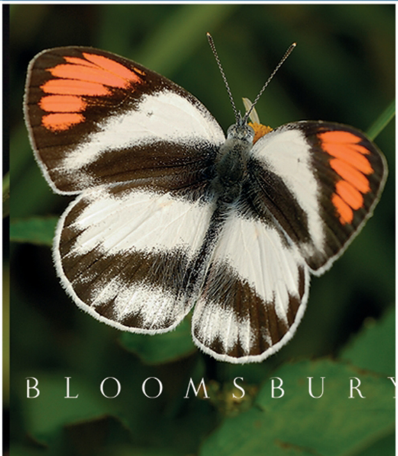
Second Edition

BUTTERFLIES OF SOUTH AFRICA

A FIELD GUIDE

Steve Woodhall



BLOOMSBURY

Field Guide to BUTTERFLIES of South Africa

Steve Woodhall

B L O O M S B U R Y W I L D L I F E
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QUICK COLOUR-CODED REFERENCE TO BUTTERFLY SUBFAMILIES

FAMILY NYMPHALIDAE

DANAINAE – Tigers, Friar, Novice, Layman, Chief. Medium-sized to large butterflies; slow, sailing flight, distasteful. The African Plain Tiger's orange coloration is a deterrent to predators. Black and white or yellow are also warning colours, as shown by other butterflies in the subfamily. **Pages 42–46**

SATYRINAE – Browns, Patrollers, Beauties, Widows, Shadeflies, Ringlets, Three-rings. Small to medium-sized butterflies (e.g. Dark-webbed Ringlet) with a few larger species (Beauties and Widows). Characteristic brown colour, often with red or orange patches. Almost all have eyespots on both the upper- and undersides. **Pages 46–87**

HELICONIINAE – Bitter Acraeas, Telchinias, Polka Dot, Leopards. Bitter Acraeas, Telchinias and the Polka Dot are small to medium-sized with elongated wings and a slow, leisurely flight; distasteful; often with red and yellow or black and white colouring, or transparent wing areas. Leopards are tawny with dark spots. **Pages 88–106**

CHARAXINAE – Charaxes. Medium-sized to very large, robust, agile, high and fast flying. Do not usually feed at flowers, fonder of rotten fruit, tree sap and animal droppings. Many are orange (e.g. Pearl Charaxes); others have blue markings (e.g. Large Blue Charaxes), or are black (e.g. Demon Charaxes). All (except the Forest Queen) have at least one tail on the hind wing. **Pages 106–119**

LIMENITIDINAE – Gliders, Nymphs, Foresters, Guineafowl, False Acraeas, Sailers. Small to quite large, showing characteristic gliding flight with few wingbeats. Gliders have angular wings and often settle with flat open wings. Nymphs and Foresters are brightly coloured and fly low. The Guineafowl has a unique dark grey ground colour with white dots. False Acraeas closely resemble Bitter Acraeas, and Sailers are small black-and-white butterflies. **Pages 120–128**

CYRESTINAE – Map Butterflies. Monotypic in Africa; unmistakable. May fly high or low. **Pages 128–129**

BIBLIDINAE – Tree Nymphs, Jokers, Pipers. Small to medium-sized with characteristic expanded forewing veins at base and a flap-glide flight pattern. Tree Nymphs are usually brown (one is brilliant mauve), Jokers orange, and Pipers black with white or orange bands. **Pages 130–134**

NYMPHALINAE – Diadems, Mothers-of-pearl, Pirate, Commodores, Pansies, Painted Lady, Admirals. Medium-sized to large butterflies; colourful and robust, strongly attracted to flowers, flap-glide flight pattern. Diadems are mimics of distasteful species such as the African Plain Tiger. Mothers-of-pearl are large, pale and iridescent. Pirates, Commodores, Pansies, Painted Lady and Admirals are brightly coloured and conspicuous. **Pages 134–146**

LIBYTHEINAE – Snouts. Monotypic in Africa; unmistakable. Small, brown and orange, with low flight. **Pages 146–147**

FAMILY LYCAENIDAE

PORITIINAE – Zulus, Buffs, Glasswings, Rocksitters. Small, sedentary, slow flying. Zulus and Buffs are flimsy, yellow to buff with dark markings. Glasswings are usually white with dark margins and black spots. Rocksitters have undersides reminiscent of lichen, and bright black-and-orange uppersides. **Pages 148–156**

MILETINAE – Purples, Woolly Legs, Skollies. Small, dull-coloured butterflies with secretive habits. Purples and Woolly Legs are dull mauve-grey, fast flying around trees and shrubs. Skollies are brown, black or buff, found in small colonies, and with a low flight. Pages 156–172

THECLINAE – Sapphires, Hairstreaks, Black-eyes, Proteas, Playboys, Fig-tree Blues. Small to medium-sized butterflies with robust bodies. Sapphires, Hairstreaks and Fig-tree Blues are bright blue, conspicuously tailed, high flying. Black-eyes, Proteas and Playboys are brown or orange, fast and darting. Pages 172–189

APHNAEINAE – High-fliers, Silverlines, Gems, Scarlets, Arrowheads, Coppers, Russets, Opals, Greys. Small to medium-sized butterflies, robust powerful fliers. High-fliers, Silverlines and Gems are brightly patterned, very fast flying. Scarlets, Arrowheads, Coppers, Russets, Opals and Greys are brown or red to copper. Undersides often have bright metallic marks. Pages 190–257

LYCAENINAE – Sorrel Coppers. Small, low-flying butterflies, red to copper with black spots. Page 258

POLYOMMATINAE – Blues, Hearts, Bronzes, Pierrots, Pies, Giant Cupids, Cupids. Small to medium-sized, slim-bodied, often with small hindwing tails, uppersides often bright blue, also brown or pied. Undersides white to grey or brown with darker spots and streaks. Pages 258–333

FAMILY PIERIDAE

PIERINAE – Zebra White, Vagrants, Arabs, Tips, Whites, Dotted Borders. Medium-sized to large, showy butterflies usually in pale colours, attracted to flowers. Vagrants are large, tinged green or blue. Arabs are pink to buff chequered with black. Tips are white with red, orange or purple wing tips. Whites and Dotted Borders are pale with black spots and streaks. Pages 334–364

COLIADINAE – Clouded Yellows, Migrants, Grass Yellows. Small to medium-sized, yellow or green-white with dark borders. Pages 364–369

FAMILY PAPILIONIDAE

PAPILIONINAE – Swallowtails, Ladies, Swordtails. Large to very large with fluttering flight, not always tailed. Swallowtails are larger and more robust than Ladies and Swordtails. Attracted to flowers and mud puddles. Pages 370–378

FAMILY HESPERIIDAE

COELIADINAE – Policemen. Comparatively large, fast-flying, fond of flowers; often with bold markings. Pages 378–382

PYRGINAE – Flats, Elves, Elfins, Skippers, Sandmen, Dancers. Tiny to medium-sized Skippers that often sit with wings held flat. Flight very fast and darting. Skippers are robust and brightly marked. Sandmen are black with white spots. Dancers are tiny and dark; low flying with fast wingbeats. Pages 382–404

HETEROPTERINAE – Sylphs. Small brown Skippers, usually with bright markings; slow, low flight. Pages 404–407

HESPERIINAE – Sylphs, Rangers, Small Foxes, Oranges, Darts, Night-fighters, Hoppers, Swifts, Skippers, Dodgers. Small to medium-sized Skippers, with darting, skipping flight. Sylphs are dull brown, weak flying. Rangers are brown with varying degrees of bright markings. Small Foxes and Oranges are bright orange with dark markings. Darts and Hoppers are brown with large white to cream marks. Night-fighters, Swifts, Skippers and Dodgers are brown with few pale marks; very fast flying. Pages 408–441

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Contents

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Drs Silvia Mecenero, Colin Beale, Res Altwegg and Jonathan Colville produced the distribution maps that I adapted for use in the book.

In the past 15 years, the LepiMAP team – headed by Professor Les Underhill and Dr Megan Loftie-Eaton – has produced a great deal of the new information used in this book. And the fact that it contains over 70% new photographs is due in part to all the LepiMAP photographers who kindly gave permission for the use of their images.

Finally, I'd like to thank my fellow lepidopterists and other nature lovers for all their help and support. Many of you have helped me with photographs, accommodation, transport, counsel, company … all the things that go towards making a book like this.

PREFACE

Field Guide to Butterflies of South Africa was first published in 2005, and proved very popular. Its publication coincided with the rise in use and quality of digital cameras, making it possible to photograph many more butterflies in detail in their natural habitat than killing them in order to take pictures of them at a later stage. The quality and range of images included in the original guide made it a valuable resource for enthusiasts wanting to identify the butterflies they were seeing in the field.

At the same time, public interest in the natural world was stimulated by the development of online virtual museums such as LepiMAP, an online atlas of African butterflies and moths managed by the Animal Demography Unit at the University of Cape Town and the Lepidopterists' Society of Africa, and iSpot, since superseded by iNaturalist. Both these platforms encourage citizens to submit their digital photographs, along with basic information about the location of the butterflies they shot. These data are then used to determine the distribution and biodiversity of these insects. And, of course, there has been an explosion in the creation and membership of social media platforms – with several of these dedicated to butterflies, moths and other insects. The combination of all these factors has ensured that there are many more people who are interested in butterflies (and moths) now than there were in 2005.

In the years since the first edition of this Field Guide enthusiasts have explored many areas that had not been covered properly, leading to new discoveries. The South African butterfly list now stands at 671 species, although some of these are vagrants from further north. Consequently, the text of this edition has been fully updated and revised. Furthermore, it features more than 1,850 photographs, of which at least 1,400 have not been published previously.

Increased use of diagnostic tools such as DNA barcoding (and whole genome sequencing) has generated new insights about relationships between genera and species, inevitably resulting in changes in taxonomy. The taxonomic debates that were alluded to in the introduction to the first edition have not ceased. In fact, they have grown in complexity and controversy to the point where they are not covered in this edition at all! At least one species that had been 'sunk' when the first edition was published, has now been restored.

Steve Woodhall

Introduction

South Africa is often described as 'a world in one country' because of its spectacularly diverse scenery and vegetation. This diversity extends to the country's wildlife, including its butterflies. There are about 20,000 species of butterfly worldwide, and South Africa is home to at least 671 of these – a vast proportion for a country that lies mostly outside the Tropics.

Generally, the further an area lies from the Equator, the poorer its butterfly fauna. Tropical butterflies are evolutionarily advantaged in that the lush, varied vegetation and warm climatic conditions encourage continuous generations that rapidly fill the region's many environmental niches. South Africa's butterfly richness stems in large part from the many specialist species that have adapted to niches created by our arid and temperate climate and our diverse vegetation types. Many of the butterflies are endemic, being found nowhere else in the world.

Butterflies, like most invertebrates, are sensitive to environmental change and have been recognised as important indicators of terrestrial environmental health. Invertebrates usually don't disperse as widely or as rapidly as vertebrates, making them more vulnerable to the presence of toxins in the immediate environment; therefore, if there are no butterflies (probably the most visible of the invertebrate species), it is more than likely that the environment is unhealthy, whether as a result of climate change or habitat encroachment and loss due to residential, commercial or agricultural development.

Butterflies are members of the insect order Lepidoptera, which consists of over 126 families grouped into 45–48 superfamilies. Most Lepidoptera species are moths, with only about 10% of species in this order consisting of butterflies. Butterflies fall within three superfamilies, two of which occur in Africa, and seven families, with six of these occurring in Africa. This book covers all 671 butterfly species known to occur in South Africa – many of these are commonly encountered while others are rarer and found as tiny populations in isolated or inaccessible locations.

Left: Male Green-veined Charaxes *Charaxes candiope*

Right: Male Mocker Swallowtail *Papilio dardanus cenea*

HOW TO USE THIS BOOK

Photographs

Full-colour photographs show male and female forms, where these differ, and, where possible, both upper- and undersides. A simple numbering system links the photographs to individual species descriptions on the facing page.

Layout of species accounts

The species accounts are arranged according to family, subfamily and genus groups. Each genus is described in some detail and covers life history (ova–larvae–pupae) and habits, as these are usually constant within a genus. Each species account is given in a standard format, as shown below, and is accompanied by photographs of the species on the facing page to allow easy identification and quick reference in the field.

About the maps

The distribution maps in this book are based on maps produced by Mecenero, Altwegg, Colville and Beale (see Bibliography) from butterfly distribution data gathered during the South African Butterfly Conservation Assessment (SABCA) survey. It was based on the assumption that each butterfly species favours a particular micro-climate, and if one can show where that micro-climate exists on the map of South Africa, one can derive a predictive map for that species.

