



Diversity and assemblage of moths in Cauvery basin, Kumbakonam, Tamil Nadu, India

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Abstract

Some of our most beautiful winged creatures are moths, especially the giant silk moths such as the Atlas Moth and luna. The larger, more ornate species have inspired many an artist, and dazzled scores of people who stumbled into one in the wild. Biologically, moths rank high among our most important groups of organisms. Adult moths serve as food for many predators, perhaps most notably bats, and a number of birds. Moths also serve as a major food source for many species of spiders. Moth collections were carried out from evening onwards till morning on next day by using Light trap. The identification of moths was carried out in laboratory with help of identified specimens of museum and literature. The present study reveals that a total of 13 species have been identified. A maximum of 8 sightings of Black witch moth and 7 sightings of Virginian Tiger Moth was noted. The diversity index of the 55 individuals of moth species collected shows that species dominance of 0.09157 and 0.09025±0.1339. The present study has been carried out to elucidate a fauna which was previously unknown, and it is a small step towards a complete taxonomic understanding of moth species in the Cauvery basin region.

Keywords: moths, diversity, assemblage, Cauvery delta, Kumbakonam

1. Introduction

Moths are the close relatives of butterflies, both of them belonging to the order Lepidoptera gets its name from the Greek word *lepis*, meaning scale, and *pteron*, meaning wing (Gadhikar *et al.*, 2013) [4]. The colours and patterns on their wings are made up of thousands of tiny scales, overlapping like tiles on a roof. For convenience moths are split into two groups, the larger (or macro-) moths and the smaller (micro-) moths, although some of the latter groups are larger than some of the former. Around 900 species of larger moth have been found in this country. Among moths, the Tortricidae is one of the largest families of so called micro-lepidoptera, second only to the Gelichiidae in number of described species (Baixeras *et al.*, 2010) [1] with over 10000 species in approximately 1050 genera and a large number still to be recorded, especially in the tropics. Though, worldwide in distribution, the family is more strongly represented in temperate and tropical upland regions than lowland tropics and probably reaches its greatest diversity in the moss forests of tropical latitudes (Brown, 2005) [3]. Members of this family are characterized by a combination of characters such as rough scaled head above, short scaling of frons, thread like antenna, unscaled proboscis, very small or vestigial maxillary palpi, porrect or upcurved three segmented labial palpi, absence of tympanum, presence of chaetosema and ocelli and flat ovipositor lobes (Horak, 2006) [11]. Fore tibia is with epiphysis and tibial spur formula of 0-2-4. Wing coupling mechanism is fenate type, chorda and M-stem often developed in discal cell and hind wing often with cubital pectin at base of CuA and CuP is usually present (Horak and Brown, 1991) [10].

Moths are commonly nocturnal, holometabolous and phytophagous a total of 1, 20, 000 species have been described in the world wide. They occur in all kinds of habitats including natural forests, grasslands, agro-horticulture fields and crop plantations. Being primary

herbivorous insects, they help in natural control of weeds in an agro-ecosystem. Some of our most beautiful winged creatures are moths; especially the giant silk moths such as the cecropia and luna. The larger, more ornate species have inspired many an artist, and dazzled scores of people who stumbled into one in the wild. Biologically, moths rank high among our most important groups of organisms. Adult moths serve as food for many predators, perhaps most notably bats and a number of birds. Many species of songbirds feed on moths, especially flycatchers and moths are a primary component of the diets of chuck-will's-widows and whip-poor-wills. Moths also serve as a major food source for many species of spiders (Biswas *et al.* 2016) [14].

Megadiverse groups like the insects form a major component of the biodiversity of any area and thus scientific surveying and documentation of this fauna is indispensable to any scientific study and conservation programme. It is not possible to assess the value of a site for conservation without such data (Kendrick 2002) [12]. Being a megadiverse taxon with enormous species richness in the tropics, the evaluation of the total species richness of all insects would be extremely laborious and time consuming. Therefore, indicator groups, such as moths, are frequently selected as the subject of study. Such a taxon is often selected because it is taxonomically well-known and thus species are relatively rapid to identify (Holloway 2011) [9]. The objective of this research study was to collect, identify and calculate diversity, species richness and evenness of moth fauna of Kumbakonam region of Cauvery delta region.

2. Study area

Kumbakonam is located at 10.97°N 79.42°E. It lies in the region called the "Old delta" which comprises the north-western taluks of Thanjavur district that have been naturally irrigated by the waters of the Cauvery and its tributaries for

centuries in contrast to the "New Delta" comprising the southern taluks that were brought under irrigation by the construction of the Grand Anicut canal and the Vadavar

canal in 1934. It has an average elevation of 26 m. The town is bounded by two rivers, the Cauvery River on the north and Arasalar River on the south (Fig. 1).

