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Indian Butterflies: Pests Status and Reproductive Behaviour

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ABSTRACT

Butterfly fauna forms an important economic group of insects i.e. as a pest of various economically important crops and as well as a pollinator. In this research study total fauna of butterflies of India has been reviewed and their pest status along with their reproductive behavior towards their respective host plants especially the oviposited plants and their parts have been emphasized. Through the respective contribution of various authors on Indian butterflies concerning about cycle of their life along with the behavior of their immature stages help in understanding the pattern of action of pest species. Ecological interaction of butterflies associated with their phytophagous behavior is key points in demonstrating the complicated linkage with their respective host plant taxonomic diversity. In a recent piece of research work, we emphasized on the important role of Indian butterflies as a pest, behavior of their immature stages and along with their reproductive behavior as well as pollinators and summarized the contribution of various authors under a single shed..

1. Introduction

Estimate from different regions of the world about 15,000 species of butterflies recorded according to the documented reports. Our country India is also rich in butterfly fauna and 1504 species reported from our Indian subcontinent. Most of the species live at average altitudes but many are also common at foothills and plains close to the highland. Although all butterflies do not segregate at those finer scales at which rest of butterflies perform finer selection among varied plant species, host preferences, genotypic makeup of plants and plants with distinct physiological and phonological properties (Thompson and Pellmyr 1991; Bernays and Chapman, 1994). Beck et al.,1999 mentioned the interesting pattern of adult butterflies to humid-muggy type soil and dirty places (a behavior termed as mud-puddling). Butterflies also act as extensive plant pollinators in the regional environment surroundings and aid to pollinate more than fifty economically important plant crops and their yield (Borges et al., 2003). Approximately ninety percent of butterfly species live in the tropics. The proportionate inadequacy of the report's information on tropical butterfly populations put the barrier on our capability to effectively safeguard those (Timothy et al., 2010).

For understanding the relationship of age-definite reproductive arrangements and their survivorship, the addition of assets from varied resources such as fruit, pollen, and carrion by adult tropical butterflies can serve as a basis (Boggs, 2009).

According to reports, there is a lower proportion at the time of emergence of mature eggs by tropical butterflies, however they produce eggs through all over their entire sexually active life span by practicing distinct assets and adults also feed on broad array of resources among other things like fruit, pollen, and carrion (Boggs, 1986, 1997; Jervis et al., 2005; Gilbert, 1972; DeVries, 1987; DeVries and Walla, 2001; Hall and Willmott, 2000)). On the other hand in the case of butterflies of temperate regions that majorly feed on a broad range of nectars (Scoble, 1992), complemented by the fluctuating supplies of dung or carrion, mud (Boggs and Dau 2004). Butterfly species breed once in an exceeding year or double in a year and which shows their varied distinct type of voltinism characters in the temperate region.

However, many butterfly species occur almost throughout the year in tropics (Owen et al., 1972). There is difference between the life span duration of Fruit-feeding butterflies that tend to live longer and the adult butterflies that only feed on nectars which comparatively live shorter than fruit feeding ones (Beck, 2008) as well as the fruit-feeding butterflies from fruits derive many benefits related to fertility (Molleman et al., 2009).

As a function of the monsoon, butterfly species in India further appear to counter the changing arid and wet surrounding conditions through the act of migration (Kunte, 2004) and as well as occurrence of seasonal polyphenism event however that probably disappears during the time period of monsoon, there is uncertainty about this fact that why this event happen (Tiple et al., 2009). Butterflies are plant and plant parts feeding insect (phytophagous) in nature. The report has been documented that there is very complicated linking between the plant taxonomic diversity and the competence of herbivorous insect to feed (Mitter et al., 1988) and also there is involvement of clash competition between the plants and insects for better survival.

PESTS STATUS AND REPRODUCTIVE BEHAVIOR OF INDIAN BUTTERFLIES

Habitat association of butterflies can be directly related to the availability of food plants. As herbivorous insects, the distribution of larval hosts and nectar plants has a distinct impact on the status of butterfly diversity (Solman Raju, 2004).