1 2 3 4

1 Layman *Amauris albimaculata albimaculata*

Wingspan: ♂ 50–60mm ♀ 62–68mm. **Identification: 1A** ♂ upperside, **1B** ♂ underside. Distinguished from similar *Amauris echeria* by the labial palpi on the front of the head. *A. albimaculata* has a white line on the front of each palp; *A. echeria* has two tiny white dots. Upperside black with *white* forewing spots, hind wing patch pale buff. Sexes similar; ♀ lacks hind wing sex brands. Slow, floating flight. ♂ is South Africa's smallest danaid. May be seen on certain plants (eg *Senecio*, *Heliotropium*) that have been cut and are wilting. **Mimic:** ♀ *Papilio dardanus cenea* f. *acene*; both sexes of *Hypolimnas anthedon wahlbergi* f. *mima*; *Pseudacraea lucretia*. **Distribution:** Commoner and more widespread than *A. albimaculata* or *A. ochlea*. Coastal, lowland and riverine forests and savanna. Mbashe R, E Cape, to KwaZulu-Natal, eSwatini and n to Mpumalanga and Limpopo. Vagrant as far w as Gauteng and NW Province. **Habitat:** Forest edges, clearings and tracks, parks and gardens, flatlands. **Flight period:** Year-round, peak summer/autumn. **Larval food:** *Cynanchum chirindense, C. natalitium* and *Tylophora anomala*. **Alternative common name:** Layman Friar.

5 6 8 7 10 9

1 **Map:** A quick-and-easy guide to the distribution of the species.
2 **Name:** The species' common name and scientific name.
3 **Wingspan:** A typical range of sizes, from wingtip to wingtip for male and female.
4 **Identification:** Identifies corresponding photographs on the facing page, points out diagnostic features (with the main ones shown in italics) and describes behavioural traits particular to the species.
5 **Mimic/Model:** Indicates whether the butterfly is a mimic of another species, or a model for a mimic (see Coloration – avoiding predators, p. 19).
6 **Distribution:** A detailed description of the species' geographical distribution, including the biome(s) in which it is found; to be used in conjunction with the map.
7 **Habitat:** Indicates the terrain in which the butterfly is most likely to be found.
8 **Flight period:** Gives typical and peak flight periods, i.e. when the butterfly is most likely to be seen.
9 **Larval food:** Refers to major larval food sources, usually plants but often (in lycaenids) other insects or insect secretions. Plants are mentioned by scientific name only. A list of both scientific and common names starts on p. 442.
10 **Alternative common name:** Lists an earlier or different common name for the species.

For each species' known localities (from SABCA), five climatic variables were obtained from known historic data. These were mean summer and winter temperatures, mean annual precipitation, and two factors for rainfall concentration. One of these gave a value depending on whether the rainfall pattern is spread evenly over the year, to 100% in a single month. The other dealt with the seasonal category of the rainfall. It showed whether the rainfall is all year, winter, early, mid-, late, or very late summer. The values of these variables were used to create a model that predicts, geospatially, where each species might be *expected* to be found, based on its micro-climatic preferences. The model was subjected to spatial modelling techniques that corrected for bias caused by greater frequency of observations where human observers had been most active.

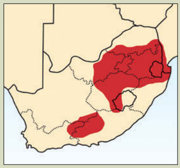
The resulting map does not show the **actual distribution** of the butterfly; rather, it shows the areas where you are **most likely** to find it, provided that you are at the right altitude, slope and aspect, and in the right vegetation type. The small size of the maps makes it impossible to show such fine detail, but they are a vast improvement on previous field guide maps that were based on educated guesswork.

Not all species were covered by SABCA. Extinct species and doubtful records were omitted. In addition, new species have been described and there are new records for existing species.

Layman *Amauris albimaculata albimaculata* is found in coastal, lowland and riverine forests and savanna, from the Eastern Cape to Limpopo.

MAP LEGEND

Red: Smoothed polygon (or area of likely occurrence) inferred from SABCA data.
Blue: Estimated range for species/subspecies not covered under SABCA. New out-of-range records, or known vagrants, may be shown by a blue dot (single record). Larger blue shapes indicate areas where a species described after SABCA concluded is likely to be found, or where records have been allocated to a different species following the outcome of the African Lepidoptera Conservation Assessment (SALCA).
Green: Doubtful or disputed records. Usually shown as a dot. If the description of the record was vague, a shape indicating the area that could include the correct location is shown.
Orange: Extinct species (using IUCN Red List criteria). Shown as estimated range based on vegetation type at last known locality.



Red

Blue

Green

Orange

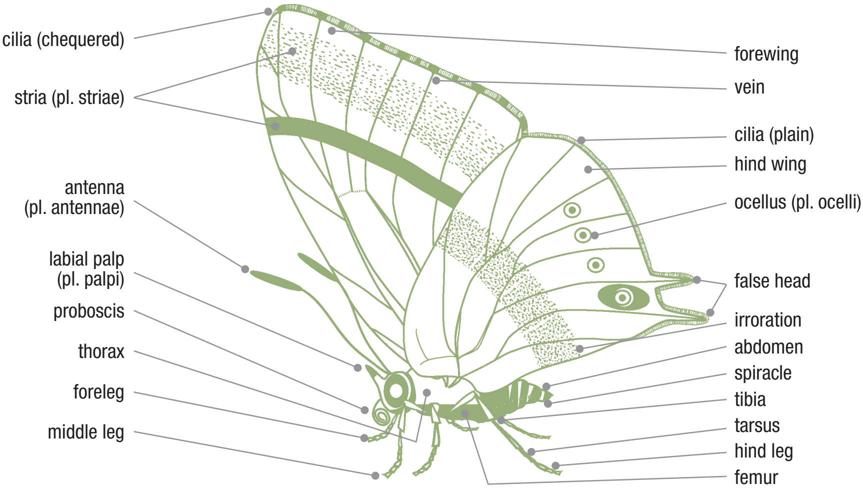
ABBREVIATIONS USED

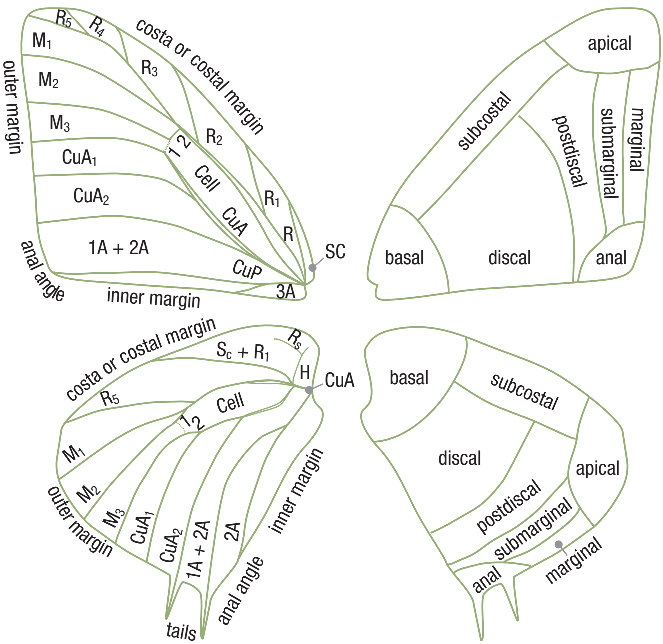
ca = circa (about); **DSF** = dry-season form; **f.** = form (morph of polymorphic species; refers to specific colour/pattern); **GR** = game reserve; **L** = left; **Mtn** = mountain; **n, s, e, w,** etc. = north, south, east, west, central, etc.; **nr** = near (as in an undescribed taxon resembling one already described); **NP** = national park; **NR** = nature reserve; **R** = river, right; **sp.** = species (plural spp.); **subsp.** = subspecies; **WSF** = wet-season form.

WHAT IS A BUTTERFLY?

A butterfly's body is made up of three sections – head, thorax and abdomen. The outer shell, or **exoskeleton**, is made of a complex polysaccharide (a carbohydrate made up of sugar molecules) called **chitin**. This is tough and strong, but flexible. It maintains the animal's structural integrity and shape. The muscles are attached to the exoskeleton, which also contains the liquid body contents.

Butterflies have four wings: two forewings and two hind wings. Each is made up of thin skins of chitin held rigid by veins. The larger veins are used to pump blood through the





Butterfly wing plan, indicating the veins and wing areas used to show the location of patterns and markings. Each vein names the wing area above it, as follows:

M = medial vein

R = radial vein

(R_s = radial sector vein)

CuA = anterior cubital veins

CuP = posterior cubital vein

A = anal veins

H = humeral vein

S_c = subcostal vein

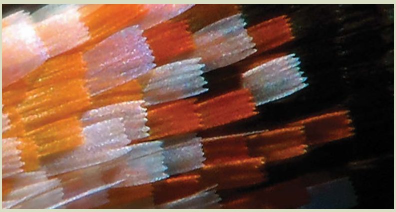
(1A+2A) and ($S_c + R_1$) = composite veins

wings to warm them. The pattern of veins on a butterfly's wings differs between species and is of great significance in determining its relationship to other butterflies. Each area of the wing has its own name, used to describe the location of pattern features. In flight, the fore- and hind wings are coupled by the overlap where they join the body.

The colours of the wings, and all the hairs on the body, are made up of minute **scales**. Each scale is made of chitin and is attached to the body or wing by means of a tiny ball-and-socket joint. The patterns are in the form of spots, stripes (known as **striae**), bands, blotches and speckles. Many wings have tiny lines or spots set close to one another and running in one direction – these are known as **irrorations**.

ORDER LEPIDOPTERA

The name of the order to which butterflies (and moths) belong – the Lepidoptera – stems from the Greek word *lepis*, meaning scale, and *pteron* meaning wing. The patterns that the scales make are distinctive to each species and are important in the identification of butterflies.



Magnified wing scales of the Red-line Sapphire *Iolaus sidus*

TAXONOMY AND NOMENCLATURE

The classification of butterflies

All animals are classified into groups, or phyla. Each of these is made up of creatures with broadly similar anatomy and with certain features in common. The phylum is split up into a hierarchy of subdivisions. The table below follows the hierarchy down to the basic unit of nomenclature – the species – using the African Plain Tiger *Danaus chrysippus orientis* as an example.

The naming of butterflies

The purpose of scientific names is to avoid the ambiguity and confusion that arises from the use of common names, which tend to differ from region to region and country to country. Scientific names, on the other hand, are standard worldwide.

Carolus Linnaeus (1707–1778), a Swedish-born naturalist, was the first person to describe southern African butterflies using a binomial.

Table Mountain Beauty *Aeropetes tulbaghia* was initially described as *Papilio tulbaghia* by Linnaeus

Phylum	Arthropoda	Invertebrate animals with jointed legs and an exoskeleton enclosing the body organs, providing support and shape
Class	Insecta	Insects
Order	Lepidoptera	Butterflies and moths
Superfamily	Papilionoidea	'True' butterflies
Family	Nymphalidae	Brush-footed butterflies
Subfamily	Danainae	
Genus	*Danaus*	Tigers
Species	*chrysippus*	African Plain Tiger
Subspecies	*orientis*	

The first part of the binomial is the **genus** name. This serves to group together closely related species, although in some instances a genus can contain only one species. The second part of the binomial is the **species** (or **specific**) name. Each combination of a genus and species name is unique.

Species may be further subdivided into **subspecies**, which are well-defined local races. Taxonomically, these are identified by a trinomial – genus, species, subspecies – for example, *Danaus chrysippus orientis*. If the species and subspecies names are the same, as in *Danaus chrysippus chrysippus*, this is referred to as the **nominate** race, and is the one that was first described to science.

Name changes

In the early days of taxonomy, biologists classified animals largely on the basis of their external appearance (their **phenotype**). Physical features (known as the **facies**) are still used by modern taxonomists, together with an arsenal of modern techniques such as analysis of DNA (the **genotype**) and increasingly **ethology** (study of behaviour). Genetic study may show that species whose physical appearance is quite similar are only distantly related to one another; the similarity in their phenotypes is merely an evolutionary response to living in the same environment (termed **convergence**).

Changes to genus names

A new genus may be erected when, for example, a naturalist who has intensely studied a group of butterflies decides that some are more closely related to each other than they are to the rest of the species in the genus. Conversely, two genera may be so closely related that they are, to all intents and purposes, the same. In instances where two genera need to be merged, the name that was described first in history takes precedence, and the more recent name is 'sunk' or synonymised.

Groups of species within a genus that have broadly similar characteristics are known as 'species groups'. Sometimes species groups are reclassified as genera, or they are moved from genus to genus. In neither case, however, does the specific name change.

Changes to specific names

A biologist may gather enough evidence to prove that one (or more) of a group of subspecies is actually a distinct species. In these cases, the trinomial name is reduced to a binomial, and the original subspecies name becomes the new specific name. This process is known as 'splitting'.

The reverse of this is found where studies show that two or more populations of butterflies that were thought to represent species or subspecies are in fact the same animal. In these cases, as with genera, the older name takes precedence and the newer one is sunk. This process is known as 'lumping'.

The western population of Coastal Skolly *Thestor rossouwi* (above) used to be known as Swanepoel's Skolly *Thestor swanepoeli*, but when the two species were found to be the same insect, the *swanepoeli* was 'lumped' in favour of the older name *rossouwi*.

