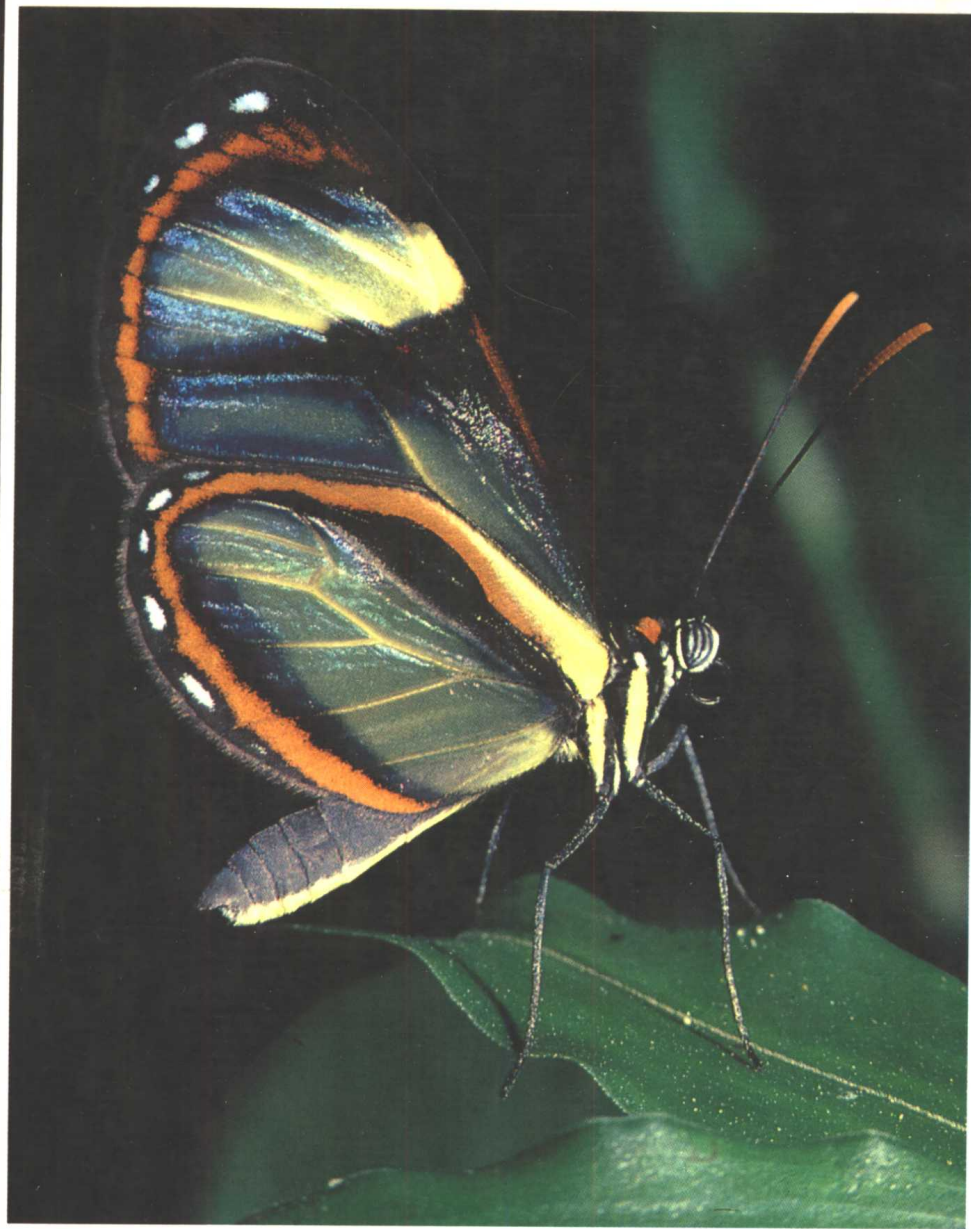


# BUTTERFLIES OF THE WORLD



Rod & Ken Preston-Mafham

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ON FILE



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# Preface

When we were asked to write the present volume, our second in the 'of the World' series, our first concern was how to write an original book on butterflies. Our thoughts inevitably turned to bookshop shelves already creaking under the weight of butterfly books, including virtual encyclopedias of voluminous information. At first sight it appeared that we would find it difficult to present anything original in any work which we could possibly contemplate writing. However, after due consideration we saw that the wisest approach was to present a certain amount of subject matter based on well-known and sound research, encompassing the kind of background material necessary in any serious book on the biology of butterflies, seasoned with a rich sprinkling of unique anecdotal material gleaned mainly by Ken on his wide-ranging travels around the world. In a work of this size, intended to give an overall insight into the subject, it is sadly inevitable that an enormous amount of relevant information has to be omitted, simply on the grounds of space, and we have therefore been forced to be very selective in choosing the material for presentation. This has meant leaving out, or considering only briefly, some well-researched scientific observations. Instead, we have included many personal observations which, although not as scientifically valid as properly conducted research, nevertheless might add something to our growing body of knowledge on butterfly behaviour, as well as communicating in some small measure the excitement of observing butterflies in the tropics. Many readers will be limited to first-hand experience of the butterflies of Europe or North America, so we felt justified in biasing the text towards tropical butterflies, especially when dealing with personal anecdotal observations.

Mindful of the fact that many butterfly enthusiasts are also interested in other forms of insect life and may already own a number of books thereon, we have chosen the illustrations with some care in order to ensure that none has previously appeared in print. In our picture library at *Premaphotos Wildlife* we currently hold 2,300 colour slides of butterflies covering 405 species, mostly depicted in the adult stage. Every one of these photographs, including the pictures in the present work, was taken by the authors without resorting to the use of captured or bred specimens or any kind of human interference designed to obtain a picture, thus following our broad philosophy that wildlife photography should portray animals living wild and free in their natural environment. The



