Pocket Guide to the Insects of Costa Rica

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Foreword by Tracie Stice

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Foreword

Every insect, spider, or so-called creepy crawly has an incredible story, the bounds of which often defy the imagination. Singing genitalia, fecal shields, and zombie parasites may sound like the inventions of a sci-fi writer but, in truth, there are "aliens" tiptoeing just beyond your front door.

Nothing has given me more pleasure over the past 25 years than stepping into this magnificent realm and sharing the secret lives of insects and their eight-legged kin with travelers from around the world. After a couple of hours of exploration—and with a rekindled sense of wonder—most of my tour guests are not only excited to learn more but are curious to discover the hidden worlds in their own backyards. Insects are everywhere, after all, and there is always something new and exciting to be found.

If each of the earth's currently named insect species could teach a 4-week course covering all the intimate details of its life—how it mates, what it eats, and all the special tricks it has up its chitinous sleeves—it would take more than 80,000 years to complete the curriculum. And consider this: scientists estimate that 80% of all insects have yet to be discovered.

While unraveling these mysteries is a daunting task, there is, thankfully, a dedicated legion of entomologists and enthusiasts alike who have passionately accepted the challenge. In Costa Rica, their numbers include Paul E. Hanson, Kenji Nishida, and Ángel Solís.

If you are captivated by insects and their relatives, then *Pocket Guide to the Insects of Costa Rica* will be an ideal addition to your nature library. Beautiful and easy to use, this guide will introduce you to some of Costa Rica's most charismatic insects, along with a host of other arthropods, through stunning photographs, concise descriptions, and natural history notes.

For travelers, budding entomologists, and guides who wish to expand their knowledge of arthropods, the authors will lead you through the different insect groups, show you where to look and what to look for, and point out the key features to help make identifications. More seasoned naturalists will appreciate the up-to-date diversity statistics specific to Costa Rica and the inclusion of related-species data. Not only is this guide eye candy for the insect enthusiast but it also packs a wealth of information into a field-friendly size.

As you continue seeking out new insect adventures, remember to bring along a sense of curiosity, a keen eye, and *Pocket Guide to the Insects of Costa Rica*. These will stand you in good stead!

Tracie "The Bug Lady" Stice
The Night Tour
Drake Bay, Costa Rica

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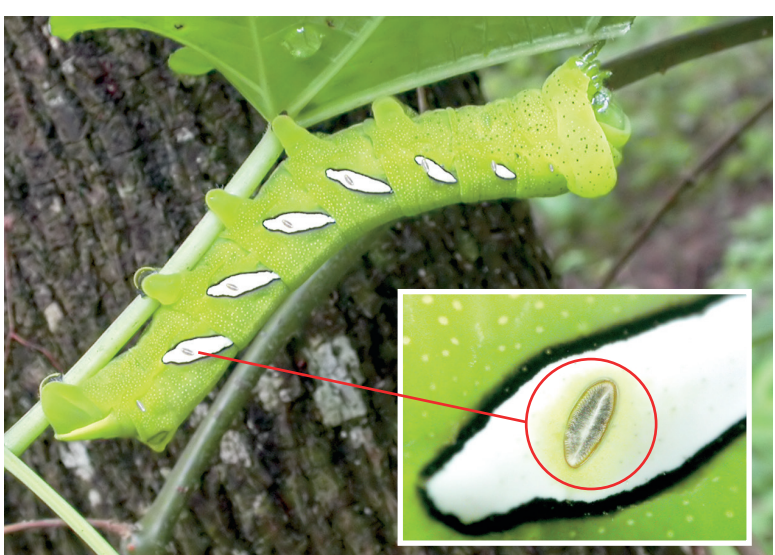
Introduction

In Costa Rican rainforests—indeed in most terrestrial ecosystems—you are more likely to see an insect than any other animal, so long as you pay attention. While everyone seeks out a view of the large showy butterflies, the majority of insects are smaller—though often every bit as beautiful in their own right—and generally go unnoticed.

