

Taxonomy of Stonefly eggs of the genus *Isoperla* (Plecoptera, Perlodidae)

ALBERT LILLEHAMMER AND BJØRN ØKLAND

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Females of *Isoperla difformis*, *I. grammatica* and *I. obscura* can be separated on the microstructures of their eggs visible by S E M photos. The characters are seen in material from Museum collections that have been alcohol preserved and can therefore be included in a key to species.

Albert Lillehammer and Bjørn Økland, Zoological Museum, Univ. of Oslo, Sarsgt. 1, N-0562 Oslo 5, Norway.

INTRODUCTION

In Fennoscandia three species of *Isoperla* occur, *I. difformis* (Klapálek), *I. grammatica* (Poda), *I. obscura* (Zetterstedt). In some populations of the three species the form of the female subgenital plate may vary considerable and the identification may be difficult (Lillehammer 1974a). The present study is therefore an attempt to find valid characters in the microstructures (S E M) of eggs taken from alcohol preserved females of the three species.

Studies of egg structures have previously been made by authors such as Szczytko & Stewart (1978), Stark & Szczytko (1982) and Stark, Gonzales del Tango and Szczytko (1986).

MATERIAL AND METHODS

Eggs from females of the three species preserved in 70% alcohol were dissected out and mounted for S E M studies. Since the eggs were preserved in alcohol, no aldehyde was used. Dehydration towards absolute alcohol was started directly from 70% alcohol. The orientation and shape of the microphytes and the form of the perforation of the chorion was used. In addition the length and with of the egg were measured to the nearest 0.01 mm under a binocular microscope with a magnification of 50x. The volume were calculated for a representative number of each species, and the formula used were $v = \pi ab^2/6$, a = egg length (mm) and b = egg with (mm). In the search for the morphological structures on the egg chorion, the eggs dissected from the female had to be cleared for an outer coat (Fig. 1) that might occur in some eggs. The S E M photos have been taken by Fredrik Weidemann, Electron Microscopical Unit for Biological Sciences, Biological Institute, University of Oslo.

DIAGNOSTIC

Eggs of *Isoperla* species are all rounded and longer than wide. Collar stalked and margin unregular, neck of collar with several unregular ribs (Fig. 2). The anchor plate with perforation and the stalk with several ribs. Eggs of all three species have perforations of different types on chorion.

Isoperla difformis (Klapálek)

Eggs are dark pigmented and the egg volume was $123 \times 10^{-5} \mu m^3$ in mean, sd (95%

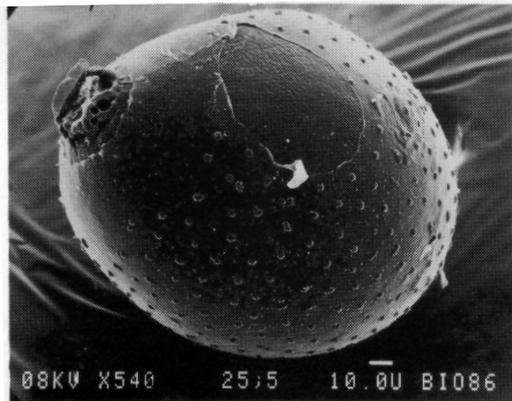


Fig. 1. S E M-photos of *Isoperla difformis* egg, showing the outer coat.

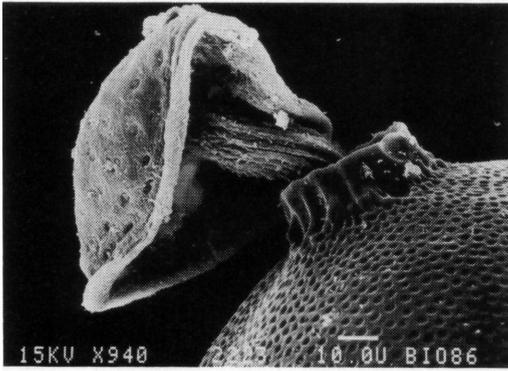


Fig. 2. S E M-photo of *Isoperla grammatica* egg showing the neck of collar and the anchor plate.

