More Ephemeral Than We'd Like

Dr. Cyril Bennett asks what might be causing the decline in our upwinged mayflies, and gives practical advice on how to boost numbers on your river.

With the publication of the Chalk Stream Malaise by Allan Frake and Peter Hayes and the continuing concerns of anglers about the reductions in fly life on our rivers, it could be that people are convinced that there really is a problem. Perhaps it is time to start looking for an answer.

POLLUTION

Under normal conditions, a female blue winged olive (*Serratella ignita*) will produce about 1000 eggs: of these only two will survive to become a breeding adult. Ninety five percent of the losses will occur during larval stages; this is an obvious place to start looking because these stages may be particularly sensitive to pollution.

There has been a number of reports into the effects of endocrine disrupters and the feminisation of fish. No research has been done into the effects these hormones may be having on freshwater invertebrates, although there are some disturbing indications that this may be a problem.

Fig. 1 shows a microphotograph (recorded in 1990) of a "male" large dark olive (*Baetis rhodani*). This fly has considerably reduced claspers, apparently inadequate for gripping the female during mating and it is producing eggs.

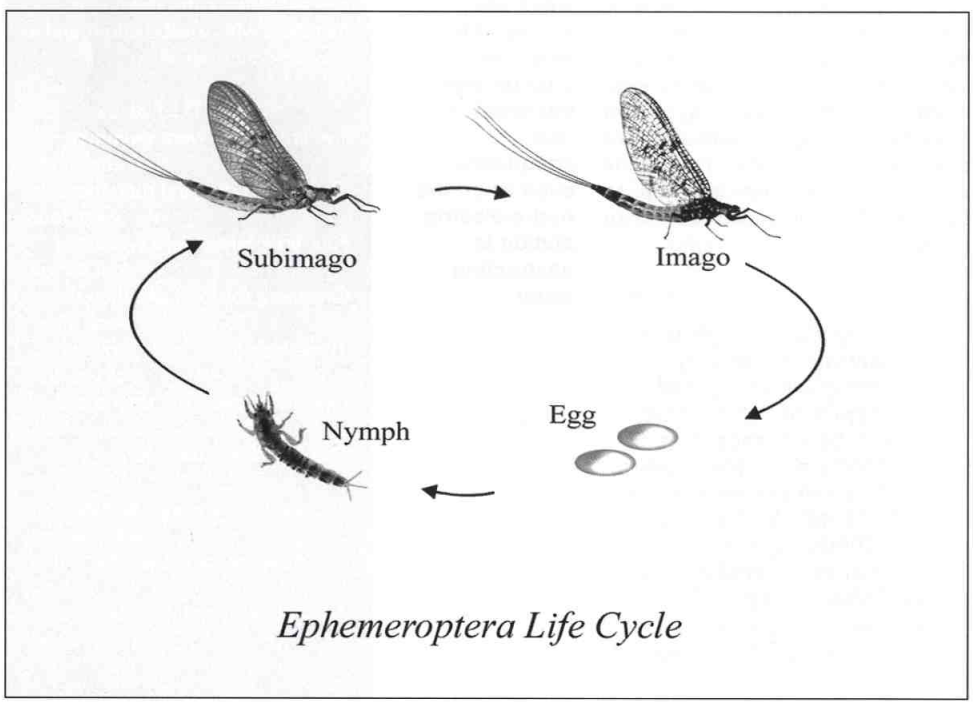
On the middle and upper Test John Goddard has observed large numbers of female blue winged olive spinners flying over the water without any visible sign of the eggs that are normally carried on the abdomen of females (Fig. 2). This suggests that the eggs may not have been fertilised. The eggs of most upwinged flies can develop parthenogenetically (without fertilisation) but they take longer to hatch and in most cases produce only females.

Even before the eggs start to face the onslaught of predators, considerable losses can occur. To avoid being swept downstream in the current they must be able to attach themselves to some suitable substratum where they can complete their development. To facilitate this, there is an array of "attachment structures" on the surface of the eggs: these are activated as soon as the eggs enter the water (Fig. 3). The type of structure varies considerably and in many cases it can be used to identify the species.

If the efficiency ("stickiness") of these structures is undermined in any way, perhaps by some form of pollution, large numbers will be lost. It may be coincidental that all of the *Baetidae* that have no attachment structures are far less sensitive to pollution than those that do. Subjecting eggs to various forms of pollutant under controlled conditions may be a way of finding out what is happening to our fly life, but the research remains to be done.

AN INTERIM SOLUTION?

Although less than 0.2% of the eggs produced survive to become mature adults under normal conditions, this usually would be sufficient to maintain the size of the population. As nearly all of the losses occur in the egg and early larval stages, breeding these stages under controlled conditions could be a way of increasing local fly populations. This would both overcome many of the natural losses that occur



Ephemeroptera Life Cycle

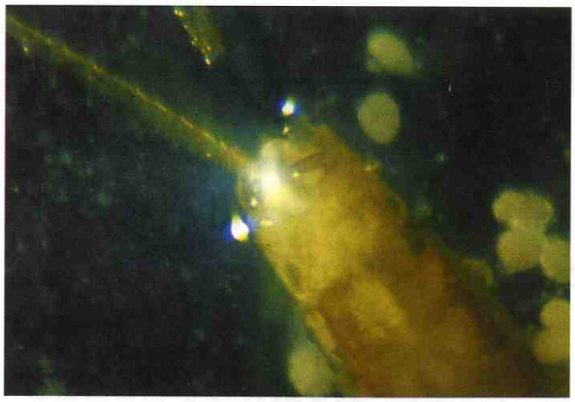


Fig. 1

Fig. 3

Fig. 2

Fig. 4

and might also protect delicate stages from pollution.

The first problem is to obtain a good supply of eggs. Fortunately one of our most important river flies, the blue winged olive produces around 1000 fertilised eggs all neatly packaged into a small ball. Large numbers can be collected in a relatively short time and transferred to containers that are suitable for incubation.

Fig. 4 shows about 25,000 eggs attached to one of the eighteen microscope slides that can be accommodated in the incubating jar. A fully loaded jar will hold about half a million eggs, nearly all of which will hatch.

Whilst the eggs can be incubated on a whole range of different substrates, using glass microscope slides enables the development to be checked periodically.

Fig. 5 shows the developing stages of the eggs over a six-week period up until development is suspended (this is called diapause). Rising water temperatures in the early spring reactivates development. This study has revealed that diapause occurs just before the last stage of development, which means that the eggs will hatch quickly as soon as conditions are right.

Whilst eggs normally come out of diapause with rising water temperatures in early March, under certain controlled conditions, eggs can be brought out of diapause prematurely by raising the temperature. It is possible that this could be used to induce a second generation under laboratory conditions. This could be used to increase populations on a localised basis.

THE FUTURE

Finding an answer nearly always raises more questions and although research is still at a very early stage, it is hoped that it can be increased next year. Who knows, in a few years time we may even be able to increase the evening rise to the blue winged olive. Meanwhile, if anyone is interested in raising some blue winged olive for their local water they are welcome to contact me for a discussion.

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Fig 5