

Krushnamegh J Kunte
Centre for Ecological Sciences
Indian Institute of Science
Bangalore 560 012, India.

Krushnamegh Kunte received his M.Sc. in Wildlife Sciences, in July 1999 from the Wildlife Institute of India, Dehra Dun. His research interests are ecology and evolutionary biology of butterflies, and sexual selection in frogs.

Previous parts of the series appeared in

1. An Invitation, *Resonance*, Vol.4, No.8, p.80, 1999.
2. Flowering Plants, *Resonance*, Vol.4, No.10, p.69, 1999.
3. Genus Ficus, *Resonance*, Vol.4, No.12, p.90, 1999.
4. Diseases: Paddy, *Resonance*, Vol.5, No.1, p.93, 2000.

Lepidoptera: This is an order of Class Insecta (the insects) to which the butterflies and the moths belong. It is characterised by presence of scales that cover the body.

Project Lifescape 5. Butterfly Accounts

Project Lifescape aims to make available user-friendly accounts of a set of about 1500 species and higher taxonomic categories of target taxa to nurture the study of living organisms as a part of teaching biology and other related subjects in India. These accounts would be in a standardised format to promote studies whose results would be comparable and could eventually feed into a nationwide programme of monitoring a range of taxa of conservation and economic significance. This part includes three such accounts – one family and two species. It also includes the standardised format for butterflies. These accounts are expected to be as non-technical as possible, the technical terms unavoidably used would be in bold letters and all of these are explained in a glossary with or without illustrations. Some examples of such terms are provided in the margins.

The butterfly fauna of India is rich with over 1500 species, which is close to 9% of the total butterfly species in the world. These species belong to 5 families and about 320 genera. The families are:

1. Papilionidae: The swallowtails
2. Pieridae: The whites and yellows
3. Nymphalidae: The brush-footed butterflies
4. Lycaenidae: The blues
5. Hesperidae: The skippers

Further information on diversity within these families will be given in the next part. This part of the article concentrates on the whites and yellows.

Family Pieridae: The whites and yellows (Order Lepidoptera, Class Insecta)

Family Pieridae is not a big family. Its members are not extraordinarily beautiful or attractive. However, they are among the most familiar butterflies. In fact, the English name for

'butterfly' (butter + fly), is derived from members of this family: the sulphurs and the brimstones, due to their pale yellow ('butter'-like) wing colour. All of us know these butterflies right from our childhood days when we ran after the 'grass yellows': small bright-yellow butterflies that flutter close to the ground, and the emigrants: large whitish-yellow butterflies, to catch them and keep them as prized specimens. In general, the pierids have white or yellow wings with black, orange and red markings. Therefore they are called 'whites and yellows'.

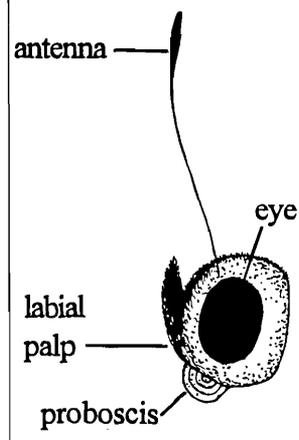
This family is among the smaller families of butterflies in India. There are 109 species so far recorded in India, which is only about 7.26% of the entire Indian butterfly fauna; 32 species represent this family in southern India.

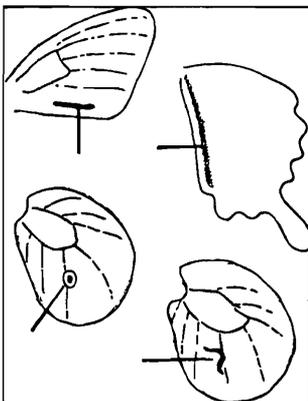
The whites and yellows have slightly broad fore wings but the wing apex may be narrow and pointed. Hind wings are always round and they never bear tails. The inner margin of the hind wings forms a channel around the abdomen which covers it completely and hence the abdomen is never visible in the field when the butterfly sits with closed wings. When they settle, wings are always kept closed on the back. At rest, the fore wings are almost completely drawn inside the hind wings in case of psyche (*Leptosia nina*), orange tips and arabs (*Colotis* and *Ixias spp.*). They bask in the sun but most of them do so with their wings closed, unlike most other butterflies.

