https://doi.org/10.26749/rstpp.106.1.87

AQUATIC INSECTS

By G.C. Wade

Department of Agricultural Science, University of Tasmania.

Insects include the greatest number of species of any class of animals. They have been divided into thirty Orders. However only four Orders of insects consist of species whose larval forms are always aquatic, while another nine Orders contain some species with either aquatic larvae or which are aquatic throughout larval and adult stages.

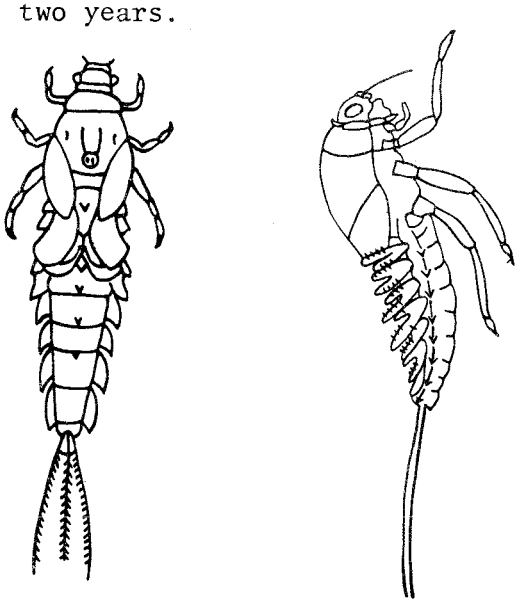
Insects are characterized by a hard, segmented, exoskeleton and by a three segmented thorax, each bearing a pair of legs and usually with two pairs of wings attached to the second and third thoracic segments. In the Diptera and some mayflies (Ephemeroptera) the wings are reduced to a single pair, while in primitive insects such as springtails and silver fish, wings are absent. They have also been lost from some species of more advanced orders of insects.

Because of their rigid exoskeleton, insects cannot grow continuously but must shed their skeleton in a series of moults, the stage between moults being known as an instar. In the most primitive insects the form of the insect does not change with successive instars but they become progressively larger. In many orders the insects become progressively more like the adult after each moult. In the most advanced forms, such as beetles, flies, moths and wasps there is a larval stage completely different in appearance from the adult and a pupal stage which then moults to the adult insect. The mayflies, which are among the insects that concern us today, are somewhat anomalous in that the larval stages become progressively larger and then finally hatch to a winged pre-adult which moults to the adult stage.

All of the four Orders which have aquatic larval stages are represented in the Central Plateau of Tasmania and are abundant in, and around lakes and streams. The larval stages are an important source of food for fish including the introduced trout.

EPHEMEROPTERA (MAYFLIES)

The larval stages, or nymphs, are elongate creatures with well devloped legs, paired external gills on the abdominal segments, and three caudal filaments. They vary in size according to species, but rarely exceed two cms in length. Some of them bury themselves in mud, while others swim actively. They are predominantly vegetarian or scavengers and live for up to two years.



21. Ephemeroptera larvae (after Tillyard 1926).

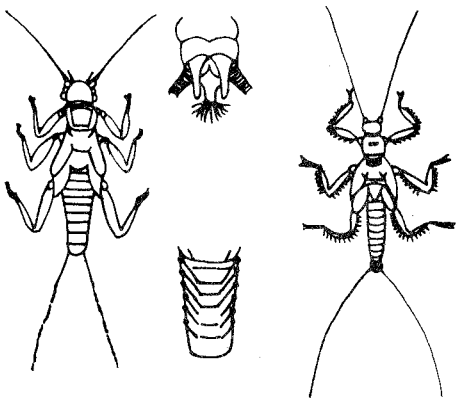
When they are mature they swim to the surface, and hatch to the pre-adult or dun, which is similar in form to the adult, but dull in colour. They fly weakly and often float on the surface of the water. After a few hours they hatch to the adults or "spinners" with glistening, transparent wings held erect in repose, vestigial mouth parts and either two or three long caudal appendages. The males fly in swarms into which the females fly, and mating takes place in the air. The females then deposit their eggs on the water.

