

On the distribution and ecology of *Gampsocleis glabra* and *Tettigonia caudata* (Orthoptera) in Slovakia

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Abstract

In 2005–2006, the authors found *Gampsocleis glabra* on 12 localities (only 6 had been known before 2005). Summarizing all published and their own unpublished data, the species is known from 17 localities in nine mapping squares of the Slovak Fauna Databank (2.1% of all squares). *Tettigonia caudata* was found on 16 localities in 2000–2006 (15 had been known before 2000). Altogether, the species is now known from 29 localities in 20 mapping squares (4.6%). For these species which are vulnerable in Slovakia, the habitat choice, accompanying species, abundance and phenology were analysed.

Zusammenfassung

In den Jahren 2005 bis 2006 haben die Autoren die Art *Gampsocleis glabra* an zwölf Fundorten nachgewiesen (nur sechs Lokalitäten waren vor dem Jahr 2005 bekannt). Mit diesen und allen bisher publizierten Nachweisen wurde die Art insgesamt an 17 Fundorten in neun Kartenblatt-Quadraten der Slowakischen Fauna-Datenbank registriert (2.1% aller slowakischen Quadrate). *Tettigonia caudata* wurde von 2000 bis 2006 an 16 neuen Fundorten nachgewiesen (vor 2000 waren 15 bekannt). Insgesamt wurde diese Art an 29 Fundorten in 20 Quadraten registriert (4.6%). Habitatauswahl, begleitende Orthopterenarten, Abundanz und Phänologie wurden bei diesen beiden bedrohten Arten analysiert.

Introduction

Bush cricket *Gampsocleis glabra* (Herbst, 1786) is a species with West-Siberian and European distribution of Pontic or Angaric origin, and *Tettigonia caudata* (Charpentier, 1845) is a bush-cricket with Central Asian and East European distribution of Angaric or Atlantic origin (INGRISCH & KÖHLER 1998). *Gampsocleis glabra* figures in the European national Red Lists as an endangered or critically endangered species (e.g. Austria: BERG & ZUNA-KRATKY 1997, Germany: MAAS et al. 2002, Poland: LIANA 2007). In Central Europe it reaches actually the northern edge of its range in Poland and it is extinct in the Czech Republic (BAZYLUK & LIANA 2000, MAAS et al. 2002, FEDOR et al. 2004). *Tettigonia caudata* is not so endangered, but it is rare mainly on the northern edge of its range, which runs across Europe in Poland and Germany (BAZYLUK & LIANA 2000, FARTMANN 1997). Distribution of the mentioned species at their northern range limits was analysed by several authors in the last 10 years (BERG & ZUNA-KRATKY 1997, MAAS et al. 2002, KRIŠTÍN & ZACH 1997, KRIŠTÍN et al. 2004a, b). Distribution and abundance in Slovakia, however, were not clearly specified; for *T. caudata* see

ČEJCHAN (1985), for *G. glabra* FEDOR et al. (2004). Both species were listed in the National Red Data Book as vulnerable (KRIŠTÍN 2001).

The aim of this paper is to contribute to the knowledge of:

- 1) distribution and phenology of both species in Slovakia; and
- 2) habitat and altitudinal distribution in relation to density.

Material and Methods

In May – October 1995–2006, we checked out 418 localities in 175 mapping squares of the Slovak Fauna Databank (41% of total squares in Slovakia, KRIŠTÍN et al. 2007, one square area = 132 km²). *Gampsocleis glabra* was mapped through acoustic identification and localisation. Consequently, stridulating individuals were directly caught with the sweeping net in the field. The species *Tettigonia caudata* was monitored and passively collected by sweeping the herbal layer (less also by individual collection). We have collated the already-published data on the distribution of both species in Slovakia from 1897 to 2006, including our data (Figs 1, 2). Unpublished distributional data are described in the following way: code of the Databank of Slovak Fauna (Figs. 1, 2) – name of the locality (altitude), number of trapped or listened specimens, sex and date.

The assessment of habitat quality in both species was expressed through: 1) habitat type, 2) altitude, and 3) height of herbal layer. For the analyses of altitudinal distribution in various habitats we used also already published data. The abundance of *Gampsocleis glabra* was recorded by assessment of the density in small-plots (1000 m²) on a selected study plot in sandy dunes near the village Veľký Kamenec (102–108 m a.s.l.) and by counting of stridulating males and sweeping the herbal layer over the whole season (June – October) in wetland area near Beša (102–103 m a.s.l.). Abundance of *Tettigonia caudata* was estimated by sweeping the herbal layer at selected breeding sites (sandy dunes near Veľký Kamenec village, ruderal plots near Svätuške village) irregularly from June to October. The phenology of occurrence and development were recorded from June to October irregularly within the whole range of both species in Slovakia.