The status of butterfly (as a herbivorous type insect) diversification has been greatly impacted by the different circulation (distribution) of nectar plants and also of the appropriate larval host plants. There is the availability of documentation in many previous detailed reports on the conclusively positive correlation between the herbivorous butterflies and their associated plants. (Erhardt 1985; Simonson et al. 2001).

Here in the present work of paper review, we summarized the contribution of different authors who recorded the cycle of life pattern of Indian butterflies along with their reproductive behavior with respect to their host plants. A total of 1504 species of Indian butterflies has been described by different authors but only 25-30% of it has been studied in details including their host plants interaction and life stages study. Pests status and reproductive behavior of Indian Butterflies In India pioneering work in butterfly studies date back to the 19th Century (Wood-Mason and De-Niceville, 1887; Gaonkar, 1996). Since then, from the different parts of our country India there has been the availability of many detailed reports on butterflies (Fergusson, 1891; Sudheendra Kumar et al., 2000; Larsen, 1989; Mathew et al., 2000; Roy et al., 2010). The number of Indian butterflies amounts to one-fifth of the worlds butterfly species (Kunte, 2000).

Although detailed work documented on the larval host plants of our Western Ghats butterflies for more than a century (Bell, 1927) however there has largely been lacking of appropriate regionally reports and detailed information exclusively from the recent decades Wynter-Blyth (1957) in his book entitled, “Butterflies of the Indian Region” documented the pest status of 308 species under 10 families. Reinforce details are accessible on Lepidopterous insects that are in relation with the vegetables present in India. In India, according to many authors, there is the availability of detailed reports in concern with the Lepidopterous insects of 152 species that are associated with vegetable fauna (Lefroy, 1909; Pradhan, 1969; Nair, 1970; Butani and Jotwani, 1984; Gupta, 1990; Kumar et al., 2007).

Proctor and Yeo (1972) mentioned that in the case of Lepidoptera, the same plant species serve as the host for both larvae and adults. Several workers contributed much to the development of ideas in the area of host plant selection and oviposition (Chew and Robbins, 1984; Singer, 1984; Nylin, 1988; Janz et al., 1994). Several authors have speculated that ovipositing females select those plants for oviposition that is most suitable for larval growth and survival (Chew, 1975; Gilbert and Singer, 1975; Smiley, 1978; Damman and Feeny, 1988). Nectar sources also make impacts on the choice of ovipositioning by butterflies on the host plant species in its micro-environment (habitats) where these species are spatially separated.

As the hatching larvae of butterflies are often relatively immobile so, depending on the choice of the sexually matured female butterfly the main crucial concern of matter in the life history of butterflies is to finding the suitable host for the eggs that they are going to laying on that host plants. According to Thompson and Pellmyr, 1991; Kitching 1981 on the basis of egg-laying behavior (habit) of butterflies there are mainly 3 categories of butterflies, however according to the most of authors there are only two categories: (i) the one who lays their eggs in bundle(grouped/batched) form and (ii) others which lay their eggs separately (single). Butterflies exhibit distinct flower preferences that can differ between species. Some studies (Ritsuo et al., 1990) showed that not all the taxonomically related plant species are preferred for oviposition, because they may contain chemical factors, which deter oviposition. During oviposition, the adults used to test the rightness of the environment for laying eggs by tapping the leaves with forelegs. Ilse (1955) and Fox (1966) showed that this behavior acts as a chemical test of the properties of the leaf with the help of foreleg chemoreceptors.

Most butterfly species oviposited on young shoots, flower buds, and terminal foliages. Such plant structures are rich in nitrogenous compounds, and served to meet the nitrogenous requirement of larvae because the adults contribute nothing in many cases (Cottrell, 1984) and the older leaves evidently being unpalatable or even toxic. For curry leaf, orange and other plants of family Rutaceae, the common Mormon is a severe and ordinary blight (pest) among the assorted insect pests that attack the lemon (Antram, 1986 and Gunnathigalraj, 1998). India loses about 30% of its crops due to the blight by pests and defects and disorders each year. There is the vigorous loss to plants and crop in which pest damage majorly subjected to the vegetable where the main attack occurs to stems, leaves, roots, seeds, and fruits (Deeplata and Rao, 2012).

