Light attracted butterflies: a review from the Indian sub-region with an inventory from West Bengal, India

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Some of the nocturnal Lepidoptera, mostly moths (Heterocera) are negatively heliotropic but positively phototactic, being impelled by an irresistible attraction to a bright lamp (Willey 1867). Phototaxis (attraction to artificial lights) has, however, been explained to be somewhat different from heliotropism (attraction to natural/sunlight) by Willey (1867). On the basis of exploiting natural light/sunlight, butterflies (Rhopalocera) can be categorized in two broad groups, viz., (i) the diurnal ones, with day flying habit and retiring at dusk, and (ii) the crepuscular ones, with a flying habit at dusk and even low-light conditions. For the night, they usually take shelter among bushes and trees. However, several observations regarding their occasional response to artificial light have been reported from both old and new worlds.

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The occasional phenomenon regarding attraction of butterflies to artificial lights in the Indian sub-region have been reported in the literature. The first report was published by J.I. Alfrey in a paper by Best (1951) concerning the sighting of Lime Butterfly (*Papilio demoleus demoleus* Linnaeus) attracted to "Kitson Oil Lamps" at night at the railways station in Jhansi (southern Uttar Pradesh State, India) during a migration. Later, more detailed observations were published by Usman (1956), Donahue (1962), Shull (1964), Shull & Nadkerny (1967), Nadkerny & Shull (1968), Sharma & Chaturvedi (1999), Nair (2001) and Sharma & Chaturvedi (2005).

The present article deals with a review on the earlier observations on light-attracted butterflies in the Indian subcontinent with additions of four new species responding to the same from West Bengal. The primary objective is thus to elaborate the diversity and seasonal inclination of light-attracted butterflies in the Indian sub-region along with a possible explanation for such an unusual phenomenon.

Materials and Methods: The primary review work regarding the cases of light-attracted butterflies in the Indian sub-region from the period between 1951 and 2005 was accomplished through literature surveys.

Both inadvertent observations as well as designed experiments were undertaken during that period. However, the records for light-attracted butterflies in the urban (Kolkata) and forested regions (Samsing and Buxa of the Dooars) of West Bengal are new from this region and resulted from incidental observations during the period 2008 to 2009. No intentional light-traps were designed in those places for attracting butterflies at night.

Results: The light-attracted butterflies recorded by the earlier authors from 1951–2005 revealed 27 species belonging to five families. Table 1 shows a list of the species, along with the place; season of observation and the type of artificial light source to which they were attracted. The observations by the present authors (2008–2009) report six butterfly species that were attracted to light at night from Kolkata and Dooars (Samsing and Buxa) regions of southern and northern West Bengal, India. Four species reported here, viz. *Papilio polytes* Linnaeus, *Tanaecia lepidea* Butler, *Neptis* sp. and *Pelopidas*

Table 1. A summary of the published data on butterfly species attracted to artificial light sources (1951–2005).