Results and Discussion

Gampsocleis glabra

Distribution

Before 2005, the species had only been found at six localities in Slovakia (cf. FEDOR et al. 2004, Fig. 1). Thanks to more extensive mapping in suitable localities, we found the species during 2005–2006 in 12 localities in E Slovakia (we confirmed pre-1960 findings for one locality – Veľký Kamenec = Veľký Kevežd). Summarizing all known data, the species was found in total at 17 localities in nine mapping squares (2.1% of all squares; Fig. 1). It can be expected also in more localities along southern Slovak border. In Hungary near the Slovak border, this species was found in the National Park Aggtelek (NAGY et al. 1999).

Published data: 7596 (ČEJCHAN 1985); 7597 (MAŘAN 1954); 7696 (ČEJCHAN 1959a, GULIČKA 1992); 8070 (MAJZLAN 1992); 8171 (FEDOR 2001); 8175 (MAJZLAN et al. 2000a, b).

Unpublished data: 7497 – Beša (101 m a.s.l.), 30 ♂♂, 6 ♀♀, 14.7.2005; 7596 – Malá Trňa (145 m a.s.l.), 1 ♀, 1 ♂, 7.7.2006; 7597 – Svätušie (150 m a.s.l.), 2 ♂♂, 2 ♀♀, 14.7.2005, Malý Horeš (106 m a.s.l.), 3 ♂♂, 1 ♀, 14.7.2005, Rad (98 m a.s.l.), < 100 ♂♂, July – August 2006; 7598 – Kráľovský Chlmec (112 m a.s.l.), 2 ♂♂, 25.8.2006; 7696 – Veľký Kamenec, castle (115 m a.s.l.), 3 ♂♂, 15.7.2005, 7696 – Veľký Kamenec, sandy dune (105 m a.s.l.), ca. 200 ♂♂/♀♀, 15.7.2005; 7697 – Strážne (106 m a.s.l.), > 100 ♂♂, 15.7.2005, So-motor (102 m a.s.l.), > 100 ♂♂, 5.7.2006, Veľký Horeš – Strážne (99 m a.s.l.), 5 ♂♂, July – August 2006, Strážne, railway station (102 m a.s.l.), 1 ♂, 1 ♀, 24.8.2006.

