



## A Review of Composition and Diversity of Butterfly (Lepidoptera: Rhopalocera) Fauna in India

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**ABSTRACT:** This paper is aimed to review the butterfly diversity, distribution and composition in different localities of various states of India either in cities, forests and protected areas. A number of different parameters have been used by authors to designate the composition and species richness status of different butterfly families. Few parameters like common, very common, rare, very rare, evenness index and other ecological statistical have been used. Out of this review, it has been noticed that family Nymphalidae found to be most dominant in the number of individuals and very less individuals found in the family Lycaenidae. Other butterfly families have been recorded as moderate occurrence in the environment. As indicated by the scrutiny of the literature, it is evident that every butterfly family has its own significance in the stability of the ecosystem so in view of this there is need of future planning for effective conservation of butterflies, their host plants as well as nectar food plants.

**Keywords:** butterfly, family, species, wing venation

### I. INTRODUCTION

“Fauna of British India” was published in 1905 (first volume) by Bingham followed by the second volume in 1907 [9-10]. Bell (1909) reported the common butterflies on the Indian plains [8] whereas Evans (1912) published the book, “Identification of Indian butterflies” in two volumes. He recorded 962 butterfly species from North-Eastern region of India [16]. While Pandharipande recorded 61 species from Nagpur from families viz., Papilionidae, Pieridae, Danaidae, Satyridae, Lycaenidae, Nymphalidae and Hesperidae and prepared a comparative account with fauna of South India [41]. Rose and Sidhu (1994) recorded of Lycaenid diversity of Mussorie in Uttar Pradesh [64]. They found the differences in the species of *Junonia orithya* complex of family Satyridae (Lepidoptera) from the same region were thoroughly studied by Rose and Sharma (1995a) [58]. Janz and Nylin (1998) used phylogenetic systems to learn the relations between butterflies and their host plants with the database records from 437 in group taxa. The patterns of organization model in most insect-plant interactions were influenced by host shifts, through specialization and colonization than by cospeciation [25]. *Dallacha hygriva* Moore of family Satyrid of Himalayan region were thoroughly studied by Rose and Sharma (2000a) along with some important record of some important information on them [26]. They also surveyed the

North-Western Himalayan region and traced the distribution of 4 species of *Callerebia* Butter [63]. A butterfly inventory of Chandigarh and Punjab were also prepared by Rose and Sidhu (2001) [66]. Nijhout (2001) described the color patterns on the butterfly wings that make up the overall pattern and have characters that vary from species to species and specially across genera and families. This character make possible to determine homologies among pattern elements and help to study their diversification and evolution [47]. The swallowtail, *Papilio xuthus*, occurring veinless in nature were thoroughly examined by Koch and Nijhout (2002) for an exceptionally varied colour pattern. These types of butterflies without veins are provisionally called *veins-reduced* mutant [29].

Bashar *et al.*, (2005) studied and recognized 22 species of Pieridae on the basis of wing venation. They noticed the association of these species with different plant families viz., Amaranthaceae, Compositae, Gramineae, Leguminosae and Moraceae with butterflies larvae [7]. Breuker *et al.*, (2007) compiled research on Speckled Wood butterflies *Pararge aegeria* by studying the interaction between eyespot integration and wing venation patterns of fore and hind wings of these butterflies [12]. Kaygin *et al.*, (2009) recorded and identified 90 species from 21 families in Bartin province of Turkey besides reporting that the species viz., *Arctia villica*, *Autographa gamma*, *Catocala elocata*, *Dysgonia algira*, *Emayurga*

*atomaria*, *Laotloe populi*, *Nycteolaasiatica*, *Nymphalis polychloros*, *Phalera bucephala*, *Thaumetopoea pityocampa*, *Tortrix viridana* and *Zeuzera pyrina* were identified as harmful species. He further noticed that the species, *Arctia villica*, *Pieris brassicae*, *P. napi* and *Polyommatus icarus* have been found harmful to the agricultural crops [26]. Singh (2009) enlisted a total of 3617 butterflies of 147 species along with their seasonality, altitudinal distribution and relative abundance of Kedarnath Musk Deer Reserve, Garhwal Himalaya, India [72].

