra sordidula* | 9 | 6 | 7 | 5 | 6 | 1.07 |
| *Ranatra gracilis* | 5 | 8 | 5 | 3 | 2 | 0.74 |
| *Anisops batilliforns* | 7 | 10 | 8 | 3 | 6 | 1.10 |
| *Anisops sardea* | 4 | 5 | 3 | 2 | 1 | 0.49 |
| *Enithare ciliata* | 6 | 9 | 5 | 3 | 3 | 0.84 |
| *Enithare mandalayensis* | 6 | 8 | 6 | 5 | 4 | 0.94 |
| *Micronecta scutellaris* | 45 | 50 | 38 | 36 | 42 | 6.85 |
| *Micronecta haliploides* | 35 | 42 | 32 | 25 | 23 | 5.09 |
| *Sigara distorta* | 5 | 7 | 3 | 2 | 3 | 0.65 |
| *Limnogonus hyalinpennis* | 5 | 9 | 4 | 3 | 1 | 0.71 |
| *Limnogonus nitidus* | 4 | 6 | 3 | 2 | 2 | 0.55 |
| *Aquarius* sp. | 8 | 8 | 6 | 5 | 4 | 1.00 |
| *Gerris* sp. | 7 | 13 | 6 | 4 | 2 | 1.04 |
| *Mesovelia douglasi* | 0 | 8 | 3 | 3 | 2 | 0.51 |
| *Mesovelia vittigera* | 4 | 12 | 0 | 3 | 0 | 0.61 |
| *Paraplea litutrata* | 15 | 17 | 16 | 13 | 12 | 2.37 |
| *Hydrometra greeni* | 8 | 21 | 7 | 4 | 6 | 1.49 |
| *Hydrochus* sp. | 14 | 23 | 12 | 8 | 6 | 2.05 |
| *Hydrovatus acuminatus* | 23 | 12 | 21 | 13 | 12 | 2.63 |
| *Hydrovatus bonvouloiri* | 22 | 10 | 20 | 12 | 11 | 2.43 |
| *Hydrophilus indicus* | 25 | 8 | 12 | 15 | 12 | 2.33 |
| *Tropisternus* sp. | 12 | 7 | 11 | 8 | 4 | 1.36 |
| *Rhantus* sp. | 6 | 4 | 5 | 3 | 3 | 0.68 |
| *Cybister tripunctatus* | 7 | 3 | 8 | 4 | 2 | 0.78 |
| *Cybister sugillatus* | 6 | 4 | 5 | 3 | 1 | 0.62 |
| *Leiodytes nicobaricus* | 15 | 8 | 15 | 6 | 12 | 1.82 |
| *Hydrocanthus guignoti* | 23 | 12 | 21 | 10 | 15 | 2.63 |
| *Canthydrus nitidus* | 6 | 4 | 4 | 12 | 11 | 1.20 |
| *Laccophilus chinensis* | 24 | 14 | 18 | 12 | 14 | 2.66 |
| *Laccophilus parvulus* | 23 | 12 | 21 | 13 | 14 | 2.69 |
| *Laccophilus ineficience* | 13 | 10 | 12 | 11 | 11 | 1.85 |
| *Enochrus* sp. | 6 | 3 | 6 | 4 | 2 | 0.68 |
| *Amphiops* sp. | 12 | 8 | 16 | 8 | 7 | 1.65 |
| *Neohydrocoptus subvittulus* | 14 | 9 | 13 | 8 | 5 | 1.59 |
| *Regimbartia attenuata* | *34* | *14* | *31* | *12* | *21* | *3.63* |
| *Helochares crenatus* | 10 | 5 | 13 | 6 | 9 | 1.40 |
| *Halipid* sp. | 12 | 3 | 10 | 11 | 8 | 1.42 |
| *Cercyon* sp. | 10 | 12 | 14 | 8 | 6 | 1.62 |
| *Donacia* sp. | 3 | 0 | 5 | 0 | 1 | 0.30 |
| *Notiodes* sp. | 5 | 0 | 3 | 3 | 2 | 0.42 |
| *Hydrogyphus flammulatus* | 31 | 16 | 23 | 17 | 14 | 3.28 |
| *Chironomus* sp. | 15 | 2 | 12 | 6 | 8 | 1.40 |
| *Culex* sp. | 34 | 10 | 25 | 20 | 26 | 3.73 |
| *Tipula* sp. | 5 | 0 | 6 | 4 | 3 | 0.58 |
| *Phryganeid* sp. | 3 | 0 | 6 | | 3 | 0.39 |