Because a small percentage of insects sting, transmit diseases, or destroy our crops, they get a bad rap in the eyes of some. This is a striking irony given that human society and the natural world itself are so dependent on insects. They pollinate most of our food crops and most wild plants. They provide most of the protein for many birds, lizards, frogs, and freshwater fish. Insects facilitate the recycling of decomposing organic matter. And predatory and parasitic insects control the populations of pest insects. But aside from their usefulness, insects include some of the most beautiful, gemlike creatures on the planet.

Insect Anatomy

On insects and their relatives (the non-insect arthropods), the skeleton is located on the outside of the body. Granted, this provides protective armor, but it also means that they must periodically molt (or shed) their exoskeleton in order to grow. Once shed, this exoskeleton is replaced by a larger version. In most insects, this occurs only during the juvenile stages, and adults, therefore, can grow to only a limited extent.



Spiracles in the caterpillar of the Anchemoia Sphinx Moth (*Eumorpha anchemolus*). Red circle indicates location of a spiracle. Insects receive oxygen through these tiny openings.

Like most animals, including ourselves, insects have a digestive system, a circulatory system (including a heart), a respiratory system (though they lack lungs), an excretory system, a nervous system (including a brain), and a reproductive system. Insect blood, which is generally not red, flows through the cavities of the body instead of through blood vessels. Rather than relying on blood to distribute oxygen, insects have a network of tiny tubes (tracheae) that carry oxygen directly to all parts of the body. They breathe through tiny holes in the sides of their bodies (the openings to the tracheae, known as spiracles).

We humans rely primarily on vision and sound to perceive the world, but insects rely mainly on their sense of smell; their small size imposes limits on visual and auditory reception. In place of a nose, they smell with their antennae, which have receptors so sensitive that humans have yet to develop artificial detectors to match them. Most communicate with other members of their species via odors known as pheromones. Insects have compound eyes: each eye is made up of numerous independent photoreception units that offer up an extremely pixilated image. While compound eyes generally provide very poor image resolution, they are superb motion detectors. In addition to the set of compound eyes, most adult insects also have one to three tiny, simple eyes (known as ocelli) on the top of their head, which likely help them maintain stability while flying

Female dragonfly (*Rhionaeschna cornigera*) with large compound eyes and a simple eye (ocellus) sandwiched between the top of the face and the compound eyes.

Classification

Classifications of organisms are based on hypotheses about their evolutionary history, and as such they are subject to modification when new information becomes available. Thus, recent findings strongly suggest that termites evolved from cockroaches and that lice evolved from barklice. There are 31 orders of insects in the world, 28 of which occur in Costa Rica, and 13 of which appear in this book. Orders are divided into families, families are often divided into subfamilies, then tribes, and ultimately into genera and species.

The insect orders can be arranged into three groups. The most ancient insects appeared before wings evolved and include such wingless insects as springtails and silverfish, though none of these are included in this book. It should be noted that some wingless insects (lice and fleas, for example) evolved from winged ancestors and are therefore grouped with the winged insects. The majority of insects have two pairs of wings; these we can divide into those with an incomplete or gradual metamorphosis, wherein the juvenile stages (nymphs) are quite similar to the adults (except that their wings are not fully grown), and those with complete metamorphosis, in which the juveniles (larvae) look nothing like the adults. Insects with complete metamorphosis must pass through a pupal stage, during which the juvenile body

Developmental stages of the Helenor Blue Morpho (*Morpho helenor*). Left to right, top to bottom: egg, young larva (recently hatched from egg), mature larva, pupa (chrysalis), and adult butterfly.

is disassembled and the adult body is formed. The group whose members undergo incomplete metamorphosis includes more insect orders, but the group with complete metamorphosis includes the majority of species because it includes the four largest orders: Coleoptera (beetles), Hymenoptera (wasps, bees, and ants), Diptera (flies and mosquitoes), and Lepidoptera (moths and butterflies).