New scientific names

New populations are being discovered all the time; sometimes they are sufficiently distinctive to be described as new species or subspecies. To achieve this, the author – the person describing the species or subspecies – must publish a description of the new species in a recognised learned publication, for example, the journal of the Lepidopterists' Society of Africa, *Metamorphosis*. Publication implies an acceptance by peers of the new species. If you have a copy of the first edition of this Field Guide, you'll notice that there have been quite a few scientific name changes since its publication.

New common names

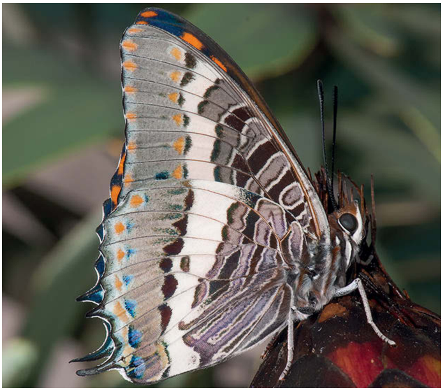
There are no international 'rules' to guide the use of common names for butterflies, with the result that many genera and species share the same name, while others have vastly divergent ones. This inconsistency is understandably confusing. Recently, in an effort to harmonise names with those used in other parts of the world, and for them to be more descriptive of the genus or species, there has been a sea change in the common names of butterflies in South Africa. These revisions are included in this edition, and have been approved by the Lepidopterists' Society of Africa, which assisted in developing the new names.

Many local names now conform with those used in Africa and the rest of the world. As an example, while the common name Emperor is used globally for the genus *Apatura*, locally it served to describe the genus *Charaxes*. In this case, it was decided to substitute the name Emperor with Charaxes, and butterflies such as the Pearl Emperor and the Protea Emperor are now known as the Pearl Charaxes and the Protea Charaxes. In other examples, the common name for the genus *Lepidochrysops*, locally described as Blues or Ant Blues, is now Giant Cupids – the name by which this genus is known elsewhere in the world.

There are other examples of South African common names that are out of step with the rest of the world. One is *Junonia orithya madagascariensis* (p. 144). Locally, it became Eyed Pansy, whereas over the rest of its range its English common name is Blue Pansy. Its name has since been harmonised with international usage, and it is now called African Blue Pansy.

On the other hand, some common names followed their butterfly around the world because the species is so distinctive. Painted Lady *Vanessa cardui* (p. 144) is an example. This butterfly has flesh-pink markings on a dark background, which with some poetic licence can be said to resemble a lady's made-up face. It is almost cosmopolitan and very common, so its name has become globally 'harmonised' automatically.

Another common name 'convention' came into being when people describing a new species wished to honour its discoverer,



Originally called the Protea Emperor, this species is now known as Protea Charaxes *Charaxes pelias*, reflecting the change in the common name of the genus *Charaxes* from Emperor to Charaxes.

Swanepoel's Blue *Lepidochrysops swanepoeli* has been renamed Barberton Giant Cupid, making it consistent with the new common name, Giant Cupid, given to the genus *Lepidochrysops*.

or their wife, or a famous person, etc. As an example, David Swanepoel (1912–1990), a prolific South African collector, discovered many of the species shown in this book – Swanepoel's Widow *Dira swanepoeli* (p. 54) and Swanepoel's Brown *Pseudonympha swanepoeli* (p. 78) are just two examples. However, neither common name provides much of a clue about what the species looks like or where it is found. In keeping with practices elsewhere, the new common names of these species, and many others like them, are now generally descriptive of the appearance, distribution or habitat of the species. For example, Swanepoel's Widow is now known as Northern Autumn Widow (referring to the region where it is found) and Swanepoel's Brown has become Woodbush Brown (denoting its habitat).

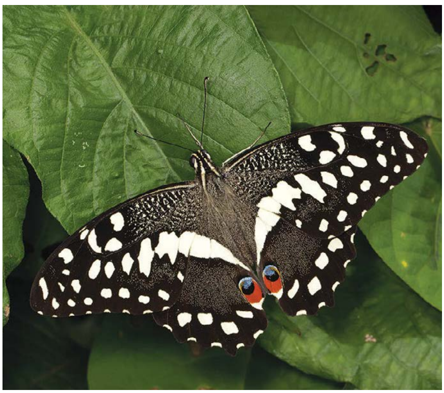
Finally, some of the descriptive common names can be confusing or are too broad in scope. For example, all the little orange Lycaenid butterflies in South Africa used to be called Coppers, because that was the convention for small reddish lycaenids in Europe, most of which have a shining metallic colour. In South Africa, however, many of these small butterflies, including those in the genus *Aloeides*, range in colour from non-metallic orange to dark red, or even brown. For these butterflies, Russet, as they are now called, is a more descriptive name.

There are many more examples, and where space allows all alternative and earlier common names are shown in the species accounts and the index.

What constitutes a 'species'?

The 'species concept' has evolved in recent years. It is recognised that a species is actually quite a 'fuzzy' entity; it can be difficult to say where one species ends and another closely related one begins. The biological species concept holds that members of different species don't, under normal circumstances, voluntarily mate. But it is well documented that this is not the case. Is it, therefore, the point at which hybrids are not fertile, as in the horse and ass producing a mule? Recent evidence shows that this is probably not the case. The distinctive European Mallard and African Yellow-billed Duck successfully hybridise and produce fertile offspring.

For many butterflies, the difference between species is visibly obvious. Consider the genus *Papilio*, or Swallowtails. If physical appearance were vital to mating success, crossing the species line would be difficult, if not impossible. Yet, in East Africa two closely related but very distinctive Swallowtail species do sometimes hybridise in the wild, but their offspring's fertility is doubtful. The Narrow Green-banded Swallowtail *Papilio nireus lyaeus* (p. 374) and Citrus Swallowtail *P. demodocus*



The Narrow Green-banded Swallowtail *Papilio nireus lyaeus* (left) and the Citrus Swallowtail *P. demodocus demodocus* (right) are easily recognisable as different species, despite being members of the same genus.

The Maluti Giant Cupid *Lepidochrysops oosthuizeni* (left) and Koppie Giant Cupid *L. ortygia* (right) look similar but occur in different localities.

demodocus (p. 370) look very different, are not known to mate in the wild, and no hybrids have ever been seen. But what about species that look very similar but fly in different localities? The high-altitude Maluti Giant Cupid *Lepidochrysops oosthuizeni* (p. 302) closely resembles the lower-altitude Koppie Giant Cupid *L. ortygia* (p. 300). These are found not far from one another, behave similarly, and are very difficult to tell apart. To make matters worse, there is another population of Blues in between their ranges with intermediate characters. Would these Blues mate if they met? Is the darker colour and smaller size of Maluti Giant Cupid merely an adaptation to cooler and wetter living conditions?

Taxonomy is the discipline of naming things and placing them in hierarchies, as shown for *Danaus chrysippus orientis* (see p. 13). Originally it was based on **phenetics** – the similarity (or otherwise) between organisms. Nowadays, **phylogenetics** is used as the basis for taxonomy. This is the study of relationships among groups of organisms – such as a species or genus. These relationships are worked out by evaluating heritable traits such as DNA sequences or **morphology** and creating a model of how these evolved. This model often takes the form of a phylogenetic 'tree' which is a hypothesis showing which species appear to have evolved from common ancestors, given the evidence available. It has resulted in the so-called phylogenetic species concept. This holds that a species is the smallest cluster of individual organisms within which a parental pattern of ancestry and descent can be diagnosed.

Much use is made of mathematical modelling of the evolution of species' characters. Phylogenetic trees are often depicted as **cladograms**, which use statistical techniques to work out the most likely derivation of those characters, and present them in a format resembling a family tree. These 'family trees' can be useful in illustrating the relationships between species, and also families and subfamilies.

This technique helps us to understand species as dynamic entities that are evolving as they are being observed. There are many 'grey areas', especially in butterfly phylogenetics, where it is not clear whether two or more populations are diverging (or speciating) or converging (and interbreeding). What is clear is that biodiversity is far more complicated than we used to think, which makes it important that we work as hard as we can to conserve it.

BUTTERFLY BIOLOGY

How butterflies function

Insect bodies are unlike those of vertebrates in that the cavity inside the exoskeleton (known as the **haemocoel**) is totally bathed in blood. All the internal organs are directly bathed in this. Insect blood is called **haemolymph** and lacks the corpuscles found in mammal blood; it is usually green, not red. The haemolymph cannot stay still, otherwise the various organs would be starved of food and oxygen. A simple 'heart' picks up haemolymph in the abdomen, where food and oxygen are exchanged for waste and carbon dioxide, and pumps it to the head, from where it flows back down the body carrying nutrients.

Butterflies breathe through tiny holes positioned along the sides of the body (two per segment), known as **spiracles**. The holes have muscular walls, which expand to suck up air, and can be closed at will. These divide into progressively smaller branches inside the body until they are microscopic and capable of diffusing gas molecules into the haemocoel. Carbon dioxide is likewise expelled through the spiracles. Although this breathing technique works very well for a small organism, it is less efficient in larger animals, probably explaining why insect bodies are limited in size.

A butterfly's digestive system is simple. Liquid food is sucked up the proboscis into the crop, from where it is passed via a one-way valve into the gullet and stomach for digestion. A partial vacuum is created by muscles in the crop to facilitate the suction. Nutrients are passed directly from the gut to the haemolymph, and then to the organs as needed. The organs pass waste products into the haemolymph. **Malpighian tubules** extract moisture from the waste, and are connected via a network of tubes to the gut and eventually the anus, where the residue is excreted. In larvae, the moisture combines with solid faeces, known as **frass**, that has moved through the gut. Adult butterflies excrete only liquid.

Feeding and food – energy for life

As larvae, the vast majority of butterflies feed on plant matter. Choice of larval food is often highly specialised – in some cases restricted to a single plant species. As a result, butterfly distribution patterns are very strongly influenced by the food requirements of the larvae. Leaves are the most common food source, but many larvae feed on seeds or the immature ovules in flowers. Larvae of some of the Lycaenidae eat cyanobacteria (previously called blue-green algae) that grow in symbiosis with fungi as lichens. Others feed on animal matter. For example, *Lepidochrysops* caterpillars enter ant nests and devour the ant brood, and *Thestor* larvae are fed regurgitated food by the ants – just like young birds.

Larval fat deposits stored in the form of waxy sheets in the thoracic cavity and abdomen are vital to the survival of butterfly species that don't feed as adults. Some adults, such as Skollies (*Thestor* spp.), lack a fully developed proboscis and cannot feed. These butterflies tend to have short, sedentary lives spent near the larval food source.

Species in the *Charaxes* genus, such as this White-barred Charaxes *Charaxes brutus natalensis*, feed on tree sap, rotten fruit or dung.

The high-energy demands of flight require adults to consume sugar-rich foods. They most commonly feed on nectar, but also on fermenting fruit, sap from trees and shrubs, and honeydew from aphids and scale insects.

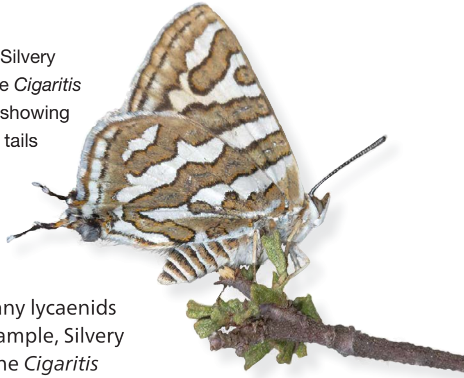
Some butterflies feed on the juices from carrion. *Charaxes* species are often seen sucking at dead mice, crabs, etc., and *Papilio* species are particularly fond of rotten prawns. Descending the ladder of taste still further, they also feed on the faeces of mammals and birds; this sometimes contains valuable trace nutrients as well as proteins. The faeces of predators – particularly cats – and primates seems to offer the most attractive meals, although dog dung is also popular.

In hot weather, butterflies need to drink, and river and pond banks often swarm with butterflies. Puddles of mammal urine are also an important source of minerals.

Coloration – avoiding predators

Butterflies are attractive prey for many predators, from chameleons to birds and small mammals. In terms of their physical attributes, however, they have few options for escaping such unwanted attention. Exceptions to this include the *Charaxes* species, which are large and extremely fast-flying. The largest ones are capable of outflying even birds as fast as swifts and swallows! Some lycaenids are also extremely rapid and, on the wing, can avoid birds with ease.

Most species, however, rely on cryptic coloration, deception or camouflage to avoid detection. For example, the undersides of Rocksitters (*Durbania* spp., pp. 150–152) closely resemble the lichen on the rocks that they frequent, rendering them virtually invisible. The Pearl Charaxes *Charaxes varanes varanes* (p. 106) and Dead-leaf Commodore *Precis tugela tugela* (p. 140) look like dead leaves, while others resemble objects that are unattractive or obviously inedible; in the case of the Buff-tipped Skipper *Netrobalane canopus* (p. 390), it is bird droppings.

