Butterflies of the Golfo Dulce Region Costa Rica

Corcovado National Park
Piedras Blancas National Park
‚Regenwald der Österreicher'

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The main building of the Tropical Research Station

In 1991, Michael Schnitzler, a distinguished musician and former professor at the University of Music and Performing Arts in Vienna, founded the 'Association Rainforest of the Austrians' (*Verein Regenwald der Österreicher*). Over many years, he collected contributions in Austria and forwarded the funds to the Costa Rican government. With the money, the government purchased large tracts of forest from landowners and placed it under the control of the 'Parque Nacional Piedras Blancas', thereby preserving the Esquinas Rainforest in southwestern Costa Rica. It soon became apparent that this protected area also provided ideal conditions for promoting Austrian research and teaching programmes in rainforests. To make the area more accessible, the 'Association Rainforest of the Austrians'bought an old farmhouse (a *finca*) in 1993. This formed the nucleus for a tropical field station, located directly on the border of the National Park near the small village of La Gamba. With the support of the 'Association Rainforest of the Austrians', the Ministry of Science and Research and the University of Vienna, the 'Tropical Research Station La Gamba' flourished and grew. It now comprises several buildings and includes comfortable living and research facilities for more than 30 visitors as well as a botanical garden. In 2008 an airconditioned laboratory was constructed with the support of the Faculty of Life Sciences of the University of Vienna. With its infrastructure, the field station is currently on the threshold of becoming an internationally established research institution and education centre, focussing on the exploration and conservation of Neotropical rainforests. Since its foundation, many scientists have carried out field research in the Esquinas rainforest and many visitors have admired its beautiful surroundings. As well as supporting research and teaching activities, the station helps the inhabitants of La Gamba by means of a series of applied projects to improve their living conditions. These projects are partly run in

Scientists at work in La Gamba

collaboration with the nearby 'Esquinas Rainforest Lodge', another brainchild of Michael Schnitzler, which represents an Austrian example of sustainable ecotourism. Indeed, the lodge was awarded some years ago the official Costa Rican 'Three-Leaf Certificate of Sustainable Tourism'. We are particularly proud that the former European Commissioner for Agriculture, Dr. Franz Fischler, has been a patron of the 'Society for the Preservation of the Tropical Station La Gamba'(*Verein zur Förderung der Tropenstation La Gamba*) since 2006. Numerous scientific publications have resulted from research performed at the Tropical Research Station La Gamba, including about 70 doctoral and diploma theses. The scientific work initially focussed on the flora and vegetation of the Esquinas forest but it has now broadened to include a wide range f other topics, such as animal-plant interactions, herpetology, ornithology, entomology (especially studies of butterflies), limnology, chemical eco-physiology, bio-geochemistry, geography and sociology. About 60 field courses and excursions have been organized, enabling students and scientists from universities all over the world to visit the Piedras Blancas National Park.

Our Society is particularly interested in providing all our visitors, and beyond that the many friends and admirers of the tropics, with information on the biology and ecology of the local and regional rainforests and of the adjacent cultural land. Following the publication of an internationally acclaimed 'Field Guide of Flowering Plants of the Golfo Dulce Rainforests' in 2001, seven colourful brochures have to date been published: 'Amphibians and Reptiles of the Golfo Dulce Region', 'The Birds of the Golfo Dulce Region, Costa Rica', 'Das Leben hier und dort – La vida aquí y allá', 'Ecosystem diversity in the Piedras Blancas National Park and adjacent areas (Costa Rica)', 'Fruits in Costa Rican Markets', 'Corbiculate Bees of the Golfo Dulce Region, Costa Rica', 'Dragonflies of the Golfo Dulce Region, Costa Rica'. Adittionally, a scientific monograph 'Natural and Cultural History of the Golfo Dulce Region, Costa Rica' has been published in 2008.

We are now proud to offer a further colorful issue dealing with a group of animals - the butterflies – which on the one hand belong to the most eye-caching insect groups, and can be encountered on the other hand due to their behaviour usually more frequent by rain forest visitors as some other insect groups. We hope that this booklet – as all our former brochures and books - will be a source of information and joy to lovers of tropical life, to scholars und students, to teachers and researchers at the University and – finally - to all the friends of the 'Rainforest of the Austrians' and the 'Tropical Research Station La Gamba'.