Insects belong to the class Hexapoda (meaning six legs), which in turn belongs to the phylum Arthropoda (meaning jointed legs). The first chapter (Small Orders), describes a selection of species that do not belong to the "main" orders presented in the subsequent chapters.

Arthopods include three other classes besides the insects and a few examples of these are presented in the final chapter (Other Arthropods). Members of the class Chelicerata are characterized by having four pairs of legs and no antennae; these include spiders, scorpions, and mites. The majority of Myriopoda (among them, centipedes and millipedes) have numerous pairs of legs. Finally, most Crustacea have two pairs of antennae and a variable number of legs, depending on the species; most occur in the ocean, including the animals we are all familiar with: crabs, lobsters, and shrimp. There is now very strong evidence that insects evolved from a group of crustaceans.

About This Book

There is a huge number of insects in Costa Rica—perhaps more than 250,000 species. However many there are, it is estimated more than 80% of them have yet to be named. The species described in this book—a mere drop in the bucket—were selected to give you an idea of some of the colorful and fascinating creatures you will likely encounter on a walk through a rainforest or other habitat in Costa Rica.

For each species we provide one or more photographs, range map (in most cases), and information describing the animal, indicating similar or related species, and conveying natural history snippets. When it was impossible to identify the species in a photograph, only the genus name is given. In a few other cases the entire family (leafhoppers, ichneumon wasps, gall midges) or subfamily (sulfur butterflies and passion-vine butterflies) is discussed and photos of a few representatives are provided.

The organizational structure varies a bit from chapter to chapter. The Small Orders chapter, for example, is divided into orders, while Other Arthropods is divided into subphyla. Most chapters, however, simply present the representative species that belong to the respective group. The Lepidoptera chapter is divided into moths and butterflies, the latter being further divided into families and, in several cases, subfamilies.

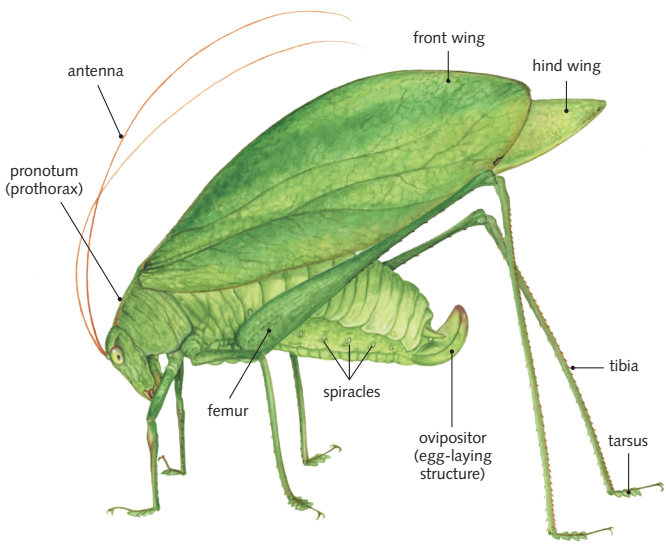
Please note that the photos do not show insects at a consistent scale and in fact a given page often shows two different insects at different scales.

Description. Measurements (cm = centimeters, in = inches) of body length do not include antennae or legs. The size of moths and butterflies is given by wingspan (wing tip to wing tip in outstretched wings). In many cases the description and photograph are not sufficient to definitively identify the species. A little known and seemingly bizarre fact about insects is that to identify a species one must often extract and examine the male genitalia or some other microscopic feature.

Related species. This section provides a context for the species under discussion. Obviously, the numbers of species mentioned here are subject to change as more studies are done.

Maps. These are based on data from specimens (collected by the Instituto Nacional de Biodiversidad, now part of the Museo Nacional de Costa Rica); the authors have not been able to verify all the specimen identifications on which the maps are based. As a result, the maps for some species will be subject to modification as new information becomes available.

The authors have tried to avoid using technical terms. When they are used, a brief definition (in parentheses) follows the term. The most essential terms that you will need are shown in the following figure.



External anatomy of a katydid. The body of an insect is divided into three parts: head (with the eyes and antennae), thorax (with the legs and wings), and abdomen (the rest of the body).

