Dragonflies and Damselflies

of South Africa

PENSOFT

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Cover photograph: A young Red-veined Dropwing *Trithemis arteriosa* sunning itself in the obelisk position. **Photographic credits: Viola Clausnitzer** *Aeshna ellioti* (female, p.112); *Trithemis aconita* (male, p.177); *Gynacantha villosa* (male & female, p.122); *Gomphidia quarrei* (female, p.124); *Olpogastra lugubris* (male top, p.191) **Hans-Joachin Clausnitzer** *Trithemis aconita* (female, p.177) **Klaas-Douwe Dijkstra** *Chlorocypha consueta* (male & female, p.47); *Proischnura subfurcata* (male, p.101); *Phyllomacromia monoceros* (male, p.143) **Felicity Grundlingh** *Elattoneura glauca* (male, p.3); *Ischnura senegalensis* (pair, plate 3); *Paragomphus cognatus* (emerging, plate 14); dragonfly exuvia (plate 16); *Trithemis stictica* and *Orthetrum julia* (plate 39); *Palpopleura jucunda* (plates 44 & 45); *Ecchlorolestes peringueyi* (p.43); *Rhyothemis semihyalina* (male bottom, p.192); *Parazyxomma flavicans* (female, p.194); *Sympetrum fonscolombii* (p. 297) **Jens Kipping** *Ceriagrion suave* (male and female, p.73); *Agriocnemis exilis* (female, p.107); *Agriocnemis ruberrima* (female, p.111); *Paragomphus elpidius* (female, p.134); *Chalcostephia flavicans* (male & female, p.212); *Orthetrum machadoi* (female, p.154); *Bradinopyga cornuta* (female, p.173); *Tholymis tillarga* (female, p.195); *Pseudagrion coeleste* (male & female, p.206) **Andreas Martens** *Crenigomphus cornutus* (female top, p.129); *Crocothemis divisa* (male, p.170) **Jill Silsby** *Gomphidia quarrei* (male, p.124); *Olpogastra lugubris* (male bottom, p.191) **Frank Suhling** *Lestes dissimulans* (male p.59); *Crenigomphus cornutus* (female bottom, p.129) **Warwick Tarboton** *Pseudagrion sjoestedti* (male, p.91); *Pseudagrion commoniae* (pair, p.79); *Phyllomacromia picta* (female, p.144) www.warwicktarboton.co.za **Keith Wilson** *Macrodiplax cora* (male & female, p.203).

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Common Threadtail *Elattoneura glauca*

Contents

Green-naped Sprite *Pseudagrion acaciae*

PREFACE

"Jigamanzi!" an old Zulu man exclaimed as he pointed to a dragonfly flitting across the glinting water in the heat of the afternoon. By his graceful hand movements, I took it that he was calling it a 'water-dancer', a name that warms my heart to this day. At times though, these water-dancers have seemed more like sirens as I've ventured into crocodile-infested waters to get that ever better photograph of the elusive Silhouette Dropwing.

Yes, indeed, dragonflies are beautiful! Poets and artists in many countries around the world cannot be wrong as they capture the grace and charm of these aerial wonders. It is difficult to believe sometimes that a creature as beautiful as a Two-striped Skimmer emerges from such an ugly, mud-inhabiting, crawling little monster as its larva!

Although a dragonfly may be seen occasionally on the wing on a warm winter's day, it is in the height of summer when some stretches of water are bubbling with them. Without doubt, they are major players in shallow freshwater ecosystems. But they are more than just functional components of the warp and weft of life. They are fascinating in their own right, and even more so when one considers that over a fifth of the South African species occur here and nowhere else.

South African dragonfly identification was developed principally by F. Ris, K.H. Barnard, E. Pinhey and B.I. Balinsky. It is now over 50 years since Pinhey produced his landmark 'Dragonflies of southern Africa'. Since then, there have been many new discoveries, many corrections and much more information on distribution and ecology. This book is a response to that evolution in our knowledge, being an introduction to all South African species in their living environment. Although, it includes recent discoveries in the South African dragonfly fauna, there is still an enormous amount we do not know. There are still likely to be more new species discoveries to be made, but nevertheless, it is timely to review the South African dragonflies. The aim is to raise awareness through a field guide and handbook, much as has been done for plants, birds and mammals. A field guide is a first step in arousing conservation concern.

This guide is meant for those enthusiasts with no more equipment than close-focus binoculars and a hand lens. Although some dragonflies are famously easy to identify, others are notoriously difficult; nevertheless, using this book, both specialist and aficionado, will be able to identify males and associated females in the same habitat.