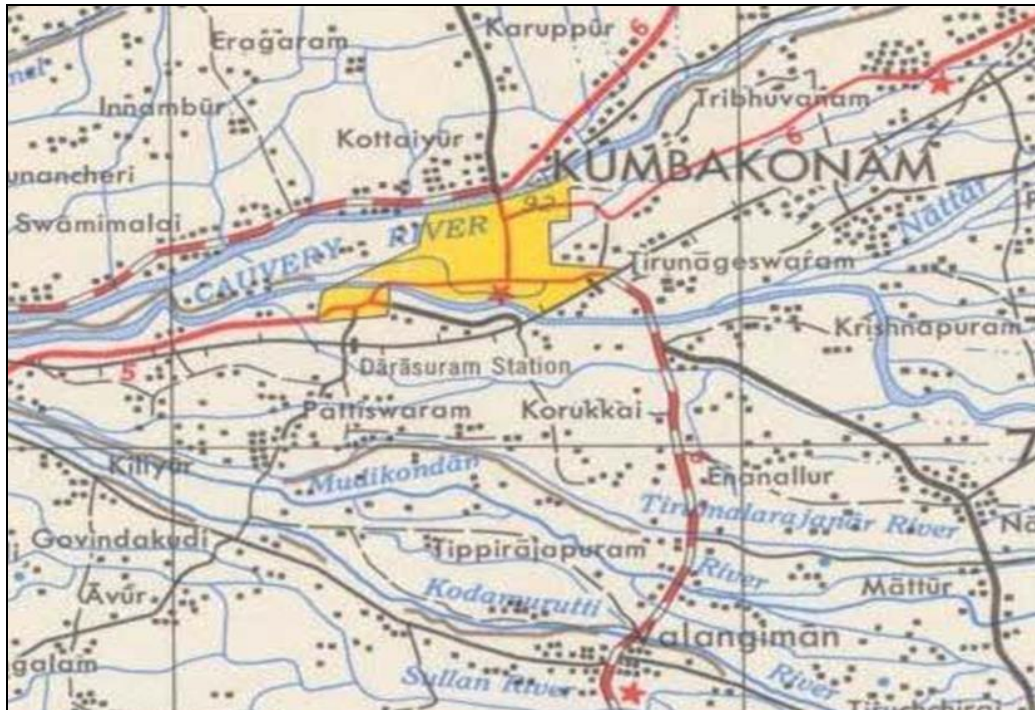


Fig 1: Map of Cauvery basin at Kumbakonam and surrounding areas

3. Materials and Methods

Moth collections were carried out from evening onwards till morning on next day by using Light trap. The identification of moths was carried out in laboratory with help of identified specimens of museum and literature (Hampson, 1892, 1894, 1895 and 1896) [5, 8]. Moths were collected by using simple light traps consisting of a plastic jar. During opportunistic search all the possible microhabitats *i.e.* tree bark, leaves, bushes, herb/grasses, shrubs, ceiling/wall/floor of houses, grounds and under street light posts were searched at evening hours (6-9 pm). The collected moths were photographed by using Digital camera. Moths collected were identified using colour identification guide to the moths by Skinner (1998) [17]. A comprehensive photographic guide to all macro-moths shown in 'set' (pinned) in Fig. It gives distribution, flight-times, habitats and food plants for each species.

Measurement of diversity, species richness and evenness

The type of diversity used here is E- diversity which is the diversity of species within a community or habitat. The diversity index was calculated by using the Shannon – Wiener diversity index (1949) with PAST (Paleontological Statistics) statistical software.

$$\text{Diversity index} = H = - \sum P_i \ln P_i$$

Where

$$P_i = S / N$$

S = number of individuals of one species

N = total number of all individuals in the sample

In = logarithm to base e

Margalef's index was used as a simple measure of species richness (Margalef, 1958).

$$\text{Margalef's index} = (S - 1) / \ln N$$

Where

S = total number of species

N = total number of individuals in the sample

In = natural logarithm

For calculating the evenness of species, the Pielou's Evenness Index (e) was used (Pielou, 1966) [15].

$$e = H / \ln S$$

Where

H = Shannon – Wiener diversity index

S = total number of species in the sample

4. Results

The present study on moths reveals that a total of 13 species have been identified from in and around Kumbakonam city. The moths which are collected during the study period are listed out and their numbers of sighting were given in Table 1. A maximum of 8 sightings of Black witch moth and 7 sightings of Virginian Tiger Moth was noted. The diversity index of the 55 moths collected shows that species dominance of 0.09157 and 0.09025±0.1339. Simpson index shows 0.9084 whereas the lower and upper limits show 0.8661±0.9098. The Shannon indexes of moths collected are 2.471 with its lower and upper limits of 2.196±2.47 (Table 2) & (Fig. 2).