Tasmanian species vary in size from the large black spinner (*Atalophlebia albiterminata*) which may have a wing span of 30 mm to minute caenids about 2 mm across. *Tasmanophlebia lacustris* (highland spinner) is a large, distinctive species with very active nymphs, which half settle into the sand when at rest.

All stages are attractive to trout and the art of fly fishing developed from attempts to imitate them with concoctions of feather and silk.

PLECOPTERA (STONE FLIES)

Stone flies are soft bodied insects with a pair of caudal appendages, long antennae, and usually well developed wings which are folded longitudinally when at rest. They are rather poor fliers, and are not found far from water. Most of



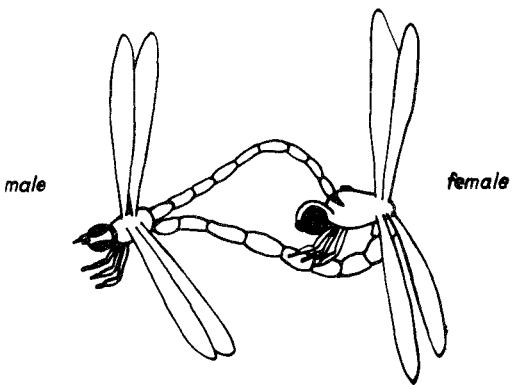
them are drab brownish grey in colour, but Tasmania possesses several large stone flies with bright orange hind wings which belong to the endemic genus *Eusthenia*.

The larvae are elongate with a pair of caudal filaments. They have gills which are more filamentous than the leafy gills of the mayflies. They may be found crawling on the surface of stones in both streams and lakes.

22. Plecoptera larvae
(after Tillyard and Riek, from Williams 1968).

ODONATA (DRAGON FLIES AND DAMSEL FLIES)

These large winged, net veined insects are abundant and conspicuous. They have very large compound eyes, slender legs, and a long thin abdomen. They are divided into two suborders, the Anisoptera or dragon flies and the Zygoptera or damsel flies. In the former the venation of the fore and hind wings are different, and the wings are spread horizontally when these insects are at rest. In the Zygoptera the wings are similar and slope backwards or are held vertically when at rest. In both groups there is a nodus on the front edge of both wings which clearly distinguishes them from the ant lions, the only group with which they could be confused.



23. Mating Odonata
(after Williams 1968).

The method of mating is unusual. Although the sperm of the male is produced at the rear of the abdomen, the copulatory organ is on the second abdominal segment. The male

transfers sperm to an associated sac. When mating takes place the male seizes the female behind the head by a pair of claspers, and the female bends her body forward as shown in the diagram.

Eggs may either be dropped into the water, or in some species inserted into plants.

The larvae are carnivorous with a projectile labium (under lip) with movable hooks to clasp the prey. Those of dragon flies are relatively bulky and are known to anglers as "mudeyes". Damsel fly larvae are much more slender. They may remain in the larval stage for up to several years. When mature the larvae leave the water and the adult hatches.

TRICHOPTERA (CADDIS FLIES)

The caddis flies are related to the Lepidoptera, but most of them differ in having hairs on the wings rather then scales. More consistent differences between the Orders are the venation of the wings, and the greatly reduced mouth parts. They resemble small moths with long filamentous antennae, wings which fold roofwise over the body when at rest, and a habit of running after they alight.

The larvae and pupae are almost invariably aquatic. The larvae are elongate, often with a soft abdomen. The front pair of legs are shorter and stouter than the remainder and are used in holding food and in case making. Many of the species construct a protective case of plant material or sand grains, while others make a silken case or are free living.

The larvae form an extremely important source of food for trout, and frequently trout stomachs are full of small pieces of sticks from caddis cases.

