

## STUDYING TROPICAL DRAGONFLIES AND DAMSELFLIES (ODONATA)

### Finding habitats

Dragonflies and damselflies occur in all types of freshwater habitats. Generally habitats with a good water quality (e.g. clear water), aquatic and bankside vegetation (e.g. water lilies, rushes, weeds) and a natural morphology (e.g. not canalised or dammed) have more species. An important habitat aspect is sun: adults like to sit in the sun (bask), but in the tropics there are also many species that prefer the shade.

The easiest localities to observe and collect dragonflies are often open unshaded habitats like ditches beside the road and artificial ponds (figure 1). These habitats often hold only common and widespread species. More interesting species are found in forest and almost all endemic species (species with a small range) are confined to forest habitats. Good habitats to look are small running waters in the forest, especially those with some sunny spots (figure 2). Such waters are usually largely shaded, have clear shallow water, and no aquatic and bank-side vegetation. Also very interesting are rivers, especially forested ones (figure 3 & 4). Here there is more sun and vegetation, allowing a different spectrum of species. Small special habitats can contain some very specialized, rare species. Examples are places where water oozes from the ground (seepage), the spray-zone of waterfalls, wet trickles along rock faces, torrents, small pockets of water in tree holes (phytotelmata) or small pools and swamps in forest (figure 5). On first impression these habitats often seem poor in dragonflies; take your time to wander around and get a feeling of where the dragonflies are. Species occurring in these habitats often appear inconspicuous (less colourful) and inactive, only moving from their perch when approached.

### Collecting adults

#### *Finding adults*

As can be imagined, the best place to look for adults is around freshwater. Here the males defend territories and look for females, which come to lay eggs. Adults can also be found away from water, for instance to roost, mature or feed. Adults often concentrate in or at the edges of open areas, such as forest clearings, roadsides and grassy fields to feed on insects. Some species are very shy at the breeding habitat and are more easily captured at their feeding grounds. Most species are active during the day, with a maximum of activity at midday. They prefer warm (sunny) weather. Other species are only active in twilight, at dusk and dawn, and spend the day hiding in the vegetation. Species that perform high and fast patrol flights along streams during the day, may be much easier to catch while feeding lowdown along forest roads at dawn. There are even species that are most active during rain, but information is scanty simply because few people go out to observe dragonflies under such conditions.

Most dragonflies show a seasonal pattern, being less common or even absent during parts of the year. In the tropics this is mostly correlated with the rainy season. Numerous species that breed in temporary pools (for instance of the family Aeshnidae) survive the dry season as adult, waiting for the rains (that will provide breeding habitat) in bushes or trees. This behaviour is called siccation. These species reproduce shortly after the rainy season starts and are far less common during the rest of the raining season simply because most adults have died. The larvae of these species are of course largely absent during the dry season but can be rather numerous during the wet season. For many species breeding in running water the seasonal cycle may be inverted: for them it is safer to survive the rains as adult because the larvae may be washed away by high water.

So in order to get a good impression of the dragonfly fauna of an area it is necessary to visit a broad range of habitats during different times of the day and different periods in the year.

### *Catching adults*

Adults are caught with a net. Generally the type used for butterflies is suitable (net opening about 50-75 cm wide, handle about 100-200 cm long). The net must be deep enough to fold closed, so the catch cannot escape. For large Anisoptera a large, light net is useful. Such a big net can be hard to manoeuvre when catching Zygoptera in dense vegetation. A net with a handle composed of aluminium tent pole segments or a telescopic rod is useful, because you can vary the length.

The easiest way to store live dragonflies is in small envelopes (like those used by philatelists for postage stamps) or folded paper triangles ("papilottes") which are often used by butterfly collectors. Put pairs (tandems, copulas) together in one envelope. Carry a container (like a Tupperware box) with you to put them in. Because the colours of adults fade or change after preservation it is very valuable to take photographs of the adults, either free or in the hand.

### *Preserving adults*

It is best to keep dragonflies alive some time after capture, so they can dispose of waste products. After a day in the field it will take a few hours in the evening to note down your results and to store collected material. In the tropics there are basically two preservation methods: acetone and alcohol. The first is definitely the best. Very fresh (teneral) specimens are still soft and will crumple when dried and are therefore best stored in alcohol.