Note: RA-Relative abundance

**Table 5: Distribution profile of aquatic insect fauna at Loktak Lake of Manipur**

| Species | Variance | Mean | Chi-sq | d.f. | Probability | Aggregation |
|---|---|---|---|---|---|---|
| *Baetis* sp. | 93.8 | 15.4 | 24.3636 | 4 | 9.16E-005 | Aggregated |
| *Rhyothemis decoratus* | 11 | 7 | 6.2857 | 4 | 0.1773348 | Random |
| *Rhodothemis rufa* | 31.3 | 7.4 | 16.9189 | 4 | 0.0021562 | Aggregated |
| *Pantala flavescens* | 10.3 | 7.4 | 5.5676 | 4 | 0.2326716 | Random |
| *Ischnura* sp. | 29.7 | 17.8 | 6.6742 | 4 | 0.1526458 | Random |
| *Tramea* sp. | 10.3 | 8.4 | 4.9048 | 4 | 0.2966347 | Random |
| *Diplonychus rusticus* | 74.3 | 14.4 | 20.6389 | 4 | 0.0004432 | Aggregated |
| *Diplonychus molestus* | 137.3 | 33.6 | 16.3452 | 4 | 0.0027523 | Aggregated |
| *Lethocerus indicus* | 70.2 | 23.8 | 11.7983 | 4 | 0.0188761 | Aggregated |
| *Laccotrephes griseus* | 2.8 | 2.4 | 4.6667 | 4 | 0.3229727 | Random |
| *Laccotrephes ruber* | 8.8 | 8.6 | 4.093 | 4 | 0.3942193 | Random |
| *Ranatra varipes* | 65.3 | 12.4 | 21.0645 | 4 | 0.00037 | Aggregated |
| *Ranatra sordidula* | 20.3 | 7.6 | 10.6842 | 4 | 0.0300778 | Random |
| *Ranatra gracilis* | 2.3 | 6.6 | 1.3939 | 4 | 0.8464541 | Random |
| *Anisops batilliforns* | 5.3 | 4.6 | 4.6087 | 4 | 0.3296678 | Random |
| *Anisops sardea* | 6.7 | 6.8 | 3.9412 | 4 | 0.585039 | Random |
| *Enithare ciliata* | 2.5 | 3 | 3.3333 | 4 | 0.5057687 | Random |
| *Enithare mandalayensis* | 6.2 | 5.2 | 4.7692 | 4 | 0.3113999 | Random |
| *Micronecta scutellaris* | 2.2 | 5.8 | 1.5172 | 4 | 0.8253087 | Random |
| *Micronecta haliploides* | 31.2 | 42.2 | 2.9573 | 4 | 0.5677307 | Random |
| *Sigara distorta* | 59.3 | 31.4 | 7.5541 | 4 | 0.107998 | Random |
| *Limnogonus hyalinpennis* | 4 | 4 | 4 | 4 | 0.4068319 | Random |
| *Limnogonus nitidus* | 8.8 | 4.4 | 8 | 4 | 0.0903743 | Random |
| *Aquarius* sp. | 2.8 | 3.4 | 3.2941 | 4 | 0.512038 | Random |
| *Gerris* sp. | 3.2 | 6.2 | 2.0645 | 4 | 0.7269872 | Random |
| *Mesovelia douglasi* | 17.3 | 6.4 | 10.8125 | 4 | 0.0285125 | Random |
| *Mesovelia vittigera* | 8.7 | 3.2 | 10.875 | 4 | 0.0277791 | Random |