fact that we have managed to amass such a large number of photographs from around the world, often under difficult conditions, should be a considerable stimulus to any readers who have considered photographing butterflies in the field but have been disillusioned by hearing or reading about the difficulties intrinsic in such an exercise. You should also bear in mind that our coverage of butterflies has been compiled as part of a much greater coverage of the world's plant and animal life, a time-consuming occupation which has often left only a small percentage of our effort to be dedicated to butterfly photography. Anyone willing to go out into the field and restrict their attentions solely to butterflies would therefore have an excellent chance of achieving a great degree of success.

In writing this book, we have employed two different approaches in that the early chapters, which contain basic, background information on butterflies as a group, have been written in the third person; whereas much of the rest of the book has been written in the first person, mainly by Ken. We would also like to take the opportunity to justify what might appear to be the over-frequent use in the text of 'possibly', 'probably', 'often' and other words implying a measure of uncertainty. The more that we learn about butterflies the more we realise just how little we understand of their daily lives, despite the long popularity of collecting them. There is much disagreement among different groups of researchers concerning the reasons for certain types of behaviour or physiological adaptations, and even more over the interpretation of experimental data. This work is not aimed at the expert lepidopterist and we therefore make no apology for the occasional anthropomorphism where it is used to enlighten the uninitiated reader who may find scientific jargon difficult to comprehend.

In travelling around the world in pursuit of our wildlife subjects we have been fortunate to enjoy the assistance of numerous, generous people to whom we offer our grateful thanks. In particular we must mention Dr Gerardo Lamas, Peru; Dr Vitor Becker, Brazil; Adriana Hoffmann, Chile; Prof. Gilberto Rios, Cecilia de Blohm, Venezuela; Dr Mario Boza, Costa Rica; Dr Angus McCrae, Kenya and England; Ken Proud, Java; Ken Scriven, WWF Malaysia; Dr Roger Kitching, Australia; Dr John Ismay, New Guinea; Dr Amnon Freidberg, Israel; Dr Thomas Emmell, USA, to whom we offer special thanks. We also thank Rod's wife Jean, our computer expert, who taught us the ins and outs of the word-processor on which the manuscript was prepared.