Sharma and Joshi (2009) studied a total of 41 species of butterflies from 5 families belonging to order Lepidoptera from Dholbaha dam (Dist. Hoshiarpur) in Punjab Shivalik, (India), out of which Nymphalidae found to be dominant and represented by 19 species, followed by Pieridae, Lycaenidae, Papilionidae with species richness of 10,8,3 respectively and only 1 species from Hesperidae. On the basis of total number of individuals *Eurema hecabe* Linnaeus remained the most dominant species followed by *Danaus chrysippus* Linnaeus, *Euchrysops cnejus* Fabricius, *Euploea core* Cramer, *Junonia lemonias* Linnaeus, *Catopsilia pyranthe* Linnaeus and minimum by *Delias eucharis* Drury and *Graphium sarpedon luctatius* Fruhstorfer [68].

Pathania and Kumari (2009) compiled a report on 28 species collected from 15 locations of district Una in Himachal Pradesh pertaining to 19 genera i.e., *Aglais* Dalman, *Anosia* Hübner, *Ariadne* Horsfield, *Atella* Doubleday, *Catopsilia* Hübner, *Cepora* Billberg, *Colias* Fabricius, *Delias* Hübner, *Eurema* Hübner, *Hypolimnas* Hübner, *Ixias* Hübner, *Junonia* Hübner, *Lethe* Hübner, *Morpho* Fabricius, *Neptis* Fabricius, *Papilio* Linnaeus, *Pieris* Schrank, *Pyronia* Hübner and *Satyris* Westwood belonging to 3 families i.e., Pieridae, Papilionidae and Nymphalidae of the superfamily Papilionoidea. Besides this, a list of host plants along with their old distribution was also prepared [50]. Ghorpade and Kunte (2010) recorded butterflies of Palni hills in South-Western Ghats of Peninsular India and listed a total of 310 species related to 162 genera and 6 families viz., Hesperidae, Lycaenidae, Nymphalidae, Papilionidae, Pieridae and Riodinidae [19]. Ramesh et al., (2010) collected 1908 individuals belonging to 55 species were seen across the 5 habitat types viz., *Casuarina* plantation (Monoculture), Sandy area, Riparian woods, Scrub jungle and Garden, besides discussing their abundance, pattern of diversity and habitat associations in heterogeneous landscapes of the department of atomic energy (DAE) campus at Kalpakkam, South India. Out of these, Nymphalids were the very common species of butterflies viz., *Appears libythea*, *Ariadne merione*, *Castalius rosimon*, *Danaus chrysippus* and *Tirumala septentrionis*. They preferred habitats like garden and scrub jungle than the other habitats [56]. Nair (2011) found three new butterfly species viz., *Gerosis phisara* Moore (Hesperidae), *Polyura eudamippus* Doubleday

(Nymphalidae) and *Poritia hewitsoni* Moore (Lycaenidae) from Similipal hills of Odisha in India as the new records in Peninsular India occurring outside the Himalayan foothills [43]. Tiple (2011) studied 167 butterfly species representing 90 genera of 5 families from Vidarbha region of Central India. Besides recording the largest number of butterflies pertaining to 50 species of Nymphalidae, followed by 47 species of Lycaenidae, 34 species of Hesperidae, 23 species of Pieridae and 13 species of Papilionidae, author also noticed that 14 species viz., *Appias albino*, *A. libythea*, *Baoris farri*, *Euchrysops cnejus*, *Euploea core*, *Eurema andersonii*, *Hypolimnas misippus*, *Ionolyce helicon*, *Lampides boeticus*, *Melanitis zitenius*, *Pachliopta hector*, *Spindasis elima*, *Tanaecia lepidea* and *Tarucus ananda* are included in the protected category of the Indian Wildlife Protection Act of 1972 [77]. Sidhu (2011) prepared a checklist of 66 species of blue butterflies (Lycaenidae) of Mussoorie and updated about the changing biodiversity scenario in the Himalayan ecosystem [71]. Tiple and Ghorpade (2012) besides reporting new records of 55 species also described 104 species of butterflies belonging to 69 genera in 6 families from Achanakmar-Amarkantak Biosphere Reserve, in Chhattisgarh and Madhya Pradesh with a new record of 55 species. Among the 104 species of butterflies, the species which remain to be active throughout the year are *Catopsilia pomona*, *Danaus chrysippus*, *Euploea core*, *Eurema hecabe*, *Freyeria putli*, *Junonia lemonias*, *Papilio demoleus* and *Tirumala leopardus*. It had been found that the remaining 96 species were active only after June-July till the onset of summer (April-May). The seasonal occurrence of butterfly species was high from rainy season to early winter but decreased afterwards from early time of summer from March to June. This decline may be due to unavailability of nectar food plant, larval host plant, the dearth of available water and trimming of grasslands [78]. Kunte et al., (2012) studied the diversity and conservation of butterflies, 3736 individuals from 298 species were recorded in Baghmara Reserve Forest, Balpakram National Park and Siju Wildlife Sanctuary in Southern Garo hills and Nokrek National Park in Western Garo hills [38].