| *Paraplea litutrata.* | 24.2 | 3.8 | 25.4737 | 4 | 5.74E-005 | Aggregated |
| *Hydrometra greeni* | 4.3 | 14.6 | 1.1781 | 4 | 0.8818277 | Random |
| *Hydrochus* sp. | 45.7 | 9.2 | 19.8696 | 4 | 0.0006145 | Aggregated |
| *Hydrovatus acuminatus* | 43.8 | 12.6 | 13.9048 | 4 | 0.0077603 | Aggregated |
| *Hydrovatus bonvouloiri* | 28.7 | 16.2 | 7.0864 | 4 | 0.1299349 | Random |
| *Hydrophilus indicus* | 31 | 15 | 8.2667 | 4 | 0.0811769 | Random |
| *Tropisternus* sp. | 41.3 | 14.4 | 11.4722 | 4 | 0.0216422 | Aggregated |
| *Rhantus* sp. | 1.7 | 4.2 | 1.619 | 4 | 0.807461 | Random |
| *Cybister tripunctatus* | 6.7 | 4.8 | 5.5833 | 4 | 0.2313087 | Random |
| *Cybister sugillatus* | 3.7 | 3.8 | 3.8947 | 4 | 0.5785379 | Random |
| *Leiodytes nicobaricus* | 16.7 | 11.2 | 5.9643 | 4 | 0.2004492 | Random |
| *Hydrocanthus guignoti* | 31.7 | 16.2 | 7.8272 | 4 | 0.0968558 | Random |
| *Canthydrus nitidus* | 14.8 | 7.4 | 8 | 4 | 0.0903743 | Random |
| *Laccophilus chinensis* | 22.8 | 16.4 | 5.561 | 4 | 0.2332436 | Random |
| *Laccophilus parvulus* | 25.3 | 16.6 | 6.0964 | 4 | 0.1906399 | Random |
| *Laccophilus ineficience* | 1.3 | 11.4 | 0.4561 | 4 | 0.9743853 | Random |
| *Enochrus* sp. | 3.2 | 4.2 | 3.0476 | 4 | 0.5524901 | Random |
| *Amphiops* sp. | 14.2 | 10.2 | 5.5686 | 4 | 0.2325798 | Random |
| *Neohydrocoptus subvittulus* | 13.7 | 9.8 | 5.5918 | 4 | 0.2305765 | Random |
| *Regimbartia attenuata* | 97.3 | 22.4 | 17.375 | 4 | 0.0017758 | Aggregated |
| *Helochares crenatus* | 10.3 | 8.6 | 4.7907 | 4 | 0.3090216 | Random |
| *Halipid* sp. | 12.7 | 8.8 | 5.7727 | 4 | 0.2154767 | Random |
| *Cercyon* sp. | 10 | 10 | 4 | 4 | 0.4068319 | Random |
| *Donacia* sp. | 4.7 | 1.8 | 10.4444 | 4 | 0.0332318 | Random |
| *Notiodes* sp. | 3.3 | 2.6 | 5.0769 | 4 | 0.2787275 | Random |
| *Hydrogyphus flammulatus* | 47.7 | 20.2 | 9.4455 | 4 | 0.0502163 | Random |
| *Chironomus* sp. | 25.8 | 8.6 | 12 | 4 | 0.0173428 | Aggregated |
| *Culex* sp. | 78 | 23 | 13.5652 | 4 | 0.0089603 | Aggregated |
| *Tipula* sp. | 5.3 | 3.6 | 5.8889 | 4 | 0.2062486 | Random |
| *Phryganeid* sp. | 6.3 | 2.4 | 10.5 | 4 | 0.0324734 | Random |