Species	Observer	Place	Season (Year)	Artificial Light Source
Papilionidae				
1. Lime Butterfly (*Papilio demoleus demoleus* Linn.)	J.I. Alfrey (in Best 1951)	Jhansi (southern Uttar Pradesh, northerncentral India)	Data Deficient	Kitson oil lamps
2. Tailed Jay (*Graphium agamemnon* Linn.)	Sharma & Chaturvedi (2005)	Pune (Maharashtra, western India)	April (2002)	Neon tube
Pieridae				
3. Common Emigrant (*Catopsilia crocale* Cramer)	Shull & Nadkerny (1967)	Surat Dangs (Gujarat , western India)	Mid June – Mid Oct (1961)	Mercury vapour lamp
4. Small Grass Yellow (*Eurema brigitta* Cramer)	Shull & Nadkerny (1967)	Surat Dangs (Gujarat, western India)	Mid June – Mid Oct (1961)	Mercury vapour lamp
5. Common Grass Yellow (*Eurema hecabe* Linn.)	Shull & Nadkerny (1967)	Surat Dangs (Gujarat, western India)	Mid June – Mid Oct (1961)	Mercury vapour lamp
6. Spotless Grass Yellow (*Eurema laeta* Boisd.)	Shull & Nadkerny (1967)	Surat Dangs (Gujarat, western India)	Mid June – Mid Oct (1961)	Mercury vapour lamp
7. Common Gull (*Cepora nerissa* Fab.)	Shull & Nadkerny (1967)	Surat Dangs (Gujarat, western India)	Mid June – Mid Oct (1961)	Mercury vapour lamp
8. Pioneer (*Anaphaeis aurota* Fab.)	Nadkerny & Shull (1968)	Dangs (S. Gujarat, western India)	Aug – Sep (1961)	Mercury vapour lamp
9. Small Salmon Arab (*Colotis calais* Cramer)	Nadkerny and Shull (1968)	Dangs (S. Gujarat, western India)	Aug – Sep (1961)	Mercury vapour lamp
Nymphalidae				
10. Striped Tiger (*Danaus chrysippus* Linn.)	Donahue (1962)	New Delhi (northerncentral India)	October (1961)	150W porch light, 60W tungsten bulb
11. Black Rajah (*Charaxes solon* Fab.)	Sharma & Chaturvedi (1999)	Tadoba National Park (Maharashtra, western India)	December (1996)	Data deficient
12. Common Evening Brown (*Melanitis leda* Linn.)	Donahue (1962)	New Delhi (northerncentral India)	August (1961)	Porch light
13. Blue Pansy (*Junonia orithya* Linn.)	Donahue (1962)	New Delhi (northerncentral India)	November (1961)	Porch light
14. Nigger (*Orsotrioena medus* Fab.)	Nair (2001)	Aralam Wildlife Sanctuary (Kerala, southern India)	February (2001)	Neon tube light
15. Common Castor (*Ariadne merione merione* Cramer)	Shull & Nadkerny (1967)	Surat Dangs (Gujarat, western India)	Mid June – Mid Oct (1961)	Mercury vapour lamp
16. Common Baron (*Euthalia aconthea* Cramer)	Shull & Nadkerny (1967)	Surat Dangs (Gujarat, western India)	Mid June – Mid Oct (1961)	Mercury vapour lamp
17. Yellow Pansy (*Junonia hierta hierta* Fab.)	Shull & Nadkerny (1967)	Surat Dangs (Gujarat, western India)	Mid June – Mid Oct (1961)	Mercury vapour lamp
18. Painted Lady (*Vanessa cardui* Linn.)	Shull & Nadkerny (1967)	Surat Dangs (Gujarat, western India)	Mid June – Mid Oct (1961)	Mercury vapour lamp
Lycaenidae				
19. Red Pierrot (*Talicada nyseus* Guérin-Menéville)	Usman (1956)	Bangalore (Karnataka, southern India)	Mar – May (1955)	Tungsten lamp (25W)
20. Gram Blue (*Euchrysops cnejus* Fab.)	Nair (2001)	Aralam Wildlife Sanctuary (Kerala, southern India)	February (2001)	CFL lamp
21. Lime Blue (*Chilades lajus* Stoll)	Sharma & Chaturvedi (2005)	Sanjay Gandhi National Park (Maharashtra, western India)	September (2001)	Neon tube light
22. Tiny Grass Blue (*Zizula hylax* Fab.)	Nair (2001)	Aralam Wildlife Sanctuary (Kerala, southern India)	February (2001)	CFL lamp
23. Dark Grass Blue (*Zizeeria karsandra* Moore)	Shull & Nadkerny (1967)	Surat Dangs (Gujarat, western India)	Mid June – Mid Oct (1961)	Mercury vapour lamp
24. Powdery Green Sapphire (*Heliophorus tamu tamu* Koll.)	Nadkerny & Shull (1968)	Dangs (S. Gujarat, western India)	Aug – Sep (1961)	Mercury vapour lamp
Hesperiidae				
25. Common Redeye (*Gangara thyrsis* Fab.)	Best (1956)	Bombay (Maharashtra, western India)	Feb – June (1956)	Lamp
26. Common Banded Awl (*Hasora chromus* Cramer)	Shull & Nadkerny (1967)	Surat Dangs (Gujarat, western India)	Mid June – Mid Oct (1961)	Mercury vapour lamp
27. Conjoined Swift (*Pelopidas conjuncta* Herrich-Schaeffer)	Shull & Nadkerny (1967)	Surat Dangs (Gujarat, western India)	Mid June – Mid Oct (1961)	Mercury vapour lamp

Table 2. A summary of the butterfly species attracted to artificial light sources as recorded by present authors (2008–2009)

Species	Place	Season (Year)	Artificial light source
Papilionidae			
1. Common Mormon (*Papilio polytes* Linn.)	Kolkata (West Bengal, eastern India)	August (2009)	Neon tube light
Nymphalidae			
2.Grey Count (*Tanaecia lepidea* Butler)	Samsing (West Bengal, eastern India)	June (2009)	Hazack lamp
3. Sailer species (*Neptis* Fabricius)	Samsing (West Bengal, eastern India)	June (2009)	Hazack lamp
4. Common Evening Brown (*Melanitis leda* Linn.)	Kolkata (West Bengal, eastern India)	October, November (2009)	Neon tube light
Lycaenidae			
5. Lime Blue (*Chilades lajus* Stoll.)	Buxa Tiger Reserve (West Bengal, eastern India)	May (2008)	Neon tube light
Hesperiidae			
6. Small Branded Swift (*Pelopidas mathias* Fab.)	Kolkata (West Bengal, eastern India)	October (2009)	Neon tube light

