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Capnopsis schilleri (*Plecoptera: Capniidae*) in South Bohemia, Czech Republic

Capnopsis schilleri (*Plecoptera: Capniidae*) v jižních Čechách

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Abstract
Although earlier mentioned to occur in the Czech Republic several times and mentioned in the red list of endangered animals, *Capnopsis schilleri* is documented for the first time from this area at two localities situated in the Šumava Mts. (Černý brook, Blažejovice, 49°57′15″ N, 13°57′25″ E, uniform grid system 7050, and tributary of the Slatinný brook, Gerlova huť, 49°09′30″ N, 13°17′45″ E, 6845) and a single locality situated in foothills of the Novohradské Mts. (Keblanský brook, Buškův Hamr near Trhové Sviny, 48°50′20″N, 14°36′20″ E, 7152). Based on these findings, some aspects of its distribution in Central Europe and biology (vertical distribution, accompanying stonefly taxocoenes, abundance, habitat and microhabitat preference, development, emergence and life cycle type) are discussed.

Key words: Plecoptera, *Capnopsis schilleri*, South Bohemia, distribution, abundance, life cycle

Introduction

Capnopsis schilleri (Rostock, 1892), a single representative of the genus, is a widely distributed Eurasian species with conjunctive area in Fennoscandia (Norway, Sweden, Finland) and Russian Karelia (Brittain & Saltveit 1996), area extension to Central Europe – Germany, Switzerland, Austria and Slovakia (Aubert 1959, Illies 1978, Graf & al. 1995, Krno 1997). It has been found also in Romania, Asia Minor and Caucasus (Kis 1974, Illies 1978) and documented from oligocene Baltic amber (Rauser 1992). However, this species is considered extremely rare and endangered in Central Europe (Zwick 1984, Rauser 1992, Krno 1994, 1997). Its biology was poorly known since larvae remained unknown for more than a century till a description published about ten years ago (Lillehammer 1988). The only data on its life cycle and development published by Haland (1988) and Lillehammer & al. (1989) concern solely the Fennoscandian populations.

Although mentioned to live in the Czech Republic several times (Rauser 1959, 1977, 1980, 1992) any precise localities of its occurrence have never been published so far and thus this species have not been confirmed as a true representative of the Czech fauna of stoneflies. The

present paper is mentioned to verify its distribution in the Labe basin and to briefly describe its life cycle, habitat preference and emergence at three localities in South Bohemia.

Material and Methods

The following material was studied: 2 mature larvae: Šumava Mts., Černý brook, Blažejovice, 49°57′15″ N, 13°57′25″ E, coordinates according to uniform grid system 7050 (see Fig. 1), 768 m alt., April 1997, leg. J. Hodovský, det. J. Špaček; 2 mature larvae: tributary of the Slatinný brook, Gerlova huť, 49°09′30″ N, 13°17′45″ E, 6845, Fig. 2), elevation 930 m, January 7, 1999 leg. M. Putz and T. Soldán, det. J. Špaček; 1 mature larva: Keblanský brook, Buškův Hamr near Trhové Sviny , 48°50′20″N, 14°36′20″ E, 7152 (Fig. 1), 463 m alt., April 1997, leg. J. Hodovský, det. J. Špaček; 1 mature larva; same locality, January 28, 1999, leg. et det. M. Putz; 25 mature larvae, 1 adult male, 3 adult females (reared); same locality, March 17, 1999 leg. et det. M. Putz and T. Soldán; 3 mature larvae: May 7, 1999, leg. et det. T. Soldán. The material fixed in formaldehyde (4 %) and alcohol (75 %) is deposited in the collection of State Melioration Agency in Brno and Institute of Entomology, Academy of Sciences of the Czech Republic, in České Budějovice.

Samples of macrozoobenthos at the localities studied were taken semiquantitatively by usual hydrobiological techniques (time limited sampling by kicking technique using a metal cup, for details see SOLDÁN & al. 1998) and standardized method used by the State Melioration