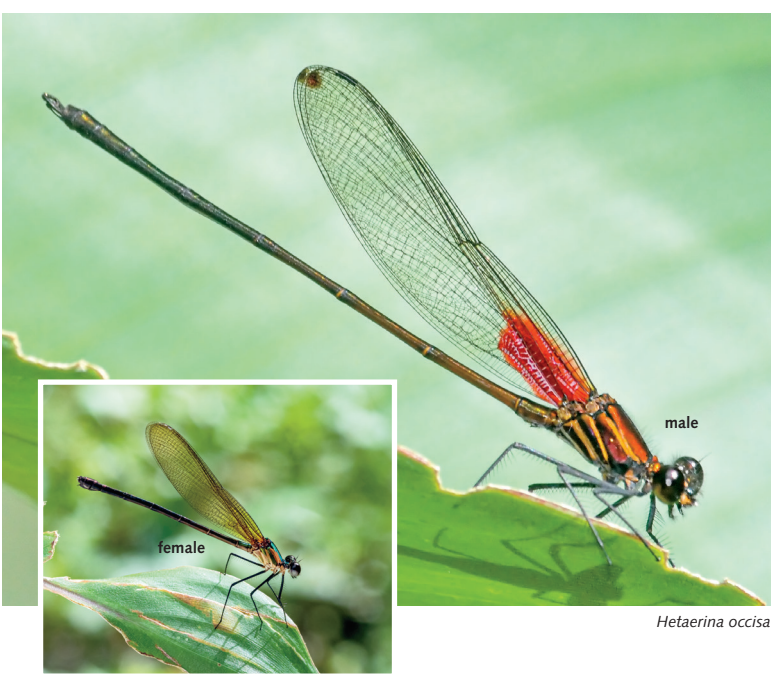
Small Orders

Dragonflies and Damselflies (order Odonata)

These aerial predators have a unique way of mating. The male uses the tip of his abdomen to hold the female by her neck; she then bends her abdomen forward and upward to receive sperm from the base of the male's abdomen. The immature stages are also predatory, but they live in ponds or streams and breathe with gills. In Costa Rica there are 14 families and around 300 species.

Rubyspot Damselfly (*Hetaerina occisa*)

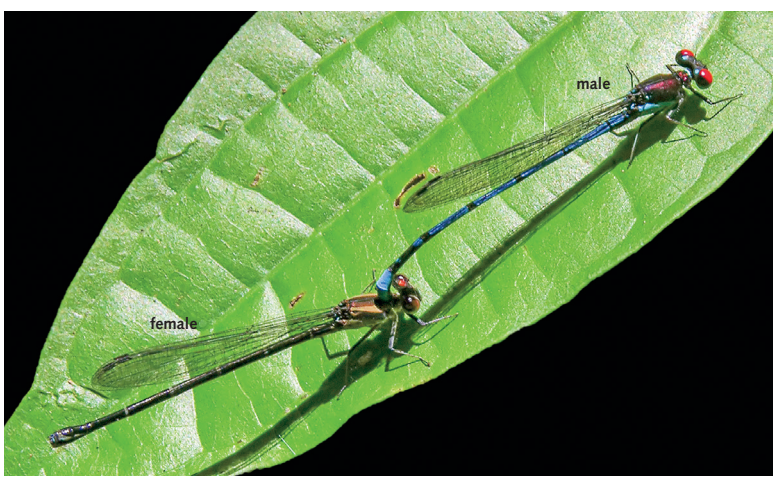
Description: 4.5 cm (1.8 in) in length. Members of the genus *Hetaerina* are known as rubyspots because the males have a red mark at the base of the wings. The females, which have metallic green marks on the thorax, lack the red spots on the wings. Members of the genus are often difficult to distinguish in the field. **Natural history**: Male rubyspots guard territories along the edges of streams, spending much time perched on the tips of leaves with their body inclined forward. When a female enters his territory, he mates with her (or at least attempts to do so) and continues holding her by the neck even after mating; the male releases the female when she begins laying eggs in submerged plants in the stream. **Related species**: There are 9 species of rubyspot in Costa Rica, the only representatives of the family Calopterygidae in the country.