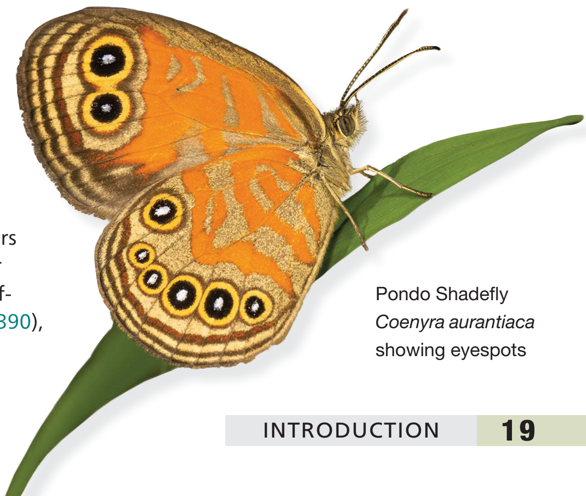


Female Silvery Silverline *Cigaritis phanes* showing hair-like tails

Many lycaenids (for example, Silvery Silverline *Cigaritis phanes*, p. 192) have hair-like hind wing tails with eyespots at the base. When the insect is sitting, these look like the head and antennae, a deceit the insect embellishes by moving the tails slowly up and down. The Ella's Silverline *Cigaritis ella* can lose its tails and part of the hind wing, and still fly with ease. This is preferable to being pecked on the 'real' head, which is likely to prove fatal.

Some Ringlets (Satyrinae, pp. 46–87) have prominent eyespots on the wings – features that fool a bird or lizard into attacking the wings instead of the head. The larger Ringlets tend to sit on the ground with closed wings, and then flip them open when disturbed. The suddenly revealed eyespots give the impression of eyes being opened, which can startle small predators.

Butterflies cannot sting, but many – for example, most Heliconiinae and all Danainae – are **distasteful**, or even **poisonous** to predators. To advertise the fact that they are



Pondo Shadefly *Coenyra aurantiaca* showing eyespots unpleasant to eat, these species have evolved bright warning or **aposematic** coloration and markings. Red, black, yellow and white, or some combination of these, are typical aposematic colours.

So how do butterflies become toxic or distasteful? Larvae of the subfamily Heliconiinae typically feed on plants, such as *Kiggelaria* species (Wild Peach trees), that contain cyanogenic glycosides. These plants use these compounds (a sugar and cyanide) for protection from herbivores. They decompose when the plant is injured to create the toxic gas cyanogen. The butterflies' larvae are able to absorb these poisons in their bodies; the poisonous substances remain in the body even as the pupa transforms, although there is evidence that the adults are able to synthesise similar compounds in their own bodies as well. The larvae and pupae are conspicuous and aposematic, and are usually avoided by predators (although some birds, such as cuckoos, are immune to the poisons).

The larvae of Danainae feed on poisonous plants, such as *Asclepias* (Milkweed), that contain another type of glycoside, a sugar bound to a cardenolide steroid which can disrupt the heartbeat. The larvae and pupae are highly conspicuous and, until recently, it was thought that these cardiac glycosides were transferred to the adults. In fact, such butterflies (*Danaus, Tirumala* and *Amauris* spp.) – males only – can suck up chemicals called pyrrolizidine alkaloids from certain plants (see photograph on this page), and use them to synthesise other chemicals in their bodies that make them poisonous. When the butterflies mate, the male transfers alkaloids to the female with his sperm.

The distasteful Black-based Acraea *Acraea natalica*

Novice *Amauris ochlea ochlea* and African Plain Tiger *Danaus chrysippus orientis* males taking alkaloids from Heliotropium

When a poisonous butterfly is bitten, the toxins released stimulate a vomiting reflex in the predator that results in immediate release. The chastened predator learns to avoid that particular pattern and colour in future.

There are no business ethics in nature, and 'software piracy' is rife. For every brightly coloured distasteful species, there is usually at least one perfectly palatable species that looks just like it and gains protection from the resemblance. For example, form *hippocoonides* of the palatable female Mocker Swallowtail *Papilio dardanus cenea* (p. 370) **mimics** the distasteful Southern Friar *Amauris niavius dominicanus* (p. 44). The species being mimicked is called the **model**. Mimicry by a palatable species of a distasteful one is termed **Batesian mimicry**.

In **Muellerian mimicry**, distasteful species resemble one another. In this way, the tendency of palatable Batesian mimics to dilute the effect of warning coloration is counteracted. Examples of this are White-barred Telchinia *Telchinia encedon encedon* (p. 102), which mimics the African Plain Tiger *Danaus chrysippus* (p. 42), and Waterberg Acraea Copper *Erikssonia edgei* (a distasteful lycaenid, p. 256), which mimics the Dancing Telchinia *Telchinia serena* (p. 102).

The lines between Batesian and Muellerian mimicry have recently become blurred, with several species thought to be Batesian mimics proving distasteful in their own right. The theory that *all* brightly marked butterflies are distasteful to at least some predators is gaining ground.

REPRODUCTION

Butterflies are essentially sex machines. The search for a mate and accompanying sexual displays form a major part of butterfly behaviour. A butterfly's time as an adult (or **imago**) is usually short compared to its total life cycle, hence the adult butterfly has only one purpose in life – to reproduce. (See pp. 40–41 for examples of eggs, larvae and pupae of different subfamilies.)

Territoriality

Like other animals, male butterflies often occupy and defend territories. However, the butterfly male does not do this to protect food sources, but rather to win the attention of a female with which he can mate. The most common form of territorial behaviour is hilltopping (see p. 38) and related activities.

Many butterfly host plants are widely scattered. If the adults kept close to their home plant, they would stand little chance of mating with any female, let alone one descended from different parents. Males of low population density species, such as Hutchinson's High-flier *Aphnaeus hutchinsonii* (p. 190), tend to congregate at prominent hilltops, around large trees, big rocks on ledges, or bare rocky patches among vegetation. Sometimes, male butterflies endlessly patrol a particular piece of forest edge. This behaviour not only renders the male of the species far more conspicuous than the female, but attracts females to males. When the female visits the male's territory, she is quickly pursued and mated with by the dominant male, who will usually have found a position at the highest point on the hilltop. The female then returns to the food plant to lay eggs.

Finding a mate

Butterflies have colour vision and there is no doubt that the **patterns of colour** on their wings play a large part in their recognition of potential mates. Scent also plays a significant role in mate identification, although it tends to have a short-range effect and seems to be used to augment visual cues when the potential partners get close together.

Some male danaines extrude hair pencils from their abdomens, which exude pheromones designed to induce the female to copulate. The pheromone is derived from chemicals that the male imbibes by consuming

A mating pair of Black-haired Bush Browns *Bicyclus safitza safitza* plants containing poisonous pyrrolizidine alkaloids. The more alkaloids they carry, the stronger the scent. The toxins serve an additional function, in that they augment chemical defence against predators; in copulation, the male transfers these poisons to the female in his sperm – hence ensuring her survival too.

Sexual behaviour patterns are thought to be of great significance in the evolution of butterflies. Precopulatory behaviour often takes the form of a 'dance', in which the male flits about in an effort to stimulate a response from the female. Although females regularly go in search of males with the specific purpose of mating, they will break off the encounter if they are not correctly stimulated.

Mating and egg-laying

Pairs copulate by joining the sex organs situated at the tips of their abdomens (see p. 21 for a pair of mating Black-haired Bush Browns *Bicyclus safitza safitza*). At first they may sit side by side, but during the act they face in opposite directions. If disturbed, they may fly united during mating. During mating, the male passes a package of sperm called a **spermatheca** to the female via his **aedeagus** or penis. The female stores the spermatheca in her abdomen and breaks it open to release sperm to fertilise each egg. Mated females of certain heliconiine nymphalids, such as the genus *Acraea*, carry a 'chastity belt', in the form of a horny covering to the tip of the abdomen, called the **sphragis**. This covering is placed there by the male during copulation, obviously to stop other males from copulating with his chosen mate. However, forced copulation is not unknown in these butterflies.

Once the female is mated, she carries the male's sperm inside her and uses it to fertilise the eggs as she lays them, either in batches or singly, on the appropriate food plant or in the appropriate ant nest. The female shows distinctive behaviour in her search for an oviposition site. Led by scent, a female seeking an oviposition site usually flies slowly, with distinctive quivering wingbeats. On landing, her antennae and 'taste' organs on the legs and feet are brought into play. Usually the correct plant odour is sufficient to induce her to lay her eggs, but in the case of ant-associated species, she searches for the correct ant scent-trail as well.

A batch of eggs laid by the Eastern Dotted Border *Mylothris agathina agathina*

Eggs and larvae

The egg (ovum) is either attached to the food source by an adhesive excreted by the female or dropped loose onto the plant. The shape, coloration and patterning of the egg is specific to each butterfly subfamily, and is useful in identification (see p. 40). The egg hatches after a period ranging from a few days to months into a larva (the caterpillar). From birth, the larva (generally equipped with rudimentary eyes, smell and taste organs, and strong jaws) eats voraciously.

Butterflies undergo complete **metamorphosis** (from the Greek for 'change in form'), in which the hatchling is totally different from the adult. The larva undergoes successive moults as it grows, because its chitinous skin is not very flexible and cannot stretch sufficiently to allow for the tremendous growth in size to adulthood (the adult is hundreds of times the size of the newly hatched larva). The stage between each moult is called an **instar**. After four to six instars, the larva is fully grown.

Like ova, larvae are distinctive at family and subfamily level, and sometimes even at genus or species level. Their distinctive characters (physiological and behavioural) have evolved to protect these soft-bodied, flightless and slow-moving insects from potential predation.

Some green larvae (for example, Sapphires and Swallowtails) are so well camouflaged on their food plants that they are almost impossible to see, while heliconiine and danaine larvae are often highly brightly coloured (and sometimes bad-smelling), advertising their distastefulness. The heliconiines sometimes gather together in large groups to enhance the effects of coloration and odour. At the other extreme, many satyrine and lycaenid larvae only feed at night in an effort to avoid diurnal predators.

Probably the most important larval survival strategy, at least for the majority of lycaenids, is their association with ants. Certain ant species are attracted to, and possibly controlled by, the sweet substance secreted by these larvae. The ants, of course,

Larva of the Peninsula Skolly *Thestor yildizae* accepting ant regurgitation

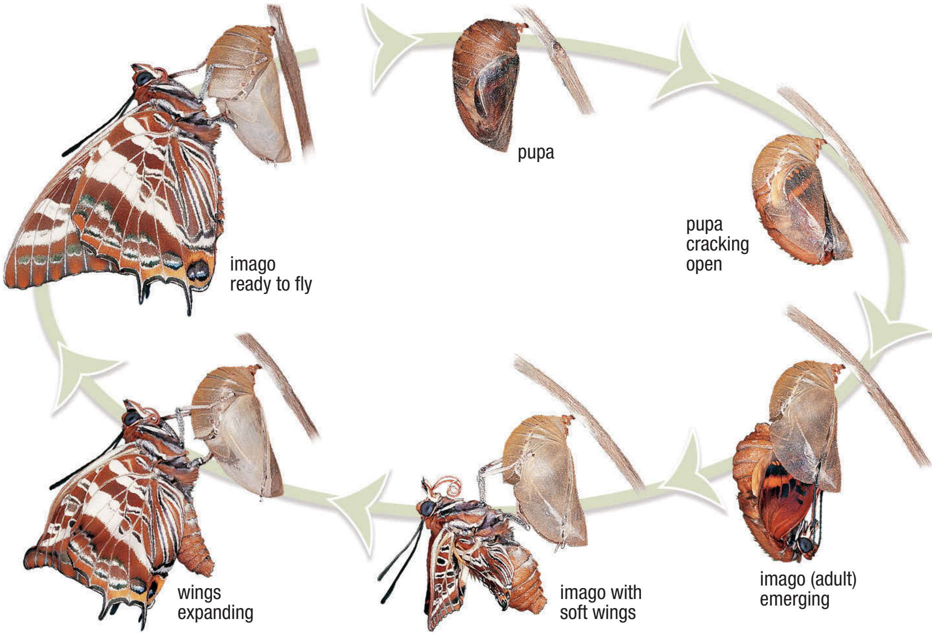
deter caterpillar predators such as parasitic wasps and flies. Some lycaenid larvae hide inside the ants' nests all the time and are fed by the ants by regurgitation.

When the larva has completed several moults (usually three to five) it stops feeding, often leaves the feeding area, and prepares to pupate. It may look for a sheltered spot, sometimes burrowing underground, or spinning a cocoon in a leaf or debris shelter or in the base of a grass clump, sometimes suspending itself from a suitable support, until its final moult, or pupation.

Pupae and the imago

Members of the Hesperiidae family pupate within a larval shelter. Some spin a silken girdle; others, such as the Hoppers (*Platylesches* spp.), spin a simple cocoon. The stationary pupae are distinctive at subfamily level, and sometimes at genus or species level. Pupae are usually well camouflaged, some danaines and Acraeas being the exception.

The manner in which pupae are attached to the substrate is indicative of the family to which they belong. For example, Nymphalidae (with the exception of some satyrines, which are found loose in grass litter) are suspended from the substrate by the hook-like cremaster on their tail end. Some lycaenids (for example, *Iolaus*) are attached tail-end only. Pierid and papilionid pupae are attached at the tail, and held upright by a thin girdle of silk around the thorax and wing case. Some lycaenids also have a girdle.