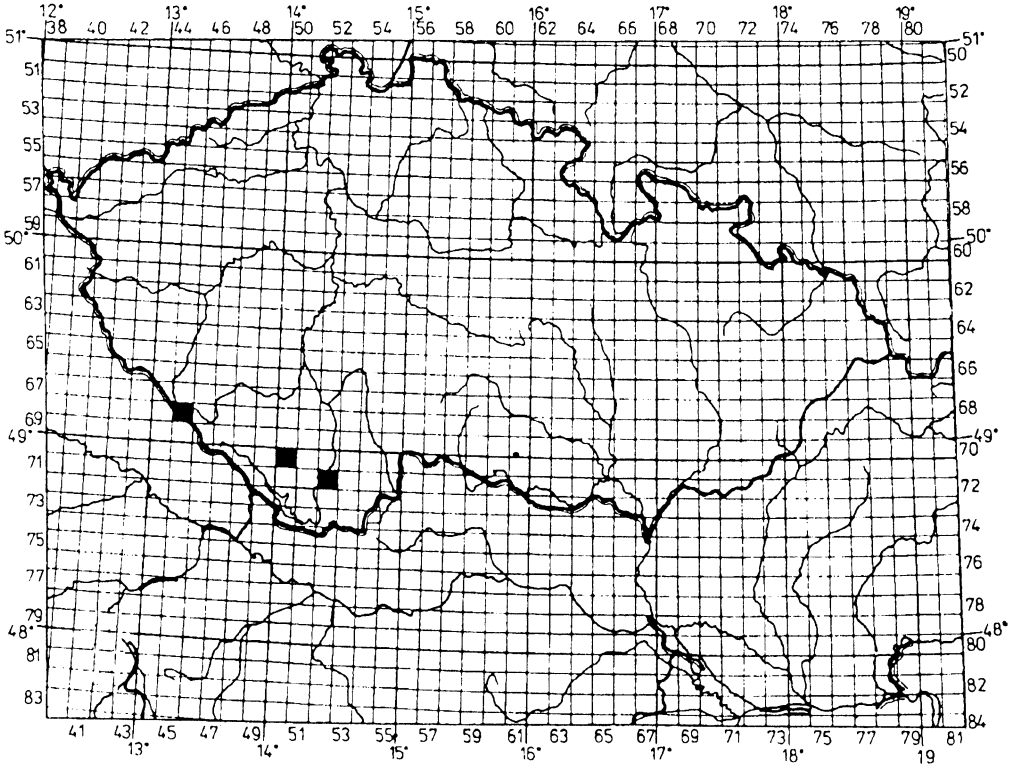

Fig. 1. – Localities of so far known positive occurrence of *Capnopsis schilleri* in the Czech Republic (see text for names of sampling places).

Agency. To distinguish larvae from related species of the Capniidae the keys by RAUŠER (1980) LILLEHAMMER (1988) and BRITTAIN & SALTVEIT (1996) were used, determination was verified according to reared males and females (keys by AUBERT 1959, RAUŠER 1959 and BRITTAIN & SALTVEIT 1996). Larvae to be reared were kept in a standard laboratory aquarium with aerated water, stones and organic debris taken from the locality at 4 °C and 12L : 12D photoperiod.

Results

Despite an extensive and long-term programme on distribution and quantititative presentation of aquatic insects in the Labe basin (for details see KŘELINOVÁ 1962 and SOLDÁN & al. 1998) including more than 150 localities (Fig. 2) *Capnopsis schilleri* was not found in this area in 1955–1995. This species was found neither by SOLDÁN (1996) nor RŮŽIČKOVÁ (1998) who devoted a particular attention to the Šumava Mts. localities, however, the latter contribution was directed to localities close to the basin of the Slatinný brook in this area.

Larvae were first determined by one of us (J. Špaček) in samples taken by Dr. Hodovský at two South Bohemia localities not included in previous research activities (Fig. 2). According to these initial findings they occurred in a very low quantitative presentations reaching less than 1–2 % of stonefly standing crop. As far as stonefly taxocoenes are concerned *C. schilleri* is accompanied by *Brachyptera risi* (dominant species), and subdominant or recedent *Isoper-*