In general for Lemon butterfly, the major supportive duration of its exercise (activity) are months from July to late December and from October to December there will be a peak in the population of larval forms. The entire duration of its life cycle varied between the twenty-one to fifty days and with the three to nine breedings per annum that majorly banks on the weather at various locations (Ramana et al., 2014).

The caterpillar of the common Lime butterfly was reported as a serious defoliator and widely distributed all over the citrus growing areas. Besides citrus, it was also recorded on various species of plants that have relation to family Rutaceae (Ayyar, 1940; Bindra, 1957 and Atwal, 1964; Jandu 1942) reported a number of alternate host plants for citrus caterpillars viz. Trichodesma indicum, Feronia elephantum, Glycosmis pentaphylla, Zizyphus jujuba, Ruta graveolens, Citrus decimana, Chloroxylon sweitenia, Murraya koenigii and Aegle marmelos were the most preferable food plants for this pest.

The life cycle of the many different species of Indian butterflies that ordinarily occurs in the agriculture ecosystems is insufficient in India (Tiple et al., 2011). During the varied seasons of annum, there is considerable variation in the time period of the life cycle of Catopsilia pomona butterflies. There is a major role of Abiotic and biotic factors which also influence the life cycle stages of butterfly species (Choudhry and Agarwala, 2013).

A large number of observations and pieces of information are present on the life history of butterfly species by Barrose

(2000), Mcneely and Singer (2001), Beebe et al., (1960), Janz et al., (2005), Bala et al., (2014) and others. Furthermore, Bell (1909, 1927) has published the reports pertaining to egg and larval stages of 238 butterfly species in India.

There is the requirement of describing the life history of approximately seventy percent of Indian butterfly species according to the reports of Haribal (1992). Papilionidae feeding patterns range from the rigid monophagy in which a single species of a food plant is utilized to wide polyphagy. Many of the life history studies indicated that the larvae of the butterflies feed mostly on herb and shrub flora. The larval host of Danaus chrysippus are Calotropis procera and Asclepias currasavica, Pergularia daemia specific (Vekata Ramana et al., 1998), Acraea terpsicore is Hybanthus ennaespermus (Atluri et al.,1999), Pachliopta aristolochiae are Aristlochia bracteolata and A. indica (Atluri et al., 2001, 2004a), Anaphaeis aurota are Capparis spinosa, C. zeylanica specifc (Venkata et al., 2003), Leptosia nina is Capparis spinosa (Samatha et al., 2008) specific. In Asia, on the plants of the different Families like Apocynaceae, Arecaeae, Asteraceae, Connaraceae, Cucurbitaceae, Euphorbiceae, Rhamnaceae, Rubiaceae, Santalaceae, Theaceae, Verbenaceae the feeding activities of larvae of E. hecabe reported (more details in Vane-Wright and de Jong, 2003).

Harinath et al., 2015 reported that biology and ecology of South Indian butterflies, the small grass yellow butterfly Eurema brigitta (Moore) of Pieridae was found ovipositing on several leguminous plants including Cassia tora, Cassia occidentalis, Cassia siamea, Mimosa pudica, Samanea saman, and Peltophrum. The larval and pupal duration is longer on babchi (Psoralea corylifolia) than on lemon (Citrus lemon) and females prefer babchi for ovipostion compared to lemon (Tripathi et al., 1998).

Egg bundling (grouped form) is established in some specific butterflies groups like nymphalids, acraeids and pierids, however very hardly in the hesperiides, satyrids, danaiids, rioidinids and papilionids (Nancy, 1980). The tendency of higher utilization aids accumulation of sufficient energy to tide over the non-feeding pupa stage. The tendency of greater consumption by the penultimate and/or ultimate instars have been reported for Lepidopterous larvae in general (Mathavan and Pandian, 1975; Venkata et al., 2001). Cepora nerissa is of having multiple brood types in single season means it is the multivoltine type and breeds all over the year with greater frequency during the July-December in the flora of North seaside Andhra Pradesh. Life cycle duration completes in the time of 21 to 28 days. Cepora nerissa (Fabricius) of the Pieridae lays their eggs on the vegetation of the leafy Caparis spinosa and forages on the floral nectar of the ditto same plant. The breeding females laid eggs singly on the undersides and fringes of the budding leaves or more frequently on the spines of the host plant (Atluri et al., 2001). Seasonal data of Junonia lemonias showed that it was essentially a rainy season butterfly. Food utilization recorded study shows that the caterpillars of lemon pansy feed on the host plants from families Verbenaceae, Malvaceae, Tiliaceae, Acanthaceae, Rubiaceae and Amaranthaceae (Harinath et al., 2012).