Rod and Ken Preston-Mafham  
King's Coughton, 1987

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*Chapter 1*

# Introduction to the Butterflies

Butterflies are members of the insect order Lepidoptera, the literal meaning of which is 'scale-winged', and included with them are the moths. It is the wing scales which give the butterflies their beautiful colours and patterns and make them one of the most familiar of all insect groups. The exact origins and age of the Lepidoptera are not precisely known, since the fossilisation of such delicate creatures has occurred only rarely, but fossils of some primitive moths in amber have been dated as originating in the Lower Cretaceous period between 100 and 130 million years ago. This fits in quite well with the estimated age of the flowering plants alongside which it is assumed that the Lepidoptera have evolved, since all but a few of them depend upon flowers as a source of food as adults. The closest relatives of the butterflies and moths are believed to be the caddis flies of the order Trichoptera, both these and the Lepidoptera having probably evolved from a common ancestor. The exact number of members of the Lepidoptera in existence is not precisely known, since new species are still being discovered and described. The likely number is in the region of 160,000 of which about 20,000 are butterflies and the remainder moths. This makes them one of the most diverse groups of living organisms and within the insects only the beetles exceed them in the number of species to be found today.

Like the beetles, the butterflies and moths belong to a sub-division of the insects called the Endopterygota, in which there are four distinct phases in the life-cycle, namely egg, larva, pupa and adult. The more primitive sub-division, the Exopterygota, includes insects such as the locusts, in which the egg is followed by a series of instars, each of which is a wingless miniature of the adult, the final instar moulting into the adult proper. The apparent advantage of the endopterygote type of life-cycle is that the young utilise a totally different food source from that of the adults and as a result there is no competition between them. The disadvantage is that the soft-bodied butterfly caterpillar is very vulnerable to both parasitisation and predation with the result that some very interesting adaptations, discussed in later chapters, have evolved to cope with these problems.

The separation of the Lepidoptera into the butterflies and the moths is a somewhat artificial one, since although most butterflies are recognisable clearly as such and most moths similarly so, there are some of each

which do not fit so neatly into this tidy pattern. As an example, one usually thinks of butterflies as being day-flying with clubbed antennae and moths as nocturnal with feathery antennae, but where do the day-flying moths with clubbed antennae fit into this simple classification? Despite these problems it is possible to construct a reasonably acceptable system of classification for the Lepidoptera, separating the butterflies and moths, and it is the characteristics of the major butterfly families which will be considered shortly. Before doing so, however, it might be useful if the workings of the biological classification system are looked at first.

Although many of the butterfly groups have common names, e.g. the Papilionidae are the swallowtails and the Lycaenidae are usually referred to as the blues (despite the fact that large numbers of them are not blue), relatively few of the twenty or so thousand butterflies in the world have a common name. Those which do are either easily recognisable, like the swallowtail in the UK, or there are so few species in a particular area that each is instantly recognisable, this being basically true for the British Isles. As a consequence, although some species might be referred to in the text by their common names, others can have only their species name.

The structured form of classification used worldwide is that developed by the Swede Linnaeus during the eighteenth century. In this system, the living world is divided up into a number of sections, each containing organisms with a fairly close relationship to each other, the final division being that of the species. A species is defined as a population of individuals which are very similar to each other and can breed successfully amongst themselves to produce fertile offspring. Taking the example of one of the world's largest butterflies, the giant birdwing butterfly, it is classified as a member of the animal kingdom in the following manner:

|               |                     |
|---------------|---------------------|
| KINGDOM       | Animalia            |
| PHYLUM        | Arthropoda          |
| CLASS         | Insecta             |
| ORDER         | Lepidoptera         |
| FAMILY        | Papilionidae        |
| SUB-FAMILY    | Papilioninae        |
| GENUS         | <i>Ornithoptera</i> |
| SPECIFIC NAME | <i>goliath</i>      |

Thus the species name of the birdwing butterfly is *Ornithoptera goliath*, all such names being italicised in the text. Whereas some genera have only one species, others contain many species which share the generic name but have their own specific names, e.g. *Ornithoptera alexandrae*, the world's largest butterfly, shares its generic name with *O. goliath*. The European swallowtail, on the other hand, is not a birdwing and is sufficiently different from them to be included in a separate genus, *Papilio*, to which many of the world's other swallowtails also belong. Bearing these rules



in mind, the names given to the various butterflies discussed in the text should now be more easily understood.