According to Indian Wildlife Protection Act (1972), 8 species are legally protected under Schedule I and 33 under Schedule II. The Western Ghats of India were elaborately studied by Padhye et al., (2012) for composition and distribution of different species of butterflies. The most dominant family was Lycaenidae with 101 species followed by 97 species of Nymphalidae, 82 species of Hesperidae, 34 species of Pieridae, 19 species of Papilionidae and 1 species of Riodinidae [48]. Kumar (2012) reported the abundance and foraging activity of butterflies at various locations of Jhansi. Some butterfly species were collected as they were visiting different flowering plants in cultivated, garden, wild and semi wild areas. Some species like *Catopsilia crocale* Cramer, *C. pyranthe* Linnaeus,

*Colias electo fieldi* Ménétries, *C. erate* Esper, *Eurema hecabe fimbriata* Wallace, *Ixias pyrene* Cramer and *Pieris canidia* Sparrman were seen on the flowering plants [31]. Perveen (2012) studied the distribution of 21 butterfly species from families Nymphalidae, Papilionidae and Pieridae of Kohat, Khyber Pakhtunkhwa, Pakistan and recorded the species *Ariadne merione* Cramer, *Argynnis hyperbius* Linnaeus, *Cynthia cardui* Linnaeus, *Hipparchia parisatis* Kollar, *Junonia almanac* Linnaeus, *J. orithya* Linnaeus and *Phalanta phalantha* Drury of Nymphalidae, *Papilio demoleus* Linnaeus and *P. polytes* Linnaeus of Papilionidae, while Pieridae included *Belenois aurota* Fabricius, *Catopsilia pomona* Fabricius, *C. etrida* Boisduval, *Colias croceus* Geoffroy, *Colotis protractus* Butler, *Eurema hecabe* Linnaeus, *Gonepteryx rhamnii* Linnaeus, *Ixias pyrene* Linnaeus, *Pieris ajaka* Moore, *P. brassicae* Linnaeus, *P. napi* Linnaeus and *P. rapae* Linnaeus [53].

Guptha et al., (2012) explored 50 species of butterflies under five families by photographic documents of Sessa chalam Biosphere Reserve in Eastern Ghats of Andhra Pradesh in India. The families Lycaenidae and Nymphalidae were found to be dominant with 12 species and 20 species respectively. Six scheduled species namely *Amblypodia anita*, *Euchrysops cnefus*, *Euploea core*, *Hypolimnas bolina*, *Lampides boeticus* and *Pachliopta hector* were observed [23]. Majumder et al., (2012) investigated the species richness and butterfly diversity in the Trishna Wildlife Sanctuary in Tripura in Eastern India and showed the presence of 59 species of butterflies that included 21 distinctive species and 9 species included in the threatened category. The greater species diversity and richness (39 species under 31 genera) was noticed in the mixed moist deciduous forest of the sanctuary than other parts, which comprised of regenerated secondary mixed deciduous forest (37 species of 32 genera), degraded forests (32 species of 28 genera) and open areas of grassland with artificial lakes and scattered plantations (24 species of 17 genera) [39]. Khanal et al., (2013) enlisted some of the threatened butterfly species of Nepal viz., *Euripus consimilis* Westwood, *Euthalia franciae* Gray, *Maneca bhotea* Moore, *Meandrusa lachinus* Fanahashi, *Papilio krishna* Gray, *Phaedyra aspasia* Leech, *Tajuria luculentus* Swinhoe and *Teinopalpus imperialis* Hope [27]. Sharma and Kumar (2013) noticed butterfly diversity in and around the Renuka lake of Himachal Pradesh and indicated the presence of 49 insect species belonging to 37 genera of 9 families. Nymphalidae represented by 12 species, spread over 8 genera was the largest family followed by 11 species of Pieridae, 8 species each of Papilionidae and Satyridae, 4 species of Danaidae and 2 species each of Lycaenidae and Hesperidae. Two families viz., Acraeidae and Erycinidae were represented by one

