"NET-WINGED" MIDGES OF SOUTH AFRICA

by Shirley Chinn, Natal Museum, Pietermaritzburg

Mountain midges or net-winged midges are flies which belong to the family Blephariceridae. The common name"net-winged'' midges, came into use because of the characteristic creases visible in the wing membrane (figure 1). These creases result from the flies developing to near maturity inside the pupal cases, with the wings having to develop while folded and compressed.

These flies are found only in mountainous areas as the larvae require cool, well-oxygenated and unpolluted water. All stages of the life cycle exhibit adaptations for life in and near torrential water (Hogue, 1981a).

Nineteen described species are found in the southern African region and all belong to the endemic genus *Elporia*, Edwards, 1915. Up to three species may be found together in a stream (Barnard, 1947).

Life cycle

In the summer-rainfall areas most species overwinter in the egg-stage. Larval development begins in early summer after the first rains and pupation, adult activity and egg-laying occur in late summer (late March to early April). A few species, eg. *E. hiemis*, from Natal, undergo larval development during the winter, and the adults are active for a short period in the spring. In the winter-rainfall areas the larvae begin their development at the beginning of winter and the adults emerge during the late winter, spring and early summer.

Eggs: *Elporia barnardi* (Edwards), which is a Cape species, aestivates (is dormant in summer) in the egg stage. This period occurs during mid and late summer when the volume of water in the streams is greatly reduced, and this allows the eggs to survive unfavourable conditions (Barnard, 1947). The eggs are laid singly on rocks that are wet, to which they adhere (Barnard, 1947).

The eggs of *E. barnardi* are blackish and the dimensions are approximately 0,25mm x 0,2mm. They are laid from August to January, so there is a succession of different broods of adults emerging during the late winter, spring and early summer months. During the late summer and autumn (January to mid-May) only the egg stage is found (Barnard, 1947).

Larval stages (figure 1): Larvae, of all different stages, are often found in groups in swift-flowing water (Hogue, 1981a). They require well-oxygenated, unpolluted, silt-free water to develop successfully. They are streamlined and ventrally flattened, and can be found clinging to rocks in waterfalls and rapids. The larvae appear to consist of 6 or 7 segments separated by deep constrictions and each segment bears a midventral sucker which allows the larva to hold onto rocks and move in strong currents (Zwick, 1989). They move by releasing their suckers progressively, one at a time. Larvae breathe by means of tracheal gills which are arranged in paired tufts (Stuckenberg, 1980). Blephariceridae go through 4 larval instars before pupation takes place (Hogue, 1981b).

The larvae feed on microscopic algal growths and diatoms, which they scrape off the rocks (Stuckenberg, 1980). The mouth of the larva is situated ventrally.

Predation on the larval stages seems to be minimal and larvae are rarely found in trout stomachs. Nematode worms have been recorded as larval parasites, but these have not been found in South Africa.

The larvae of *E. barnardi* can be found in Cape streams from mid-May until the end of December (Barnard, 1947). The transformation from larval stage to pupal stage takes only 5-10 minutes (Hogue, 1981b). The final stage larva fixes itself to the surface of a submerged rock immediately after the last moult and forms the pupal case.

Pupae (figure 1): The pupal case which is oval in outline and markedly flattened, with a flat, soft ventral surface, is attached to rocks by means of 3 pairs of ventrolateral adhesive pads (Hogue, 1981b). The pupal case is usually dark brown and darkens with age. The pupae breathe by means of 2 respiratory horns. Each horn comprises 4 erect plates which are arranged behind one another. A bubble of air forms between the plates where it is held to allow oxygen to diffuse through a narrow slit between the second and third plates into the tracheal system.

The pupal case has a"T''-shaped fracture line which is forced open when the adult emerges

from the case. Some species such as *E. barnardi*, attach to the substratum with the head pointing downstream before they pupate. This position makes the emergence of the adult easier as the current washes the fly out of the case.

Adults (figure 1): The adults are active for only a brief period of 2-3 weeks after the pupae have developed (Hogue, 1981b) and they develop to near maturity within the pupal case. They are capable of flight almost immediately after emergence as their pre-folded wings expand rapidly. Some can even rise into the air from completely submerged pupae (Hogue, 1981a). Emergence from the pupal case takes 3-5 minutes (Hogue, 1981b).

Adults spend most of the day at rest, hanging onto vegetation near the stream with their spurred legs (Barnard, 1947). Hogue 1981b stated that blepharicerids rarely hover or dance in swarms, but both male and female specimens of South African species have been observed flying in sunlight on calm days in a manner similar to the"dancing'' of May-flies (Barnard, 1947; Stuckenberg, 1980). The flight pattern of blepharicerids is characteristically undulant (Stuckenberg, 1980). The adults are not always easy to find, but they are not rare.

The adults are beautiful flies with glistening wings and often have glowing, green eyes and brightly-coloured bodies. They are slender-bodied with long legs. The fore and mid pairs of legs are about twice the length of the abdomen, and the spurred hind pair are about three times the length of the abdomen. When at rest the wings are not folded, but held out to the side of the body. The antennae are relatively short, about the same length as the height of the head.

