Predation of *Oligotricha striata* (Trichoptera, Phryganeidae) larvae on amphibian eggs

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The eggs of amphibians are not easily accessible prey. The anuran eggs are often deposited in large dense clumps, toad eggs are unpleasant to the taste (Licht, 1968), and newt eggs are protected by wrapping (Miaud, 1994). But despite this, amphibian eggs can be eaten by some aquatic vertebrates and invertebrates. Banks and Beebee (1987, 1988) found that some toad eggs were eaten by anuran larvae, and some species of leeches are known to prey on bullfrog eggs (Howard, 1978). Newt eggs are consumed by newts and water beetles (Miaud, 1993, 1994). Caddis fly larvae, such as *Ptilostomis* sp. (Phryganeidae) have been reported to prey on the eggs of the salamanders *Ambystoma maculatum* (Murphy, 1961) and *A. tigrinum* (Dalrymple, 1970). Furthermore the larvae of *Eubasilia regina* (Phryganeidae) are known to feed on eggs of the endemic Hokkaido salamander, *Hynobius retardatus* (Sato, 1990). However, until 1990 frog eggs have not been reported to be fed upon by caddis larvae. In the Świętokrzyskie Mountains (central Poland) Majecki (1990) noticed a large concentration of *Oligotricha striata* larvae on *Rana temporaria* spawn in a small pond. This phenomenon was observed over two subsequent years. In one exceptional case, 150 specimens were found in about 5 litres of spawn, while on the bottom of the pond (where spawn was not deposited) the number of larvae did not exceed 7 specimens per 1 m². It can be assumed that the larvae did not occur there by accident but that they preyed on the eggs.

*Oligotricha striata* occurs almost all over Europe (Botosaneanu and Malicky, 1978). The larvae build transportable tube-shape cases with uniform pieces of plant detritus. The larvae are characteristically found in small reservoirs. They particularly inhabit stagnant waters (Malicky, 1973), but also are found in running waters (Statzner, 1979). *Oligotricha striata* larvae often occur in the mating areas of amphibians. Phryganeid larvae feed mainly on detritus and living vegetation (Lepneva, 1966), but occasionally are predators (Hagge, 1970).

Subsequent laboratory experiments on the feeding behaviour of omnivorous *O. striata* showed that larvae attached and fed upon *Rana temporaria* eggs and mostly ignored plant material offered along with the eggs. They very easily bit through the jelly-like sheaths and consumed the egg cell (Majecki and Majecka, 1996). Because eggs of different groups of amphibians have different antipredator protections, the aim of the present investigation was to observe the feeding activity of *O. striata* larvae in relation to eggs of *Rana lessonae*, *R. arvalis*, *Bufo bufo*, *Triturus alpestris* and *T. vulgaris*. 

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The larvae of *O. striata* were collected at the end of April, from a small pond (13 \(\times\) 42 m, max. depth 1.3 m) located on the northern slope of Święty Krzyż in the Świętokrzyskie Mountains (central Poland). The pond is fed by ground water and its bottom is covered by a thick layer of leaves. The highest recorded water temperature was 21°C (in June, at 0.5 m depth). The aquatic vegetation was sparse and only a few *Potamogeton* sp. plants and some small clusters of *Callitriche* sp. were present. *Oligotricha striata* larvae were the only trichopteran larvae present.

The eggs of *T. alpestris*, *T. vulgaris* and *R. arvalis* were spontaneously laid in the laboratory by females collected in nature. The two species of newts were collected from the pond in the Świętokrzyskie Mts., and the marsh frog came from northern Poland (Kujawy District). The eggs of *R. lessonae* and *B. bufo* were collected from ponds in the vicinity of Łódź. In the laboratory amphibian eggs were stored in a refrigerator at +3°C.

Larvae were split in two experimental groups (A and B). Both short and long term experiments were undertaken. In the long term experiment (Group A), each larva of *O. striata* was kept separately in a small container 8 cm long and 6 cm wide filled with water up to 5 cm. The water was refreshed every 2-3 days. As a food source, the larvae were offered the eggs of *R. lessonae* and plant material (lettuce, maple and hornbeam leaves from the bottom of the pond).

The short term experiments (Group B) were performed in aquaria 40 \(\times\) 25 cm, water depth 15 cm, filled with filtered tap water, continuously aerated. The number of larvae per aquarium was six. As a food source, the larvae were offered eggs of *R. arvalis*, *B. bufo*, *T. alpestris*, *T. vulgaris* and plant material. In all experiments, the water temperature was maintained at 16-18°C and the tanks were under natural light condition.

The experiments were carried out in May and June, which partly correlated to the natural occurrence of spawn in the environment. During the experiments, every 24 hours a known number of amphibian eggs were provided, as well as lettuce, maple and hornbeam leaves. The eggs were given in excess to the requirements of the larvae. After 24 hours the number of eggs eaten by the larva was determined and the uneaten eggs were removed. The maple and hornbeam leaves were collected from the bottom of the pond. The lettuce and other leaves were cut into squares (2 cm \(\times\) 2 cm). The squares of plant material were checked every 24 hours for bite marks.

The experiments revealed that *O. striata* larvae prey on *R. lessonae*, *R. arvalis*, *T. alpestris*, *T. vulgaris* but not on *B. bufo* eggs (table 1). The total number of *R. lessonae* eggs eaten in 45 days by larvae of Group A was 1170. The average rate of egg consumption was more than 1 egg per larva in 24 h (table 1). *Oligotricha striata* larvae ate little or none of the plant matter available. Only in aquaria with *B. bufo* eggs did the larvae eat the lettuce leaves.

The larvae of *O. striata* live in huge numbers in a small pond in the Świętokrzyskie Mountains. In spring the pond was used for breeding by *T. alpestris*, *T. cristatus*, *T. vulgaris*, *R. temporaria* and *B. bufo*. In another locality in the vicinity of the city of Łódź the larvae of *O. striata* occurred in several water bodies where *R. lessonae*,