For further information see:

www.lagamba.at

and

www.regenwald.at

The 'Comedor'

Martin Wiemers with students in the laboratory

The rainforests of the Golfo Dulce region

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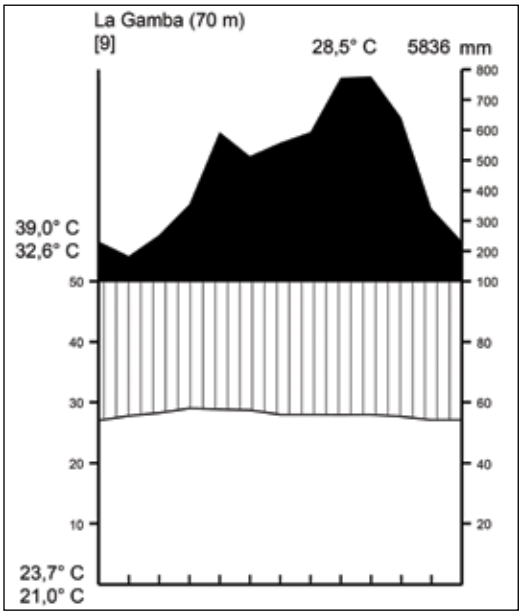
The Golfo Dulce region is located in the southern corner of the Pacific coast of Costa Rica, near the border with Panama. Within this region are the Corcovado and Piedras Blancas national parks. The forests of the region are the only moist or wet evergreen lowland forests that still exist on the Pacific coast of Central America. The elevations range from sea level to 745 m on the Cerro Rincón, Peninsula de Osa; the annual precipitation is up to 6,000 mm with a short or almost nonexistent dry season from December until March; the relief is strongly structured at the landscape level and contains many microhabitats and niches; and the soil types are diverse and the vegetation highly dynamic. All of these factors, coupled with the biogeographical position of the Golfo Dulce, have led to a very species-rich forest: about 2,700 species of higher plant have been recorded from the area.



Climatic diagramm, La Gamba


Morning clouds above the forest

The tallest trees in the moist and wet evergreen lowland forests grow up to 60 m high (e.g.


Waterfall on the Quebrada Chorro

The Rió Bonito in the NP Piedras Blancas

A*nacardium excelsum*, *Parkia pendula*, *Carapa guianensis*, *Brosimum utile* and *Caryocar costaricense*). Most trees retain their foliage throughout the year. Palms (about 45 species) such as *Socratea exorrhiza*, *Iriartea deltoidea*, *Welfia regia* and *Asterogyne martiana* are typical features of the forest. *Heliconia* herbs are obvious near streams and in gaps. Lianas (e.g. *Bauhinia* and *Entada*), vines and epiphytes (Bromeliaceae, Orchidaceae) are found on many trees. About 100 species of orchid (e.g. vanilla) and 40 species of bromeliad are distributed in the region.

Hemi-epiphytic plants of the genus *Clusia* are abundant in the very wet parts of the forest while fig trees (*Ficus*) are more frequent in the drier regions (on the Corcovado plains). On the coast, the coconut palm (*Cocos nucifera*) and the ''tropical almond tree' (*Terminalia catappa*) are the most conspicuous plants; in the mangroves this position is taken by red mangrove (*Rhizophora mangle*) and mangle pinuela (*Pelliciera rhizophorae*). In addition to the various types of primary and secondary forest, the area also features other types of habitat such as pastures, pools, rivers, cultivated land and various kinds of plantation (e.g. oil palm, teak and manioc). Bees are very abundant and are found in all habitats.

Costa Rica's geographic location on the 'bridge' between North and South America and the fact that the country formed a kind of refuge for tropical animals and plants during the last ice age has led to remarkable biogeographical patterns. Restricted-range plants and animals are abundant and many reach their northern limits in southern Costa Rica. The region is an excellent place for naturalists to enjoy tropical nature. An extensive system of trails in the Corcovado and Piedras Blancas national parks (La Gamba) offers wonderful insights into tropical rainforests.

