



## ***Chorthippus brunneus* subgroup (Orthoptera, Gomphocerinae) in Anatolia with description of two new species: data suggest an Anatolian origin for the lineage**

DENIZ SIRIN<sup>1</sup>, OTTO VON HELVERSEN<sup>2</sup> & BATTAL CIPLAK<sup>3,4</sup>

<sup>1</sup>Department of Biology, Graduate School of Applied and Natural Sciences, Antalya, Turkey. E-mail: denizsirin19@gmail.com

<sup>2</sup>Universität Erlangen-Nürnberg, Lehrstuhl für Zoologie, Staudtstrasse 5, D-91058 Erlangen, Germany

<sup>3</sup>Department of Biology, Faculty of Art&Science, Akdeniz University 07058 Antalya, Turkey, Tel: +90 242 310 23 56, Fax: +90 242 227 89 11. E-mail: ciplak@akdeniz.edu.tr

<sup>4</sup>Corresponding author

### **Abstract**

The *Chorthippus biguttulus* group distributed in the west Palaearctic, while intensively examined in Europe, is poorly known in the glacial refugia such as Anatolia. This produces constraints in making accurate statements about evolution and the biogeography of the group. The *C. brunneus* subgroup of this lineage is examined using large amounts of morphological and song data from Anatolia (Asian Turkey) and representatives from Europe. Song and morphology in combination suggested three species to be found in Anatolia. The first is *C. bornhalmi* Harz which is also known from south-east Europe. The other two are new species: *Chorthippus antecessor* **sp. n.** and *Chorthippus relicticus* **sp. n.** Morphologically, *C. antecessor* **sp. n.** is the most aberrant species of the *C. brunneus* subgroup, but is similar to *C. bornhalmi* in song. The specific song and morphology (the aberrant number of stridulatory pegs) define *C. relicticus* as a new species and both also indicate that it is closely related to *C. brunneus* and *C. jacobsi*. A song and morphology based phylogenetic assumption for *C. brunneus* subgroup suggests *C. antecessor*, *C. bornhalmi* and *C. miramae* to constitute one clade and *C. brunneus*, *C. jacobsi* and *C. relicticus* another. The scenario suggested for their evolution assume the following steps: (i) divergence of *C. bornhalmi* from a *C. antecessor* like ancestor, (ii) derivation of an ancestral population (which later give rise to *C. brunneus* + *C. jacobsi* + *C. relicticus*) from a *C. bornhalmi* like ancestor, and (iii) later fragmentation of this ancestral population to result in the present three species (*C. brunneus* + *C. jacobsi* + *C. relicticus*). All of these events seem to be correlated with the climatic cycles during Pleistocene. The conclusion is that the two new species are range-restricted, vulnerable species as is the case for many other taxa present in the Mediterranean Taurus biodiversity hotspot.

**Key words:** *Chorthippus*, song, morphology, Anatolia, Europe, biogeography

### **Introduction**

Phylogeographic studies of the lineages distributed in glacial refugia and adjacent northern territories have produced striking results. For example, several cryptic species or high genetic diversities of refugial populations have been discovered and the recolonisation of northern territories from southern refugia could be reconstructed (Cooper *et al.* 1995; Challis *et al.* 2007; Gunduz *et al.* 2007; Hewitt 1996, 1999, 2000; Ingrisch 1995; Taberlet *et al.* 1998; Tarkhnisvili *et al.* 1998). Anatolia is assumed to be one of the most important refugia in southern Europe and western Asia, and several northern lineages are assumed to have originated from there (Hewitt 1996; Ciplak 2003, 2004a, 2004b). However, researches on the lineages represented in this peninsula still are far from explaining the real case.

The *C. biguttulus*-species group is a lineage distributed in west Palaearctic with its about 25 species and subspecies. The group has been investigated intensively from different aspects such as taxonomy, evolution, biogeography, hybridisation and behaviour (Perdeck 1957; Helversen & Helversen 1975a, 1975b; Ragge 1976; Helversen & Elsner 1977; Ragge & Reynolds 1988, 1998; Ragge *et al.* 1990; Schmidt 1990; Ingrisch