All the six legs are perfect. The **labial palp** is short and close to the face; not very large or projecting as in families Lycaenidae and Nymphalidae, nor as hairy as in family Hesperidae. The compound eyes are pale yellow, faint bluish or greyish and have large black spots on them. The thorax is of a medium size and the abdomen is usually long and narrow; except in fast-fliers such as the great orange tip (*Hebomoia glaucippe*), which have a robust thorax and a relatively shorter abdomen.

Males generally have distinct secondary sexual characters, such as the 'brands' on the wings, which are easily visible if the specimen is held in hand. The males are brighter, their markings,

Labial palpi (or Palpi): Hairy processes at the base of the head in adult butterflies; a sense organ that also protects the proboscis. These curve up and usually protrude in between the eyes, and are prominent in the blues and the brush-footed butterflies.





Brand (Sexual brand): A patch of specialised scales, usually raised above the surface but of various shapes and sizes, on the wings of males of certain butterflies, for example, the tigers and bushbrowns. The brand performs function in attracting female butterflies by the scent it produces. The brands may be present on the upper or underside of the wings, usually near the wing margins.

such as stripes and spots, narrower. The females are dull, heavily marked and are generally larger in size as compared to the males.

The pierids are found in all types of habitats ranging from semi-desertish arid grasslands, with short and sparse vegetation to the thick wet-evergreen forests of the 'Southern Western Ghats'. However, in the evergreen montane forests they prefer openings and edges where sunlight is plentiful. The arabs (genus *Colotis*) are inhabitants of dry open areas, blackveins (*Aporia*) and cabbage whites (*Pieris*) abound on the slopes of the Himalayas (one species in southern India). Emigrants (*Catopsilia*) and grass yellows (*Eurema*) are found in gardens, scrub-lands and deciduous forests, lesser gull (*Cepora nadina*), albatrosses and puffins (*Appias*) dwell in semi-evergreen and evergreen forests.

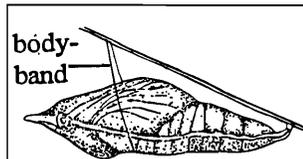
Despite this wide range of habitats used, most of them fly close to the ground at the level of herbs and shrubs, where their choicest food-nectar – is most abundant. The exceptions are jezebels (*Delias*) and albatrosses, which also fly among the treetops in the tallest forests. The method of flight varies greatly. Psyche and grass yellows flutter weakly, orange tips (*Ixias*) and gulls have moderate speed but albatrosses, great orange tips and emigrants are swift and dashing. The males inhabit more open areas, are fond of the sunshine and are very active. They sometimes assemble on wet soil patches in massive numbers, especially during summer. The females keep more to the shade, close to the larval host plants and are less active. All the common species sleep on the upper side of herbs and low, pendant branches of shrubs.

The capers (family Capparidaceae) and the legumes support larval populations of most of the South Indian species. The jezebel caterpillars feed on the relatives of mistletoes; Loranthaceae, and cabbage whites on cruciferous plants. The jezebels are unpalatable and therefore are safe from the predators. Some pierids and nymphalids have learned to fool their predators by mimicking the jezebels. The female of the common wanderer

(*Pareronia valeria*) mimics well blue tiger (*Tirumala limniace*) and glassy tiger (*Parantica aglea*).

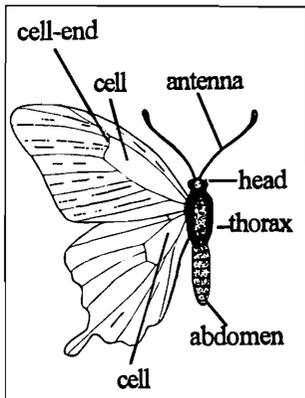
The pierids generally have distinct seasonal forms, which vary in coloration and markings. The dry season forms are paler, and their markings are obscure. The wet season forms are bright and well marked and generally larger in size. Grass yellows, such as the common grass yellow (*Eurema hecabe*), have a brown blot on the underside of the fore wing in their **dry season form**. The spotless grass yellow (*Eurema laeta*) has brown, tiny dots and a line on its underside in the dry season.

