JOHN ACORN

Damselflies
of Alberta

Flying Neon Toothpicks in the Grass

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Carroll Perkins: pages 42, 63, 69, 71, 72, 74, 75, 78, 117, 125
Jonathan Hornung and Christine Rice: pages 16 (bottom left), 30 (bottom), 45 (top)
Red Deer Archives: pages 22, 25 (top)
Sid Dunkle: pages 52, 57
Blair Nikula: page 54

To Gordon Pritchard, and his many fine students.

Contents

Preface

This is the second in what I plan to be a series of books featuring selected groups of Alberta insects. The first book of the Alberta Insects Series was about tiger beetles, and the volumes that follow will, if all goes well, treat ladybugs, the larger moths (what I call the "big snazzy moths"), the dragonflies proper, and possibly the grasshoppers as well. *Tiger Beetles of Alberta: Killers on the Clay, Stalkers on the Sand* was an experiment of sorts, and in most respects I think it succeeded. One tiger beetle specialist called it "a splendid mix of science and élan." Another entomologist wrote to me to say " WOW, is the tiger beetle book ever great! I have been standing in the hall like an idiot exclaiming to everyone who goes by about it." That made me feel good.

I think that most entomologists would love to write about their favourite bugs in a conversational fashion, if only the world of scientific publishing would let them. I'm very fortunate to be able to write in a less constrained style in these books. By contrast, in the "primary literature" of journal papers and technical works, all emotive language must be purged from the text. The result, predictably, is dull writing in which all authors sound pretty much alike. After more than two centuries of this sort of thing, scientific writing has become almost inaccessible to average readers, regardless of their intelligence or overall education. This saddens me, and I think it also weakens science by making its details seem less and less relevant to the rest of the thinking world.

Scientists, however, behave one way in print and another way in person, and in so doing they make it clear that they are no more Vulcan-like than anyone else. (I assume that most people reading this will be familiar with the Vulcans of *Star Trek* fame, and their so-called logical outlook on life.) In person, scientists are people like any others. They discuss scientific matters with little or none of the stylistic constraints that they show on the printed page. This leads many people to think that the conventions of scientific writing are largely trappings. The trappings of dull-style science give the ritual of science (if I may be so bold as to call it such) an aura of objectivity, and that is what counts on a purely subjective level—the aura.

It is my view that true objectivity (and objectivity is the usual justification for dry prose in science) is a matter of thinking clearly and self-honestly about evidence, and about the reasoning process that you use to link evidence to your conclusions. What the rest of your mind does at the same time is of no scientific consequence. The important thing, aside from correct logic and careful measurement, is self-honesty. In other words, you have to allow your deep curiosity about the nature of whatever it is that you study to continually push you to examine and reexamine your beliefs and conclusions. Without this sort of self-honesty, science becomes little more than a game of writing papers and applying for grant money. To me, the best way to demonstrate self-honesty is to write in a frank and personal fashion, admitting to one's influences, desires, uncertainties, and dislikes. I hope you agree. Fortunately, the study of damselflies has seen many such self-honest scientists, and I have been equally fortunate to fall under their influence.

Having expressed my views on this rather abstract subject, I would now like to invite you back down to earth, perhaps among the reeds at the side of a prairie pothole in mid-June. So join me if you will, and let me introduce you not only to the damselflies of Alberta, but to my own spin on their fascinating lives, and the community of real-life, subjectively biased people who have loved and studied them.