species each [69]. Aizaz et al., (2013) surveyed and recorded 36 species of butterflies belongs to 8 families and 30 genera from district Kupwara of J and K state. Authors have noticed that highest number of butterflies were in the months of June to August instead of March to November. But no butterfly species reported in the winter season [2]. Gogoi (2013) recorded extremely rare species viz., *Amathuxidia amythaon*, *Capilia zennara*, *Dodona longicaudata* and *Pithecopis fulgens* in Jeypore Reserve Forest of Eastern Assam [20]. Kumar and Mattu (2014) shared valuable information on population dynamics and diversity of butterfly species from Balh valley of district Mandi in Himachal Pradesh, indicating the presence of 40 species of butterflies belonging to 31 genera of 8 families of order Lepidoptera [35]. A faunistic study of butterflies by Koren and Letic (2014) through photography was brought into practice in Donji Emovci, Pozega in Croatia [30]. The Kudankulam Nuclear Power Plant area in Tamil Nadu was intensively surveyed by Kumar and Murugesan (2014) for studying species diversity of butterflies along with their habitat association. They have identified 64 species of butterflies belonging to families viz., Papilionidae, Lycaenidae, Pieridae, Hesperidae and Nymphalidae [34]. In the Republic of Macedonia four new butterfly species i.e., *Carterocephalus palaemon*, *Nymphalis vaualbum*, *Papilio alexano* and *Polyommatus aroaniensis* were recorded by Melovski and Bozhinovsk (2014) [40]. Narayanankutty et al., (2014) recorded the diversity and distribution of butterflies belonging to five families with Nymphalidae (81) Hesperidae (71), Lycaenidae (72), Pieridae (24) and Papilionidae (17) in the Shendurney Wildlife Sanctuary, which is one of the richest areas of biodiversity in Western Ghats [44]. Unusual species like *Colotis amata*, *Euploea crameri* and *Idea agamarshchana* were recorded by Chowdhury (2014) while conducting an initial survey of taxonomic butterfly diversity in the Mangrove areas of Sundarban Biosphere Reserve in West Bengal in Eastern India. The most common butterfly in the biosphere reserve was *Danaus genutia* [14]. Qureshi et al., (2014) reported two Nymphalid butterflies i.e., *Junonia orithya* Linnaeus and *Neptis Sappho* Pallas from Kashmir Valley for the first time in Dachigam National Park in India. Maximum species of butterflies were seen visiting flowers of *Tagetes patula* (Asteraceae). *Aglais cashmirensis*, *Colias fieldi*, *Pieris brassicae*, *Pontia daplidice* and *Vanessa cardui* were the most common butterflies in the valley [55]. For contribution in the plan of biodiversity restoration and development of management strategies so as to ensure ecosystem services and sustenance of butterflies, a study was conducted by Nair et al., (2014) in Sarojini Naidu college campus of Kolkata. A total of 49 butterfly species under 5 families and 36 genera were compiled.