### Classification of the butterflies

Despite the fact that the butterflies are one of the most studied insect groups, there is no real consensus of opinion as to precisely how they should be classified and the system used here is based on that published in 1984 in the proceedings of the Symposium of the Royal Entomological Society of London, No. 11. In this system, the butterflies are sub-divided into two superfamilies, the Hesperioidea and the Papilionoidea, the former containing one family, the HesperIIDae, and the latter four families, the Papilionidae, the Pieridae, the Lycaenidae and the Nymphalidae. Each one of these families contains a number of sub-families, though not all of these will be discussed here.

### Family HesperIIDae

These are usually referred to by the familiar name of 'skippers' on account of their rapid, erratic flight which resembles that of a moth more

*Papilio phorcas*. The green-patch swallowtail is a typical swallowtail butterfly with its 'tailed' hind wings. This specimen spent a few minutes basking in a sunlit patch in Kakamega Forest in western Kenya after a cool night of heavy rain.



than that of a butterfly. The similarity to the moths does not stop here for they tend to have the short, stout body of a moth with a broad head and wide-spaced antennae. Although they usually sit with their wings held closed above their backs in typical butterfly fashion, they also have the ability to hold their wings out to the side in the manner of a moth. They are separated into six sub-families with an estimated 3,500 species worldwide. Many of them, such as the typical European species, are coloured rather drab shades of brown, but some tropical species are very beautifully marked. Hesperiid larvae feed on a wide range of plant families and across the sub-families there is a tendency for them to form shelters, tubes or tunnels using the leaves of their food plants, within which they can lie concealed. Pupation takes place in a cocoon in which pieces of dried-up leaves are incorporated.

The sub-family Megathyminae are somewhat different from the more typical skippers and some taxonomists include them in a family of their own. They are called yucca skippers, since they feed upon yuccas and agaves of the plant family Agavaceae. Unlike the other hesperiids, they have the head narrower than the thorax and the antennae close together. The larvae are interesting in that they are root- and stem-borers of their host plants, a moth-like rather than butterfly-like habit. They eventually pupate in holes mined in the leaves, after first spinning a silken cocoon.

## **Family Papilionidae**

Members of this family are collectively referred to as the swallowtails since the hind-wings of many members of the family have backward extensions resembling the streamers of a swallow's tail. Many members of the family are beautifully marked and coloured and included amongst them are the world's largest butterflies, the bird-wings, most of which come from New Guinea and the surrounding islands. Curiously, the majority of the bird-wings lack the characteristic swallow tail. The larvae of the swallowtails are unique in the possession of a structure, the osmeterium, details of which are discussed in a later chapter. The pupae are usually attached to a plant or other object by means of the cremaster, in a head-up manner supported by a silken girdle. There are three sub-families within the Papilionidae, one of which, the Baroniinae, contains but a single unusual species from Mexico.

### **Sub-family Parnassiinae**

This small group of about 50 species is generally referred to as the apollo. They are not typical of the rest of the family in that they generally lack a swallowtail, the wings being rounded and semi-transparent, and the body is thickly covered in hair. The majority of apollo live at high levels in Europe and Asia and their slow lazy flight also distinguishes them from the typical, fast-flying swallowtails. The saxifrage, typical mountain plants, are included amongst those upon which the larvae feed.

### Sub-family Papilioninae

This group of about 650 species is worldwide in distribution, though with its greatest numbers in the tropical regions of the Old World, and it contains the typical swallowtail butterflies. As a result of the relatively large numbers of species in this group, some lepidopterists recognise three sub-divisions within it, based upon shape and food plant. The true swallowtails are the typical members of the family with a very wide distribution; the kite swallowtails are so named on account of their wing shape, and the poison eaters get their name from the fact that their caterpillars feed upon the poisonous vines of the plant family Aristolochiaceae.

### Family Pieridae

This family includes the well-known whites, the orange tips, the brimstones and the sulphurs, the majority of which are white or yellow in colour, though reds, browns and blues do appear in some members. The family as a whole totals about 1,000 species and their larvae are very uniform in shape and are naked or slightly hairy, lacking the external projections of other families. Most are coloured to match their backgrounds, though some, such as those of the large white, *Pieris brassicae*, are warningly coloured. The pupae adopt a similar coloration and lie head-up attached by the cremaster and the silken girdle. Of the four sub-families, three have sufficient members to be worth a separate mention.