Acknowledgments

As with any book, this one was not a lonely project by any means. Over the years I have enjoyed many good odonatological discussions and times in the field with Miriam Abbas-Nejad, Kirsten Beirinckx, Randy Dzenikiw, Chris Fisher, Lee Foote, Ed Fuller, Su-Ling Goh, Hans Van Gossum, Jon Hornung, Doug McCauley, Layla Neufeld, Natasha Page, Christine Rice, Celine Sirois, Andreas Stange, Godo Stoyke, Lindsay Wickson, and, of course, my family: Dena, Jesse, and Benjamin. Rob Baker, Carl Cook, Lynda Corkum, Nicky Koper, Fred Korbut, Wayne Roberts, and Felix Sperling shared their notes, specimens, and observations. For inspiration and mentorship, I couldn't ask for better role models than Rob Cannings, Dick Cannings, Philip Corbet, and Dennis Paulson. I should also acknowledge my American colleagues and field buddies, Bob Behrstock, Blair Nikula, and Jackie Sones, all of whom helped motivate this book, albeit along streams and pondsides in Texas and Mexico.

For help with the historical portions of this book I acknowledge Charley Bird, Kelvin Conrad, Philip Corbet, Michael Dawe, Cedric Gillott, Gordon Pritchard, and Mark Wilson. And finally, I would like to tip my hat in appreciation to all of those who participated in the "Hyperboreal Odonatists' Guild and Social Club," especially Barb and Jim Beck, Charity Briere, Sean Bromilow, Chris Fisher, Kamal Ghandi, Kevin Hannah, Jon Hornung, Robert B. Hughes, Al Lindoe, Natasha Page, Greg Pohl, Christine Rice, Carole Patterson, Carroll Perkins, Sandi Robertson, Cindy Sheppard, and Terry Thormin.

These people have given me hope that a book about damselflies might not be such a weird idea after all. The University of Alberta Press deserves great praise as well, and I am happy to be working with such fine individuals as Alethea Adair, Alan Brownoff, Cathie Crooks, Jill Fallis, Michael Luski, Linda Cameron, and Yoko Sekiya. To Linda, especially, I owe a great thanks.

A lovely male taiga bluet, resting on ribbon grass, the way I first encountered them at age 5.

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Flying Neon Toothpicks?

AN INTRODUCTION TO DAMSELFLIES

I expect that everyone has seen a damselfly at least once. Near ponds and the likes, damselflies often appear to be everywhere, especially among lush grasses. The most common ones are bright blue, and about the size and shape of a toothpick, with wings. From June through September, almost any sunny location in the province is likely to produce at least a few damselflies on a warm day.

My first memories of damselflies date back to when I was in elementary school, when I started noticing them along the back alley and in the back corner of my parents' garden, where the ribbon grass grew. I especially remember one sunny afternoon, walking to the bus stop to meet my grandfather and stopping along the way to admire what was probably a male taiga bluet resting on a white fence. At the time, it looked like it had every colour of the rainbow somewhere on its body, and it was with great surprise that I eventually discovered that these damselflies are merely blue and green.

I experienced my first spectacular emergence of American bluets at Gull Lake, the one and only time that our family rented a boat for an afternoon outing. Brilliant blue damselflies were skimming around everywhere I looked, just over the water's surface, and to be honest I remember that and not much else about the day.

Damselflies are related to dragonflies, and together they form the insect order Odonata (making those who study them "odonatologists"). Remember that insects form a class (Insecta, or Hexapoda) and that classes are divided into orders. In turn, the order Odonata is divided into three suborders. The first, Anisozygoptera, contains only two species and is found only in Asia. The second comprises the dragonflies proper—the suborder Anisoptera. The third suborder, Zygoptera, includes the damselflies.

In Europe, the entire order Odonata is referred to in English as "dragonflies," but here in North America we call the Anisoptera dragonflies and the Zygoptera damselflies. The order as a whole has no English name equivalent in North America, but most of us call them "odonates" or "odes" for short.

Odonates are some of the most primitive of all flying insects. Together with mayflies (the order Ephemeroptera) they possess wings that cannot be folded back flat over the insect's abdomen—a condition generally presumed to represent the state of affairs among the earliest flying insects, long before the days of the dinosaurs. In fact, the largest flying insect that ever lived was a primitive sort of odonate (*Meganeura monyi*—which was not a dragonfly in the modern sense) with a wingspan of about 75 centimetres.