Sequence of Silver-Barred Charaxes *Charaxes druceanus moerens* emerging

The final metamorphosis occurs within the pupa. The time between pupation and emergence of the adult varies. Some species hibernate or aestivate inside the pupa. During this time, the adult structures develop. Finally, the pupal skin becomes transparent, rendering the wings of the adult visible. When this occurs, emergence is only a few hours away. When the time is right (usually early in the morning), the pupa splits over the thorax and the adult (imago) crawls out (see sequence above). The imago climbs up a nearby twig, rock or leaf, and hangs upside down while the heart pumps haemolymph into the wing veins. These straighten under pressure and 'push' the wings into shape while they are still soft. The wings then harden into their final form.

Flight periods

Adult butterflies appear when the conditions are optimal for oviposition, and flight periods are governed by this need. If there are no food plants available for the larvae, there is no point in the adult emerging.

Availability of food plants is largely influenced by climatic factors. The most important are temperature and rain, which govern plant growing seasons, as well as flowering and seeding times.

Simplistically, South Africa can be split into two climatic zones – winter- and summer-rainfall areas, with an ill-defined transition zone that receives rain year-round.

Winter-rainfall regions

The Western Cape, southern Northern Cape, and western Eastern Cape receive most of their rainfall in winter. The climate is driven by the south Atlantic high-pressure system in summer and anticyclonic frontal systems in winter. Cold, wet, wintry weather is the norm from May to August, followed by a cool, moist spring from September to early November. The summer is long, hot and dry, from late November to March, becoming cooler during autumn, with some rain alternating with sunny spells.

In the true winter-rainfall zone, plant growth is most vigorous in spring and early summer. Butterfly emergence fits a similar pattern, most species being active in spring and early summer. As summer progresses and the weather becomes hotter, drier and windier, fewer butterflies are seen, but there is often a second emergence in late summer and autumn. Some, particularly the satyrine genera *Dira* and *Torynesis*, only emerge at this time. Others have larvae that use seeds as food sources, and these are generally more abundant in late summer. The picture is made more complicated by the lycaenids, many of which are capable of flight at the driest times of the year because of their larvae's ability to shelter in ants' nests. Some larvae have even become aphytophagous (non-plant eating), for example, the Skollies (*Thestor* spp.), whose larvae are fed by ants in a relationship rather like a cuckoo chick in another bird's nest.

The Lesotho Veined Widow *Torynesis pringlei* emerges in late summer or early autumn.

Summer-rainfall regions

In the eastern part of the Eastern Cape, the northeastern Free State, KwaZulu-Natal, North West Province, Gauteng, Mpumalanga, Limpopo and the northern parts of the Northern Cape, the climate is subtropical. There are still well-defined summer and winter periods, with a short spring after the September/October rains. Early summer, from November to mid-December, is hot and humid, with moist air drawn into the area from the Mozambique Channel, developing into the characteristic afternoon thunderstorms. Late December and January are usually drier, with a second, smaller rainfall peak in February and March. Autumn, from March to May or June in the northern areas, is dry and warm, becoming cooler between June and September. On the highveld, winters are colder and more prolonged.

There is usually a strong butterfly emergence in September and October, especially in high-altitude grasslands after the first rains. Many species fly only at this time.

Machacha Brown *Pseudonympha machacha*, a summer-rainfall species

However, the majority of subtropical species fly year-round, with emergence peaks during or after the rains, and a lull in the heat of midsummer. This phenomenon is exaggerated in the forests, where the emergence is often split into two distinct flight periods. The second (late summer/autumn) peak is usually the stronger, when mass emergences or migrations take place; in warmer areas these stretch into the winter months of June and July.

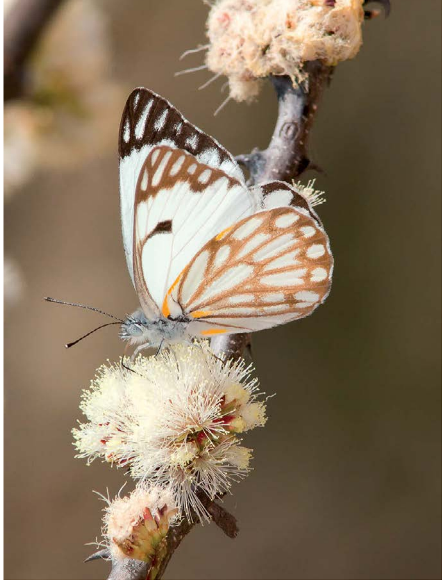
Along the highest peaks of the eastern mountain chain from Lesotho northwards, the warm summer period is restricted to December and January. Butterflies in these areas are best seen in those months.

Autumn-leaf Vagrant *Afrodryas leda*, a summer-rainfall species that has wet- and dry-season forms

The transition zone

There is a boundary zone running between the winter- and summer-rainfall zones, where aridity is the norm. Here, karoo vegetation dominates in the south, and semi-desert is prevalent in the north. Moving north and east, the winter rains split into two bands – spring (August to October) and autumn (May to June), with a dry period in between. Summer thunderstorms occur during the hot, dry season from November to April.

This is the home of specialised arid-adapted butterflies – lycaenids, which have evolved **myrmecoxenous** (ant-associated) life histories, and satyrines, which are capable of feeding on dry grasses over an extended larval stage. Generally, the best time to see butterflies in this climatic zone is from August to November, but some double-brooded species fly in spring and autumn, and some species fly in midsummer – the hottest, most desiccating time of year.



Adult Pioneer Caper Whites *Belenois aurota* may travel over long distances in search of food.

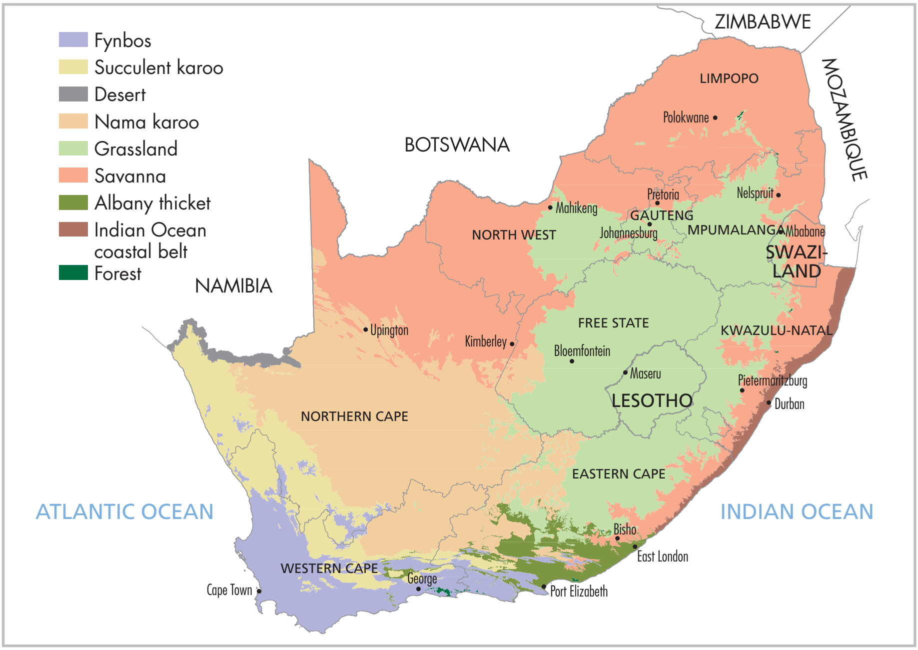
Movements

South African butterflies are not migratory in the strict sense of the word; that is, individuals don't make repeated journeys that are predictable in time and space. They do, however, undertake considerable movements, usually in response to food shortages. In the context of this book, the term **migratory** is used to describe butterflies that disperse over long distances from their natal colonies. The pierids African Migrant *Catopsilia florella* (p. 366) and Pioneer Caper White *Belenois aurota* (p. 352), for example, are native to the arid west. At certain times of the year, usually early summer, the adults travel eastwards, sometimes over thousands of kilometres. Those that find new populations of their food plants will mate and lay eggs. The triggers of such behaviour are currently unknown and the subject of much research.

BIOMES OF SOUTH AFRICA

The term **biome** is used to describe the type of climate and dominant plants and animals that occur in a particular area.

Note that patches of vegetation typical of one biome frequently occur inside another biome. Here we describe the main biomes in the region, highlighting the butterflies most closely associated with each.



South Africa's biomes (from *The Vegetation of South Africa, Lesotho and Swaziland* (2006), by kind permission of the South African National Biodiversity Institute and L. Mucina & M.C. Rutherford (eds))

Fynbos

South Africa's most celebrated biome, fynbos is remarkable for its floristic diversity. It occurs mainly in the mountains and inland parts of the Western Cape and along a narrow coastal belt that stretches from the Western Cape as far as the Eastern Cape. It comprises two main vegetation types – true fynbos, found on hills, valleys and mountains, and the endangered renosterveld, which grows along the coast.

Many endemic butterflies occur here, mostly Blues, Coppers, Russets and Browns. Species are often confined to small areas and are difficult, but very rewarding, to find. Many of the region's most endangered butterflies occur in the fynbos biome.

Fynbos vegetation, Tygerberg, Western Cape

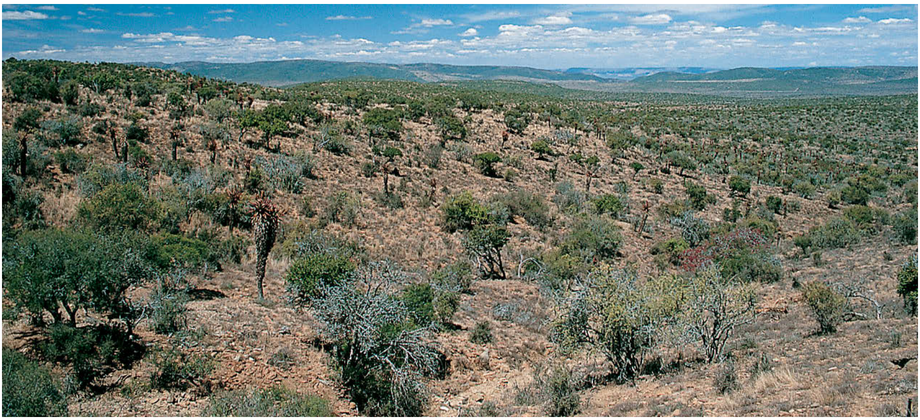
Succulent karoo, Springbok, Northern Cape

Succulent karoo

Found along the Atlantic coast and inland mountain ranges, this biome includes pockets of fynbos. Succulent dwarf shrubs are typical and grasses are rare. The main area covered by the Succulent karoo is known as Namaqualand. Many people visit Namaqualand in spring to see the flowers, and this is also the season to look for some very special butterflies, including many endemics. Namaqualand's butterflies have much in common with fynbos and Nama karoo species. Finding mountain-dwelling species generally requires strenuous climbing.

Nama karoo

This vegetation type covers the rain shadow of the Cape mountain chain in the south-central to western parts of South Africa. Overgrazing by livestock has degraded large parts in this region. There are two main areas: the Great Karoo and Little Karoo. Dwarf shrubs and sparse hard grasses characterise the biome, and the butterflies here are similar to those found in the Fynbos biome. Nama Karoo butterflies tend to be extreme specialists. They include many rare butterflies and endemics, but are hard to find, as they tend to live in small pockets with special microclimates.



Nama karoo, near Jansenville, Eastern Cape


Desert, near Vioolsdrif, Northern Cape

Desert
In South Africa, true desert occurs only in the extreme northwest, along the Orange River valley. The sparse vegetation here is adapted for very arid conditions. The few butterflies are mainly those typical of savanna and Nama karoo, and occur along river courses. A few desert specialists occur in Namibia, of which one or two also occur in South Africa.

Grassland
Grassland typifies the eastern central plateau of South Africa. This habitat has largely been transformed by maize farming, but some true grassland areas still survive along the hills south of Johannesburg. The best places to search for grassland butterflies are on the eastern Drakensberg and Wolkberg escarpments and on the Lesotho plateau. These areas are home to several rare and specialised species.

Savanna
Savanna is our largest biome. It is moist in the north and east of South Africa, but arid in the west, where it blends with Nama karoo and desert. Typically it consists of a grassy lower layer with stands of dense or scattered trees


Grassland, Drakensberg foothills, KwaZulu-Natal

Savanna, Phinda Private Game Reserve, Northern KwaZulu-Natal

and shrubs. The butterflies here are mainly widespread species or species closely related to those occurring to the north, but there are also small populations of specialist endemics.

Albany thicket

This short, dense, woodland vegetation is better adapted to arid conditions than true forest. It includes fewer grasses than savanna, but is less arid than Nama karoo. Butterflies here are also typically found in Nama karoo to the south and west, although forest and savanna species penetrate Albany thicket in the north. Few endemics occur here. This harsh, spiny, often impenetrable vegetation makes for interesting butterflying.