Interior of the forest of the NP Piedras Blancas

Butterflies of the Golfo Dulce Region Costa Rica

Introduction

The butterflies of Costa Rica are extraordinarily diverse and rich in species. They are one of the most thoroughly studied butterfly faunas of the Neotropics. At least 1,323 species of true butterflies and skippers (Papilionoidea and Hesperioidea) have been identified in the various habitats of the country, according to the study of DeVries (1983). It is estimated that about 5% of the total number of butterfly species of the world live in Costa Rica (Wiemers & Fiedler 2008).

The preliminary checklist of the surroundings of the Tropical Research Station La Gamba accounts for a total of 216 butterfly species (202 Papilionoidea and 14 Hesperioidea, Appendix 1). The list summarizes the results of four standardized one-week-surveys which were carried out from 2006 to 2010 (mainly in February), and includes species, which were encountered outside of the time period of the studies. Additional species were added from two longer surveys carried out by Hellena Binz (December 2008 – January 2009 and November 2009 – February 2010) who also employed fruit baiting for her second study. The results of the first two surveys in 2006 and 2007 were published by Wiemers & Fiedler (2008), who list 144 butterfly species (130 Papilionoidea and 14 Hesperioidea) and estimate at least 156-204 species of Papilionoidea for the area of La Gamba within the Esquinas Rainforest. An additional 64 species (49 Papilionoidea and 15 Hesperioidea) were reported from the Corcovado National Park. Thus, a total of 280 butterfly species (251 Papilionoidea and 29 Hesperioidea) are currently known from the Golfo Dulce region of the Costa Rican province Puntarenas.

The habitats surrounding the research station can be divided into three types with varying degrees of land use: the natural forest, the secondary forest and the intensively used land systems. The natural forest consists of primary forests which are located mainly in the Piedras Blancas National Park. This habitat type contains the highest number of butterfly species. It is followed by the secondary forest habitat, which borders the protected areas of the National Park. The habitat type characterized by intensive land use consists of pastures, oil palm plantations, roadsides, and gardens and shows the least number of butterfly species (Wiemers & Fiedler 2008). Typical for the natural forests are the nymphalid species *Philaethria dido*, *Heliconius sapho*, *H. cydno*, *Eueides lybia* and the lycaenid species, *Arumecla galliena*. In the intensively used habitats, the nymphalids *Hermeuptychia hermes*, *Anartia jatrophae*, *A. fatima* and the pierid butterfly *Pyrisitia nisa* are most common (Wiemers & Fiedler 2008).

Diurnal butterflies, unlike moths, are active during the daytime. They are presently classified into two superfamilies: Papilionoidea and Hesperioidea. The Papilionoidea (or true butterflies) are split into five families: Papilionidae (swallowtail butterflies), Pieridae (sulphures and whites), Nymphalidae (brush-footed butterflies), Lycaenidae (blues) and Riodinidae (metalmarks). Of these, the Nymphalidae is the group richest in species. The Hesperioidea includes only one family, Hesperiidae (skippers).

This booklet includes the most frequent and most conspicuous butterflies in the examined region. A short description is given for each of the selected species along with general information about aspects of its natural history. In addition to the scientific names of the butterflies, we provide common English and Spanish names, in as much as they are available. Most species in the booklet can be seen during the whole year; however, the frequencies of the species will vary over the seasons. Typical for tropical biodiversity is that a high number of species may be present but the number of individuals is usually low. Thus, on a brief visit, one should not expect to be able to see all the butterflies mentioned in the book.

This guide book is a product of a field course in tropical biology for students of the University of Vienna (Austria) during August and September 2009 and is based on results of similar student courses of previous years. Determination of the butterfly species was based on the two volumes of 'The Butterflies of Costa Rica and their Natural History' (DeVries 1987, 1997) and the recent field guide 'Mariposas de Costa Rica – Butterflies and moths of Costa Rica (Chacón

& Montero 2007). The nomenclature, systematic classification and order in the book follow Lamas (2004) and the preliminary checklist of the Papilionoidea and Hesperioidea of the Tropical Research Station La Gamba (Wiemers & Fiedler 2008). English common names were taken from the internet site: www.neotropicalbutterflies.com. For comprehensive information on the biology of butterflies, see DeVries (1987, 1997) and Janzen (1983). Aspects of climate, habitats and biodiversity are well summarized in 'Natural and cultural history of the Golfo Dulce Region, Costa Rica' (Weissenhofer et al. 2008).