Odonate and mayfly wings are attached directly to the flight muscles that propel them, as opposed to the situation in other flying insects in which the flight muscles change the shape of the thorax, and the wings flap as a result. The odonate condition is called paleopterous (ancient-winged), while indirect flight muscles are called neopterous (modern-winged). Paleopterous insects cannot fold their wings flat over their backs, while most neopterous insects can. Butterflies are a familiar exception to this rule, since they are neopterous but cannot fold their wings flat over their backs. This condition was acquired "secondarily" in butterflies, which evolved from moth ancestors with folded wings.

Odonates are predatory creatures, and this, along with their obvious structural differences, sets them apart from mayflies. As adults, odonates have four well-developed flying wings and an elongate body. On the head, they have huge compound eyes made up of thousands of individual visual receptors, each with its own lens.

As larvae, they are generally aquatic (although some elsewhere live in moist mossy places) and they are always predatory. Odonate larvae have the most amazing lower lips (*labia* is the plural, *labium* is the singular) in the entire insect world. The lower lip of an odonate larva is folded beneath the head. When the larva wants to capture another small creature for food, the labium shoots out to almost half the larva's body length and grasping jaws at its tip seize the prey. To my knowledge, the only other insects that possess this sort of labium are tiny rove beetles in the genus *Stenus*—often found along the shores of the very ponds and lakes that make up our finest damselfly habitats.

The larvae catch and eat a variety of small aquatic creatures (including extra-small fishes), and in general there are two types of larval feeding patterns. Some roam around on underwater vegetation in search of their prey, while others sit quietly and cryptically in wait. Generally, larvae that live in streams or under the threat of being eaten by a fish do the latter, while those in still waters without fish predators do the former. As well, hungrier larvae forage more, while those with lots of food around them are more content to wait for the prey to come to them.

By the way, the word *larva* (plural: *larvae*) is now the accepted term for any sort of immature insect. Some people prefer, however, to call the larvae of odonates "nymphs" (to indicate that they do not pass through a resting pupal stage in their life cycle) or "naiads" (to indicate that they are aquatic). I support

Top: Dragonflies, unlike damselflies, have semi-spherical heads, and quite stocky bodies. Bottom: To recognize a damselfly as such, look for the hammer-head, and the long, very thin abdomen.

This is a dragonfly larva, not a damselfly, since the three projections on the end of its abdomen are short and pointy, rather than long and leaf-like. Compare with the damselfly larvae on page 16.

the general use of the word *larva*, since it is one more way to reduce entomological jargon. Most damselfly larvae shed their skins about a dozen times before emerging as adults, and the number of moults can vary, even within a species.

To tell the difference between a damselfly and a dragonfly, look first at the head. If the insect is hammer-headed, with the eyes on either side of a wide head, then it is a damselfly. Dragonflies generally possess more bulbous heads with eyes that meet or nearly meet at the top of the head. Then look at the wings. If the hind wings are slightly broader than the front wings at the base (next to where they meet the body) and all the wings are held out to the sides at a right angle to the body, like the wings of an airplane, it is a dragonfly. If all four wings are of almost identical shape and are held vertically together over the back, or out to the sides at an acute angle to the body, then it is a damselfly. Once you get a feel for the general look of the two groups, these features will no longer be necessary for a quick identification, but when you are first learning to distinguish between damselflies and dragonflies, these are the features that work best.

You should also know that there is a group of vaguely damselfly-like insects found in dry, sandy habitats called ant lions (order Neuroptera, family Myrmeleontidae). To tell the difference between an ant lion and a damselfly, look for the long antennae of the ant lion—as opposed to the almost inconsequential antennae of the damselfly—and the dull brown colours of the ant lion as well.