- Acetone. Throwing the individual in acetone kills it and makes it limp, so you can easily stretch the abdomen and legs a bit. Fold the wings above the body. Now leave it in acetone for 12 to 24 hours. When they are in the acetone put each individual in an envelope or between permeable paper, in order to avoid spreading of the wings. Afterwards dry it quickly. A breeze or some sun helps (but don't overheat). Keep your eyes on the material and beware of potential consumers, especially ants! Because the acetone has replaced the water in its body, the animal dries very quickly, with relatively little colour loss and odour development. Acetone also makes the material very stiff and sturdy. Putting the material in acetone is time-consuming, and acetone may be hard to find. Acetone is not allowed on aeroplanes, but should be available in chemical supply stores (for schools and laboratories) in larger towns. Using acetone gives the best material (strong, odourless, good colours), which has a lower risk of consumption by insects or fungi.
- Alcohol. Simply put the adults in 70% alcohol. Refresh the alcohol frequently. The downside of collecting in alcohol is storage, as it requires a lot of small, not-leaking containers. These are expensive and take up a lot of room. Alternatively, put all specimens together in a large container, filled with alcohol. Keep the specimens separate by putting them in envelopes or paper triangles (but beware, the alcohol may dissolve the envelope's glue). When transporting such a container full of paper and dragonflies you can simply pour off the surplus alcohol. The paper will retain enough alcohol to keep the specimens saturated for several hours. As more studies of dragonfly DNA are undertaken, there is great demand for samples in which the DNA is preserved well: alcohol of 95% or more is best. Entire specimens can be preserved for this purpose (but refresh alcohol several times, as body moisture dilutes it) but alternatively you can remove one or two legs (with muscle). These can be preserved in alcohol, while the rest of the specimen is preserved with acetone.
- In a very dry climate it is possible to simply dry dead specimens in their envelope, although this does not give ideal material.

For storage of dry material put the specimens in stamp envelopes or paper triangles in an airtight container. Label clearly! Add silica gel to keep the material dry (and to extract additional moisture) and perhaps some insecticide (e.g. naftaline).

## Collecting exuviae

### *Finding exuviae*

Searching exuviae (the larval skins left when a adults emerge) can be very rewarding as you often will find exuviae of species which are difficult to find as adult. This is especially true for species of the family Gomphidae and Corduliidae of which the adults seldom come to the waterside while exuviae can be common. Exuviae are always found near water. Look for them just above the surface to about 50 cm high (figure 6). Some species may go further, even several metres far. Dragonflies prefer vertical substrates for emergence (e.g. plants, tree roots, steep banks, rock faces), but may also be found on horizontal substrates (floating plants, flat banks). When you chase up a freshly emerged adult (which is still very pale, soft and shiny) from the waterside, try to catch it and look for the exuvia. Exuviae are nothing more than dried skin, and are therefore vulnerable. The legs easily break off when the exuvia is picked up: by splashing some water on it, the exuvia becomes moist and more flexible. Notes about the emergence site (place, height, substrate) can be useful.

### *Preserving exuviae*

Exuviae must be stored dry. For storage, it is easiest to use photo film containers, as these are small, close tightly and are easy to come by, although their availability may diminish as the digital revolution progresses. Exuviae will often be moist after collecting, and when put in a closed container may become covered with fungi. Dry wet exuviae in the sun, or make a hole in the lid, so moisture can escape through it. Never store exuviae in alcohol, as they will become soft, soggy and battered.

## Collecting larvae

### *Finding and catching larvae*

Many species are more easily found as larvae than as adult. An important purpose of searching larvae is rearing them to adult (see below). Rearing will give you the opportunity to match the larva to the adult. A small metal kitchen sieve is often most suitable to find larvae in standing waters (between water weeds, small patches of leaf litter, under roots of riverside trees). In these situations it can be handy to put the leaf litter and plants in a white plastic container. This makes it easier to find the larvae among the litter. In running water it is more convenient to have a larger net with a more sturdy frame. A good method to catch larvae that live under rocks or burried in sand, is to place the net on the bottom and disturb the substrate (stones, gravel, sand) upstream from the net's opening with a rock or your feet. The disturbance will dislodge and expose the larvae, the current carries them into the net. Another good method is to put roots of riverside trees that hang in the water in the net and shake them vigorously. Such clumps of wet roots often harbour larvae of the family Calopterygidae.

