Two typically fruit and sap feeding Indian butterflies shift to flower nectar (Lepidoptera: Nymphalidae)

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Abstract: *Sephisa dichroa* Kollar, 1844 and *Charaxes solon* Fabricius, 1793 (both Nymphalidae) are reported feeding on flowers of *Prunus cerasoides* and *Lantana camara,* respectively. This is unreported and represents a shift in feeding habits. The probability of this shift being triggered by loss of wild sources of fruit and sap is examined.

Zwei überlicherweise an Früchten oder Baumwunden saugende indische Tagfalter an Nektarblumen beobachtet (Lepidoptera: Nymphalidae)

Zusammenfassung: Die beiden Nymphaliden *Sephisa dichroa* Kollar, 1844 und *Charaxes solon* Fabricius, 1793 werden von nektarsaugenden Blütenbesuchen auf *Prunus cerasoides* und *Lantana camara* gemeldet. Diese Art der Futteraufnahme wurde zuvor von diesen sonst an Früchten oder Baumwunden saugenden Faltern noch nicht gemeldet. Die Wahrscheinlicheit, daß der Ernährungswechsel durch den anthropogenen Verlust der früheren Futterquellen ausgelöst wurde, wird diskutiert.

Introduction

Probably all butterflies (Papilionoidea and Hesperioidea) possess a proboscis to enable them to feed. This feeding apparatus effectively restricts them to a liquid diet, usually nectar. Kingsolver (1985) noted that butterflies found a diet of nectar or other fluids containing 15–30% of simple sugars economical to feed upon, due to the greater energy expended on sucking up viscous solutions containing greater proportion of sugars through their narrow probosces.

While a large number of butterflies obtain their nutrients from flower nectar and pollen, there is a group of butterflies that apparently never visit flowers. These are usually thick-bodied butterflies that seem to require richer foods to supply their powerful flight muscles, such as members of the generea *Euthalia* Hübner, 1819, *Kallima* Boisduval, 1836, *Charaxes* Ochsenheimer, 1816, *Dilipa* Moore, 1858 and *Sephisa* Moore, 1882 in Asia and Africa.

Observations on Indian Nymphalidae and their habits were noted by de Nicéville (1886), Peile (1937) and Wynter-Blyth (1957), among others. At the time of their observations, the human population in India was not very large. During the latter half of the 20th century, the Indian population expanded rapidly. This led to widespread degradation of forests to meet the direct human requirement in the form of fuel, minor forest produce and lumber and also indirectly in the form of fodder, because India supported the largest population of cattle in the world, most of them fed from village commons and the forests that remained.

De Nicéville (1886: 3) noted: "Many of the species [of Nymphalidae] are very foul feeders, the depraved tastes of the 'Purple Emperor' [*Apatura iris* Linnaeus, 1758] are well known, species of *Charaxes* have also been taken on carrion, *C. fabius* [= *C. solon* Fabricius, 1793] is very fond of the juice of the toddy palm, *Euthalia* of rotten fruit, &c. One of the most successful modes of catching many species of rare butterflies is to place rotten fruit or some other attractive, strong-smelling bait on the ground near their haunts, when numbers of specimens may often be found busily regaling themselves where previously not an individual was to be seen."

Concerning *Charaxes,* Wynter-Blyth (1957: 143) noted that "The males also visit damp patches and are greatly attracted by over-ripe fruit, refuse and manure, and consequently may be caught by means of baits. Neither sex visits flowers." Woodhouse (1950) noted that *Charaxes solon* comes readily to bait in Sri Lanka.

De Nicéville (1886) noted for *Sephisa dichroa* Kollar, 1844 that "Col. A. M. Lang, R.E., records that it is partial to ripe fruit, that he has 'seen it in open woods in the interior of the Himalaya, pitching on the sprays of tall shrubs, making rapid flights and returning to the same spot'."

Peile (1937) noted for *Sephisa dichroa* that "it is attracted by refuse. Taken at sap on a tree in Murree." To this, Wynter-Blyth (1957) added that this species is attracted to over-ripe fruit. Long experience with *S. dichroa* in the Bhimtal valley has borne out these observations.

Normally, the non-flower visiting butterflies are found in dense forests and would have found sufficient provender there but as fruiting trees were logged for fodder, sap exuding trees cut for firewood or lumber, sources of carrion and dung greatly diminished due to reduction of the population of wild animals, such butterflies naturally faced a resource crunch.

Earlier, fruit, sap and refuse feeding butterflies did not contribute to the task of pollinating flowers, since they went nowhere near them.

Observations

On 25. x. 2013 around noon, RB and PS noted two ♀♀ of *Sephisa dichroa* feeding on a flowering wild cherry tree (*Prunus cerasoides*) near Dhanachuli in Nainital district,

Uttarakhand, India (latitude 29°38′48″ N and longitude 79°52′57″ E). There were two cherry trees flowering some hundred m apart, but only one was attracting butterflies at that point of time. In addition to the *S. dichroa*, there were 2 ♀♀ of *Gonepteryx rhamni* Linnaeus, 1758, 2 *Pieris canidia* Sparrman, 1768, 1 *Aglais cashmirensis* Kollar, 1844, 2 *Vanessa indica* Herbst, 1794, *Celastrina* sp. and a *Rapala,* presumably *R. nissa* Kollar, 1844.