In both males and females the compound eyes may be divided into upper and lower divisions, and the relative sizes of these divisions are distinctive in different species (Stuckenberg, 1956). The males of some species have very large eyes and the ommatidia (lenses) in these large eyes vary in size (Stuckenberg, 1956). The males of *E. saltatrix, E. armata, E. barnardi, E. spinulosa, E. hystrix, E. natalensis, E. hiemis, E. scruposa, E. edwardsi* and *E. femoralis* all have large ommatidia in the upper division of the eye and smaller ommatidia in the lower division (Stuckenberg, 1956). It is thought that this may facilitate focusing on objects at close range. It is the large-eyed males which can be observed swarming over cascades. The males of *E. capensis, E. flavopicta, E. anisonyx, E. capra, E. uniradius* and *E. vidua* have a very reduced upper division with small ommatidia (Stuckenberg, 1956).

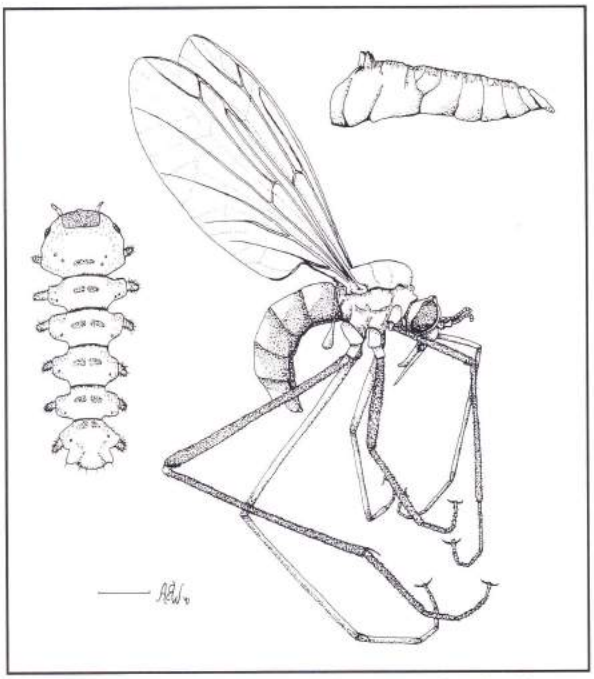
In some species the females have mandibles and suck the blood of other smaller, weak, slow-flying flies (Hogue, 1981b). All males and the females of some species do not have mandibles and it is thought that they may feed on the nectar of stream-side flowers, if they feed at all (Stuckenberg, 1980).

The males of some species, eg. *E. saltatrix*, have modified front legs. The femora are spiny and at the tip of the femur there is a projection which has closely-packed, stout, erect, black spines and bristles at its tip. The front of the tibia also bears a knob-like projection and has 7 curved, thorn-like spines arranged in a whorl (Stuckenberg, 1955). It is thought that these modifications of the front legs are used to clasp the female during mating.

While ovipositing, the female flies over shallow water or amongst the spray and pauses frequently to lay eggs in the cracks of rocks (Barnard, 1947)

Distribution: The factors which limit the distribution of blepharicerids are the conditions which the larvae require for their successful development, namely well-oxygenated (fast-running), unpolluted mountain streams and rivers (Stuckenberg, 1956). Because of their need for such pristine conditions this family may be of use as an indicator group when doing environmental impact assessments, as they are very sensitive to any changes in their habitat, eg. restricted water-flow due to dam-building or drying-up of headwater streams caused by afforestation.

The distribution of blepharicerids in South Africa is discontinuous because they are restricted to mountainous areas which have a reliable, high rainfall. Six species of *Elporia* occur in the mountains of the south-west Cape: *barnardi, spinulosa, capensis, anisonyx, capra* and *uniradius* (Stuckenberg, 1956). Two species are known from the Kologha and Amatola mountain ranges of the eastern Cape. Six species occur in the Drakensberg and two species have been recorded from Eshowe in Natal (Stuckenberg, 1956). Some species also occur in the eastern Transvaal. Other new species have been found and await description. Blepharicerids are not found north of the Limpopo River and this is a distribution pattern which is also exhibited by other primitive insects, eg. the .



Various stages in the life-cycle of the net-veined midge.

alder-flies (Order Megaloptera). The closest relative of *Elporia* is found in south-east Brazil.

Acknowledgements

I thank Mr A.E. Whittington for preparing the illustrations and Dr D.A. Barraclough and Dr B.R. Stuckenberg for reading and commenting on the manuscript. Dr Stuckenberg also provided valuable additional information, which has been incorporated in the text.

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IMITATIONS OF THE NET-VEINED MIDGE

by Ed Herbst

On an early September morning a few years ago I was working my way up the Smalblaar and arrived at Granite Basin to find the water at the head of the pool boiling with rising fish.

It was quite obvious what was causing their excitement because the air above the riffles was blue with the wings of hundreds of insects rising and falling as they seemed to dance over the water.

Although I didn't know what they were then I now know them to have been mating swarms of the Net-Veined Midge, the subject of the afore-going article by Shirley Chinn.

The emergence and mating flight of these insects takes place over a very short period in early spring and if you don't have a suitable imitation you might as well be cherry picking.

There have been two slightly differing approaches to adult Diptera imitations - the Americans favour the Griffiths Gnat which is a simple fly with a grizzly hackle palmered over a peacock herl body and the British favour the Knotted Midge which is a fore and aft pattern consisting of a black thread body separating a black hackle at the bend of the hook and another at the eye.

Ernest Schweibert's book, "Nymphs" published in 1973 brought the Griffiths Gnat to the attention