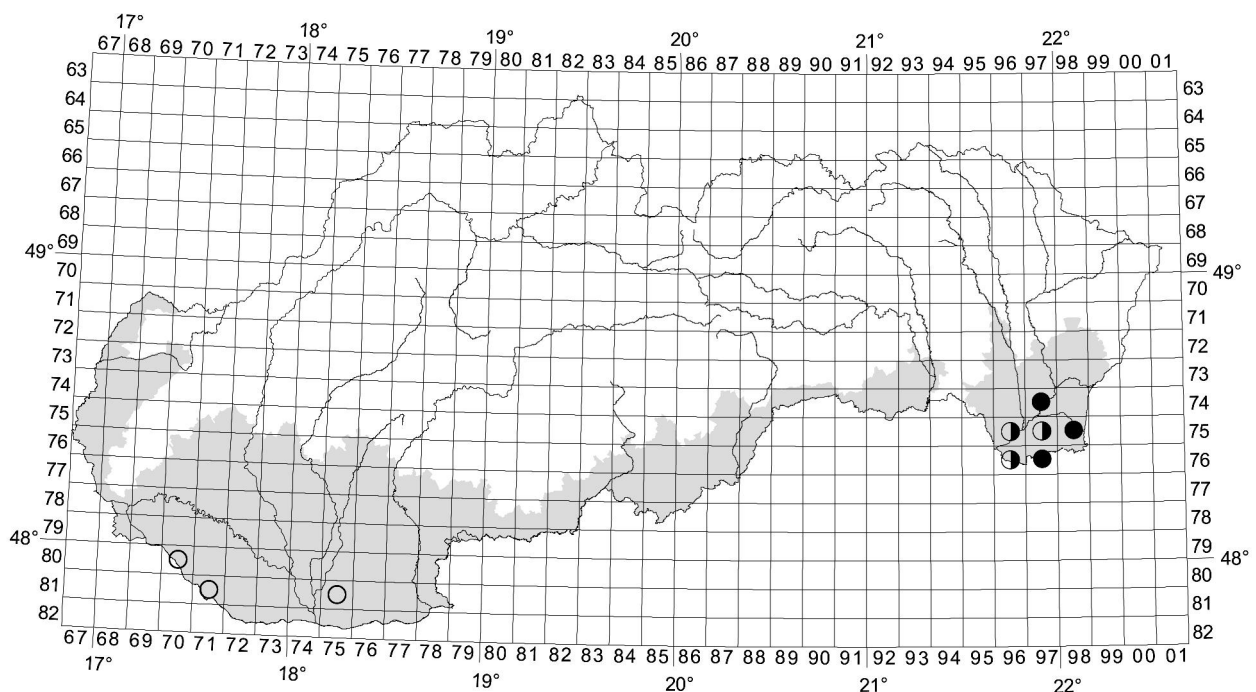


Fig. 1. Distribution of *Gampsocleis glabra* in Slovakia in mapping squares of the Slovak Fauna Databank (empty circles = published data, full circles = unpublished data, semi-full circles = published and unpublished data, light-grey area = Pannonian bioregion, white area of Slovakia = Carpathian [Alpine] bioregion).

Habitats and accompanying species

This stenotopic species was found in Slovakia only in warm lowland habitats at altitudes 98–150 m a.s.l. (mean $\pm$ SD = 110 ± 16 m a.s.l., $n = 15$ localities) within average annual air temperature higher than 9 °C (1961–1990, ŠŤASTNÝ et al. 2002). The need of high soil temperature for egg development was observed at the northern limit of its distribution in N Germany by CLAUSNITZER & CLAUSNITZER (2005). In Slovakia, during its larval development, it prefers desiccating wet meadows (38.5%, $n = 13$) and sandy dunes along wet depressions (23.1%), but

also ruderal vegetation along similar well preserved habitats (38.5%). Stridulating males and copulating pairs were registered even in tall hygrophilous grassy stands directly above a low water stand (10 cm, Beša, 14.7.2005). On the other hand, also xerothermous sandy dunes were visited by flying adult individuals (Veľký Kamenec). Hence, we can consider it as a thermophilous species, with affinity either to wet or to xeric vegetation (according with NAGY 1983), and not as a characteristic xerothermophilous species as given in ČEJCHAN (1985) or FEDOR et al. (2004). Considering the height of the herbal layer, the species prefers grassy stands taller than 50 cm (91% of localities, n = 12 localities). It can be found in shorter vegetation only rarely (9%) and it avoids stands lower than 10 cm. In the localities where it is most abundant, it occurs mainly in xeric sandy stands with *Verbascum phoenicum*, *Gypsophila paniculata*, surrounded by wet grassy depressions (Veľký Kamenec), and in desiccating wetland habitats (Beša, Rad, Strážne). In wetland stands, the species occurs together with characteristic hygrophilous species like *Ruspolia nitidula*, *Conocephalus dorsalis*, *Conocephalus fuscus*, *Stethophyma grossum*, *Mecostethus parapleurus*, *Chorthippus albomarginatus*, in salty soils also with *Aiolopus thalassinus*, but also with *Polysarcus denticauda*. In sandy and ruderal localities, it occurs simultaneously with e.g. *Tetrigonia caudata*, *Platypleis veyselei*, *R. nitidula*, *Oecanthus pellucens* and *Dociostaurus brevicollis*. Its regular simultaneous occurrence with the predatory *Decticus verrucivorus* is remarkable.

Abundance and phenology

FEDOR et al. (2004) summarized all known registrations in Slovakia until 1999, but there were found only one specimen in each of the three Danube localities in SW Slovakia. We checked annually in May – October 2001–2006 altogether 44 suitable localities (14 mapping squares) in the Danube area of SW Slovakia, but we found no individual of *Gampsocleis glabra* in the suitable habitats (KRIŠTÍN 2004, KRIŠTÍN et al. 2004a).

