

# Morphological and acoustic analysis of *Cicada* Linnaeus, 1758 species in Turkey

(Hemiptera: Cicadomorpha: Cicadidae)

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**Abstract.** The morphological characters and the male calling songs of four species of *Cicada* occurring in Turkey, namely *Cicada lodosi* Boulard, 1979, *C. mordoganensis* Boulard, 1979, *C. orni* (Linnaeus, 1758) and *C. permagna* (Haupt, 1917), were compared. Figures of the fore body and genitalia, and song oscillograms, are given for each species. *Cicada mordoganensis*, *C. orni* and *C. permagna* are very similar but they clearly differ from *C. lodosi*. *C. permagna* was determined as a valid species.

**Key words.** *Cicada lodosi*, *Cicada mordoganensis*, *Cicada orni*, *Cicada permagna*, morphology, male calling songs, Turkey.

## Introduction

The genus *Cicada* Linnaeus, 1758 includes more than twenty species in the Palaearctic Region. Numerous studies have been conducted on e.g. the morphology (QUARTAU 1988), faunistics (NAST 1972, BOULARD 1979, LODOS & KALKANDELEN 1981, DLABOLA 1981), acoustics (JOERMANN & SCHNEIDER 1987, QUARTAU et al. 1999, 2000b, SIMÕES et al. 2000, FONSECA 1991, FONSECA & REVEZ 2002, QUARTAU & SIMÕES 2006) and molecular taxonomy (QUARTAU et al. 2000a, SEABRA et al. 2000). We compare here the morphology and acoustics characters of four *Cicada* species occurring in Turkey.

Song production plays an important role in intraspecific interactions. The male cicadas impress female specimens with the songs generated by their tymbal, and as a consequence partners come together (CLARIDGE 1985, JOERMAN & SCHNEIDER 1987). Acoustic studies have helped distinguish allopatric populations and sibling species (CLARIDGE 1985, STUMPNER & HELVERSEN 1994, INGRISCH 1995, QUARTAU et al. 1999, 2000b, SIMÕES et al. 2000, MOL et al. 2003, ÇIPLAK et al. 2005, QUARTAU & SIMÕES 2006).

So far, four species of the genus *Cicada* have been reported from Turkey, namely *C. orni* (Linnaeus, 1758), *C. permagna* (Haupt, 1917), *C. lodosi* Boulard, 1979 and *C. mordoganensis* Boulard, 1979 (BOULARD 1979, LODOS & KALKANDELEN 1981, DLABOLA 1981, DUFELS & LAAN 1985). Although *C. permagna* has been the subject of many studies since the original description, QUARTAU & SIMÕES (2006) doubt whether it really is a good biological species. The aims of this study are (i) to determine if *C. permagna* is a biological species, (ii) to further examine, using more specimens outside the type localities, the morphological and acoustic characters of *C. lodosi*, *C. mordoganensis* and *C. permagna*, and (iii) to provide insights into the morphological and acoustic characters of specimens of *C. orni* collected from the Black Sea region.