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# The "*Sericostoma*–problem" – molecular genetic, chemotaxonomic, and autecological approaches (Trichoptera: Sericostomatidae)

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**Molecular and ecological data reveal conflicting results concerning the taxonomical status of the European *Sericostoma* species. We suggest to keep the current designation, but with respect to the genetic data, we regard it as provisional.**

## 1 Introduction

The taxonomical status and distribution of the West Palearctic *Sericostoma* species complex is subject of a controversial debate (e.g.. Botosaneanu & Malicky 1978, Tobias & Tobias 1981, Malicky 1999, Botosaneanu 2001). Despite the nomenclatorial clarification concerning *Sericostoma personatum* (Spence in Kirby & Spence, 1826), *S. schneideri* Kolenati, 1848, and *S. flavicorne* (Schneider, 1848) by Botosaneanu (2001), correct species identification still remains uncertain, since important diagnostic characters show high morphological plasticity. Since species descriptions are generally based on the minor and variable morphological differences of the male genitalia it is indispensable to use other methods than comparative morphology to find diagnostic traits. In this work, species boundaries of these taxa, mainly the Central European species pair *S. personatum* and *S. schneideri* are reconsidered using autecological, chemotaxonomic, and molecular genetic methods.

Autecological analyses focused on differences concerning emergence period, diurnal activity as well as on swelling of the egg masses and temperature dependence of embryogenesis. The aim of the chemotaxonomic approach was the detection of compounds within the pheromone glands that differed between the two taxa. For molecular genetic investigations two mitochondrial genes (16S rDNA, Cytochromoxidase I) were used.

## 2 Results

Autecological investigations revealed differences concerning emergence period and diurnal activity between the two populations. *S. personatum* hatched some weeks earlier than *S. schneideri*. *S. personatum* was active chiefly from noon to dusk while specimens of *S. schneideri* were mostly nocturnal.

No differences concerning the swelling of egg masses were observed, volume of the egg masses increased by the factor 13.9 (SD ± 5.6). All but one of the egg masses remained partially developed, diapausing at all incubation temperatures thus limiting the interpretation. Maternal induction of diapause by means of diapause hormones due to unfavourable environmental conditions during development of last instar larva and pupa seems most likely to explain this phenomenon.

No components directly related to pheromones could be identified yet from male and female pheromone glands.

Molecular markers investigated in this study do not support a division of *S. personatum* and *S. schneideri* into two distinct groups or potential species. The genetic data thus exhibited a unique geographical pattern with one haplotype group primarily found in Eastern Europe (including Finland and eastern parts of Austria), one in Central Europe (including Norway and Sweden), and one group predominantly located in the Alps, to which surprisingly the specimens from United Kingdom clustered. Specimens morphologically distinguished as *S. flavicorne* Schneider, 1845 from Turkey and *S. vittatum* Rambur, 1842 from Spain were distinct from the European *S. personatum/schneideri* complex. The haplotype pattern can be explained with the Quaternary ice ages and the resulting glaciations of major parts of Europe.

Molecular data prove that Scandinavia was colonized postglacially from south-western Europe (via Norway and Sweden) and from south-eastern Europe (via Poland and Finland). Few data from Irish specimens are available but a close relation to South European populations seems likely.

Morphological characters frequently used for the identification of species may be the result of phenotypic plasticity and were therefore considered as not useful to resolve systematical questions. In this context, the division of the Central European *Sericostoma* taxa into *S. personatum* and *S. schneideri* seems doubtful.

An alternative hypothesis supports the division of *S. personatum* and *S. schneideri*. Observed genetic differences of the investigated mitochondrial markers could be the result of non-representative evolution of mitochondrial DNA in contrast to nuclear DNA (see Ballard & Whitlock 2004). Minor genetic differences between the European genera of Sericostomatidae and, more significant, within the genus *Sericostoma* might lead to the conclusion that

members of *Sericostoma* are still in the process of speciation. Observed haplotypes patterns could be the result of ancestral polymorphisms and of no importance to the actual speciation event. This hypothesis is well supported by different diurnal activity and emergence patterns.

Additionally, a phylogeny hypothesis of the four European genera of Sericostomatidae, *Notidobia*, *Oecismus*, *Schizoplex,* and *Sericostoma,* based on the partial 16S rRNA gene was deduced. While some methods resolved a basal position of the genus *Notidobia*, most methods resolved solely polytomic relationships.

The current designation of the Central European *Sericostoma* species should be kept but, with respect to molecular genetic results, be regarded as provisional. Further investigations of the genetic structure of different populations as well as further specimens from different parts of Europe will contribute to solve the "*Sericostoma*-Problem" as well as further autecological and chemotaxonomical investigations.

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