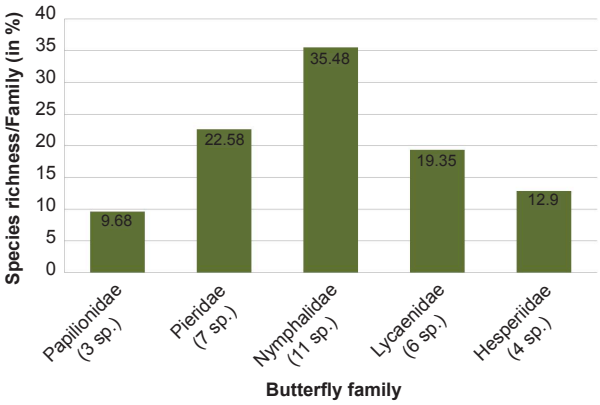

Figure 1. A graphical representation showing the relative richness for light-attracted butterfly species in terms of their families (1951–2009).

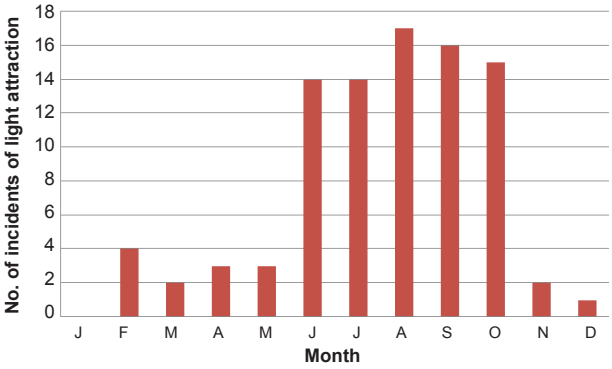

Figure 2. Incidences of butterfly species attracted to light in accordance with months (1951–2009), showing maximum records during the monsoon (Jun–Oct).

mathias Fab. are additions to the known butterflies subject to this phenomenon in India (Table 1), while *Chilades lajus* Stoll. and *Melanitis leda* Linn have also been reported earlier by Sharma & Chaturvedi (2005) from Maharashtra and by Donahue (1962) from Uttar Pradesh respectively. All the species were observed as single individuals during a single light-attraction event. No mass attractions were thus observed for the species in West Bengal. The observations by the present authors are detailed in Table 2.

A total of 31 species of butterfly resulting from the past and present observations showed occasional response to a variety of artificial lights in different parts of the Indian region. Among these, nymphalids (35.48%) outnumber the rest, followed by pierids (22.58%), lycaenids (19.35%), hesperiids (12.9%) and papilionids (9.68%) (Fig. 1). The observations (Tables 1 & 2) also reveal a seasonal inclination for such a phenomenon, as the maximum incidents were recorded during the monsoon months (June–October) in the Indian sub-region (Fig. 2).

Discussion and Conclusion: Crepuscular species, like *Melanitis leda*, are more active in the dark than the sun-loving, diurnal species, and thus are attracted more frequently to artificial lights (Donahue 1962).

The phenomenon of light attraction among butterflies has been found to be inclined more in the monsoon season (June–October) in the Indian sub-region. Heavy downpours during the monsoon months may disrupt the night-time shelters of some butterfly

individuals, inducing them to move from their former preferred site to a new one. In the absence of optimum light, they fail to do so using visual cues. In that case, a source of artificial light with an intensity enough to stimulate them to get attracted may serve the purpose of utilizing their visual potency to search for a safe shelter. Throne (1961) also suggested that a butterfly may fly at light if it is disturbed at night and is near the light in the first place. Heitzman (1965) was certain that a large percentage of the specimens collected at light were startled from their resting places in nearby trees or bushes by the collector or some larger insects attracted towards light. Donahue (1962), however, noted that the butterfly numbers were greatest during the monsoon months, particularly in arid areas (like New Delhi, where his observations were made) when there is an abundance of food. He therefore pointed out the coincidence of the population peak with the rainy season, and either one or both these factors might influence the activity of certain species at light. He also indicated the probable effect of temperature upon the nocturnal activity of the observed species, since most of his observations were in the monsoon months, with no record of any species in winter.

Furthermore, as in most cases of butterfly attraction towards a light source near their resting places, occasional incidents were reported where specimens were drawn from a considerable distance (Heitzman 1965). Donahue (1962) also argued that in some instances the butterfly would have to expend some effort to reach that light. Moreover, approaching that source, many of them tend to settle near the light. As light is an important cue that attracts insects to sources of heat (Schowalter 2006), the warmth obtained on getting nearer the light may also help in thermoregulation.

Further observations and experimentations on Indian butterflies being attracted to light at night may provide a less speculative explanation of phototactic and nocturnal behaviour.

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