Hetaerina occisa

Red-eyed Argia (*Argia cupraurea*)

Description: 4 cm (1.6 in) in length. Males of most *Argia* species have a blue abdomen and can be distinguished from other blue damselflies by their jerky flight; for this reason, they are sometimes called "dancers." They usually perch horizontally with their wings held together and raised slightly above the abdomen. Males of *Argia cupraurea* have red eyes, with the upper part of the thorax metallic red and the abdomen light blue with black rings; females are mostly brownish. **Natural history**: *Argia* species are usually found mostly in open areas, where they capture flying insects. Unlike other genera in the family Coenagrionidae, the immature stages are found in running water instead of ponds. Males often perch on sun-bathed rocks in rivers. The male continues to grasp the female as she lays eggs in algae growing on submerged rocks. **Related species**: *Argia* is the largest genus (nearly 30 species in Costa Rica) in the largest family (Coenagrionidae) of damselflies. *Argia calverti* and *A. oenea* also have red-eyed males and can be difficult to distinguish from *A. cupraurea* in the field. *A. anceps* and *A. elongata*, which lack red eyes in the males, are abundant in upland regions.



Argia cupraurea. Male holding female with claspers.

Argia anceps breeds more frequently in ponds than in streams.

Giant Helicopter Damselfly (*Megaloprepus caerulatus*)

Description: 8–11 cm (3.1–4.3 in) in length. This species has the largest wingspan of any damselfly or dragonfly in the world, up to 19 cm (7.5 in). In addition to its size, note the large black band near the tip of each wing; at least on the Caribbean slope, males are easily distinguished from females by having a large white area preceding the black band. Slow flight combined with the whirling movement of the colored wing tips gives the illusion of miniature helicopter blades. Helicopter damselflies perch by hanging from vegetation. **Natural history**: The adults prey on insects that are sitting on leaves and sometimes snatch spiders or trapped insects from spider webs. Males maintain territories in light gaps of forests, where they drive away other males and wait for a female to arrive. After mating, the female lays her eggs in water contained in a nearby tree hole. The immature stages (nymphs) feed on animals inhabiting the water, including other aquatic insects and tadpoles. The nymphs require several months to reach adulthood. **Related species**: Helicopter damselflies (3 genera in the family Coenagrionidae) include 5 species in Costa Rica. The other species are slightly smaller and differ in color.

Megaloprepus caerulatus. Male in flight (above). Resting male (left).

Turquoise-tipped Darner
(*Rhionaeschna psilus*)

Description: 6 cm (2.4 in) in length. The sexes are quite similar, though males often have blue eyes. This dragonfly has two broad, pale green stripes on the sides of the thorax and a series of small green markings all along the abdomen. **Natural history**: A very common species that sometimes even enters buildings. The males fly back and forth along the edges of ponds searching for females. Females lay their eggs on damp ground near the water's edge or on floating rotten wood. **Related species**: Two other similarly colored species of this genus occur in Costa Rica, *R. cornigera* being even more common than *R. psilus*. They are members of the family Aeshnidae.

Female *Rhionaeschna psilus*

Lowland Knobtail (*Epigomphus tumefactus*)

Description: 5 cm (2 in) in length. Unlike other dragonflies, members of this family (Gomphidae) have widely separated eyes (when viewed from above). They also differ by flying slightly slower and landing immediately on a perch—without hovering a few seconds before setting down. The sexes are quite similar, although the tip of the male's abdomen is somewhat enlarged, hence the name *knobtail*. Knobtails have a dark brown thorax with light yellow stripes and a black abdomen with well-spaced, small whitish markings. **Natural history**: Knobtails spend prolonged periods of time perched in a horizontal position on leaves, branches, or rocks. From this perch they dart out to capture flying insects. Males perch at the edge of a stream but do not make frequent patrolling flights as many other dragonflies do. They mate for an hour or longer while perched on vegetation. The male does not accompany the female when she goes to lay eggs in the water. **Related species**: Costa Rica has 13 species of *Epigomphus*; it is the largest genus in the family Gomphidae.