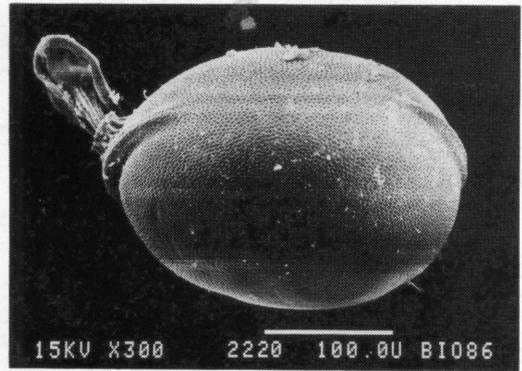


Fig. 5. The egg of *Isoperla obscura* showing the evenly scattered punctation on the egg chorium.

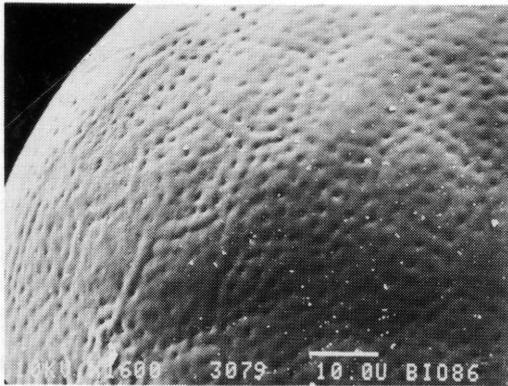


Fig. 3. The punctation structures on the egg chorium of *Isoperla difformis*.

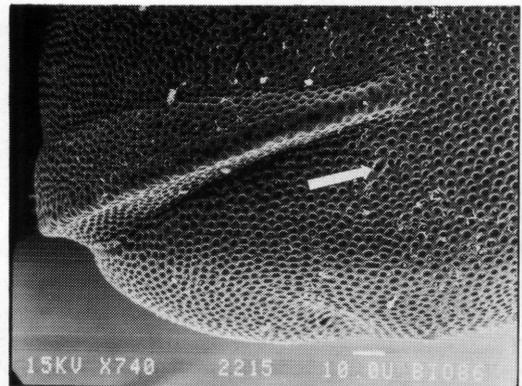


Fig. 6. The egg of *Isoperla obscura* with the microphyle (arrow).

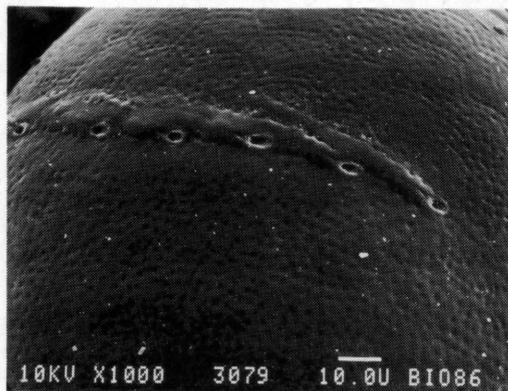


Fig. 4. The arrangement of microphyles on the egg of *Isoperla difformis*.

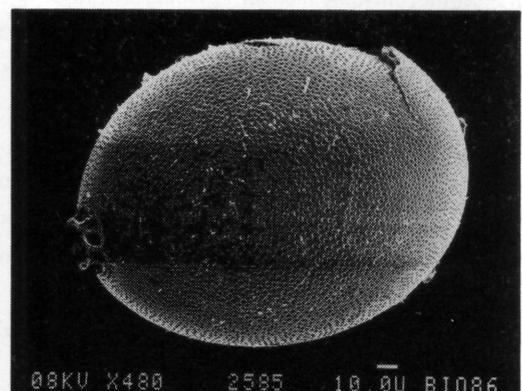


Fig. 7. The egg of *Isoperla grammatica* showing the hexagonal arranged punctation on the chorium.

Cl)—9.5 (N = 15). The eggs are oval without any ridges. The incomplete punctuation (Fig. 3) is arranged hexagonally over the whole surface. Microphyle (arrow) are closely arranged distally in a row of 6, with parallel keels (Fig. 4).

Isoperla grammatica (Poda)

Eggs are light brown or yellow in colour, and egg volume was $110.1 \times 10^{-5} \mu\text{m}^3$, in mean, sd (95% Cl) — 7.8 (N = 15). The eggs are oval without any ridges. The punctuation is deep and organized hexagonally in arrangements of 10—20 together (Fig. 7). Microphyles occur in a row with widely separated openings without keels.