This guide was made possible by an enormously understanding family, particularly my wife Melinda, and with much support from many people and organisations. In particular, I would like to thank Orty Bourquin, Pat Caldwell, Viola Clausnitzer, Tanza Crouch, Klaas-Douwe Dijkstra, Paul Grant, Felicity Grundlingh, Peter Hitchins, André Marais, Mike May, Jürgen Ott, James Pryke, Camilla Samways, Marlon Samways, Jill Silsby, John Simaika, Warwick Tarboton, Stuart Taylor, Sven Vrdoljak and Gael Whiteley for many discussions on dragonflies. Martin Brooks of Ezemvelo KZN Wildlife, Peter Lloyd of CapeNature and Ricky Pott of Mondi gave enormous support for site visits. Klaas-Douwe Dijkstra also kindly commented on an earlier draft, and John Simaika kindly prepared the distribution maps. Special thanks go to Felicity Grundlingh for her enormous input into the book design.

Sponsorship for this book from the National Research Foundation is much appreciated and gratefully acknowledged. Finally, I would very much like to thank various photographers for all their wonderful support in providing pictures of species which eluded my camera. Details are given inside the front fly-leaf. Wishing you all much enjoyment watching dragonflies, whether in your garden or in the wildest of places.

Plate 1: *Chalcostephia flavifrons*, commonly known as the Inspector, alert and ready to dart at a passing morsel of food, usually a fly.

INTRODUCING DRAGONFLIES

What are dragonflies?

Dragonflies are graceful and conspicuous insects, often seen by anyone who enjoys nature. They have even been called the 'bird watcher's insect', as their intricate behaviour can easily be watched by eye or with binoculars.

Dragonflies are scientifically termed Odonata, which means 'toothed ones', referring to their strong mandibles. Most are fairly large insects, with long bodies, large eyes and four, straight, membranous wings. The Odonata is made up of two main groups: the true dragonflies (Anisoptera) and the more delicate damselflies (Zygoptera). True dragonflies are robust-looking, and always hold their wings out to the side. Also, the forewings are differently shaped from the hindwings, which are much larger. Damselflies are much finer in build, and most of them fold their wings along their abdomens when at rest. The few that do rest with their wings outstretched are still easy to recognise by their long and very thin bodies. All four wings of damselflies are very similar, quite unlike those of true dragonflies. Nevertheless, in common parlance, and for simplicity, 'dragonflies' is often used as an umbrella term for both damselflies and dragonflies, which is the case here.

Often dragonflies are confused with long-horned antlions (Plate 2) and some other insects. But in keeping with their highly active and aerobatic life, they have distinctly larger eyes than most other insects, and even more telling are their tiny, inconspicuous antennae. Antlions have very distinct antennae and a much weaker flight.

Dragonflies are ancient insects, having changed little in the last 300 million years. During those early times, they were masters of the air, long before birds and even before pterodactyls. Without this predation and slightly higher oxygen levels in the air at the time, they grew very large, with specimens having a wingspan of 750 mm. Their main aerial enemies at that time were probably each other.

There are some remarkably well-preserved fossil dragonflies which have enabled palaeontologists to piece together the past history of the group. Fossil wings are very informative and have emphasized just how conservative dragonflies as a group have been. This conservativeness is seen in the Emperor (*Anax imperator*), where fossils five million years old are clearly the same species.

Today there are about 6000 species occurring throughout the world, except in the polar regions. South Africa so far has recorded 158 species with about a fifth of these living within the country and nowhere else. World catalogues are available on the web. Miller (1995) provides a useful introduction to dragonflies, while Corbet (1999) gives a comprehensive overview of dragonfly biology.

Plate 2: A long-horned antlion with long antennae - not to be confused with a dragonfly with minute, barely-visible antennae.

Life cycle

Mature adult

The familiar damselfly or dragonfly seen at a pond is the mature adult. If it is brightly coloured and perching or cruising, it is probably a male. Females are generally much less conspicuous and in many species, only visit water to lay eggs. The young male, like the female, is camouflaged. The mature adult dragonfly does not grow anymore. It is an effective aerial predator, feeding mostly on other insects, but sometimes on other dragonflies, including their own immature adults. With their acute and wide field of vision, adults swoop and catch flying insect prey using a spinous basket formed by the criss-crossing of spines on the outstretched front legs.

Mating

Many male dragonflies are highly territorial, defending their area from other males of the same species, and sometimes other species. Territories vary in size, depending on the size of the insect and male density. A small damselfly may only defend a 1m-length of stream, but a large dragonfly may defend a 100 m-length. The damselflies with black patches on their wings (some Malachites) appear to use this pattern as a territorial defence display, as well as to court females.

Dragonflies recognise their mates by movement patterns as well as by body and wing colour and patterning. Males usually approach females, sometimes vigorously, toppling them over. In some species, a female may indicate she is not ready to mate by bending her abdomen downwards, as if to lay eggs in the water. Courtship may be minimal, as in most dragonflies, or involve intricate movements such as leg waving as in some damselflies, especially in the Jewels (*Platycypha* species).