The most dominant family with maximum number of species was Nymphalidae, represented by 20, followed by 12 species of Lycaenidae, 10 species of Pieridae, 6 species of Papilionidae and 1 species of Hesperidae [42]. Chandel et al., (2014) photographed 98 butterfly species belonging to 66 genera of five families i.e., Pieridae, Nymphalidae, Papilionidae, Lycaenidae, Hesperidae from Shivalik hill areas of Kangra and Hamirpur districts of Himachal Pradesh in India [13]. Different habitat types in Royal Manas National Park of Bhutan were studied for taxon diversity of butterflies by Nidup et al., (2014), which revealed *Coon (Sancus folio-Mabille)* of Hesperidae family as a new record. Nymphalidae was the most common family [46]. The diversity of family Nymphalidae in Kubah National Park, Sarawak in South- West Borneo in Malaysia was studied by Christharina and Abang (2014) by employing both conventional and taxonomic biodiversity indices. In total 665 individuals, representing 49 species were sampled [15]. The investigation on butterfly species diversity and abundance was carried out in Jhansi city by Kumar (2014), identifying 948 individuals of butterflies of 38 species belonging to 29 genera [32]. Kumar and Singh (2014) investigated the life history of *Graphium doson* Felder & Felder thoroughly from the plains of Punjab which included egg laying, larval feeding, growth and pupation noticed on *Polyalthia longifolia* (False Ashoka Tree) belonging to family Annonaceae [33]. Neogi et al., (2014) described five new butterfly species viz., *Abisara bifasciata*, *Cephrenes acalle*, *Freyeria putli*, *Prosotas bhutea* and *Tarucus balkanicus* from Dhaka, Pirojpur and Cox's bazar districts in Bangladesh, thus updating the status in the region [45]. Revathy and Mathew (2014). Details of morphology of external genitalia were very helpful in separating three forms viz., *romulus*, *stichius* and *cyrus* belonging to this species. While studying that there is no relationship of physical factors with species richness of butterflies and their families and further the number of species of butterflies observed in garden habitat was comparatively more than both the forest and cultivated areas [57]. Alarape et al., (2015) analyzed diversity of butterfly species and affluence in University of Ibadan Botanical Garden of Nigeria. A total of 57 species of butterflies related to 9 families were examined [3]. The life cycle of *Eurema laeta* Boisduval had been studied for the first time in detail at Solan in Himachal Pradesh by Bogtapa et al., (2015) along with the durations and dimensions of various life history stages besides studying the different behaviours including mating, ovipositing and mud puddling. The larvae of the species are found on the plant *Cassia pumila* Lamk. (Fabaceae: Caesalpinaceae) [11].

Azrizal-Wahid et al., (2015) examined seven species of *Eurema* butterflies on the basis of morphological characters and variation patterns in

Malaysia. The species showed differences in the number of cell dots present in discoidal cell and the pattern of brownish patch in apical area, present on the underside of the forewing. *E. tilaha*, *E. sari* and *E. blanda* are different morphologically and easily identifiable. *E. hecabe* showed different patterns of blackish apical margin in fore wing in many individuals which was directly related to the changes in the altitudes [5]. North-Eastern Tamilnadu of India was studied for diversity of butterflies in different seasons by Anbalagan et al., (2015). A total of 4644 individuals of 101 different species were identified [4]. Harsh et al., (2015) investigated that the individuals related to Nymphalidae and Hesperidae were most prevalent with the 53 species being investigated accounting for 28.71% and 23.76% of total number of individuals collected. Their dominance and evenness were statistically analysed and found that diversity and species richness has significantly declined in the agro ecosystem habitats, probably due to the destruction of host plant in crop area habitat, use of synthetic pesticides, human disturbance and heavy vehicle pollution. Four different habitat types in Kanha- Pench corridor, viz., across river bed, forest area, near human settlement and open scrub land of Madhya Pradesh in India for butterflies diversity and their habitat [24]. Two endemic species, viz., Malabar Tree Nymph *Idea malabarica* and Southern Birdwing *Troides minos* were located by Gaude and Janarthanam (2015), while investigating 4 sacred groves of Goa, viz., Azobhachi Rai, Mharinginichi Rai, Alvatiniichi Rai and Nirankarachi Rai [18]. Gogoi (2015) gave a checklist of Lycaenidae by pertaining to 116 taxa, along with notes on significant species in lower elevation forest of Panbari Reserve Forest and adjoining areas in Kaziranga in West Karbi hills of Assam. In the study the main sightings include Elwes silverline *Spindasis elwesi*, Blue royal *Ancema carmentalis*, Plain plushblue *Flos apidanus ahamus*, Square-band brownie *Miletis nymphys porus* and Blue gem *Poritia erycinoides elsiei* [21]. A report on butterfly conservation in Bangladesh was presented by Afrin et al., (2015) emphasising that the richness of butterfly species and families is more dependent on the richness of plant species and family in a forest ecosystem. There is a deep association which is strategic and characteristic for the conservation of biodiversity not only for the plant and butterfly species richness but also for the wildlife in the forests. Butterfly diversity and conservation can improve the whole environment for wildlife biodiversity and enrich the lives of people in present as well as in future [1].

Limnitiidae was found to be the most dominant subfamily followed by Satyrinae by Pawar and Deshpande (2016) in district Satara of Maharashtra [52]. An appraisal of butterfly species diversity was made using Kolkata as a model geographical area by Mukherjee et al., (2016).