Isoperla obscura (Zetterstedt). (See Fig. 8, p. 124).

Eggs of *I. obscura* are weakly pigmented and the egg volume was $99.6 \times 10^{-5} \mu\text{m}^3$, in mean, sd (95% Cl) — 7.8 (N = 15). The eggs may have distinct ridges in both ends (Figs. 5, 6). Other eggs may be without visible ridges. These ridges seem to form zones on the eggs, and they possibly become the exit for the nymph. The punctuation is deep and evenly scattered over the egg chorium. Microphyles in a row without keels (2 microphyles visible on fig. 6).

The punctuation, which is hexagonally arranged in *I. grammatica* and *I. difformis* indicate a closer relationship between those two species than the *I. obscura*. The egg development of *I. obscura* is also different from the two other species (Saltveit & Lillehammer 1984). *I. obscura* has egg diapause, the other two have direct egg development. The distinct egg ridges of *I. obscura* is a third character that

separate it from the other two species. However, there is a greater similarity between the *I. grammatica* and *I. obscura* in the arrangement of the microphyles than of *I. difformis*.

Key to species

1. Punctuation of egg chorium deep, microphyles without keels 2
 - Punctuation narrow, microphyles with keels *I. difformis*
2. Punctuation evenly distributed over the egg chorium (Fig.) *I. obscura*
 - Punctuation hexagonally arranged in clumps of 10—12 over the egg chorium (Fig.) *I. grammatica*

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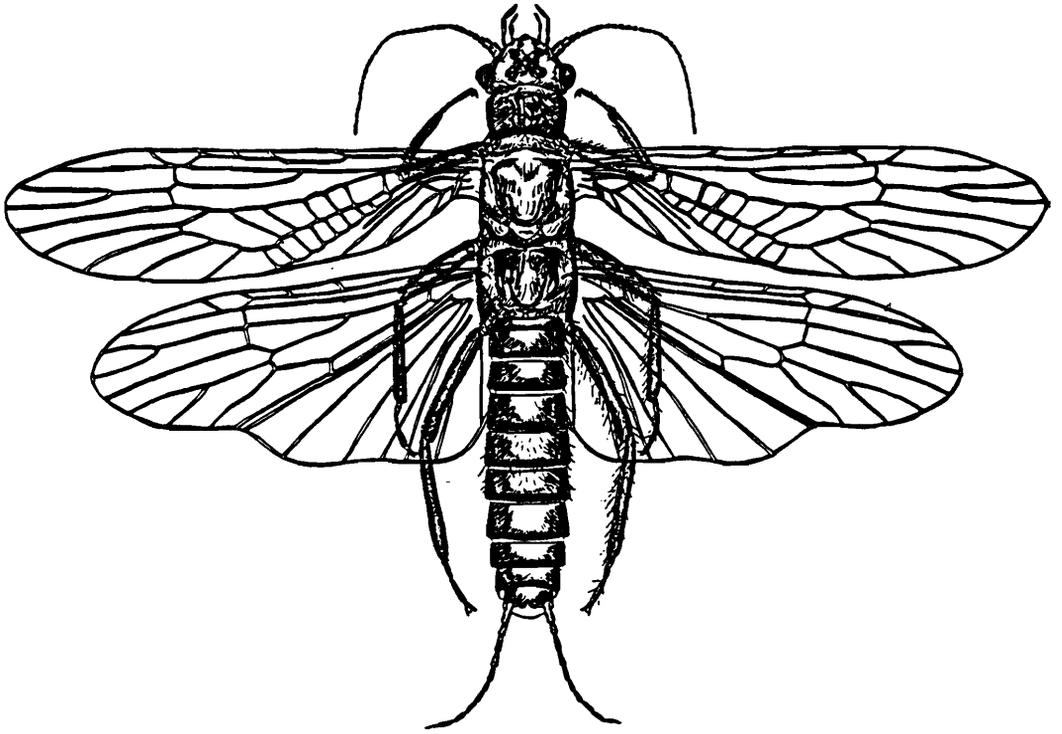


Fig. 8. *Isoperla obscura* (Zetterstedt) ♀. Drawn by Mai Britt Ringdal.