

**Pyrenean Mountain Cicada *Cicadetta cerdaniensis* PUISSANT et BOULARD (Hemiptera: Cicadomorpha: Cicadidae) found in Poland**

TOMI TRILAR\*, MATIJA GOGALA\*\*, JACEK SZWEDO\*\*\*

\* Slovenian Museum of Natural History, Prešernova 20, P.O.Box 290, SI-1001 Ljubljana, Slovenia; e-mail: ttrilar@pms-lj.si

\*\* Slovenian Academy of Sciences and Arts, Novi trg 3, SI-1000 Ljubljana, Slovenia; e-mail: matija.gogala@guest.arnes.si

\*\*\* Department of Systematics and Zoogeography, Museum and Institute of Zoology, Polish Academy of Sciences, Wilcza 64, PL 00-679 Warszawa, Poland; e-mail: szwedo@miiz.waw.pl

**ABSTRACT.** Using recording equipment for sonic and ultrasonic range we recorded and collected *Cicadetta cerdaniensis* PUISSANT et BOULARD, 2000 on two localities in Poland, at Polana Polichno (Nida Valley, Małopolska Upland), and in Ojców National Park (Kraków-Wieluń Upland). These are the first records for the fauna of Poland. Additional new bioacoustic data are included.

**KEY WORDS:** Poland, fauna, new record, singing cicadas, Cicadoidea, *Cicadetta cerdaniensis*, bioacoustics

---

INTRODUCTION

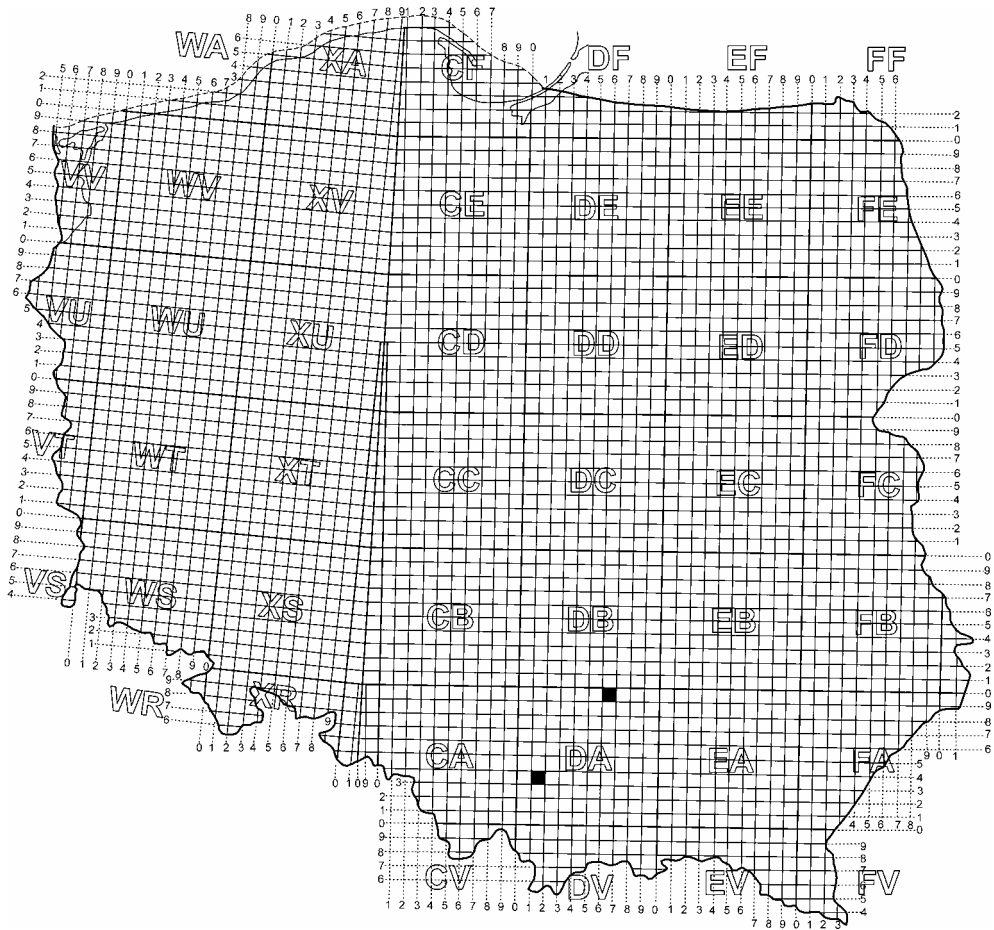
*Cicadetta cerdaniensis* PUISSANT et BOULARD, 2000 (Hemiptera: Cicadomorpha: Cicadidae) is one of the sister species of the *Cicadetta montana* complex, which has been described from the Pyrenees (France) on the basis of song pattern (PUISSANT & BOULARD 2000). Sister species of the *Cicadetta montana* complex, i.e. *Cicadetta montana* SCOPOLI, 1772, *Cicadetta brevipennis* (FIEBER, 1876), *Cicadetta macedonica* (SCHEDL, 1999), *Cicadetta cerdaniensis* PUISSANT et BOULARD, 2000, are morphologically very similar and can be with certainty distinguished only according to species-specific song patterns (GOGALA & TRILAR 2004).