The eggs of pierids are spindle-shaped, tall and ribbed. They may be finely ornamented. They are white or pale yellow. Infertile eggs turn reddish in colour. The eggs are laid singly on the fresh buds, but the pioneer (*Anaphaeis aurota*) and common jezebel lay them in large batches, of up to 200 and 20 eggs, respectively. The caterpillars are cylindrical and of uniform girth from the head to the abdominal tip. Their body and head are covered with round, pointed tubercles, which usually bear white hair. The caterpillars are dark leafy-green with little or no markings. They depend on camouflage and therefore rest during the day to evade detection. They always sit on upper side of the leaves or on twigs when they are full-grown. Caterpillars of all species give out a green fluid from the mouth when disturbed and some species, e.g. the emigrants, even jump off the leaf. This fluid is unpleasant to the senses and may act as an insect repellent. Some species are heavily parasitised by Ichneumon and chalcid wasps, against which the caterpillars are completely helpless. Before pupation, the caterpillars wander from the host plant in search of a safe place and pupate in dense foliage or close to the ground where they are well concealed. Pupae hang on the underside of the leaves or slanting twigs and are supported by a silken **body-band**. The caterpillars of 'gull' and 'cabbage white' pupate on the upper side of the leaves. The pupae may be angular and laterally flat, or roundish, with flat backs, but they always have a pointed or hooked projection before the head. A few projections may be present on the thorax. The pupa may



Body-band: A strand of silk woven by a caterpillar before pupation. Both ends of the body-band are attached to the substratum, and this embraces the pupa at the thorax. The body-band is an additional support to the pupa and present in all the butterflies except in the brush-footed butterflies and some species of the blues.

Cell-end: The end of the cell at a cross-vein that joins two longer veins starting from base of the wings that make up the cell. Identification of some species of butterflies, for example grass yellows, is based on markings in the cell and at the cell-end.



have a loose **body-band**, or is tightly embraced. In the former case, it can move violently if touched, but in the latter, it can barely move.

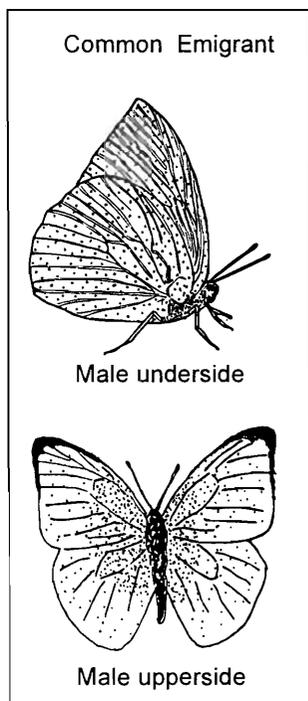
Sometimes species such as 'emigrants', 'cabbage whites' and 'common albatross' (*Appias albina*) reproduce synchronously. Their populations explode, the caterpillars devour all the available host plants, and then the adults developed from these caterpillars are forced to migrate to other areas in search of larval host plants for their larvae. This leads to mass migrations. Hordes of these butterflies flying as a single cloud covering an area of a few square kilometres may contain millions of individuals.

Common Emigrant.

Scientific Name: Old: *Catopsilia pomona* Fabricius and *Catopsilia crocale* Cramer.

New: *Catopsilia pomona* Fabricius (now the two species are merged).

Field Characters: Wingspan: 55-80 mm. This is probably the most variable of all butterfly species in India as far as the coloration and the size of the adult butterflies are concerned. The colour of the wings ranges from white with only basal areas of the wings yellow of varying shades, to completely plain lemon yellow (hence another name 'lemon yellow'). In the forested regions, especially in summer, the specimens are much larger and brighter sulphur-yellow with brown blotches. In spite of all these variations, some characters are observed constantly in all the specimens. These characters are as follows: On the upper side, bases of all the four wings are yellow. **Front margin** and apex of the fore wing are narrowly black in the male and broader in the female. In the females, the dark margin is generally joined to a spot at the **cell-end**. Apart from the blotches or the spots, if they are present, the underside is unmarked.