A synoptic checklist of butterfly diversity was prepared with details of nectar food plants along with flowering time [41]. The most abundant species was *Catopsilia pomona* and the least was *Tarucus plinius*. Gogoi *et al.*, (2016) made two additions to Indian fauna viz., Fawcett's Pierrot (*Niphanda asialis marcia*) and Multi Spotted Oakblue (*Arhopala anthelus*) from Barail Wildlife Sanctuary, Assam, India along with endangered species like Pointed Palmfly (*Elymnias penanga*), Malayan Bushblue (*Arhopala ammonides elira*) and Scarce Jester (*Symbrenthia silana*) [22]. Seven new butterfly species were enlisted by Singh *et al.*, (2016) from district Hoshiarpur of Punjab viz., *Charaxes solon* Fabricius, *Hasora chromus* Cramer, *Kaniska canace* Linnaeus, *Matapa aria* Moore, *Moduz aprocris* Cramer, *Polyura agrarius* Swinhoe and *Surendra quercetorum* Moore with a total of 81 species of different orders [73].

In order to restore the biodiversity and development of management strategies so as to ensure survival of butterflies and ecosystem services derived from them, Shukla and Maini (2016) studied the relative status of butterflies in South-East region of Narmada valley Jabalpur (M.P) [74]. Ayureshwar Wildlife Sanctuary in Baramati tehsil of district Pune of India is a habitat to a rich of butterflies diversity mainly due to the micro-habitats present within the eco-forest as revealed by Khyade and Jagtap (2016), indicating 96 species of butterflies [28]. Kumar and Sharma (2016) recorded diversity and bio-ecological assets of the North-West Himalayan butterflies in Nalagarh valley of Himachal Pradesh and revealed that seasonal fluctuation refers to the requirements of conservation and monitoring for climate change [36]. A detailed taxonomic review on the butterfly diversity and families which was a preliminary study dealing with different stages and families of butterflies, place of order Lepidoptera and short notes on the higher classification of the later was given by Kumari *et al.*, (2016) [37].

Singh *et al.*, (2017) recorded a total of 20 species of butterflies from different areas of district Ludhiana which is one of the most polluted city of Punjab due to industrialization. All 20 species were belonged to 17 genera. Family Nymphalidae was most outnumbered and dominant and Lycaenidae found to be rare one [76]. In order to understand the wing venations in butterflies, a detailed study was done by Patil and Magdum (2017), in all three families, namely Papilionidae, Nymphalidae and Pieridae from Dang district of Gujarat in India, which is identified as a hot spot for megadiversity of butterflies. Wings of all the three families showed considerable variations in shapes and vein patterns reflecting their specific nature [51]. Samanta *et al.*, (2017) documented 54 species of

butterflies through photographs belonging to 39 genera of 6 families from Baghmundi area of Purulia district of West Bengal [67]. Priya *et al.*, (2017) investigated 79 butterfly species belonging to 5 families from Adichanallor village of Kollam district of Kerala. Nymphalidae was found to be a dominant family and maximum diversity was seen in November [54]. Basavarajappa *et al.*, (2018) recorded the butterfly diversity at six forest ranges in Nagarhole national park, Karnatka. Authors found the 138 species of butterflies from 94 genera pertaining to five families viz., Hesperidae, Lycaenidae, Nymphalidae, papilionidae and Pieridae [6]. Besides this, an attempt was also made to record the composition as 113 butterfly species were common at varied forest rage and 25 species were restricted to the specific areas of forests. Gandhi Park, Shivamogga of Karnatka having tropically wet and dry climate, Sayaswara (2018) sampled the butterfly fauna in the post monsoon period and recorded 36 species of butterflies from 27 genera concerning to five families. He found that family Nymphalidae was most dominating followed by Pailionidae and pieridae with 16 and 8 species each respectively. Family Lycaenidae was represented by three species while Hesperidae only by one species [75].

## CONCLUSION

The occurrence of insects in general and butterflies in particular are very significant for pollinating different plant/crop varieties. So assays of butterfly composition should be updated sporadically to fill up any voids in the process of conservation/preservation of butterfly fauna. Infact, a remarkable work has been done in the protected areas but still attempts should be made to start monitoring the National park and sanctuaries where it is not initiated yet.

## CONFLICT OF INTERESTS

The authors have not any conflict of interest.

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