Table 1: Moth species recorded during the study period

S. No.	Common Name	Scientific Name	No. of insects sighted	Relative density
1	Swallow -tailed moth	<i>Micronia aculeata</i>	3	5
2	Tropical tiger moth	<i>Asota caricae</i>	4	7
3	Silver Y Moth	<i>Autographa gamma</i>	2	4
4	Yellow tussock moth	<i>Euproctis lutea</i>	4	7
5	Bagworm moth	<i>Hyphantria cunea</i>	3	5
6	Yellow shell	<i>Camptogramma bilineata</i>	5	9
7	Luna moth	<i>Actias luna</i>	2	4
8	Virginian Tiger Moth	<i>Spilosoma virginica</i>	7	13
9	Scalloped Hazel	<i>Odontopera bidentata</i>	4	7
10	Black witch moth	<i>Ascalapha odorata</i>	8	15
11	Arctiinae	<i>Arctia caja</i>	5	9
12	Peppered moth	<i>Biston betularia</i>	6	11
13	Straw underwing	<i>Thalpophila matura</i>	2	4

Table 2: Diversity indices of the moths species sighted

Taxa_S	Lower	Upper
13	11	13
55	55	55
0.09157	0.09025	0.1339
0.9084	0.8661	0.9098
2.471	2.196	2.474
0.9105	0.7471	0.9283



7.Luna moth (*Actias luna*)

8.Virginian Tiger Moth (*Spilosoma virginica*)



9.Scalloped Hazel (*Odontopera bidentata*)

10.Black witch moth (*Ascalapha odorata*),

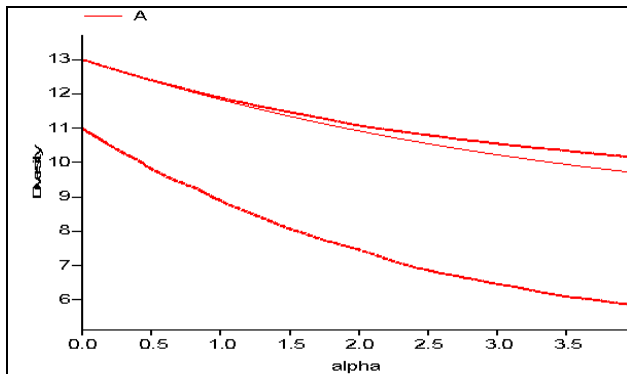


Fig 2: Graph showing the Shannon index of moths collected during the study period



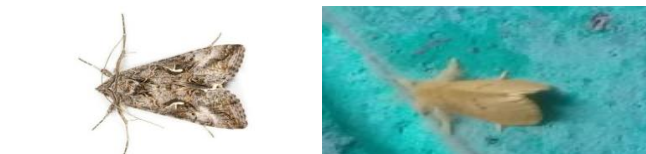
11.Arctiinae (*Arctia caja*)

12.Peppered moth (*Biston betularia*)



1.Swallow -tailed moth (*Micronia aculeata*)

2.Tropical tiger moth (*Asota caricae*)



3.Silver Y Moth (*Autographa gamma*)

4.Yellow tussock moth (*Euproctis lutea*)



5.Bagworm moth (*Hyphantria cunea*)

6.Yellow shell (*Camptogramma bilineata*)



13.Straw underwing (*Thalpophila matura*)

Fig 3: Moth species collected from the study area

5. Discussion

The total number of individuals caught in a trap is an indication of biomass although more care has been taken in its interpretation than for diversity as the size of a light trap catch can be influenced significantly by the setting of the trap, interference from other lights and lunar cycles (Barlow and Woiwod, 1989) [2]. This work was an first attempt to describe some aspects of biodiversity of moth fauna of Cauvery delta region of Kumbakonam. Further works is necessary in this regard and further collections are essential

for getting a detailed periodic estimate of the faunal diversity of moths in this area. Ultimately it is hoped that such work may lead to the development of standard monitoring procedures which could be of value in assessing the environmental stability of areas under cultivation for different crops and the prediction of the effect on the structure of moth populations of tropical forest destruction (Barlow and Woiwod, 1989) [2].

Throughout the survey the maximum population were found in the family Crambidae followed by the family Arctiidae. Family Noctuidae was found rich in species number but population size was found lesser than earlier two. The rest of the families were found very less in numbers. A significant number of insects are considered as pests for a variety of reasons including their direct damage by feeding on crop plants in the field or by infesting stored products or by spreading viral diseases of crop plants. Several lepidopteran species are of economic interest by virtue of their role as pollinators, the silk they produce, or as pest species. They attack different types of agricultural as well as non-agricultural plants thereby causing a great deal of economic loss. From the above findings it may be concluded that, significant areas of Cauvery delta region still remain insufficiently explored. Moreover, biology and ecology of this highly economic important group are also less studied. Therefore, efforts should be given on more collection in under or unexplored areas.

6. Conclusion

While studying the Biodiversity of moth fauna from the Cauvery basin and its surroundings, a total of 13 species were recorded. Regarding their seasonal abundance the activity of moths was found higher in the month of December. The present study has been carried out to elucidate a fauna which was previously unknown, and it is a small step towards a complete taxonomic understanding of moth species. As our objective was to prepare an inventory of moth species in the study area, the numbers arriving at the light trap were not completely recorded. Future studies can now include ecological studies on these species, life histories, habitat preferences, moth assemblage composition, especially of endemic species, to provide information relevant to habitat restoration and species conservation programmes.

7. References

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