Similar Species: The mottled emigrant (*Catopsilia pyranthe* Linnaeus) is slightly smaller. The male is greenish while the female is yellow and both show fine, dark grey or brownish

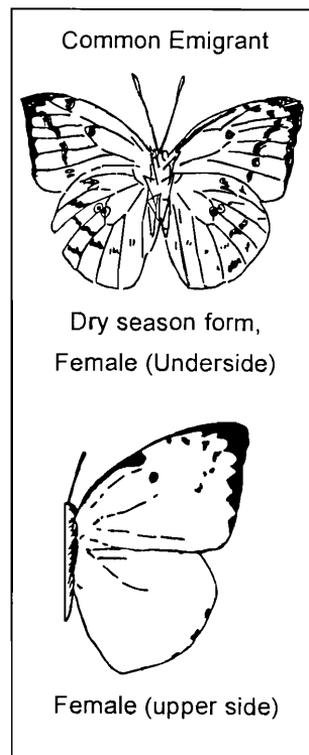
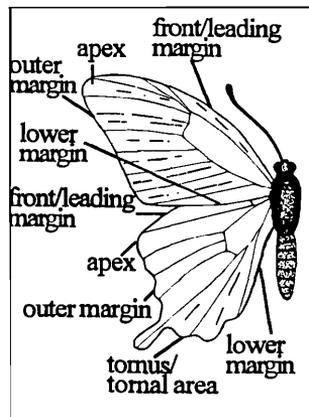
striations on the underside of the wings. It has less colour and size variations.

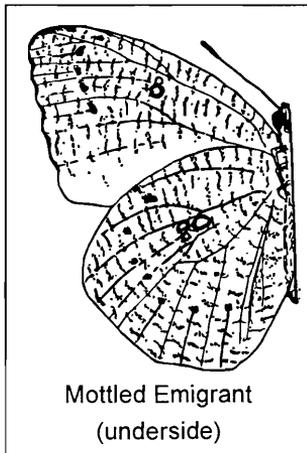
Earlier, it was believed that there were four species of emigrants in India: common emigrant (*Catopsilia pomona* Fabricius), lemon emigrant (*Catopsilia crocale* Cramer), African emigrant (*Catopsilia florella* Fabricius) and mottled emigrant (*Catopsilia pyranthe* Linnaeus). However, breeding of these species revealed that the common and the lemon emigrants were one and the same species, and so were the mottled and African emigrants.

Status, Distribution and Habitat: This butterfly is seen in all the habitats, except the wet evergreen forests and high altitudes. Climatic, geographic and vegetational variations apparently have little effect on its distribution, since it adjusts to local conditions easily. However, it avoids very hot and dry areas, where the mottled emigrant is much more common. Its global distribution covers the entire south and southeast Asia and Australia.

It is commonly found in all habitats where it occurs and in all the seasons, too. However, it is more abundant in monsoon and post-monsoon months, progressively becoming less common in winter and early summer; again getting numerous just before onset of the monsoon. In the pre-monsoon months, most of its larval host plants produce fresh shoots, and that boosts the larval as well as adult butterfly populations.

Habits: This butterfly is most active in sunny weather. In the mornings it can be seen basking with its wings closed over the back and tilted a bit to face the sun at about 90°. Once it is on the move, it is amongst the liveliest of butterflies. It flies in a powerful manner with erratic ups and downs and unpredictable jerks. It is an efficient disperser in new areas and in places where annual fires are common, this is one of the first butterflies to frequent the burnt areas. It wanders in search of flowers, the omnipresent *Lantana* being the most sought-after species. There on the flowers it is so engaged in sipping the nectar that one can often touch it and it rarely responds to a human observer standing close by. In open areas, it prefers the flowers of herbs,





Mottled Emigrant
(underside)

especially those of 'coat button' (*Tridax procumbens*).

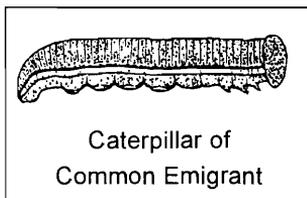
It starts retiring from late afternoon. Then it can be seen sitting openly on the upper side of leaves, on branches of shrubs and small trees, or sometimes on grass, where it sleeps. At rest the wings are closed. In the monsoon, just before it starts raining, as the black clouds gather over the head and darken the sky, this is among the first butterflies to retire. During this time, however, slightly secluded branches are selected for resting.

In the dry months, the common emigrant crowds on the forest water holes, sometimes in flocks of hundreds and thousands, to quench its thirst. These mud-puddling assemblages are excellent art galleries of varied colour forms and markings exhibited by the species. The flock members at these sites display habits similar to the common albatross, as described earlier.

During its peak season, predators of the adults – spiders, birds and to some extent lizards, take a heavy toll on the flourishing population. The web-spinning spiders and the bee-eaters are notorious among them, from whom there is rarely an escape.