Epigomphus tumefactus. Female in light gap of forest understory.

Silver-sided Skimmer (*Libellula herculea*)

Description: 5 cm (2 in) in length. The thorax is dark brown, with a white (male) or yellow (female) stripe running down the middle of the top surface; powdery gray on the sides. The broad abdomen is a deep crimson-red in males and dark orange in females. They perch with the body tilted slightly downward. **Natural history**: Found near ponds and sections of still water in streams. Males guard territories near shaded ponds or occasionally sunlit pools of water, though they spend most of their time perched on branches. Mating is brief, but the male remains flying near the female as she lays eggs. She does this by hovering over the water and using the tip of her abdomen to scoop up a drop and flicking it, together with some eggs, onto the shore. **Related species**: There are 4 species of *Libellula* in Costa Rica; they belong to the family Libellulidae.

Libellula herculea. Male perching along a road.

Roseate Skimmer (*Orthemis ferruginea*)

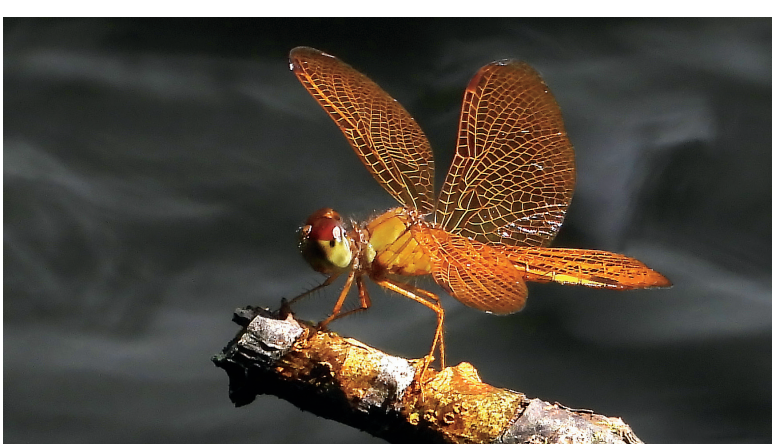
Description: 5 cm (2 in) in length. Males are almost entirely pinkish-purple; females have a brown thorax, with a light-colored stripe running down the middle of the back and an orangish-brown abdomen. **Natural history**: Because the immature stages inhabit a wide diversity of freshwater habitats, including even polluted waters in urban areas, this is one of the most common dragonflies in the country. Males sit for brief periods on branches near water but frequently leave their perch to chase away other males. If a female enters his territory, the male approaches her with his abdomen lowered. After a brief period of mating, the female hovers over the water while using the tip of her abdomen to scoop up a drop and flick it, together with some eggs, onto the shore. **Related species**: There are 7 species of *Orthemis* in Costa Rica; they belong to the family Libellulidae.

Male *Orthemis ferruginea*

Pond Amberwing (*Perithemis tenera* = *P. mooma*)

Description: 2.5 cm (1 in) in length. The smallest dragonflies, amberwings (genus *Perithemis*) are named for the yellowish-orange color on the wings of the male. The stout body is also yellowish-orange. **Natural history**: Males perch on objects just above the water and chase other males out of their territory. When a female enters his territory, the male courts her by flying in front of her, vibrating his wings faster than normal, and raising his abdomen (such courtship displays are rare in dragonflies). The male then leads the female to a place to lay eggs; if she approves of the spot, they briefly mate and the female then lays her eggs as the male remains nearby. Eggs are laid on submerged wood sticking out of the water or on floating vegetation. **Related species**: There are 3 species of amberwing in Costa Rica; they belong to the family Libellulidae.

Male *Perithemis tenera*, dorsal view.



Male *Perithemis tenera*, lateral view.