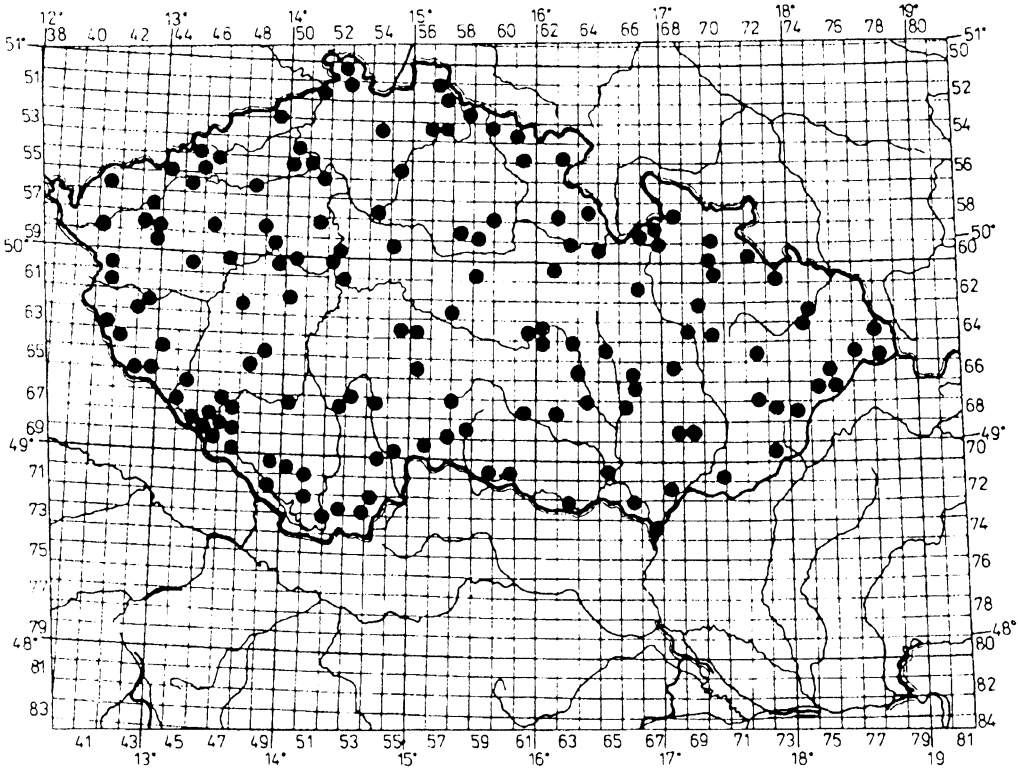

Fig. 2. – Grid system squares of localities of the Czech Republic investigated in all seasons to define stonefly taxocenes (see SOLDÁN & al. 1998 for the name of sampling places) showing places with negative occurrence of *Capnopsis schilleri*.

la difformis and *Protonemura* spp. (mostly *P. montana* and *P. lateralis*) at the locality of the Černý brook (Šumava Mts.). Stonefly taxocene at the locality of tributary of the Slatinný brook (Šumava Mts.) showed a similar composition, in addition to occurrence of *Leuctra hippopus* and *Capnia vidua* (subdominant). *Leuctra* spp. (*L. hippopus* and *L. nigra* dominant, and *L. albida*), *Brachyptera seticornis, Isoperla oxylepis, Dinocras cephalotes, Capnia bifrons, Protonemura nitida* and *Nemoura flexuosa* (subdominant or recedent) at the locality of the Novohradské Mts.

However, close investigation of the latter locality showed *Capnopsis schilleri* quantitative distribution to be rather higher. Taking samples in other microhabitats than at stony streamline places and devoting a particular attention to larvae of this species reached about 10–20 % of stonefly standing crop being accompanied mostly only by *Capnia bifrons* (dominant) and *Leuctra hippopus* here. Larvae of *Capnopsis schilleri* reached maximal density and became even dominant in mid March after finishing of emergence period of *Capnia bifrons* which culminate in late January and February. On the other hand, this phenomenon was not observed at the locality of tributary of the Slatinný brook in the Šumava Mts. Extremely low density of *Capnopsis schilleri* seems to be independent on that of *Capnia vidua* during and after its emergence period occurring here from March to April. An addition, despite detailed examination of typical *Capnopsis schilleri* microhabitats (submerged vegetation and organic debris) we did not manage to collect more larvae at this locality from January to May 1999.

Although we did not manage to observe the emergence of *C. schilleri* at the locality, we suppose maximum emergence just in this period since larvae were very rare later, in March April and May. When transferred to the laboratory, several larvae emerged within 3–5 days. Emergence takes place in the afternoon, larvae leave water and climb about 5–10 cm above the water surface. They mostly emerged on the walls of breeding vessel in perpendicular position to the water surface (head upward). All larvae and adult males examined were macropterous at all the localities investigated, no brachypterous male were observed.

Discussion and conclusions

Most probably, the late Dr. Raušer collected or observed some material of *Capnopsis schilleri* from the Labe basin or studied some material from this area since he mentioned the occurrence of this species here several times (Raušer 1959, 1977, 1980). However, these papers are directed to determination of both larvae and adults of Plecoptera or to evaluation of this species from the biodiversity protection point of view (Raušer 1992) and there are no mentions of the occurrence of *C. schilleri* at any particular locality. Moreover, no such material has been found in his collection, now deposited in the Faculty of Natural Science, Masaryk University in Brno (Helešic, pers. comm.). Consequently, our findings represent the first detailed records on the occurrence of *C. schilleri* in the Czech Republic and thus the species becomes formally a true representative of the invertebrate fauna of this country.