Reproduction: When a male approaches, the willing female sits on the ground or a leaf, its wings spread flat and tip of the abdomen turned upwards. The male grabs the female's abdominal tip with its claspers and takes off. The female remains suspended upside down. The male, which is usually smaller in size than the female, carries the female during mating. Mating lasts for a few hours.

Fresh leaves of various species of *Cassia* are chosen by the female to lay its eggs. They are laid invariably on the underside, at the margin of the leaves. Each egg is bottle-shaped and ribbed vertically and white in colour. The young caterpillar is yellowish green. Later it turns leafy green and develops a black longitudinal line, which is paired with a white one, on either side of the body. The head is green in colour. The caterpillar of the mottled emigrant has a much broader black band on the sides, leaving only a narrow green band on the back. The surface of the cater-



Caterpillar of
Common Emigrant

pillar is tubercled, each tubercle bearing a minute hair, with a tiny droplet at its tip. If disturbed, the caterpillar exudes green fluid from its mouth. The fluid has an unpleasant odour and may repel some insects. However, it does not deter the parasitoids.

Pupation takes place among dense foliage and close to the ground. The pupa is held by a silken **body-band**. It is bent on the back of the thorax and has an elongated and pointed projection in front of the head (it is shorter in case of the mottled emigrant).

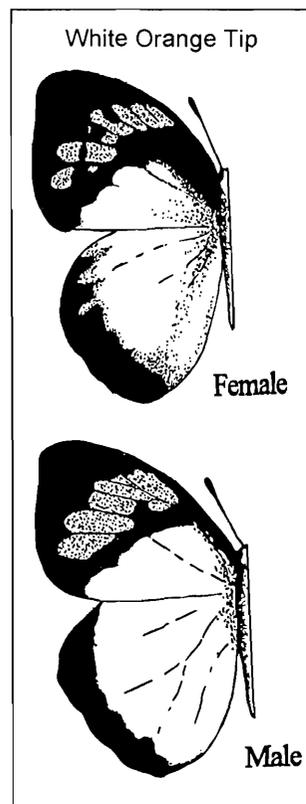
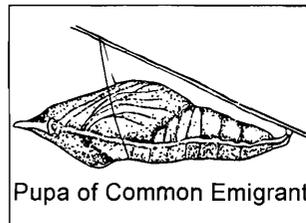
There is an intense predation pressure on larval population by a variety of predators. Among the vertebrate predators, bulbuls, warblers and even sparrows are significant. However, invertebrates, especially the insects, pose a much more serious threat. Many kinds of wasps such as mason wasps, digger wasps, paper wasps, etc. store the emigrant caterpillars in their nests to feed their larvae. Another common predator of lepidopteran larvae is the lacewing larva (order Neuroptera), whose effect on caterpillars has probably been underestimated so far. On many larval host plants the lacewing larvae, disguised as tiny worthless heaps of debris, can be found openly roaming in search of juicy meals of butterfly caterpillars. They have been seen feeding on the emigrant, common Indian crow and common gull caterpillars.
Length of Caterpillar: 41 mm; **Pupa:** 28 mm.

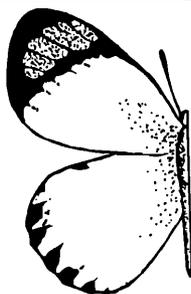
Larval Host Plants: The caterpillars feed on different species of *Cassia*: *C. fistula*, *C. siamea*, *C. tora* (Caesalpiniaceae), the first two being the most frequently used plants. *Cassia fistula* is a small tree common in the deciduous forests, and is also extensively planted along with the exotic *C. siamea* in human habitations as a garden and as an avenue plant. Other recorded plants include *Butea frondosa* and *Bauhinia racemosa* (Fabaceae and Caesalpiniaceae, respectively), which are again small trees in the deciduous forests.

White Orange Tip

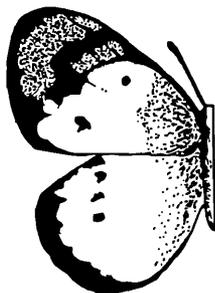
Scientific Name: *Ixias marianne* Cramer

Field Characters: Wingspan: 50-55 mm. The white orange tip

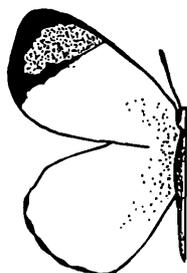




Small or Little Orange Tip



Crimson Tip



Plain Orange tip



Great Orange Tip

is white on the upper side with broad black borders to the wings, and orange fore wing apex, this character confers on it an unmistakable identity and the name. The female has a row of black spots in the orange wing tip. The underside is bright yellow with a few rusty brown spots on the hind wings.