As larvae, damselflies are also easy to recognize. Apart from the folding lower lip, they also possess three leaf-like gills on the tip of their abdomen. These gills can also be used for swimming, and a swimming damselfly larva wiggles its body from side to side. The larvae also breathe by flushing water in and out of the rectum, and as a consequence they literally breathe with their butts. For dragonflies proper, this is the primary means of respiration, but damselflies use both the rectum and the abdominal gills. Both, by the way (and I don't blame anyone for wondering about this), secrete a membrane around their feces so as not to foul their breathing apparatus—like having a built-in plastic bag dispenser when you take your dog for a walk. And damselfly larvae can develop other proctological difficulties as well. American bluets, forktails, and spreadwings are all known to have their back ends invaded by flagellate protozoa in the winter, only to lose these freeloaders with the first skin shedding of the spring.

The damselflies of Alberta belong to three different families. In fact, the three families of damselflies in our fauna represent the three main branches of the evolutionary tree of damselflies in general. Even though we only have 22 species here in Alberta, we still have representatives of the main sorts of creatures that comprise the worldwide fauna of some 2,568 species of damselflies, in 22 different families. The jewelwings represent a relatively primitive group, with extremely dense wing venation and non-stalked wings. The spreadwings are off on a branch of their own, with body colours that are formed either by iridescence or a greyish pigment called pruinosity (at least among the Alberta species). And finally, the pond damsels are the so-called typical damselflies, and they usually possess bright body colours—typically blue or green—as well.

This book deals mainly with adult damselflies, and not their larvae. Larvae are more difficult to identify, although the three families have distinctive larval types. Among the bluets, larvae identification can be so tricky that sometimes only molecular diagnostic techniques can distinguish one species from another. In other words, you have to grind them up and chemically analyze the slurry.

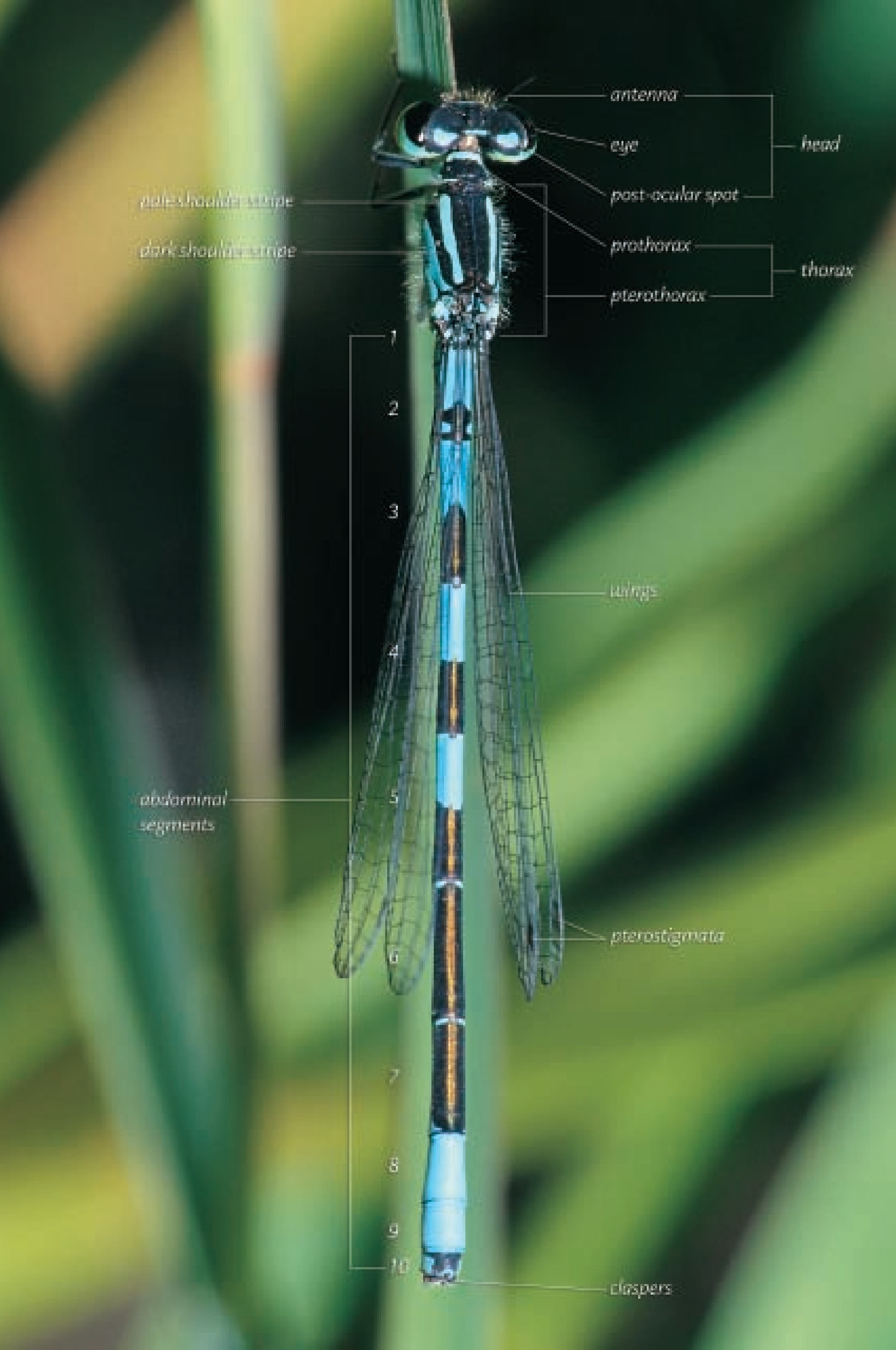
To identify adult damselflies, on the other hand, it is essential to know a certain amount about their structure. Many people think that knowledge of wing veins is needed, but luckily this is not the case for our Alberta species. Body features are much more important. On the head, the main things to look for are the postocular spots—large, pale spots behind the eyes of some members of the pond damsel family that may or may not be joined by a pale bar across the top of the head.