The caddis fly fauna is similar to that of south-eastern Australia though there is a greater abundance of some species in Tasmania. The best known of Tasmanian species is the Shannon moth, *Asmicridea grisea* which developed in vast numbers in the Shannon River between the Great Lake and the Shannon Lagoon. It was responsible for the famous Shannon Rise which occurred when trout came up into the river from the Lagoon when the insects hatched. This phenomenon was lost when the Poatina scheme was developed.

Of the aquatic insects belonging to other Orders the most familiar are the water beetles (Coleoptera), bugs (Hemiptera) and two winged flies (Diptera).

COLEOPTERA

Beetles are distinguished by hardening of the front wings to form elytra which protect the membranous hind wings. However in some species the hind wings are absent.

The main families of aquatic beetles are the Gyrinidae ("whirligig beetles"), the Dytiscidae and the Hydrophilidae. The whirligig beetles are distinguished by long front legs and short, flattened second and third pairs. They tend to congregate in groups and skim over the water surface in an erratic fashion.

The Dytiscidae have long filamentous antennae and the hind legs are fringed with hairs and function as paddles.

The Hydrophilidae (water scavenger beetles) have short clubbed antennae which may be shorter than the palps.

Except for the Hydrophilidae, some of which are terrestrial, the larvae are always aquatic and predatory.

HEMIPTERA (TRUE BUGS)

The insects of this Order differ from the others we have discussed so far in that they have piercing and sucking mouthparts. They have a gradual metamorphosis.

The most familiar families of aquatic species are the Corixidae ("water boatmen"), the Notonectidae ("back swimmers"), Nepidae ("water scorpions") and Hydrometridae ("water measurers").

Most of them are carnivorous. They are eaten by trout, but are less generally important as food than several of the other groups that have been discussed.

DIPTERA (TWO-WINGED FLIES)

In this large Order the hind wings are replaced by balancing organs called "halteres". There are many with aquatic larval forms, many of them having pestiferous biting adults.

Culicidae (mosquitoes) have aquatic larval and pupal stages, and the all too familiar adults with biting females. Fortunately they are less abundant in the Central Plateau than in places with lower elevation.

Superficially similar in the adult stage are the Chironomidae (gnats or midges). They differ in the absence of scales on the wings. The larvae are elongate and worm-like and include the "blood worms". They are able to develop in more turbid water than most other aquatic insect larvae.

The adults often occur in large swarms and are favoured as food by trout to the great frustration of the angler, who has difficulty in imitating such a small insect.

Tabanidae ("March flies") become very abundant during late summer, particularly in the western part of the plateau. Their larvae develop in swampy situations. The adults have flattened abdomen, and a conspicuous lobe (calypter) at the junction of the wing and thorax. They inflict a painful bite on humans and animals.

Small, biting midges, belong to the families Ceratopogonidae and Simulidae, and are often known as "sand-flies".

Adventitious insects

Terrestrial insects frequently fall into the water and add variety to the diet of the trout. In the Central Plateau leaf eating beetles (Chrysomelidae) belonging to the genera *Paropsis* and *Chrysoptharta* frequently occur in vast numbers during the summer and at times form a major trout food.

In the late summer and autumn large numbers of Eurymelidae develop on eucalypts around highland lakes, and are attractive to trout. They belong to the order Hemiptera and have sucking mouthparts, and hardened black and white or black and red wings which fold tentwise over the membranous hind wings. They are frequently and incorrectly referred to as Jassid beetles. They are quite unrelated to beetles. However they were formerly classified as members of the family Jassidae, so that Jassid is an acceptable common name.

REFERENCES

C.S.I.R.O., 1970: *The Insects of Australia.*

Scholes, D., 1961: *Fly-fisher in Tasmania,* M.U.P.

Tillyard, R.J., 1926: *Insects of Australia and New Zealand,* Angus and Robertson.

Williams, W.D., 1968: *Australian Fresh Water Life,* Sun Books.