Similar Species: The yellow orange tip (*Ixias pyrene* Linnaeus) has yellow wings, instead of white. The small or little orange tip (*Colotis etrida* Boisduval) and plain orange tip (*Colotis eucharis* Fabricius) are much smaller in size (wingspan: 25-45 mm.) and their undersides are white instead of yellow. In case of the plain orange tip, the orange wing tip is not completely enclosed by the black border. The crimson tip (*Colotis danae* Fabricius) is smaller (wingspan: 40-50 mm.) and has bright, gaudy crimson wing tips. The great orange tip (*Hebomoia glaucippe* Linnaeus) is largest of the orange tips (wingspan: 80-100 mm.), and among the strongest and fastest fliers among Indian butterflies.

Status, Distribution and Habitat: It is restricted to Sri Lanka and peninsular India and distributed throughout the plains and lowlands of southern and peninsular India. It is common in dry deciduous forests, scrub and fallow lands and found throughout the year. However, it is more common in monsoon and post-monsoon periods and considerably rare in summer.

Habits: Due to its coloration, the white orange tip is the most striking of the scrubland butterflies. It flies among bushes and small trees, usually within three metres from the ground, where it feeds on nectar from flowers. Its flight is rapid and fluttering, and the wing-beats are continuous. However, the flight is erratic in its course.

In summer, the males gather on damp patches and feed in the company of emigrants, grass yellows, lime, etc. While feeding from the wet soil, or when resting, the fore wings are drawn inside the hind wings.

The females are observed less often than the males. They keep close to the larval host plants, and probably remain passive in



searching for mates. Similar to the males, they bask in the sun with their wings held 3/4th open.

It participates in migratory flocks, but in very small numbers. It does not usually form migratory flocks of its own.

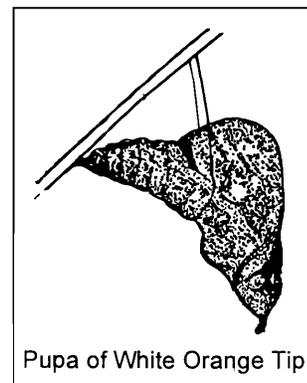
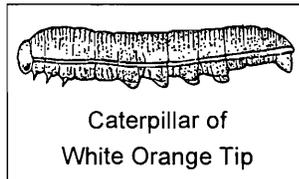
Reproduction: The eggs are laid in batches of 2 to 4, on very fresh shoots of the plant and usually within two metres off the ground. The egg is yellow and bottle-shaped. Infertile eggs turn reddish. The caterpillar hatches after 3-4 days. It is slender and cylindrical with a rounded and plain green head. Each of its body segments has transverse skin folds and therefore it looks wrinkled. It is green in colour and has two closely placed narrow red lines near the spiracles, which run from the second to the last segment. It stays always on the tender shoots, preferably on the undersides of leaves and keeps camouflaged. It eats young leaves from the sides and near the tips, leaving basal and central portions of the leaves intact.

The pupa is formed on the underside of a leaf. It is supported by a very loose **body-band**. If disturbed, it jerks sideways with violent movements. It is angular and the wing cases are parabolic in outline. A short, upwardly curved projection is present in front of the head. Colour of the pupa is either green or brown, depending on the surrounding objects to aid camouflage. The pupa is without any prominent markings.

Length of Caterpillar: 29 mm; pupa: 19 mm.

Larval Host Plants: The caterpillars feed on woody or tree species of capers (family Capparaceae). The recorded host species include *Capparis decidua*, *Capparis divaricata*, *Capparis grandis*, and *Capparis sepiaria*; of those, *Capparis grandis* is preferred whenever available.

Please note that the naturalists with first-hand experience of the butterflies in the field and familiarity with the early stages of the species are encouraged to write accounts of butterflies. The accounts should include previously published information but also new ones that are not given in earlier books. Description of



Format for Writing Butterfly Species Accounts

The butterfly accounts should include the following sections, in the same order.