The best time to observe butterflies is from morning to noon. In these hours, most butterflies are active and searching for food or mates. The best opportunity to closely observe and photograph these beautiful insects is while they are occupied with feeding. Most butterfly species can be found on or near flowering plants. Some are attracted to rotting fruits and others take up fluid from wet ground. The photographs and the text in this guidebook should be helpful in identifying some of the most frequent species and in becoming more acquainted with their natural history.


Eggs of *Heliconius melpomene*


Larva of *Heliconius melpomene*


Pupa of *Heliconius melpomene*

Life cycle of butterflies

The life cycle of a butterfly can be divided into four stages: egg, larva (caterpillar), pupa (chrysalis) and adult (imago).

Adult females lay individual eggs or clusters of eggs on surfaces of leaves, flower buds or stems of the host plants. The eggs undergo embryonic development until they hatch from the chorion shell, after which begins the larval stage.

The larvae of butterflies are known as *caterpillars*. Most are voracious herbivores and make good use of their biting-chewing mouthparts. They generally feed on more or less closely related host plants or exceptionally on a single plant species. Some are able to feed from a relatively wide variety of plant species. Caterpillars increase their size over one hundredfold. In the process, they molt four to seven times. The phases between successive molts are called *instars*. Many caterpillars assume different shapes and appearances from instar to instar. Not all instars are easy to find in nature.

During the pupal stage, larval tissues are broken down, and the new organs of the adult become differentiated (i.e., metamorphosis). Fi-

Imago of *Heliconius melpomene*

nal adjustments for adult life are made while the butterfly is still emerging from the pupal encasing. The wings unfold, and the adult feeding organ or *proboscis* becomes fully assembled.

As adult insects, butterflies take flight, consume liquid nutrients and reproduce. Many butterflies display special courtship behavior. After mating, the females search for host plants on which to lay their eggs.

Morphology of adult butterflies

Like all insects, the body of a butterfly is composed of three main parts: head, thorax and abdomen. The *head* contains the brain, the major sensory organs, mouthparts (*proboscis*) and the suction pump of the frontal alimentary tract. The proboscis is a long coil that can be extended to suck on fluids such as nectar, the juice of rotting organic matter or water. The large spherical compound eyes form the visual organs. The two elongate and club-tipped antennae on the head serve primarily tactile and olfactory functions. They are used to locate food and mates, as well as the appropriate site on the host plant to lay eggs. In addition, antennal movements help the butterfly keep its balance when flying. The *thorax* bears the locomotory organs, i.e., three pairs of legs and two pairs of wings. The fore and hindwings fold vertically over the body when the butterfly is at rest. The wings vary in color, size and form in the different groups and species. They are exceedingly thin structures, yet with an immensely large surface area in comparison to the actual body. Inside the wings is a network of supporting veins. The hind part of the body, the *abdomen*, contains the major organs for digestion, excretion and reproduction. The morphology of the male sex organs is complex. The genitalia are thus not only useful in taxonomic studies but often they provide the distinguishing traits, which unambiguously identify the species.

Wing pattern and defense mechanisms

Butterflies are among the most popular insects, mainly because of their beautifully colored wing patterns. The wing surfaces are coated with minute cuticle scales, each capable of a single color. Some scales reflect light and appear silvery. When iridescent hues are present, it is because the scales produce a particular blue or green color by physical diffraction of light. Not all patterns are visible to human eyes since we are unable to see UV-reflected or polarized light, which many butterflies can. The wing pattern may serve multiple biological functions. In many species, the underside of the wings is dark and cryptically colored so that the butterfly is hardly

detectable when sitting still with its wings closed. The upperside of the wings is often colorful and functions as a signal enabling the butterflies to recognize members of their own species as either sexual partners or co-rivals. The wings of some butterflies display eyespot patterns, and others sport a short process (tail) on the hindwing. It is postulated that eyespots and tails steer the attention of an attacking bird away from the delicate body to the wing margins thereby better enabling a butterfly to escape. In many cases, particularly colorful wing patterns are aposematic and warn potential predators of the toxicity or distasteful properties of the butterfly.