On the other hand, in Eastern Slovakia we found the species in 12 localities out of the 42 checked in 2003–2006. Assessing the density in 6 small-plots by sweeping the herbal layer, we found a maximum density of 45 individuals per 1000 m² (of them ca 5% nymphs of the 3rd – 6th instar) at 14.7.2005 in a sandy dune and surrounding wet depression (Veľký Kamenec). There we registered also more than 200 stridulating males within 2 ha at the same time. However, towards the end of summer (25.8.2006), the abundance became rapidly lower there (max 16 ♀♀, 11 ♂♂ per 1 ha). We can assume that this local population (known since 1951 – ČEJCHAN 1959b, 1985) comprises several thousands of individuals on grassy stands on the plot of ca 200 ha between Veľký Kamenec, Somotor and Strážne villages (July 2005 and 2006). This result is in accord with findings of BIERINGER & BERG (2001), which estimated the population size in two isolated localities in E Austria to be 800–1000 males. In E Slovakia, the species was found between middle of June and end of September, with the highest abundance in July. Males were found only until 15th of September, females longer, until the end of September. The first adults were found on June 21, simultaneously with early occurring *Polysarcus denticauda*. In the adult stage, the sex ratio was 1:1.

Tettigonia caudata

Distribution

Before 1999, distribution of this species was known in Slovakia at 15 localities of 14 mapping squares (c.f. ČEJCHAN 1985, CHLÁDEK 1994, KRIŠTÍN & HRÚZ 2005). Thanks to more extensive mapping in suitable localities, we found this species at 16 localities of eight new mapping squares in 2000–2006 (we confirmed pre-1999 findings in two squares). Summarizing all data, the species had been found in 29 localities in 20 mapping squares (4.6% of all squares, Fig. 2).

Published data: 7088 (EBNER 1914 ex ČEJCHAN 1985); 7277 (ČEJCHAN 1985); 7297, 7298 (GULIČKA 1967); 7367 (GAVLAS 2002); 7381 (KRIŠTÍN & HRÚZ 2005); 7390 (CHLÁDEK 1994); 7391 (ČEJCHAN 1959b); 7482 (KRIŠTÍN & HRÚZ 2005); 7568 (GAVLAS 2002); 7588 (CHLÁDEK & GAVLAS 2004); 7596, 7597, 7598, 7696 (ČEJCHAN 1985); 7868 (SCHNEEBERG 1931); 7880 (KRIŠTÍN & ZACH 1997); 8277 (MAŘAN 1954).

Unpublished data: 7497 – Beša (103 m a.s.l.), 1 ♀, 1 ♂, 14.7.2005; 7597 – Svätušie (150 m a.s.l.), 1 ♂, 1 ♀, 14.7.2005; 7597 – Věč (105 m a.s.l.), 1 ♂, 3 ♀♀, 15.7.2005; 7696 – Somotor (100 m a.s.l.), 1 ♀, 5.7.2006, Tarbucka (160 m a.s.l.), 1 ♀, 3.8.2005, – Veľký Kamenec, castle (115 m a.s.l.), 1 ♂, 15.7.2005; 7697 – Strážne – Opátske piesky (103 m a.s.l.), 1 ♀, 1 ♂, 15.7.2005, Strážne, wetlands (106 m a.s.l.), 2 ♀♀, 1 ♂, 24.8.2006, Veľký Kamenec, sandy dune (105 m a.s.l.), 10 ♂♂, 8 ♀♀, 15.7.2005.

Habitats and accompanying species

We found hatching sites and habitats with nymphs at altitudes of 100–720 m a.s.l. (mean $\pm$ SD = 195 $\pm$ 182 m a.s.l., n = 20 localities). The habitats at higher altitudes (> 500 m a.s.l.) represent ecotones of cereal and potato fields and fallow stands in traditional farming area of the Poľana Mts. in Central Slovakia (KRIŠTÍN & HRÚZ 2005).

Hatching sites of this species in Slovakia are located preferably in warmer lowland and hilly country and are represented by wet (50%, n = 8 localities), sandy (12%) and ruderal localities (38%), mostly surrounded by wet depressions. Considering the height of the herbal layer, the species, similar to *G. glabra*, prefers grassy stands taller than 50 cm (93% of localities, n = 14 localities), it was found rarely in shorter vegetation (7%), and it avoids stands lower than 10 cm. In the East Slovakian localities, where it is most abundant, it occurs mainly in xeric sandy stands with *Verbascum* sp., *Gypsophila paniculata*, surrounded with wet depressions (Veľký Kamenec). It is interesting that *G. glabra* is simultaneously, abundant in this locality. It seems to be that the eggs of both species are laid by females in wetter stands in wet depressions, and that the nymphs later migrate in surrounding xerothermic sandy dunes or even ruderals to mature. In wetland stands, it occurs together with characteristic hygrophilous species: *R. nitidula*, *C. dorsalis*, *C. fuscus*, *S. grossum*, *M. parapleurus*, *C. albomarginatus*. In sandy and ruderal localities, it occurs simultaneously with e.g. *G. glabra*, *R. nitidula*, *O. pellucens* and *D. brevicollis*. We registered simultaneous occurrence of all

