Dragonfly Group

Delving deeper into the private life of the damselflies and dragonflies (Odonata)

The main focus of the Cyprus Dragonfly Study Group (CDSG) so far, and that of many other dragonfly societies around the world, has been on the winged adults. These are conspicuous creatures of great beauty, elegance and grace and, with their mastery of flight, fascinating to watch. They are, however, amphibiotic - that is to say, during the early part of their lives, they are wingless and aquatic, breathing through gills and, for many species, their life underwater as a larva is longer than their life as an adult. The larva must undergo several (typically 7 - 16) moults as it grows and in each new instar will develop increasingly adult features, with wing pods becoming visible in the later stages.

Eventually the larva climbs out of the water, clings to a suitable surface such as a wall, rock or a stem and undergoes its final moult. Once emerged, the fresh adult will expand its abdomen and wings and at that stage is known as teneral ("soft", "tender"). It will sit for around two hours while the wings and exoskeleton harden and will then fly off, leaving behind the larval exoskeleton, known as an exuvia. Exuviae are very valuable to the naturalist since they allow identification of the species and its sex, and also provide confirmation of successful breeding. Note that unlike, for example, butterflies, odonates do not undergo a pupal stage, but go straight from larva to adult.

The newly emerged adult will generally spend around one week maturing sexually, away from the breeding sites. Males will then return to the breeding sites over or near water, where they will select and defend a territory. Females return to the water when they are ready to mate, and once copulation is complete, the females will almost immediately begin to lay eggs, which are fertilised as they pass through the sperm whilst being laid. Depending on the species, the eggs may be laid into floating, dead or live vegetation, or may be deposited directly into the water. The eggs may develop and the larvae emerge quite quickly, for example within a week, or may stop developing and enter a diapause, only to continue when conditions become favourable, such as with the onset of autumn rain or spring temperatures.

Freshwater is one of the most threatened habitats on the planet. Dragonflies are potentially one of the best freshwater bio-indicators and are excellent flagship species for studying freshwater ecosystems.

A recently emerged Caliaeschna microstigma (Eastern Spectre) below its exuviae. Photo: K. Siedle.

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They are very sensitive to conditions at breeding sites and the surrounding terrestrial areas, reacting quickly to changes in environmental quality via active dispersal, and importantly, if favourable conditions are restored, they will rapidly recolonise the habitat. So far, research in this area has mainly targeted the adult stage with adult counts considered to be indicative of species' diversity and abundance at a particular site. There is, however, an increasing awareness that the presence of adults at a site is not conclusive evidence that it is a viable breeding location. Adult dragonflies are not able to assess the quality and suitability of the water for breeding, nor are they aware of what will happen to the water body subsequently. It is very difficult to carry out effective monitoring of larvae, but exuviae are now recognised as being able to give a clear indication of breeding success at a habitat. The importance of studying exuviae was recognised by the Dragonfly Study Group but, whereas many books have been written on adult dragonflies, there is a dearth of information on their larvae and exuviae.

CDSG members looking on as Christophe Brochard finds dragonfly larvae following a net sweep of the area.

In 2019, we received a visit from Christophe Brochard, a recognised expert on European damselfly and dragonfly larvae and exuviae. He wanted to photograph and study the larval stage of *Anax immaculifrons* (Magnificent Emperor) and Ischnura intermedia (Persian Bluetail), both of which occur on Cyprus but are very range-restricted otherwise in Europe. The visit was successful and Christophe agreed to come back to Cyprus the following year to conduct a larvae and exuviae workshop with the Dragonfly Study Group. COVID restrictions got in the way, but the workshop finally took place with Christophe's return to the island from 11th - 18th May this year. The first few days were spent in the field learning how to find exuviae and then we came together for an in-house session, working through the various steps necessary to arrive at the correct identification. Identification of a species from its exuvia is very different from that of adult identification and, in many cases, requires the use of a microscope, one of which Christophe very generously donated to the group. Christophe is working on a key for the identification of the exuviae and larvae of Europe's 143 species of dragonflies, and from this he was able to distil out a tailored key for the species occurring on Cyprus. So, the Dragonfly Study Group now has ways and means to delve deeper into the life-cycles of these amazing insects.

CDSG members examining exuviae collected during the various field trips.

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You may be wondering what the larvae look like. Well, although features that will be carried through to the adult stage are visible, the larvae do look very different from the adults and are usually beige or brownish and quite frankly, rather ugly. A major way in which they differ from the adult is that the larvae extract oxygen from the water and consequently have gills. In damselfly larvae, these are visible as three external structures at the end of the abdomen. In dragonfly larvae, these are located internally in the rectum and breathing is achieved by water being sucked in and out through the anus – so, put basically, they breathe through their butts. Another unique feature in damselfly and dragonfly larvae is the way they feed. Their favourite prey is mosquito larvae, although they also feed on other invertebrates, small fish and tadpoles. Prey is grabbed by a specially modified lower lip, known as a labium, which the larva is able to extend very rapidly. The captured prey is then consumed in the sharp mandibles. It is an incredible sight to see and this short video of it is worth a quick watch.

Lestes macrostigma (Dark Spreadwing) larva. A damselfly: note the three external gills at the end of the abdomen. Photo: C. Brochard.

Some illustrations of the additional insights that can be obtained from searching for exuviae became apparent during the field trips. At one site on the Diarizos river, we only found one recently emerged *Onychogomphus forcipatus* (Small Pincertail) and just based on that would have concluded that the species was rather rare there. But with around 250 exuviae found there, it can be concluded that it is an important breeding site for the species. In another example, at one of the agricultural tanks near Eptagoneia, we did not see a single adult *Selysiothemis nigra* (Black Pennant), but found an estimated total of 1,000 exuviae, showing it had bred very successfully there.

Anax immaculifrons (Magnificent Emperor) larva.
A dragonfly: note the absence of external gills, which are located internally in the rectum.
Photo: C. Brochard.

Aeshna mixta (Migrant Hawker) larva devouring the prey that was caught with its labium (a highly modified lower lip).
Photo: C. Brochard.

A freshly emerged *Onychogomphus forcipatus* (Small Pincertail) found on the Diarizos river.