There is no doubt that *C. schilleri* is really solitary to very rare in distribution in this area taking into account relatively extensive knowledge of stoneflies occurring in the Labe basin (Fig. 1, cf. also Soldán & al. 1998). However, its quantitative presentation, as seen at the locality near Trhové Sviny can be relatively high and this species seems to be rather „locally abundant" than rare. Also Raušer (1992) reports "occurrence in mass" at some localities. Very small number of known localities in the Labe basin might be confined to very early occurrence of mature larvae (probably from November to February) since young larvae can easily escape our attention during sampling of macrozoobenthos in usual, spring and summer seasonal aspect. Since the body length of mature larvae is very small (at most 3.5–5.0 mm) younger larvae can avoid their presence in samples also due to mesh size of sampling devices. Later fin-

dings in spring thus concern only larvae late in their development when the most of population occur in the egg stage. Moreover, larvae undoubtedly exhibit a very narrow ecological range and specific microhabitat requirements possibly being often overlooked when mostly stony or sandy microhabitats are sampled.

As noted by RAUŠER (1992) *C. schilleri* exhibits no special requirement to the vertical zonation of aquatic habitats in Central Europe. He reports its occurrence in both lowlands and highlands, however, without presenting any particular locality (RAUŠER 1992) as well as in the alpine zone of the Roháče (Tatra Mts.) in Slovakia (RAUŠER 1959). This agrees well with the altitudinal range of our three localities (463–930 m a.s.l.). On the other hand, this species does not occur above the subalpine zone in Fennoscandia, and is most common in forest streams (LILLEHAMMER & al. 1989). According to RAUŠER (1992), *C. schilleri* became at present exctinct at localities of lower altitudes because of cummulative pollution and present distribution probably represents a relict remnant of originally conjunctive area in Central Europe. The same seems to be true at least in Germany (critically endangered according to ZWICK 1984) or in Slovakia (endangered according to KRNO 1994, 1997). In this respect, the classification of *C. schilleri* in endangered species category in red lists (cf. RAUŠER 1992) is undoubtedly correct.

However, we do not know the proper reasons of its gradual extinction. It is definitively not either acidification or strict temperature requirements in Central Europe. As noticed by RŮŽIČKOVÁ (1998) the Capniidae seem to show higher densities in acidified streams in the Šumava Mts. in general being found in reaches of pH 4.9–5.6. Evident resistence to acidification can be documented also by data by RAUŠER (1992) who reports larvae also in peatbog waters. Maximal summer temperatures reach only 10–12 °C at the localities of the Šumava Mts. Relatively very small larvae of *C. schilleri* can evidently develop in a considerable temperature range needing very low heat increment to complete development and having one of the lowest mean egg degree-day requirements among European species of stoneflies. The degree-day demand of this species is non-linear and increases considerably at both low and high temperatures being lowest at 16–20 °C (LILLEMAMMER & al. 1989). Most probably, pollution and specific microhabitat requirements might be the main factors responsible for present scarce distribution of this species. Localities of the *C. schilleri* occurrence always show relatively low conductivity within the range of about 15–20 $\mu S.cm^{-1}$ and high diversity showing minimal anthropic disturbation of the habitat.

According to our results obtained at the locality near Trhové Sviny larvae of *C. schilleri* exhibit special microhabitat requirements. Most of them (probably over 95 %) are being found solely in submerged vegetation and among organic debris near the stream banks, at places with minimal current speed. They nearly never occur at stony and sandy bottoms or at streamline microhabitats regardless substrate roughness and their presence at this places is undoubtedly incidental. This type of microhabitat preference might be connected with their food requirements. Although nothing is known about their food composition we can suppose feeding on algae, diatoms and plant organic detritus like in other representatives of the family Capniidae (cf. RAUŠER 1992). This might be documented by the fact that species of *Capnia* always occur at the same microhabitats. On the other hand, there are probably no other habitat requirements. As documented by our localities larvae of *Capnopsis schilleri* live in brooks and streams of different type and abiotic factors like distance from source, stream size, stream order, average substrate roughness, altitude (see above) and average slope do not play an important role although they do in distribution of most other Central European stoneflies (cf. SOLDÁN & al. 1989).

Life cycle of *C. schilleri* remains still not to be well understood. Undoubtedly, like in numerous species of Central European stoneflies, it seems to be rather plastic showing a consi-

derably extended flight period. Larvae ready to emerge are being found from January till May at the above South Bohemian localities. This seems to corresponds to a monovoltine life cycle (cf. RAUŠER 1992) most probably of the „winter" type (larval growth gradual within autumn and winter months, emergence period in the end of winter or early spring). As seen within the Fennoscandian populations, *C. schilleri* has eggs that take only a few days to hatch at suitable temperatures, no egg diapausis or quiescence occurs in this species. According to HALAND (1988) and LILLEHAMMER & al. (1989) mean egg degree-day requirements reach only 229±30.3 in Fennoscandia. This means that larvae are present at habitats at most as late as from early summer. However, no data on their growth rate in Central Europe are known, some dependence on water temperature is pointed out by HÅLAND (1988) in Fennoscandia.

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