Behind the head, the thoracic "neck" is called the prothorax, and its markings can be important, especially on the upper side, called the pronotum. Behind the pronotum lies the pterothorax (the part of the thorax that bears the wings). Markings on the pterothorax are also often important, and the most frequently consulted of these are the antehumeral stripes, which I prefer to call the pale shoulder stripes. These are the paired pale (usually blue or green) stripes on either side of the dark area down the top middle of the pterothorax. Below the pale shoulder stripe lies the dark shoulder stripe, sometimes called the humeral stripe.

On females the upper front edge of the pterothorax is thickened to form what I call "shoulder pads." In the technical literature the name for these is mesostigmal laminae—an awful bit of jargon if ever there was one. These pads are important in mating, and they are useful for the identification of some species of pond damsels, although they are difficult to see without good lighting and at least 10-power magnification from a hand lens or a microscope.

The abdomen is also an important source of diagnostic features, and in order to locate these accurately you will need to know which segment of the abdomen is which. The segments are numbered from the base to the tip—in other words, starting where the abdomen attaches to the thorax. The first two segments are short, followed by segments 3 to 7, which are long, and then 8, 9, and 10, which are again short. The tops of the abdominal segments are typically marked with black and at least one pale colour in pond damsels, and the exact nature of these markings can be important to identification.

At the very tip of the abdomen of male damselflies, there are two pairs of sexual claspers, one above the other. I like to call them "upper claspers" and "lower claspers," but this is not the usual terminology from a technical standpoint. The uppers are called cerci in modern works, and in older books they may be referred to as superior abdominal appendages. In like fashion, the lowers were called inferior abdominal appendages. The lower claspers are now called paraprocts, a word that establishes their evolutionary connection with the paraprocts of other insects. In my experience, and since their function is to clasp the female, most people prefer the familiar English word "clasper" to any of the former terms. To examine the claspers, it helps to hold the damselfly in your hand and use a 10-power (10X) hand lens.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