Albany thicket, Addo Elephant Park, Eastern Cape

Indian Ocean coastal belt, Krantzkloof Nature Reserve, KwaZulu-Natal

Indian Ocean coastal belt

This biome comprises a narrow belt of coastal vegetation that also penetrates inland along deep valleys. It is characterised by thick bush. In the southern and central areas, this biome is under threat from mining and farming. Some areas are well preserved, for example at Kosi Bay, but the Zululand flats are threatened by subsistence agriculture and human settlement. The butterflies here are similar to those found along the littoral as far as Kenya, with just a few special endemics.

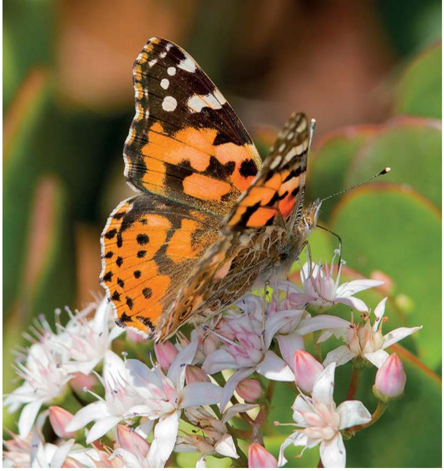
Forest

Forest is our smallest biome. The scattered patches of indigenous forest that remain are threatened by water starvation resulting from extensive exotic plantations. Forests may be Afrotemperate, lowland or riverine. The Afrotemperate type is home to many endemics, while lowland and riverine forests often harbour species also found in tropical Africa. The forests of northeastern Limpopo are richer in butterfly species than any other forested area in our region.

Lowland/Afromontane forest mix, Hlatikulu, KwaZulu-Natal

DISTRIBUTION AND CONSERVATION

Butterflies have different needs and as a result live in different populations. Some are highly adaptable and are found in many different habitat types. These are known as **eurytropes**, and include our most familiar species.
Some, however, have very specific habitat requirements and live in populations that are concentrated in a small area. The survival of these populations, known as **stenotropes**, depends on the presence of a certain food plant, a particular ant, or even a specific microclimate. These butterflies are found only where conditions are exactly right. The result is a high population density over a very small area. Stenotropes seldom stray far from where they were born. Some, in fact, are never found outside their original colonies. In extreme cases, the entire world population of a species is permanently confined to a range the size of a tennis court.



A classic eurytrope, Painted Lady *Vanessa cardui* is found in a wide range of habitats, from desert to tundra, where its larvae feed on several plant families.

Under wild conditions, several small colonies may be found close together. Colonies may occasionally die if the vegetation in which they live shows rapid changes over a short time. These colonies are usually part of a larger **metapopulation**, within which adults move between populations, allowing gene flow and formation of new colonies in suitable areas.

Some butterflies need only the correct plants and an absence of pesticides to survive. However, many species have extremely specialised food plant and habitat

Plutus Opal *Chrysoritis plutus* is a typical stenotrope. It is found only in areas where its narrow requirements of specific host plant, microclimate and associated ant are present.

Female Brenton Cupid *Orachrysops niobe*, a Critically Endangered butterfly; its last known locality was destroyed in the Knysna fires of 2017.

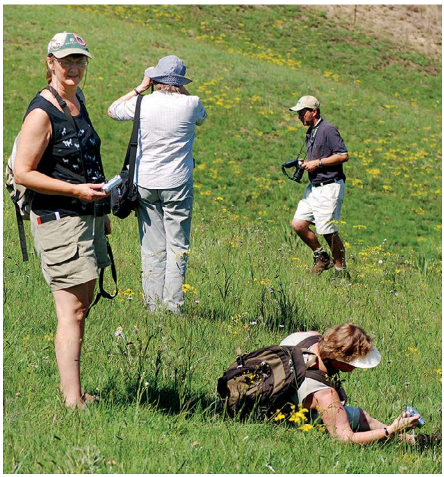
requirements. A great many South African butterflies are confined to such small, specialised habitats where a combination of factors ensures their survival. Many lycaenids, for example, require a combination of ant, plant and microclimate to survive, while a number of satyrines live in tiny areas of type-specific grassland surrounded by hostile forest or karoo. If any of these essential elements is lost, so too is the butterfly – at least in that area. These specialist species are particularly vulnerable to local extinction by habitat destruction (for example, afforestation) or alteration (such as agricultural transformation).

In many instances, there is no evidence to suggest that in the past the ranges of such species were any larger than they are now. These species are almost certainly naturally rare, rather than having been driven to rarity by any kind of habitat destruction. Nevertheless, they are at risk of natural extinction due to episodic events, such as fire, storms or drought. This condition has been termed the 'rarity trap'. Given the large number of South African butterfly species with extremely restricted ranges, it is highly likely that several such local extinction events have occurred unnoticed.

Pressures on our natural resources are increasing, with new initiatives pertaining to mining, monoculture plantations and, recently, fracking being pursued. All these endeavours have the potential to wipe out entire populations of stenotropes. In addition, the wider challenges that today's environment faces – such as global warming and pernicious pesticides – have the potential to affect the populations of even the more resilient eurytropes.

Fortunately, around the time the first edition of this book was nearing completion, the South African Butterfly Conservation Assessment (SABCA) was being born. This was a collaborative project between the Lepidopterists' Society of Africa (LepSoc), the South African National Biodiversity Institute (SANBI) and the Animal Demography Unit (ADU) at the University of Cape Town (UCT).

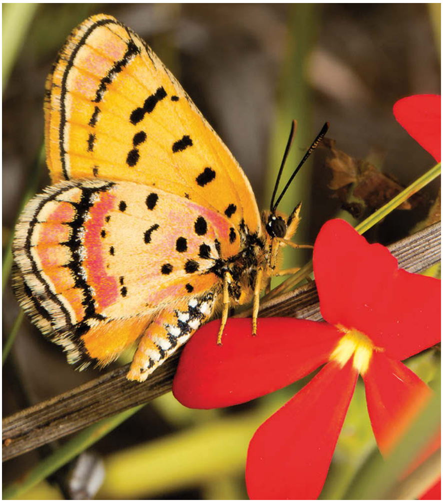
The ADU is well known for having conducted the Southern African Bird Atlas Project (SABAP) between 1987 and 1991. It used statistics to analyse data gathered by bird enthusiasts using modern, easy-to-use GPS devices. The result was the first effective conservation document for birds in this part of the world that was based on actual observations in the field.



Enthusiasts recording butterfly sightings in the KwaZulu-Natal Midlands

Citizen scientists play a significant role in observing and recording the presence of butterfly species in the wild.

The SABCA project team realised that there was an invaluable resource available to produce a baseline study of butterfly distributions – collections. The collecting of butterflies plays an important role in the conservation of these insects. LepSoc was originally established to study and conserve butterflies in South Africa, and has since expanded to cover the entire continent. The existence of collections, both private and in public museums, proved vital to the success of SABCA.



Male Waterberg Acraea Copper *Erikssonia edgei* nectaring on Elegant Witchweed *Striga elegans*

SABCA was completed over a period of four years, from 2007 to 2011, and covered South Africa, Lesotho and eSwatini (Swaziland). Its methodology was developed by the ADU, drawing on its experience with SABAP. During the first stage, a geo-referenced map of all collected specimens of butterflies in South Africa, from the earliest days, was completed. This allowed a 'gap analysis', showing areas that had not been surveyed for butterflies for a long time, sometimes never. After this, LepSoc members set out to visit these areas and observe butterflies in the wild, recording their presence and, in difficult-to-identify species, collecting voucher specimens.

During SABCA, the growing popularity of digital cameras and the Google Earth program led the ADU to add a web-based 'Virtual Museum' of butterfly sightings. This allowed the mapping of butterflies to

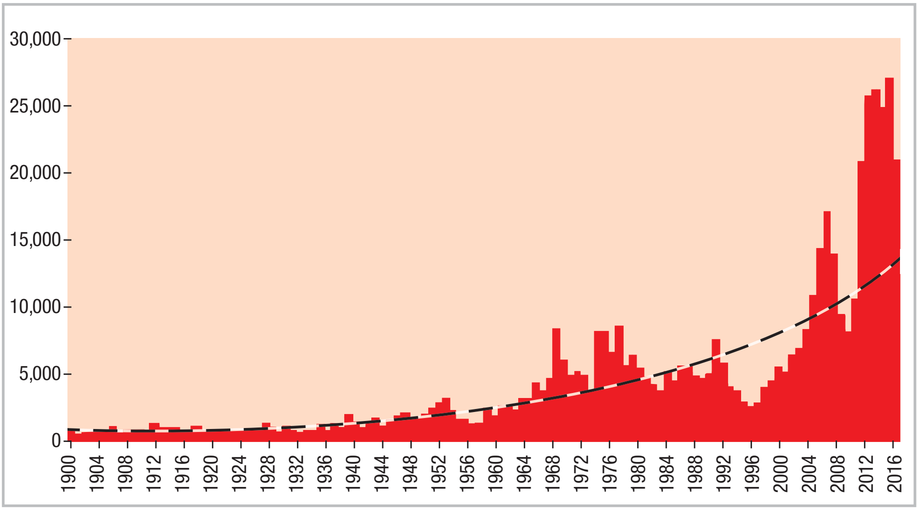


Chart showing the long-term trend in Lepidoptera observations per year, from 1900 to 2016. The massive growth in the number of observations in recent years is due to the practice of citizen science, with members of the general public voluntarily collecting and analysing data that can be used by scientists and researchers.

spread beyond the specialists in LepSoc to the general public. Later called LepiMAP, this was a great success. By the end of SABCA, nearly 340,000 records had been made, of which over 12,000 were from LepiMAP. At the time of writing, the number of LepiMAP Virtual Museum records stands at nearly 200,000, and the total database numbers at more than half a million records. Over 82% of South Africa's land area has been surveyed.

The SABCA data was used to assess the IUCN Red List status of every South African butterfly taxon (species and subspecies). In 2013, it culminated in the publication of the *Conservation Assessment of Butterflies of South Africa, Lesotho and Swaziland: Red List and Atlas*, edited by Silvia Mecenero and colleagues. The book provides a scientifically derived assessment of the threats facing every butterfly taxon (not just those of conservation concern). It identifies 60 threatened taxa (from Vulnerable to Extinct) and 151 taxa of conservation concern. Conservation professionals now have a meaningful textbook to use in setting up protected areas, and when doing biodiversity due diligence and environmental impact assessments.

LepSoc identified the 17 Critically Endangered taxa and appointed custodians to study them further and secure their future. This has resulted in the development of new nature reserves. Custodians were also appointed for the three Extinct taxa, just in case they were merely proving difficult to find. One species, the Waterberg Acraea Copper (*Erikssonia edgei*, p. 256), which was thought to have gone extinct, was rediscovered.

The work carries on as SALCA (the South African Lepidoptera Conservation Assessment) and covers all the Lepidoptera, not only the five butterfly families.

LEGALITIES OF COLLECTING

LepSoc does not frown on responsible butterfly collecting, and will assist members with such matters as permit applications. Prospective collectors need to acquaint themselves with the legalities of collecting in the various provinces of South Africa. To this end they should contact the Lepidopterists' Society of Africa (**www.lepsocafrica.org.za**) or the nature conservation department in their particular municipality or province.

IDENTIFYING BUTTERFLIES

The joy of butterfly watching is that you can do it anywhere – out in the veld or bush, in the mountains, forests, at the coast, or in a park or garden. The elements necessary for success are similar to those needed for bird watching. You will need a comprehensive and easy-to-use field guide, a pair of binoculars (or a telescope) to bring your quarry into closer view, and a notebook and pencil to record size, shape, special markings, flight patterns and specific behaviour; patience and perseverance will go a long way too, as will a digital camera.

Digital cameras are a boon to butterfly enthusiasts. They make it extremely easy to learn the art of butterfly photography because you can immediately see the results of the photograph you've just taken. 'Learning the ropes' costs you almost nothing. Even modern smartphones can be used to take macro photographs, and there is a wide range of low-cost digital cameras with powerful zoom and macro capabilities.

Being able to capture an image allows you to upload it to a Virtual Museum or an online database. That way, your record gains scientific and conservation value. In case of difficulty with identification you can also benefit from the knowledge of experts active on these forums – which is important with 'non-papilionoid' Lepidoptera, that is, moths!

Hilltops, mountainsides, urban gardens and forests all offer excellent butterfly-viewing opportunities.

BUTTERFLY PHOTOGRAPHY TIPS

For detailed instructions on butterfly photography, join LepSoc Africa and download Chapter 8 of their excellent *Practical Guide to the Study of Lepidoptera* in Africa (**www.lepsocafrica.org/?p=publications&s=pg**), which is free for members.

Some butterflies will remain still for long enough to be photographed.

You can even buy binoculars specially designed for butterfly watching. Some brands allow for 8.5 × 21 and 6.5 × 21 magnifications, making it possible to get even closer to difficult subjects. And, because they are binoculars, they give a 3-D view that is much brighter and clearer than a camera viewfinder. If you want to combine birding and butterflying, there are several choices in the 8 x 42 bracket.