### Sub-family Dismorphiinae

This is a small group of mainly tropical butterflies, there being one European representative, in the wood white, *Leptidea sinapsis*. These butterflies have long narrow wings and slim bodies atypical of the rounded, robust appearance of the other pierids. The food plants are members of the Fabaceae, the pea and bean family, and I have observed the wood white ovipositing upon a birdsfoot trefoil plant in Warwickshire, England.

### Sub-family Pierinae

The Pierinae have a worldwide distribution and contain about two-thirds of the total number of pierid butterflies. They are commonly called the whites and include such species as *Pieris brassicae* and *P. rapae*, both of which are pests of brassica crops in Europe. The African butterflies of the genus *Belenois* are migratory and often collect in extremely large numbers to drink on damp ground. The numbers involved in such a migration may be appreciated by studying the photograph of the South African migratory species *Belenois aurota*. The Pierinae also includes some brightly coloured species such as *Delias nigrina* from Australia but, in-





*Delias nigrina*. The jezabels belonging to the same family as the large and small white butterflies are noted for the striking patterns on the undersides of their wings. This is probably a form of warning coloration and advertises distasteful properties. Photographed in subtropical rain forest in Lake Barrine National Park, Queensland, Australia.

terestingly, members of this particular genus are usually less colourful on the upper surfaces of the wings than on the lower. The food plants of the majority of the larvae within this sub-family are members of the Brassicaceae.

#### Sub-family Coliadinae

Whereas members of the previous sub-family are wholly or partly white, butterflies in this group are predominantly yellow in colour and include the brimstones and the sulphurs. About 250 species are known, the majority of which are tropical, the rest being cosmopolitan in distribution. Like the previous group, some species migrate in very large numbers and the clouded yellow butterfly, *Colias croceus*, often migrates in a



*Thersamonium thersamon.* Lycaenids belonging to the sub-family Lycaeninae are commonly called coppers on account of the normal ground-colour of the upper wing surfaces. This is the lesser fiery copper, photographed in springtime on Israel's Mediterranean coast. The flower belongs to the cosmopolitan daisy family, Asteraceae, popular nectaring plants for butterflies because of the abundant nectar offered in the multiple florets which make up the composite flower-head.

good year from continental Europe to the British Isles. The larvae feed upon plants of the families Asteraceae and Fabaceae.

## **Family Lycaenidae**

The Lycaenids are a large family of some 6,000 or more species, about 40 per cent of all butterflies, with a worldwide distribution, though they exist in their greatest numbers in tropical regions. On the whole they are small, brightly coloured butterflies and include the blues, the hairstreaks and the coppers. Many tropical species possess tails, often in the form of a false head, the role of which will be discussed in a later chapter. The larvae are sometimes described as being slug-like, though in fact they bear a greater resemblance to a legless woodlouse, so that in some texts they are referred to as onisciform. They may be slightly hairy and are most often green or brown in colour and many species live in interesting associations with ants. One researcher, on making a survey of the Lycaenidae, found in fact that about one-third of those butterflies whose life histories had been studied had a larva which associated in some way with ants. The importance of this ant/larva relationship to the lycaenids will be discussed later. Like the larvae the pupae tend to be short and broad and they lack a cremaster so that they either lie free on the ground or remain attached to the host plant by means of a silken girdle. Ten sub-families are recognised according to the system being followed, though only the major ones will be discussed.

### **Sub-family Theclinae**

The Theclinae are often referred to as the hairstreaks on account of the delicate lines on the underside of the wings. They have a worldwide distribution but occur in their greatest variety in South America where some extremely beautiful species are to be found. A number of species have so-called 'false heads' in that the rear wing is marked with an eye-spot at its hindmost extremity and from the wings grow one or more extensions which resemble the antennae and front legs of the butterfly. The larvae feed upon a variety of plant families, including some trees, and a few feed upon plant bugs and ant regurgitations, at least in the later instars.

### **Sub-family Lycaeninae**

Commonly called the coppers, because of the inclusion of a lovely copper colour on the top sides of the wings, they have relatively fewer species than some of the other groups within the Lycaenidae. They are distributed mainly across the temperate regions of the northern hemisphere, though a few exist in other parts of the world. Larvae of this sub-family should be sought on members of the plant family Polygonaceae, the docks and sorrels.