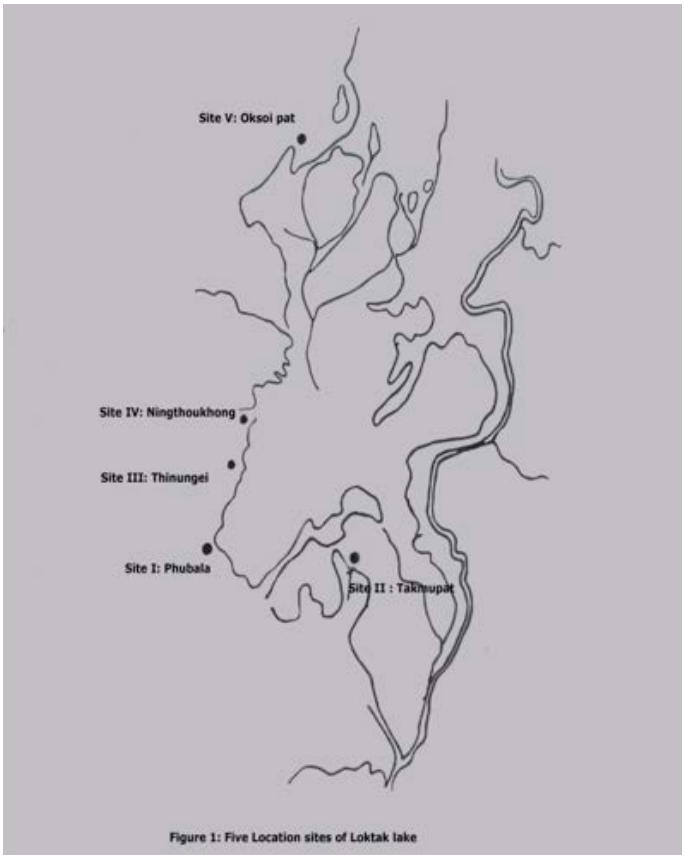
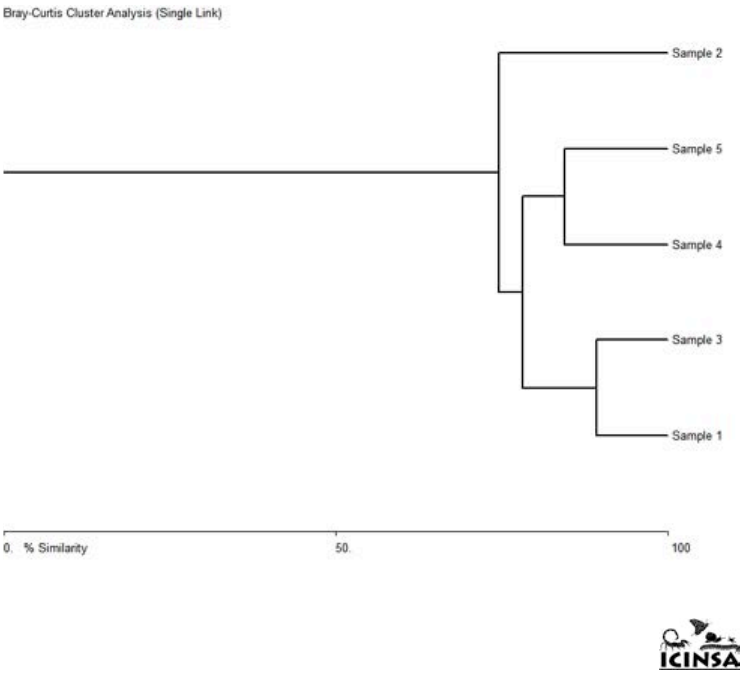




Figure 1: Five Location sites of Loktak lake

**Table 3: Distribution profile of aquatic insect fauna at Loktak Lake of Manipur**

| Order | Family | Species | Individual |
|---|---|---|---|
| Ephemeroptera | Baetidae | 1 | 77 |
| Odonata | Libellulidae | 4 | 196 |
| | Coenagrionidae | 1 | 89 |
| Hemiptera | Belostomatidae | 3 | 299 |
| | Nepidae | 5 | 94 |
| | Pleidae | 1 | 73 |
| | Hydrometridae | 1 | 46 |
| | Corixidae | 3 | 388 |
| | Notonectidae | 4 | 113 |
| | Gerridae | 4 | 102 |
| Coleoptera | Dytiscidae | 10 | 599 |
| | Hydrophilidae | 8 | 454 |
| | Chrysomelidae | 1 | 9 |
| | Noteridae | 3 | 167 |
| | Haliplidae | 1 | 44 |
| | Curculionidae | 1 | 13 |
| Diptera | Chironomidae | 1 | 43 |
| | Culicidae | 1 | 115 |
| | Tipulidae | 1 | 18 |
| Trichoptera | Phryganeidae | 1 | 12 |
| | **Total** | **57** | **3079** |