Start by familiarising yourself with the characteristics of the main butterfly families described in the guide and read about butterfly habits so that you have some knowledge before you set out. If you are looking for a specific butterfly, it is a good idea to get to know the food plants used by the larvae (discussed within each species account). Once you find the plant, you have a good chance of seeing the butterfly close by. Remember, however, that butterflies are seasonal in their appearance: some fly almost all year round, others only during very specific times of year, sometimes for periods as short as a fortnight. Again, the species account will indicate the best times at which to see each species.

A pair of binoculars is a useful aid in identifying butterflies.

Knowing the type of terrain that butterflies prefer will also help in locating them. Even the most widespread of butterflies have specific habitat preferences. Information on habitat is provided in each species account. Terrain preferences may range from parks and gardens to mountainsides, coastal areas, wetlands, forests or forest edges, and hillsides. Some butterflies confine their range to ridges, ledges or gullies and some to hilltops.

In the field

Most butterflies can be approached closely with stealth. Be sure to avoid jerky movements and don't allow your shadow to fall across them. Always approach gently and quietly; the butterflies will soon become used to your presence and will allow you to get close enough to observe them or to take a photograph.

First look at the size and overall shape of the butterfly. Our largest butterflies are in the family Papilionidae (Swallowtails), or in the subfamilies Danainae (Tigers) and Charaxinae (Charaxes) of the Nymphalidae family. Small butterflies are mostly in the families Hesperiidae (Skippers) and Lycaenidae (Blues, Hairstreaks, etc.). The majority of medium-sized butterflies can usually be placed in the Nymphalidae, or else in the Pieridae family (Whites and Yellows).

Flight behaviour offers many clues to the identity of a butterfly. Swallowtails have a restless, fluttering, dancing flight. The distasteful Bitter Acraeas and danaines have a slow, lazy, floating flight pattern that somehow suggests they are unpalatable. Limenitidinae have a characteristic gliding, 'wings-open' flight, and Nymphalinae and Charaxinae a typical 'flap-glide' action.

HILLTOPPING

Hilltopping is a well-known butterfly behaviour and is usually associated with mate location. Males compete for hilltop territories and then perch on prominent features such as twigs and rock pinnacles. Females ascend the hills to seek out the dominant individuals.

Male Ella's Silverline *Cigaritis ella* perching alertly on a hilltop tree

Butterflies are like birds in that the 'giss' (or 'jizz') or 'general impression of size and shape' (actually an indefinable combination of body language, posture and behaviour) is almost as important in identification as size, shape and markings. The live photographs in this book attempt to capture the giss as closely as possible. The more time you spend observing butterflies, the better acquainted you will become with the giss of different butterflies and butterfly groups.

Colour is another important clue to identification. Most small blue butterflies fall into the subfamily Polyommatinae. Medium-sized blues are often Theclinae, and most small orange butterflies are in the Aphnaeinae or Lycaeninae. White, orange and yellow butterflies are largely confined to the Pieridae, and brown ones to the Satyrinae. Some groups are easily identified by their markings: the satyrines show 'ringlet' eyespots and many of the heliconiines have spotted patterns, which help distinguish them. Note that colours fade with time, even in the lifetime of the insect, and colours of butterflies in the field may vary slightly from those in the photographs featured in the book.

Wing shape is also useful. The heart-shaped hind wings of *Charaxes* species are characteristic and help to identify the group. Similarly, the arched anal margin of *Papilio* species or the hair-like tails typical of the genus *Anthene* are useful clues, as are the long, rounded wings of the Bitter Acraeas.

When setting out at first, avoid trying to identify everything you see. Rather concentrate on observing behaviour, recording this and any other points notable about a species you encounter. Of course photography is helpful here, because you can identify the butterflies in the comfort of your study later on. Flight patterns (described under each species) are especially worth noting and can often help distinguish between like species. Some mimics are much easier to tell from their models by observing flight. For example, the pied form of the female Mocker Swallowtail *Papilio dardanus cenea* f. *hippocoonides* is almost identical in colour and markings to the Southern Friar *Amauris niavius dominicanus*, but she flies with a typical dancing Swallowtail motion, whereas the Friar shows the slow, floating Tiger-type flight pattern.

Use the Quick Guide (inside front cover) to find the section most likely to contain the butterfly you have just seen. Check distribution maps and photographs, and have a first attempt at identification. Careful recording of the locality where you saw the butterfly will help, as many very similar species don't fly together.

Patience and practice will bring reward, and the more time you spend observing, the better equipped you will become in identifying species. If all else fails, catch the butterfly and keep it in a small, smooth-walled container, in the dark. Contact the Lepidopterists' Society of Africa or your local museum for help. South Africa is still not fully explored butterfly-wise, so there is always the exciting possibility that you've found something totally new!

COLLECTING BUTTERFLIES

Butterfly collecting is an absorbing and rewarding hobby, and is valuable in introducing children to nature. A common misconception is that collecting leads to butterfly extinction. This is not true. Even small colonies of specialist butterflies are known to withstand regular collecting.

Insects are not as vulnerable as are mammals and birds to extirpation by hunting. Females lay from dozens to hundreds of eggs, of which only two have to reach maturity to ensure perpetuation of the species. The life cycle is very fast compared to that of vertebrates, some species having several broods per year and seldom fewer than one.

A detailed account of butterfly collecting is beyond the scope of this book, but here is a list of the basics you will need to start a collection.

- **Butterfly nets** Fishermen's landing nets serve well. Replace the open mesh with fine organza or chiffon. You can also make a net using aluminium tubing and soft fabric for the net.

Butterfly net

- **Butterfly traps** are used to attract high-flying species that seldom visit flowers. These butterflies are attracted to bait such as, for example, fermenting fruit. The traps work rather like lobster pots in that the quarry can get in but cannot escape; traps are not lethal and allow unwanted specimens to be released.
- **Cork or plastic foam-lined storage boxes and cabinet drawers**, with insect repellent to keep out pests such as museum beetles.
- **Setting boards** on which the wings are spread out while the specimen dries out and sets into its mounted position.
- **Setting papers** (tracing paper or celluloid) and glass-headed pins.
- **Entomologists' pins**, 38mm long, and in several thickness gauges for different sized specimens.
- A means of producing **labels** for attachment to the pin below the specimen (most computers can be used to make these).
- **Glassine envelopes** or plastic zip-closure bags to hold specimens.
- **A field notebook** to record data on specimens as they are collected and to note any other relevant observations.

ETHICS OF COLLECTING

1 Never take more specimens than you need, especially of specialist species.

2 Always label specimens accurately with the date of capture, locality data (GPS if possible) and your name.

3 Always consult the relevant authorities to find out the legal status of collecting; the legislation is currently under review. Some species are protected by law under various provincial ordinances. Contact your local nature conservation department for a list of these. If you are a member of the Lepidopterists' Society of Africa you can apply to join a permit through the society.

4 Ask permission of landowners before you collect on their land.

5 Contact your local museum and deposit important specimens with the Curator of Lepidoptera.

6 Make your collecting and observation data available to conservation bodies, for example, by using the Lepidopterists' Society of Africa's data capture software, Lepidops, or by recording on LepiMAP.

7 Lepidops is available to members for a small fee. See www.lepsocafrica.org.

8 LepiMAP can be accessed at vmus.adu.org.za. Contributors are asked to register with the ADU as an observer.

9 iNaturalist, accessed at www.inaturalist.org, is another citizen science project that accepts butterfly and moth records.

IDENTIFYING A SUBFAMILY IN THE EARLY STAGES

The shape, coloration and patterning of the butterfly egg is generally specific to each butterfly subfamily, as is the larva and the pupa, and this is useful in identification. The following are examples of species that best typify some of the region's butterfly subfamilies in their early stages.

Nymphalinae *Protogoniomorpha parhassus*, egg

Biblidinae *Byblia ilithyia*, egg

Limenitidinae *Pseudacraea lucretia tarquinia*, egg

Heliconiinae *Acraea petraea*, eggs

Satyrinae *Pseudonympha paludis*, egg

Charaxinae *Charaxes ethalion ethalion*, egg

Danainae *Danaus chrysippus orientis*, egg

Poritiinae *Alaena amazoula amazoula*, eggs

Miletinae *Thestor basutus basutus*, egg

Aphnaeinae *Tylopaedia sardonyx sardonyx*, egg

Polyommatinae *Zizina otis antanossa*, egg

Theclinae *Myrina silenus ficedula*, egg

Coliadinae *Colias electo*, egg

Pierinae *Belenois thysa*, egg

Papilioninae *Papilio demodocus*, egg

Hesperiinae *Afrogegenes* sp., egg

Pyrginae *Tagiades flesus*, egg

Coeliadinae *Coeliades keithloa*, egg

Nymphalinae *Vanessa hippomene hippomene*, 5th instar larva

Cyrestinae *Cyrestis camillus*, final instar larva

Biblidinae *Eurytela dryope angulata*, 3rd instar larva

Limenitidinae *Pseudacraea eurytis imitator*, 4th instar larva

Heliconiinae *Lachnoptera ayresi*, final instar larva

Satyrinae *Bicyclus safitza safitza*, final instar larva

Charaxinae *Charaxes candiope*, final instar larva


Danainae *Amauris albimaculata albimaculata*, final instar larva


Poritiinae *Pentila tropicalis tropicalis*, final instar larva


Miletinae *Lachnocnema laches*, final instar larva


Aphnaeinae *Cigaritis natalensis*, final instar larva


Polyommatinae *Anthene larydas*, final instar larva


Theclinae *Iolaus diametra natalica*, final instar larva


Coliadinae *Catopsilia florella*, final instar larva


Pierinae *Pontia helice*, final instar larva


Papilioninae *Papilio echerioides echerioides*, final instar larva


Hesperiinae *Borbo fatuellus*, final instar larva


Pyrginae *Spialia dromus*, final instar larva


Coeliadinae *Coeliades forestan*, 4th instar larva


Nymphalinae *Precis octavia sesamus*, pupa


Biblidinae *Sevenia natalensis*, pupa


Limenitidinae *Cymothoe coranus*, pupa


Heliconiinae *Acraea natalica*, pupa


Satyrinae *Bicyclus safitza safitza*, pupa


Charaxinae *Charaxes druceanus druceanus*, pupa


Danainae *Amauris albimaculata albimaculata*, pupa


Poritiinae *Alaena amazoula amazoula*, pupa


Miletinae *Lachnocnema laches*, pupa


Aphnaeinae *Chrysoritis natalensis*, pupa


Polyommatinae *Euchrysops malathana*, pupa


Theclinae *Hypolycaena philippus*, pupa


Coliadinae *Eurema brigitta brigitta*, pupa


Pierinae *Appias epaphia contracta*, pupa


Papilioninae *Papilio ophidicephalus phalusco*, pupa


Hesperiinae *Borbo fatuellus*, pupa


Pyrginae *Tagiades flesus*, pupa


Coeliadinae *Coeliades keithloa*, pupa

Family NYMPHALIDAE

This is the largest butterfly family in the world, with over 6,000 species in 12 subfamilies, of which 9 are represented in South Africa. Nymphalids are also known as 'brush-footed butterflies' because in adults the front legs are atrophied to small brush-like sensory organs, so that they appear to have only 4 legs instead of the normal 6. The front pair of legs serves no walking function.

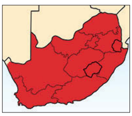
Subfamily DANAINAE

Distinguished from other subfamilies of Nymphalidae by having forewing vein 3A, which joins vein 2A close to the wing base. Flight is generally slow and sailing. Bright coloration (black patterned with white, yellow, orange or blue) warns vertebrate predators of their acrid odour and distastefulness. For this reason, danaids are models for many non-distasteful species. They derive their distastefulness from pyrrolizidine alkaloids exuded by certain plants (e.g. *Senecio, Heliotropium*) when damaged. Males metabolise these to create sex attractant pheromones and bitter predator-deterring irritants. These are passed over to the female during mating.

Genus *Danaus* Tigers

WORLD 12 SPP., SOUTH AFRICA 1

Large to very large cream to yellow or tawny orange butterflies, with black veins. Several colour morphs. Sexes similar; ♂ has black sex brands on the hind wing. Eggs laid singly; creamy white elongated oval, with about 20 longitudinal ribs with 25–30 cross-ridges. Larvae white to cream, ringed with yellow and black; pairs of long black fleshy filaments on segments 2, 5 and 11. Pupae translucent white, pale green or turquoise, smooth-skinned with ring of black and gold spots around the abdominal segments; suspended by cremaster from a twig.