The congregation was observed for about 15 min, and numerous photographs taken with the main aim of ascertaining whether the *S. dichroa* ♀♀ were actually feeding on the flowers' nectar or were attracted by some other source of nutrients. RB succeeded in obtaining photographs showing conclusively that the proboscis of at least one *S. dichroa* was undeniably inserted to the base of the flower, where nectar is known to be available (Fig. 2).

A search for photographs on internet sites possibly adding information on the subject brought to light PP's photographs of a *Charaxes solon* ♀ feeding on some attractant at the base of *Lantana camara* flowers (Fig. 3). Presumably the attractant was nectar. *Lantana camara* attracts many butterfly species. This photograph was taken on 18. ix. 2009 in Borgad forest, near the village of Rasegaon, district Nasik, Maharashtra, India. The butterfly was observed for around 5 min, perched on flowers between 1 and 2 m above the ground. Normally, *Charaxes solon* never visits flowers unless, exceptionally, as a perch. Here, however, the proboscis was unmistakably extended and inserted at the base of the flower from the side, not into the corolla tube. There have been several subsequent observations of this butterfly on *Lantana* flowers.

Discussion

In addition to existing literature on the subject, butterflies and their habits have been observed in India, mainly in the western Himalaya but also in other parts by PS for more than 40 years. There was never any reason to doubt the veracity of the observations concerning butterfly attractants noted by Wynter-Blyth (1957) and Peile (1937).

Through the 1970s and 1980s, PS regularly observed the flowering of *Prunus cerasoides,* spending hours at flowering trees to obtain specimens of *Delias eucharis* Drury, 1773 (Pieridae) and *Rapala nissa* in the Bhimtal valley. Although *S. dichroa* is very common in the same area, no individual of this butterfly was ever observed visiting *P. cerasoides* or any other flowers during those years.

Fig. 1: *Sephisa dichroa* with extended proboscis, showing length. Photo: P. Smetacek. **Fig. 2***: Sephisa dichroa* with proboscis inserted into flower of *Prunus cerasoides*. Photo: R. Bhuyan. — **Fig. 3:** *Charaxes solon* with proboscis probing the base of *Lantana camara* flowers. Photo: P. B. Pandharkar.

During the 1980s, the leaf of *Prunus cerasoides* changed from a small, glossy leaf to a large tomentose leaf. According to Prof. Y. P. S. Pangtey, then at the Department of Botany in Kumaon University, Nainital, this was due to water stress. Subsequently, *P. cerasoides* died en masse in the Bhimtal valley. Initially, it appeared to be a viral or fungal attack and samples were shown to Prof. P. Entwhistle of the Institute of Virology at Oxford, UK, in 1991, who recognized the circular black infection on the wood as a fungus. However, in retrospect, it might be that due to warming of the lower reaches of the Himalaya, *P. cerasoides* first changed in an attempt to adapt to changed environmental conditions and, failing to do so, died en masse and the fungal attack was subsequent to, rather than the cause of, the death of the trees in the Bhimtal valley.

The fact that the tree died out of the valley precluded observations during the 1990s and 2000s. Meanwhile, regular forest fires drastically reduced butterfly populations throughout the outer Himalaya in Uttarakhand.

As the area under broadleaf forests reduced due to forest fires, logging for fodder and firewood, fruit production by the forest trees greatly reduced. In some cases, entire species died out, as in the case of *P. cerasoides* in Bhimtal; *Ougenia dalbergioides* too was selectively logged because of the extremely hard wood, used for plough shares; *Celtis tetrandra* and *C. australis* were wiped out due to overexploitation of their excellent fodder, as were *Grewia optiva* and several species of *Ficus*. The result is that, today, there are fewer fruiting trees, bushes and shrubs, both in terms of variety and numbers.

Today, the forests in the Bhimtal valley consist largely of lopped oak (*Quercus leucotrichophora*) and chir pine (*Pinus longifolia*). Berries and fruit of any sort are not found in the forest as they used to be some 30 years ago, except for the ubiquitous *Lantana camara*.

The above notes concerning changes in the availability of food in forests are to do with the western Himalaya, but clearly, they hold true for other parts of India, too.

In response to the reduction or even absence of their traditional sources of food during the adult stage, it seems that ♀ butterflies have modified their feeding habits to exploit what would normally be marginal sources of food for them, i.e. flower nectar. Further observations would clarify whether ♂♂, too, have modified their behavior.

Conclusion

Changes in the availability of suitable forage for adult butterflies appears to be responsible for a shift in resource exploitation by what used to be fruit and sap feeding butterflies, who are also attracted to flowers, presumably for nectar, in parts of India.

In the present paper, ♀♀ of two species of normally fruit, sap and carrion feeding butterflies which were not known to be attracted to flowers have been observed with the proboscis extended into the base of flowers which are known to attract butterflies, but not yet these species. This suggests that either there is larger variability in the feeding strategies of the species (depending on actually availbale food ressources), or the behavior of these insects is undergoing modification and that such changes can happen over a relatively short period of time, subject to the immediate needs of the species.

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