Documented are new records of this species on two localities in Poland with additional bioacoustic notes.

### Acknowledgements

We are grateful for the financial support based on bilateral agreement between the Polish Academy of Sciences and the Slovenian Academy of Sciences and Arts. The research was partly supported from the program “Communities, relations and communications in the ecosystems” (P1-0255) by Ministry of Higher Education, Science and Technology of Republic of Slovenia and Ministry of Culture of Republic of Slovenia.

We wish also to thank Mrs. ANNA KLASA and Mrs BARBARA OSIADACZ for a kind help during research in the Ojców National Park.



**Fig. 1.** Recorded localities of *Cicadetta cerdaniensis* in Poland according to the Universal Transverse Mercator system (UTM).

## MATERIAL AND METHODS

In the years 2003 and 2005 we investigated with the use of classical and bioacoustic methods the singing cicadas (Hemiptera: Cicadomorpha: Cicadoidea) of Poland.

For sensitive detection of high pitched sounds we used an ultrasonic microphone mounted on a Telinga parabola and connected to an ultrasonic detector Pettersson D-200 in combination with a DAT tape recorder Sony TCD-D10 and Solid State recorder Marantz PMD-670. A similar system was described by POPOV et al. (1997).

The standard recordings in the human sonic range were made using two Telinga microphones, a Telinga Pro 5 stereo and Telinga Pro Science (parabola diameter 57 cm) in connection with DAT tape recorder Sony TCD-D10 and Solid State recorder Marantz PMD-670.

DAT recordings were transferred to the hard disk of a Power Macintosh G4 computer through an Audiomeia III card. Software used for viewing, editing and analysing the song signals was Digidesign ProTools 5.0 and Canary 1.2.4.

The collected specimens are preserved in the Hemiptera collection of the Slovenian Museum of Natural History (PMSL), Ljubljana, Slovenia, in the collections of Museum and Institute of Zoology of the Polish Academy of Sciences (MZPW), Warsaw, Poland and Museum of the Ojców National Park in Ojców. All sound recordings are stored in the Sound archive of the Slovenian Museum of Natural History in Ljubljana. Selected samples are available also on the web pages »Songs of the European singing cicadas«: <http://www2.pms-lj.si/european-cicadas/>.

## RESULTS

On June, 23<sup>rd</sup> and 24<sup>th</sup> 2003 we visited “Polana Polichno” reserve near Pińczów, Małopolska Upland [UTM DA69] (Fig. 1) and recorded the song pattern similar to *C. cerdaniensis* (Fig. 3) and also collected 2 males and 2 females. “Polana Polichno” reserve covers area of 9.54 ha with very specific microclimatic conditions. It is xerothermophilous meadow related to *Thalictro-Salvietum pratensis* MEDW.-KORN. 1959 and *Inuletum ensifoliae* KOZŁ. 1925. The clearings are surrounded by oak forest of the community *Quercus petraea-Melittis melissophyllum*, similar to the forests of the order *Quercetalia pubescenti-petraeae* KLIKA 1933 corr. MORAVEC in BEG. et THEURILL 1984 and lime-hornbeam forest *Tilio cordatae-Carpinetum betuli* TRACZ. 1962. Part of the clearing is covered with thickets of *Juniperus communis*. Cicadas were also mentioned from this locality under the name *C. montana* by NAST (1976) and GĘBICKI (1987).

At the same locality we also observed and recorded the courtship, where females produce short clicks (Fig. 4) associated with wing flipping.