1 African Plain Tiger *Danaus chrysippus*

Wingspan: ♂ 50–70mm ♀ 50–75mm. **Identification: 1A** ♂ upperside (*orientis* type form), **1B** ♂ underside (*orientis* type form), **1C** ♂ upperside (*dorippus* type form), **1D** ♂ upperside (*alcippus* type form), **1E** ♀ underside (subsp. *dorippus* f. *transiens*). ♂ distinguished from ♀ by large black spot on hind wing CuA_2, white-centred on the underside. 3 subspp. in South Africa. Most commonly found in South Africa is *D. c. orientis*, with subapical band of white spots, sometimes joined, on black wingtip. Degree of basal chocolate-brown varies. Form resembling *D. c. alcippus* has forewing markings as in *D. c. orientis* with varying amounts of white on hind wing upperside. Form resembling *D. c. dorippus*, wingtip orange, lacks white-spotted black pattern. Typical *D. c. dorippus* has orange all the way from the wing bases; f. *klugii* has chocolate-brown basal suffusion. Form *transiens* is similar to f. *klugii*, but in addition has traces of the white forewing spots seen in *D. c. orientis* and *D. c. alcippus*. Lazy flight, appearing aimless. Often seen in numbers feeding on flowers, or on certain plants (e.g. *Senecio*, *Heliotropium*) which have been cut and are wilting. **Mimics:** ♀ *Hypolimnas misippus* is a polymorphic mimic of all forms of this butterfly; also ♀ *Papilio dardanus cenea* f. *trophonius,* f. *aikeni* and probably f. *salaami*; *Paralethe dendrophilus*; *Telchinia encedon encedon*. **Distribution:** Common and widespread throughout South Africa in all biomes. **Habitat:** Forest edges, parks and gardens, hilltops, flatlands, coast, mountains, wetlands. **Flight period:** Year-round, peak late summer/autumn. **Larval food:** *Gomphocarpus* spp., especially *G. fruticosa, Cynanchum obtusifolium, Orbea variegata, Xysmalobium undulatum, Pachycarpus, Ceropegia, Stapelia* and *Huernia* spp. **Alternative common name:** African Monarch.

1A

1B

1C

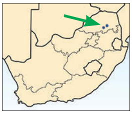
1D

1E

Genus *Tirumala* Tigers

WORLD 10 SPP., AFRICA 2, SOUTH AFRICA 1

Large dark butterflies, wings covered with paler spots. Sexes alike. Flight floating; appears weak, but capable of bursts of speed if disturbed. Early stages similar to those of *Danaus*. Eggs oval, with fine longitudinal and transverse ribs. Larvae black, white and yellow, with similarly placed fleshy filaments. Pupae pale with metallic ornamentation.



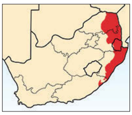
1 African Blue Tiger *Tirumala petiverana*

Wingspan: 60–75mm. **Identification: 1A** ♂ upperside, **1B** ♂ underside. Large black butterfly with pale blue spots. Easily mistaken for widespread mimics. ♂ has *anal sex brand on hind wing upperside*. Lazy flight, appearing aimless. May be seen on certain plants (e.g. *Senecio*, *Heliotropium*) which have been cut and are wilting. **Mimics:** ♂ *Charaxes wakefieldi*; both sexes of *Graphium leonidas*. Compared to mimics on the wing, flight pattern and habits are similar to those of *Danaus*. **Distribution:** Very rare vagrant, usually on Afromontane, lowland and riverine forest. Only recorded migrants from Polokwane and Chuenespoort (Limpopo) and Randburg (Gauteng). **Habitat:** Forest edges, parks and gardens, hilltops, flatlands. **Flight period:** Single-brooded. In Zimbabwe, Feb–May, peak Apr. **Larval food:** *Pergularia daemia* and *Hoya* spp. **Alternative common names:** Dappled Monarch, Blue Monarch.

Genus *Amauris* Friar, Novice, Layman, Chief

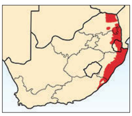
AFRICA 16 SPP., SOUTH AFRICA 4

Medium-sized to large butterflies, black, spotted or blotched with white or cream. Sexes similar; ♂ with dark, shiny scent patch on hind wing anal area. Eggs laid singly, sometimes in small groups; creamy white elongated oval, with about 20 longitudinal ribs with 25–30 cross-ridges. Larvae shiny black with white or yellow spots; 4 or 5 pairs of long fleshy filaments on segments 2, 3, 5 (sometimes absent), 11 and 12. Pupae buff with shiny golden patches; suspended by cremaster from twig or branch.



2 Southern Friar *Amauris niavius dominicanus*

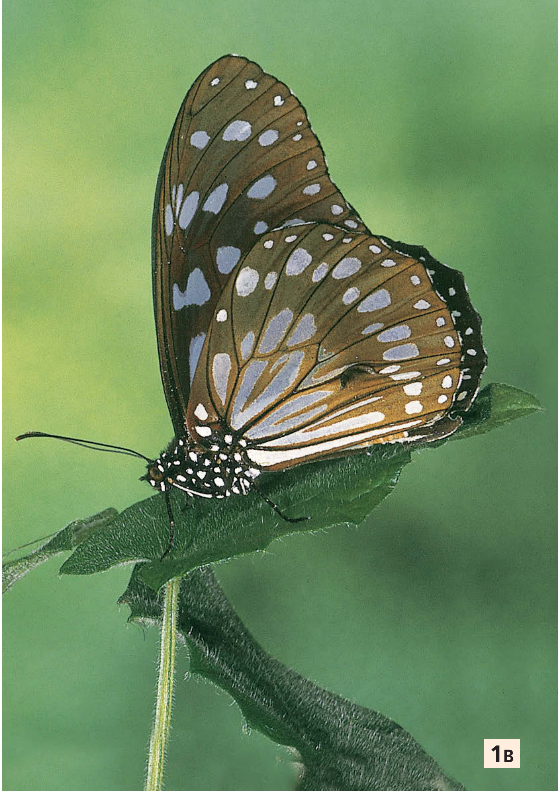
Wingspan: ♂ 80–85mm ♀ 78–82mm. **Identification: 2A** ♂ upperside, **2B** ♂ underside. Largest South African *Amauris*; *conspicuously marked black and white*. ♂ has less white on wings than ♀, which has more rounded wings. Shade-loving; seldom found in the open, except at attractive flowers. Sometimes swarms. May be seen on certain plants (e.g. *Senecio*, *Heliotropium*) which have been cut and are wilting. **Mimics:** ♀ *Papilio dardanus* f. *hippocoonides*; both sexes of *Hypolimnas anthedon wahlbergi* f. *wahlbergi*; ♀ *Charaxes wakefieldi*. **Distribution:** More common in n than *Amauris ochlea*. Coastal and inland riverine forest, dense lowland forest. KwaZulu-Natal (Umkomaas), eSwatini, n to Mpumalanga and Limpopo. **Habitat:** Forest edges, parks and gardens, flatlands, coast. **Flight period:** Year-round, peak late summer/autumn. **Larval food:** *Cynanchum* and *Tylophora* spp. **Alternative common name:** Friar.



3 Novice *Amauris ochlea ochlea*

Wingspan: ♂ 55–60mm ♀ 60–65mm. **Identification: 3A** ♂ upperside, **3B** ♀ upperside, **3C** ♂ underside. Smaller than similar *Amauris niavius dominicanus*, and less active, flying higher; major differences are smaller white forewing apical patch, basal forewing white patch *does not reach the anal edge of wing.* Sexes similar; ♂ has less white on wings than ♀; ♀ has more rounded wings and lacks hind wing sex brands. In ♂ ground colour of hind wing upperside jet-black; ♀ grey-brown. Lazy flight, appearing aimless. Sometimes swarms. May be seen on certain plants (e.g. *Senecio*, *Heliotropium*) which have been cut and are wilting. **Mimic:** (Possibly) *Hypolimnas deceptor*. **Distribution:** Scarcer than *A. niavius dominicanus* in the n. Coastal and inland riverine and lowland forests. KwaZulu-Natal s coast to Limpopo lowland forests near Pafuri and Thohoyandou and farther n. **Habitat:** Forest edges, flatlands. **Flight period:** Year-round, peak summer/autumn. **Larval food:** *Cynanchum chirindense, C. natalitium* and *Tylophora anomala*. **Alternative common name:** Novice Friar.

1A



1B

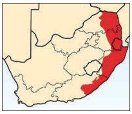
2A

2B

3A

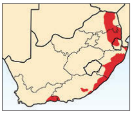
3B

3C



1 Layman *Amauris albimaculata albimaculata*

Wingspan: ♂ 50–60mm ♀ 62–68mm. **Identification: 1A** ♂ upperside, **1B** ♂ underside. Distinguished from similar *Amauris echeria* by the labial palpi on the front of the head. *A. albimaculata* has a white line on the front of each palp; *A. echeria* has two tiny white dots. Upperside black with *white* forewing spots, hind wing patch pale buff. Sexes similar; ♀ lacks hind wing sex brands. Slow, floating flight. ♂ is South Africa's smallest danaid. May be seen on certain plants (e.g. *Senecio*, *Heliotropium*) that have been cut and are wilting. **Mimic:** ♀ *Papilio dardanus cenea* f. *acene*; both sexes of *Hypolimnas anthedon wahlbergi* f. *mima*; *Pseudacraea lucretia*. **Distribution:** Commoner and more widespread than *A. echeria* or *A. ochlea*. Coastal, lowland and riverine forests and savanna. E Cape (East London) to KwaZulu-Natal, eSwatini and n to Mpumalanga and Limpopo. Vagrant as far w as Gauteng and NW Province. **Habitat:** Forest edges, clearings, tracks, parks and gardens, flatlands. **Flight period:** Year-round, peak summer/autumn. **Larval food:** *Cynanchum chirindense, C. natalitium* and *Tylophora anomala*. **Alternative common name:** Layman Friar.



2 Chief *Amauris echeria echeria*

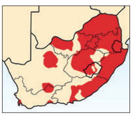
Wingspan: ♂ 55–65mm ♀ 63–70mm. **Identification: 2A** ♂ upperside, **2B** ♀ underside. Coloration variable. Distinguished from similar, slightly smaller *Amauris albimaculata* by having forewing spots *always cream to ochre*; close examination shows that the palpi carry two tiny white dots, not a vertical line. Hind wing band wider in n specimens; more frequent in forest than *A. albimaculata*. Sexes similar; ♀ lacks hind wing sex brands. Lazy flight, appearing aimless. Sometimes swarms. May be seen on certain plants (e.g. *Senecio*, *Heliotropium*) which have been cut and are wilting. **Mimic:** ♀ *Papilio dardanus cenea* f. *cenea*; some forms of *Pseudacraea lucretia*. **Distribution:** Common in lowland, riverine and Afromontane forests. W Cape (George) to KwaZulu-Natal, eSwatini, Mpumalanga and Limpopo. **Habitat:** Forest edges, flatlands, parks and gardens. **Flight period:** Year-round, peak summer/autumn. **Larval food:** *Cynanchum chirindense* and *Tylophora anomala*. **Alternative common name:** Chief Friar.

Subfamily SATYRINAE

Like Danainae and Heliconiinae, Satyrinae differ from other Nymphalidae by having well-developed discocellular veins in both wings. Unlike Heliconiinae, they lack vein 3A. Many Satyrinea have the forewing subcostal vein swollen at the base. Satyrinae are usually brown in ground colour, with patches of red to orange-yellow. Ringlets usually have eyespots (few to many) on the wings. With a few exceptions, satyrines are fairly weak fliers that settle often.

Genus *Melanitis* Evening Browns WORLD 12 SPP., AFRICA 3, SOUTH AFRICA 1

Large satyrines, with eyespots on the forewing upperside. The forewing subcostal vein is not swollen at the base. Skulking, reluctant to fly; flight is low and of short duration. Eggs white, spheroidal with flattened base, appearing smooth, but under magnification show fine net-like pattern. Larvae cylindrical, tapered at both ends, green with darker longitudinal stripes; bifid tail; two-horned, hairy head capsule. Pupae green, rounded; formed in grass debris.



3 Common Evening Brown *Melanitis leda*

Wingspan: ♂ 58–65mm ♀ 63–72mm. **Identification: 3A** ♂ upperside (f. *helena*), **3B** ♀ upperside (f. *zitenides*), **3C** ♀ underside (f. *helena*), **3D** ♀ underside (f. *zitenides*). Large brown butterfly. ♀ generally paler than ♂, for all forms. WSF f. *helena* has blunt wingtips; ♂ has small forewing ocelli. DSF f. *zitenides* larger, *both sexes* with large ocelli, undersides very variably coloured and marked. Slow, moth-like flight. Active mainly at dusk or on dull, cloudy days. Fond of fermenting fruits and tree sap. **Distribution:** Widespread in Afromontane, lowland and riverine woodland and forest from W Cape (Cape Town) and E Cape to KwaZulu-Natal, eSwatini, Mpumalanga, Limpopo and NW Province. Also in wooded riverine kloofs in fairly arid areas of N Cape. **Habitat:** Forest edges, flatlands, gullies. **Flight period:** Two main overlapping broods: winter (Mar–Aug, when most numerous), spring and summer (Sept–Mar). **Larval food:** Poaceae grasses including *Setaria* and *Cynodon* spp., *Cenchrus clandestinus* and *Saccharum officinarum*. **Alternative common name:** Twilight Brown.