Pieris brassicae is one of major destructive type blight of the Cole crops, causing severe damage to its host plants attacking the leaves as well as the inflorescence. In our country India, Pieris brassicae spends cold weather (winters) in plains and migrates to hilly areas all along the summer. Sometimes the attack is so severe that the whole crop is destroyed (Prasad, 1963). Ali and Rizvi, (2007) have reported the development response of Cabbage white butterfly, to different food plants during its larval stage and observed variation in their developmental period covered by both the lab and natural conditions and acknowledge that cabbage white butterfly needed maximal duration of the 42 days on Indian mustard and minimum 36 days on cabbage to complete the generation.

In North India, cabbage white butterfly is a frequent and euryphagous (with broad host range) blight of the cultivated cold weather crops like Brassica oleracea, cabbage, mustards (Brassica), and Rapnanus rapnanistrun (radish) (Hasan and Ansari, 2010). The females exhibit higher frequency of wing strokes & search for host plants during oviposition. Lycaenids walk over young branchlets of hosting plant and oviposit at the axils of young leaves (Deepika et al., 2014).

Meera Bai (1987) reported both adults and larvae of Colotis eucharis and Colotis. danae feed on the flowers and leaves of Cadaba fruticosa and also those of Anaphaeis aurota on Capparis spinosa. Study of Harinath et al., 2015 explains the details of life history of the peal blue butterfly (Linnaeus) larval phases in relations to the diet expenditure, using and length of the life stages on its hosting plant (wild gram) Vigna trilobata (Linnaeus) and it was usually seen in exposed scrub and grassland environments.

Despite the fact, Lampides boeticus is known for the feeding on many febaceae (Leguminosae) plants along with several (brown hemp)crotalaria spp., latest work on it found that Vigna trilobata (Linnaeus) as the most fascinating plant for the oviposition amidst this butterfly population. The sexually mature female implanted eggs separately on sepals of flower buds. Floral nectars were an essential source of the food in the adult stage of butterflies (Fischer and Fiedler, 2001). These butterflies frequently visit the flowers of Tridax daisy, Golden dewdrop, Lantana camara (wild-sage), Pongamia pinnata and Cassia alata (candle bush). The entire developmental timing from egg laying to adult formation was ~15-22 days.

Ravikanthachari et al., 2018 shows up a fundamental and essential, amended index of the larval hosting plants of butterflies basically of our Western Ghats, that encompass the latest up-to-date report, with comprehensive of relatively eight hundred four plant species that fit to the eighty eight families which are used by the three hundred twenty butterfly species of our Western Ghats (host plant reports for 16 species are anonymous). A reverse list is also provided as a reference to plant species-wise plant-butterfly associations.

CONCLUSION

It is evident from the foregoing account that although a reasonably good amount of work has been done on the life cycle of different species of butterflies under various families, yet exhaustive field studies are yet to be undertaken. So far, scattered works in the form of publications on individual species can be traced. Out of a total 1504 species of butterflies recorded and described from the present-day territory of India, host plants and life cycles of just 25-30% species have been documented. Accordingly, a good deal of work remains to be carried out on the standing of the remaining 70-75% regarding their usefulness or harming natures. A detailed study in the form of intensive field surveys will thus bring to light plenty of information on mating behavior, egg laying pattern, the number of larval instars, mode of pupation and length of developing period during different seasons in a year. Furthermore, intensive efforts shall also bring to the fore the role of parasitoid species in controlling the population of different butterfly species in nature.

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