**Figure 4: Dendrogram comparing different sites by their aquatic insect species profile.**



# A note on structure of nest of a mud dauber wasp, *Sceliphron* sp. in Solapur, Maharashtra

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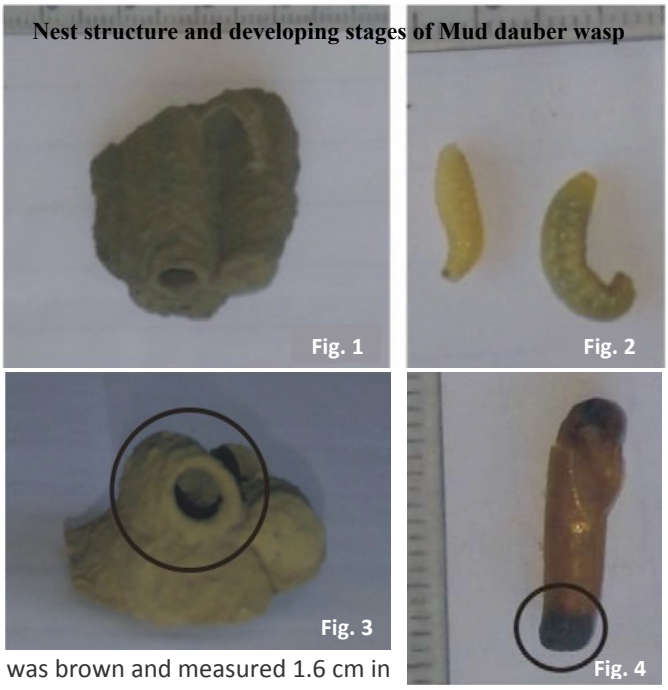
A number of different solitary wasps exist in and around houses, yards and gardens. Because of their regular associations with humans, these insects often induce a great deal of worry. Though, solitary wasps very rarely sting, and then only if mishandled. Unlike their social relatives, paper wasps, hornets, and yellow jackets, these solitary forms do not defend their nest or burrow, thus seldom sting people.

Within aculeate solitary wasps, the collection of mud as a main or accomplice material for nest construction seems to have evolved several times, as suggested by the distribution of this behaviour across different lineages. Mud dauber wasp of the genus *Sceliphron* include solitary wasp species which build their nests using mud collected from soil in the form of spherical mud balls. Nests are found in a variety of sheltered and dry places, often associated with human buildings and are composed of a number of brood cells (Bohart and Menke 1976, Budrys 2001). Females accumulate prey in these nests, consisting of paralyzed spiders, and then lay their eggs (Rau 1935, Polidori *et al*. 2007). Major aspects of nesting and foraging ecology are well familiar in the literature for a diversity of *Sceliphron* species (Rau and Rau 1916, Mazek-Fialla 1936, Grandi 1961, White 1962) but very scant information is available on mud collection, building of nests and mud-carrying behaviours. Therefore, in the present communication efforts were made to study detailed structure of a mud dauber wasp, *Sceliphron* sp. in Solapur, Maharashtra.