Take notes on the larva's habitat: was it among aquatic plants, stones, buried in the mud etc.? For both identification and rearing purposes it is important to collect full-grown larvae. These can be recognised by the well-developed wing-sheaths: the wing-venation is clearly visible in them.

### *Transporting larvae*

If you want to keep a larva alive there are three problems: drying, drowning and overheating. It is best to put the larva in a small, closed container. Do NOT put a larva in water, but rather in moist cotton wool or toilet paper, without or with very little free water and with plenty of air. Moss or other organic material can also be used, but only shortly as it may rot. Keeping the larvae cool (i.e. in a cool-box) at 5 to 10°C will extend their lifespan. Make sure that the larva remains moist and oxygenated.

### *Rearing (= breeding) larvae*

Basically a tray, basin or aquarium with water will suffice as habitat for the larvae. Provide some substrate for the larvae (e.g. sand, detritus, water plants) and for emergence of the adult (e.g. a stick). Feed it with small aquatic invertebrates (mosquito larvae, cladocerans etc.). Keep the basin or aquarium out of the full sun. After emergence, it is essential that adult and exuviae are marked as belonging to the same individual!

### *Preserving larvae*

Simply put them in 70% alcohol. Refresh the alcohol a few times. The larvae may become swollen. It is often good to prick some holes in a big larva with a pin, which prevents the swelling.

### **Storing and labelling**

Labelling is an important part of collecting (figure 7). It is important to make notes and labels every evening as this often becomes difficult after two days in the field. It is best to label with pencil as pen ink often fades.

### *Labelling*

Essential information for any label or record is:

- name of collector/observer
- locality name (at least country, region and name of nearby town)
- collection/observation date

Other useful data are:

- coordinates
- habitat description (see box)
- altitude
- colours of living specimen

### **Describing habitats**

The following list contains important factors to describe dragonfly habitats. Taking photographs of habitats is a good way to communicate about habitat types.

- type (pool, lake, paddy, river, stream, waterfall, seepage etc.)
- running (slow-moving, torrential etc.) or standing water
- temporary or permanent water
- size (i.e. diameter, depth)
- forest cover
- amount of sun and shade
- turbidity of water (e.g. clear, blackwater, murky, silt-laden, chalky)
- hydrochemistry (if possible: acidity, dissolved oxygen, trophy etc.)
- presence and type of aquatic vegetation (green algae, water lilies, emergent plants, water hyacinth)
- presence and type of bank-side vegetation (reeds, bushes, grass etc.)
- bottom substrate (e.g. mud, sand, gravel, rocks, detritus)
- human disturbance (e.g. clearance of vegetation, erosion, damming, altered course)



Figure 1. Open artificial habitats are often the easiest places to find and observe dragonflies. The species encountered at these localities are often only common en widespread species.



Figure 2. Small running waters in the forest, especially those with some sunny spots, are often rich in dragonflies. Such waters are usually largely shaded, have clear shallow water, and no aquatic and bank-side vegetation.



Figure 3. Rivers, especially forested ones, are good dragonflies habitats. Here there is more sun and vegetation, allowing a different spectrum of species.

Figure 4. Rivers bordered by degraded forest are often less rich in species but can still be interesting for dragonflies.





Figure 5. Swamps in forest often have a rich dragonfly-fauna with many species that do not occur in other habitats. On first impression these habitats often seem poor in dragonflies; take your time to wander around and get a feeling of where the dragonflies are. Species occurring in these habitats are often inconspicuous and inactive.

Figure 6. Exuviae of dragonflies are often found on vertical substrates like plants, tree roots, steep banks and rock faces.





Figure 7. Labelling is an important part of collecting. It is important to make notes and labels every evening as it often becomes difficult after two days in the field.