three congeneric *Tettigonia* species on southern slopes of a traditional farming area (Poľana Mts., Central Slovakia), with *T. caudata* being the rarest species. In this locality, adults of *T. caudata* preferred tall grass and ruderal vegetation in ecotones between extensively used corn and potatoes fields, where later also *Ephippiger ephippiger* can be observed. Adults of *Tettigonia cantans* and *Tettigonia viridissima* were registered more commonly in shrubs and trees, or at shorter distances to such woody vegetations. Regular simultaneous occurrence of *T. caudata* and *T. viridissima* was registered in all 12 checked localities with *T. viridissima*, being almost always more abundant. There was found only one exception on a sandy locality in Veľký Kamenec, where the ratio of males of *T. viridissima* vs. *T. caudata* was 1:3.

Abundance and phenology

We estimated the density from mapping small-plots, obtaining a maximum density of 9 ♂♂ per 1000 m² on sandy dunes near Veľký Kamenec village in E Slovakia, and > 5 ♂♂ per 1000 m² near Svätušie and Věč villages in E Slovakia (15.7.2005). In Slovakia, the adults were found between June 26, 2006 (Poľana, one adult male) and September 16, 1996 (Bukovinka, one adult male). The highest adult density was recorded in July, similar as for *G. glabra*.

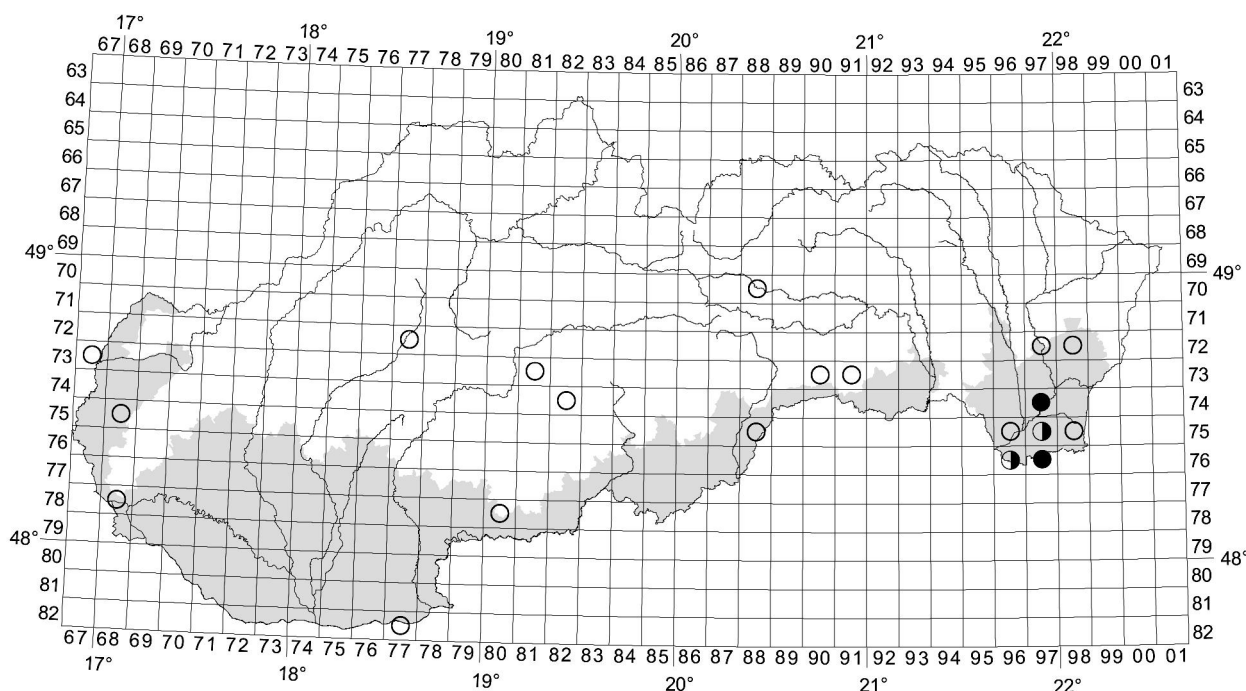


Fig. 2. Distribution of *Tettigonia caudata* in Slovakia in mapping squares of the Slovak Fauna Databank (for explanation see Fig. 1).

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