The male of true dragonflies, on seeing a potential mate, will fly up and quickly grasp the back of her head with appendages at the end of his abdomen. Damselflies behave similarly, but instead, grasp the female on the 'neck' i.e. the first segment of the thorax, which is known as the prothorax. The coupling apparatus of the male and female of the same species are intricately and accurately matched.

Some species couple entirely in the air, but others, especially damselflies, couple while perching. Mating then lasts, depending on species, for just a few seconds or for several hours. It is a complicated process and unique in the animal world. Well before mating, and often early in the morning, the male curls his abdomen underneath and transfers sperm from the abdomen (9^{th} segment) to complicated accessory genitalia positioned below the 2^{nd} and 3^{rd} abdominal segments. This is done either in flight or when perching. The male is now ready for making contact with the female's genital apparatus, which is at the tip of her abdomen (below the 8^{th} and 9^{th} segments).

Plate 3: Marsh Bluetail *Ischnura senegalensis* in mating, 'wheel' position. The male is blue and female brown. The red spots on the thorax of the male are parasitic mites.

After the male grasps the female with the tip of his abdomen, she then bends the tip of her abdomen around and under to lock with the male's accessory genitalia below the 2nd and 3rd segments. Copulation now takes place, with rapid transfer of sperm. Nevertheless, the pair may remain coupled in this 'wheel' position (Plate 3) for only a few seconds, minutes or even an hour or so, depending on the species. The accessory genitalia of the male have a small sac for sperm storage and a penis. During mating, this penis has an interesting double function. Before aiding in sperm intromission, it hooks and cleans out any sperm from a previous mating by another male. This ensures that his sperm does the fertilising and not that of a previous, rival male.

Interestingly, the tandem pair can fly well together, and is a common sight at ponds. Sometimes the female's tip releases the male's accessory genitalia, but the male still maintains a hold on the female's head area. In this position too, the linked pair fly in tandem with remarkable ease.

Egg laying

Egg-laying follows soon after copulation. In many of the large dragonflies, the pair separate and the female lays eggs on her own. Sometimes the female is guarded by the male, who hovers above or remains in contact with her (Plates 4 and 6).

Egg-laying occurs in one of two ways, according to where the eggs are laid. The exophytic species, such as the Skimmers (Libellulidae), scatter their eggs by dipping their abdomen in the water as they fly across the surface. The endophytic species, which include the Hawkers (Aeshnidae) and all the damselflies, lay their eggs in plants. Details of behaviour vary, with Malachites (Synlestidae) and Spreadwings (Lestidae) (Plate 4) laying their eggs in grass stems and twigs overhanging the water surface. The Hawker dragonflies, such as the Stream Hawker (*Aeshna subpupillata*), sit at the level of the water surface bending their abdomen downwards to insert their ovipositor in submerged vegetation (Plate 5). Many damselflies descend well below the water surface by climbing down the stems of water plants. Sometimes just the female goes down, but in other species, both the male and female, still coupled, descend below the water surface (Plate 6). It is a mystery why these species do this, because they appear to be at high risk from predation by fish and other insects. One argument is that the eggs are then positioned to avoid problems from a drop in water level during the dry season. But why not then, lay eggs in floating aquatic weeds that go down with dropping water levels?

Risk from predation in this submerged condition seems particularly high as the insects envelop themselves in a conspicuous silvery airbag around their bodies. This probably acts as a plastron, or physical underwater lung, which extracts oxygen from the water. It is not unusual for the damselflies to stay submerged for twenty minutes or so.

Plate 4: Pale Spreadwing *Lestes pallidus* with the male clasping the female's neck while she oviposits in a sedge stem.

Plate 5: Stream Hawker *Aeshna subpupillata* ovipositing in grass stems just below the water surface.

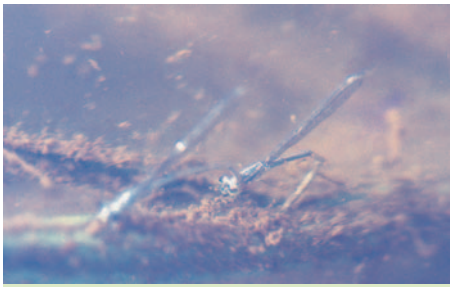

Plate 6: A pair of Slate Sprites *Pseudagrion salisburyense* under water, with the female laying eggs in the submerged vegetation.

Egg and larva

The egg is tiny, and hatches into a prolarva, which is a minute maggot-like form that, within a few hours, moults into the first-instar larva. Larval development depends very much on temperature and food abundance. In turn, survival depends on density, weed cover and prevalence of aquatic predators. If density is too high, there may be high mortality from cannibalism. Aquatic weeds, soft mud, or sand for some species, give cover and protection from predators. Indeed, among the best habitats for an abundance of dragonfly larvae is a well-vegetated, clear, sunlit pool, with an abundance of prey.