A great number of butterflies defend themselves with chemical compounds, which they acquire as larvae when feeding on toxic host plants and which they transfer via the pupae to the adults. Toxic or unpalatable butterflies often have conspicuous patterns on the wings. A bird which has eaten a poisonous butterfly may be forced to vomit it out. If it can remember the color pattern, it may avoid eating similar looking butterflies. The success of such chemical defenses has led many species to resemble closely each other in behavior and wing color pattern. In other words, they imitate each other. Two types of mimicry are distinguished.

In Batesian mimicry, a non-toxic edible butterfly looks like a toxic or distasteful species. The non-toxic species profits because an experienced predator will associate the conspicuous color pattern with the distastefulness of the toxic butterfly. However, if non-toxic mimics are too common, predators will not make the association. Thus for Batesian mimicry to be maintained, it is important that non-toxic mimics are present in lower frequency in the habitat than toxic model species.

In the second type, Müllerian mimicry, all involved butterflies are more or less distasteful and have evolved a similar color pattern of the wings. They profit from the mimetic resemblance since a predator will learn faster when the warning color pattern is more frequent. This type of mimicry is much more common, and it is considered to be a more stable evolutionary strategy.

Mimicry ring with *Mechanitis lysimnia* (top), *Heliconius hecale* (bottom, left) and *Lycorea halia* (bottom, right)

Mimicry ring with *Dismorphia theucharila* (Pieridae) (top), *Greta oto* (Nymphalidae) (bottom, left) and *Phanoptis vitrina* (Notodontidae) (bottom, right)

Rainforest gap in the Piedras Blancas National Park. In natural rainforests, gaps are regularly produced by fallen trees. Many butterfly species such as those of the Swallowtail genus *Parides* are most easily observed in light gaps.

Papilio larva with everted osmaterium

Mud puddling swallowtail *(Heraclides thoas)*

Papilionidae
Swallowtail Butterflies

The Papilionidae include many large and impressive butterflies. Some, but not all, have typical short tails on their hindwings that lend the entire group the name *swallowtails*. One feature, which uniquely characterizes all caterpillars of Papilionidae, is the osmaterium, a stink-producing organ that delivers an odious smell when it is extruded, and probably serves as a defense mechanism against predators. The host plants of the Costa Rican swallowtail caterpillars belong to the plant families Aristolochiaceae, Annonaceae, Rutaceae, Piperaceae and Umbelliferae. Swallowtails are conspicuous insects and can be seen in all habitats of Costa Rica. They are fast fliers and quite active in the sunshine. In many species, the males and females hardly resemble each other in appearance. In such cases, their wing patterns are described as being sexually *dimorphic*. Normally, both sexes visit flowers to feed on nectar, but males are often encountered on moist sand or around puddles. They use their proboscis to suck up mineral substances from the water to supplement their diets. This behavior is called ‚mud puddling'.

Parides crithalion (Variable Cattleheart)

Forewing length: 38 - 43 mm

The sexes of this butterfly are conspicuously dimorphic. The males have a green band of variable size on the forewing and they are distinguished by having very reduced white spots on the forewing. Both sexes have large red areas on the hindwings. The species is restricted to rainforest. Both sexes visit flowers in the morning and remain active until late afternoon. Like many other *Parides* species, these butterflies flutter and move their forewings while feeding nectar on flowers, yet at the same time, they keep their hindwings open and motionless. The flower visiting butterflies of this genus are thus very conspicuous, even from a great distance. Females lay their eggs during midday on host plants of the genus *Aristolochia* that may grow along forest edges and in light openings of the forest. Three other species of *Parides* can be found in the Piedras Blancas National Park. One of the most common ones is *Parides iphidamas*, which is tolerant of disturbed habitats. The males of these species can be distinguished from each other mainly by the shape of the green band. However, the females are extremely similar to each other and often cannot be reliably identified.

Parides larva on *Aristolochia*

Parides erithalion male

Parides erithalion female