1. **Common English Name(s)** of the butterfly.
2. **Scientific Name:** Old (name used in Wynter-Blyth 1957) and New (current scientific name), with authorities.
3. **Field Characters:** Wingspan in millimeters. A brief description of the physical characters that can easily be observed in the field, and are most important in identifying the species. Also distinctive characters of male and female, and seasonal forms (dry and wet season forms; if different). Any peculiar habit that may be unique to the species.
4. **Similar Species:** Description of similar-looking species, including mimics/models of the species and/or taxonomically distant but morphologically similar butterflies. Illustrations of similar species are welcome.
5. **Status, Distribution and Habitat:** This section should give range and preference of macro-habitat (vegetation type) and micro-habitat (broad streams in the deciduous forests, forest paths in the evergreen forests, secondary grasslands, etc.), altitude at which the species is found (if this is specific or may help in confirmation of identity of the species), frequency of occurrence in different habitats (abundant, common, rare etc.), seasonal variations in abundance, distribution in peninsular India, and global distribution of the species.
6. **Habits:** This section may contain as much and as diverse information as the writer is capable of writing, but should include at least the following: daily activity pattern, flight pattern, migratory habits, adult feeding resources and behaviour, basking behaviour, resting posture, and mud-puddling behaviour or its absence.
7. **Reproduction:** Courtship, mating and egg-laying behaviour, as detailed a description as possible of egg, caterpillar and pupa, habits of caterpillar, position of the pupa and emergence behaviour. Good illustrations of the early stages will make verbose descriptions unnecessary, and also help the readers.
8. **Lengths of the caterpillar (full-grown) and pupa (in millimeters).**
9. **Larval host plants:** List of species of plants on which the caterpillars feed, and families in which the plant species occur, both arranged alphabetically (refer to a species account). A separate alphabetical list of host plants giving their synonyms, families, growth forms and habitats is most welcome.
10. **Economic Importance:** Whether the species is economically important as a pest on crop or timber plants, or in butterfly trade.
11. **Suggestions for Student Projects:** Any behaviour of the species or related phenomena that merit a separate, careful study may be suggested for this section, giving key references and hints on how to carry out the study.
12. **Miscellaneous:** Popular beliefs, folklore and myths about the species; derivation of common and scientific names, if the name is interesting; conservation status and listing in endangered species lists.
13. **Name(s) and address(es) of the contributor(s):** The writer(s) and illustrator(s).



morphological characters and habits of early stages of the species should accompany *all* the butterfly accounts. Whenever available, the accounts should also be supplemented with good, clear, larger-than-life line drawings of the caterpillars, pupae and adults (male and female, and upper and undersides, if they look different). Drawings of adults should carry a half or one-line description of the butterfly (e.g. a yellow butterfly with black stripes and orange spots).

Illustrations by:
Sanjeeva Nayaka,
Sapna Rawat,
and Krushnamegh Kunte

Please contact the editor of Lifescape before writing an account. The account you plan to write may have already been written or account on some other species may be more urgently needed. All such information will be available with the editor. Also give a list of illustrations that you plan to draw.

Suggested Reading

- [1] S P Courtney, *The ecology of Pierid Butterflies: Dynamics and Interactions*, *Advances Ecol. Res.*, 15:51-131, 1986.
- [2] W H Evans, *The Identification of Indian Butterflies*. 2nd ed. (Chennai (Madras): Bombay Natural History Society), 454 pages, with 32 black-and-white plates, 1932.
- [3] D G Sevastopulo, *The food-plants of Indian Rhopalocera*, *J. Bombay Nat. Hist. Soc.*, 70(1):156-183, 1973.
- [4] A M Shapiro, *The pierid red-egg syndrome*, *Amer. Natur.*, 117:276-294, 1981.
- [5] R I Vane-Wright and P R Ackery, (eds.), *The Biology of Butterflies*, Symposium of the Royal Entomological Society of London, No. 11. Academic Press. 429 pages, 1984.
- [6] M A Wynter-Blyth, *Butterflies of the Indian Region*, 1st ed., (Mumbai: Bombay Natural History Society), 523 pages, 1957.

Further enquiries and offers of help relating to Project Lifescape may be directed to Madhav Gadgil
Centre for Ecological Sciences
Indian Institute of Science
Bangalore 560 012, India.
Email :madhav@ces.iisc.ernet.in



But the years of anxious searching in the dark, with their intense longing, their alternations of confidence and exhaustion and the final emergence into light – only those who have experienced it can understand that.

Albert Einstein