There are then many moults as the larvae go from one instar to the next. These early instars are extremely difficult to identify to species. The last-instar larva has distinct wing sheaths and a characteristic shape. Many larvae of South African dragonfly species are still unknown, and even less is known of their growth and development. Damselfly and true dragonfly larvae have different general shapes. Damselfly larvae are slender and have three paddle like terminal appendages, known as caudal lamellae (Plates 7-10). It is through these that the larva takes in oxygen from the water. True dragonfly larvae (Plates 12-13) do not have these appendages, and breathe by pumping water in and out of the rectum.

Plate 7: Feathery caudal lamellae of the Swamp Bluet (*Africallagma glaucum*).

Plate 8: Stocky larva of the Goldtail (*Allocnemis leucosticta*).

Plate 9: From above, the narrow caudal lamellae of the Slate Sprite (*Pseudagrion salisburyense*).

Plate 10: The elongate body of the Forest Malachite larva (*Chlorolestes tessellatus*).

Further details and keys to the larvae are given in Samways and Wilmont (2003) and Wilmot (2007). Currently, most larvae, and then only the last-instar, can only be identified to genus. However, Samways and Wilmot (2003) give further details of specialist articles, which enable identification to species level in certain genera.

There is much still not known of the larvae of South African species, especially their precise microhabitats. Larvae of most species can be fairly easily collected where the adults occur. A normal swimming pool leaf net can be used to collect the larvae, which can then be taken to a laboratory or home and reared in small, net cages placed in shallow trays with natural water (i.e. not from the tap) (Plate 11). The water must be aerated. This can be done with a regular aerator used for home aquaria. A stick must be placed inside the net cage, on which the larvae can crawl and emerge into an adult. For clubtails (Gomphidae) a stone should be placed inside the cage.

Food can be supplied in the form of mosquito larvae and small tadpoles, and even young damselfly larvae. The larvae must be reared individually, as they are usually very cannibalistic.

The tray with the cages is best left where there is natural air circulation and natural light. Partial sunshine is best, whether under shade cloth, or with sunshine for only part of the day. As a rule of thumb, the best conditions to rear larvae are those you would use to grow bonsai plants. If procuring food for the larvae is a problem, a rain barrel or other container(s) can be installed, and filled with water weed. These containers soon naturally attract many water insects and other invertebrates, which can be netted out and fed to the dragonfly larvae.

When the larva emerges, it is essential to preserve both the exuvia and the freshly-emerged adult together in the same vial of 80% alcohol, so as to ensure correct identification of the larva from the adult at a later date. A label, written in pencil or waterproof ink, should be placed *inside* the vial, where it cannot be separated from the specimens.

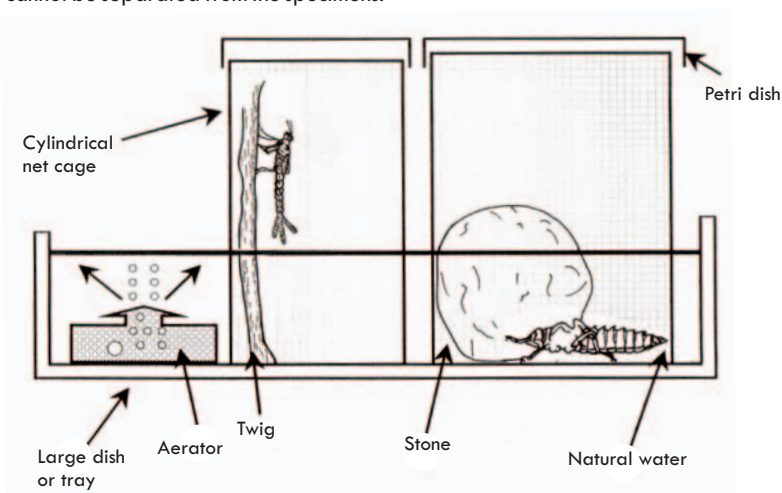

Plate 11: A rearing tank for larvae of both damselflies and dragonflies. A tray is filled with natural water (or, at least dechlorinated water by being left to stand for a few days). The tray must be aerated. The cages are cylinders of stiff netting which fit inside a lid, such as a Petri dish, which can be lifted off easily so as to introduce food items, such as mosquito larvae. Note that only one larva is placed in each cage to prevent cannibalism.

Plate 12: The weed-inhabiting larva of the Red-veined Dropwing (*Trithemis arteriosa*).

Plate 13: The bottom-dwelling larva of the Yellowjack (*Notogomphus praetorius*).