The present study has been carried out in the month of December 2015. Incidentally SRA collected the nest from National Laundry, Ekata Nagar, Solapur (17°39'57"N; 75°55'36"E). On 06.12.2015, the proprietor has handed over the nest of mud wasp to SRA. The nest has been constructed on the ironed trouser of customer. SRA brought the same to the laboratory in half liter capacity plastic container for further studies. It is identified as *Sceliphron* sp. The nest measured 2.5 cm in length and 2.7 cm in width (Fig. 1). The weight of entire nest was 3.562 g. In all, three brood cells were noted containing developing stages of the wasp including two larvae and one cocoon (Fig. 2). The mean length and width of the brood cell was 1.66 cm and 6 mm respectively (n=3). One brood cell on the dorsal side of nest was observed, which was empty (Fig. 3). This cell might be used for resting of adult wasp. The average length of larvae was 1.1 cm and width was 5 mm. (Fig. 4). The cocoon was brown and measured 1.6 cm in length and 4mm in width. Toward its posterior end dark black colored band was seen. Females store prey in these nests, consisting of paralyzed spiders, and then lay their eggs (Rau 1935, Polidori *et al*. 2007). During the present study no prey has been recorded in brood cells. Due to paucity of time the rearing was not possible to authors.

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# Announcement

**ICE 2016- International Congress of Entomology**
**25th - 30th September 2016, Florida, USA**

The latest global entomological research will be presented under the theme "Entomology without Borders" during the XXV International Congress of Entomology, September 25-30, 2016, in Orlando, Florida, USA. It will emphasize the global impact of entomology along with a multidisciplinary approach to explore and expand our scientific frontiers. ICE 2016 will be the largest gathering of scientists and experts in the history of the discipline, with an expected attendance of over 6,000 individuals. The scientific program of ICE 2016 will feature a variety of sessions including plenary sessions, symposia, 15-minute papers and poster sessions. There are 30 sections covering a range of topics. 287 symposia have been accepted under the different sections from the global entomological community. The symposia will highlight the most recent advances in a wide diversity of entomological subjects around the global theme during this six-day event.

Under the section, "Apidology, Sericulture and Social Insects", the symposium with the following details has been accepted.

Title: **Insects and Ecosystem Services with Special Reference to Pollination Biology**

The themes of the symposium are 1. Insect pollinators and plant propagation 2. Insect products for human welfare 3. Butterfly parks and ecotourism aspects. This symposium will address the theme of beneficial insects and ecosystem services. The symposium will highlight insects as friends of humankind.

The symposium can have 3 sessions one hour each with oral and poster presentations. The oral presentations can be of 15 minutes each. Abstracts must be written in English and with 250 words or less and providing key words. Please add your address and mail ID for correspondence. The abstracts may be sent to the email ID okremadevi@gmail.com within a month.

For more details contact Dr. O.K. RAMADEVI, Symposium Organiser, ICE, 2016 at okremadevi@gmail.com You can also visit the website: http://ice2016orlando.org for more details.

# 9th NABS National Conference on New Biological Researches: Opportunities and Challenges for Sustainable Development

*(Agriculture, Biology, Energy, Environment, Health and Climate Change)*

August 11 & 12, 2016

Organized by

**School of Energy, Environment and Natural Resources,**
**Madurai Kamaraj, University and**
**National Academy of Biological Sciences (NABS)**

**Objectives**

The conference is a national initiative which will focus to accelerate the emergence and growth of the New Biology to achieve solutions to societal challenges in terms of food, energy, environment, health and climate change.

- For its success, the New Biology will require the creative drive and deep knowledge base of individual scientists from across biology and many other disciplines including physical, computational, geosciences, mathematics and engineering.
- The New Biology offers the potential to address questions at a scale and with a focus that cannot be undertaken by any single scientific community, agency or sector.
- Providing a framework for different communities to work together will lead to synergies and new approaches that no single community could have achieved alone.
- A broad array of programs to identify, support and facilitate biology research exists in the federal government but value is being lost by not integrating these efforts.
- Interagency insight and oversight is critical to support the emergence and growth of the New Biology Initiative. Interagency leadership will be needed to oversee and coordinate the implementation of the initiative, evaluate its progress, establish necessary working sub-groups, maintain communication, guard against redundancy and identify gaps and opportunities for leveraging results across projects.

**Conference Themes**

The conference themes focus on New Biological Researches in the subject areas of

- Agricultural Sciences
- Biological Sciences
- Energy Sciences
- Environmental Sciences
- Health Sciences
- Climate Change

For more information contact:

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Newsletter of the Invertebrate Conservation and Information Network of South Asia (ICINSA)
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**Editor:** B.A. Daniel
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