Two years later we visited Ojców National Park (Fig. 1). In the Museum of the Park the researchers kept a specimen of the female of the *C. montana* complex found in the park

(Skała Krzyżowa, 13 June 2004). According to their instructions we visited on June, 27th 2005 a xerothermic slope of south-eastern exposition above Skała Krzyżowa [UTM DA16] (Ojców National Park, near Prądnik Korzkiewski), where we again recorded the song pattern Characteristic for *C. cerdaniensis*. The locality is covered with patches of vegetation related to xerothermophilous meadows *Origano-Brachypodietum* MEDW.-KORNAŚ et KORNAŚ 1963, thermophilous thickets *Peucedano cervariae-Coryletum* KOZŁ. 1925 em. MEDW.-KORN. 1952 and in upper portion by lime-hornbeam forest *Tilio cordatae-Carpinetum betuli* TRACZ. 1962.

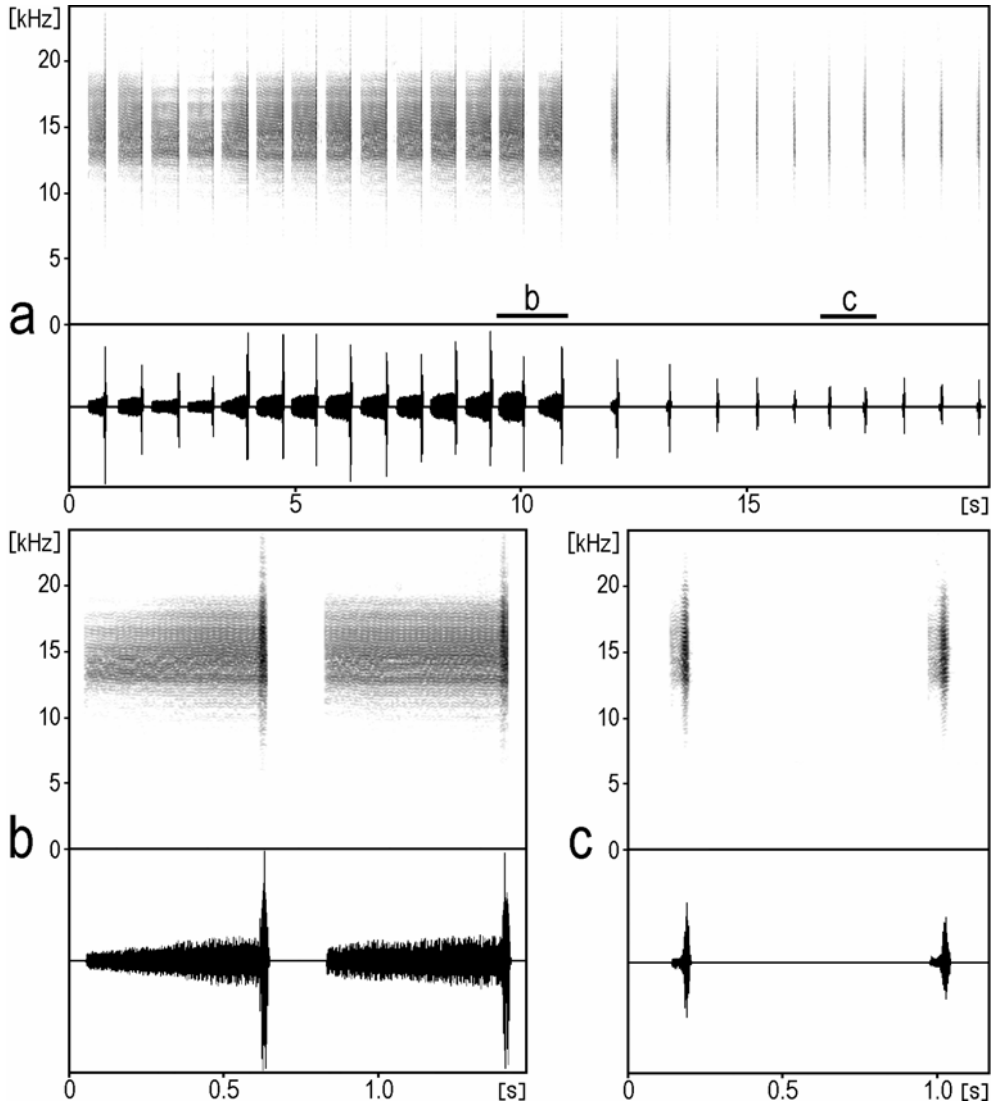
We also collected one female, which was alive given to researchers in the Park. Both specimens are deposited in the collections of the Museum of the Ojców National Park.



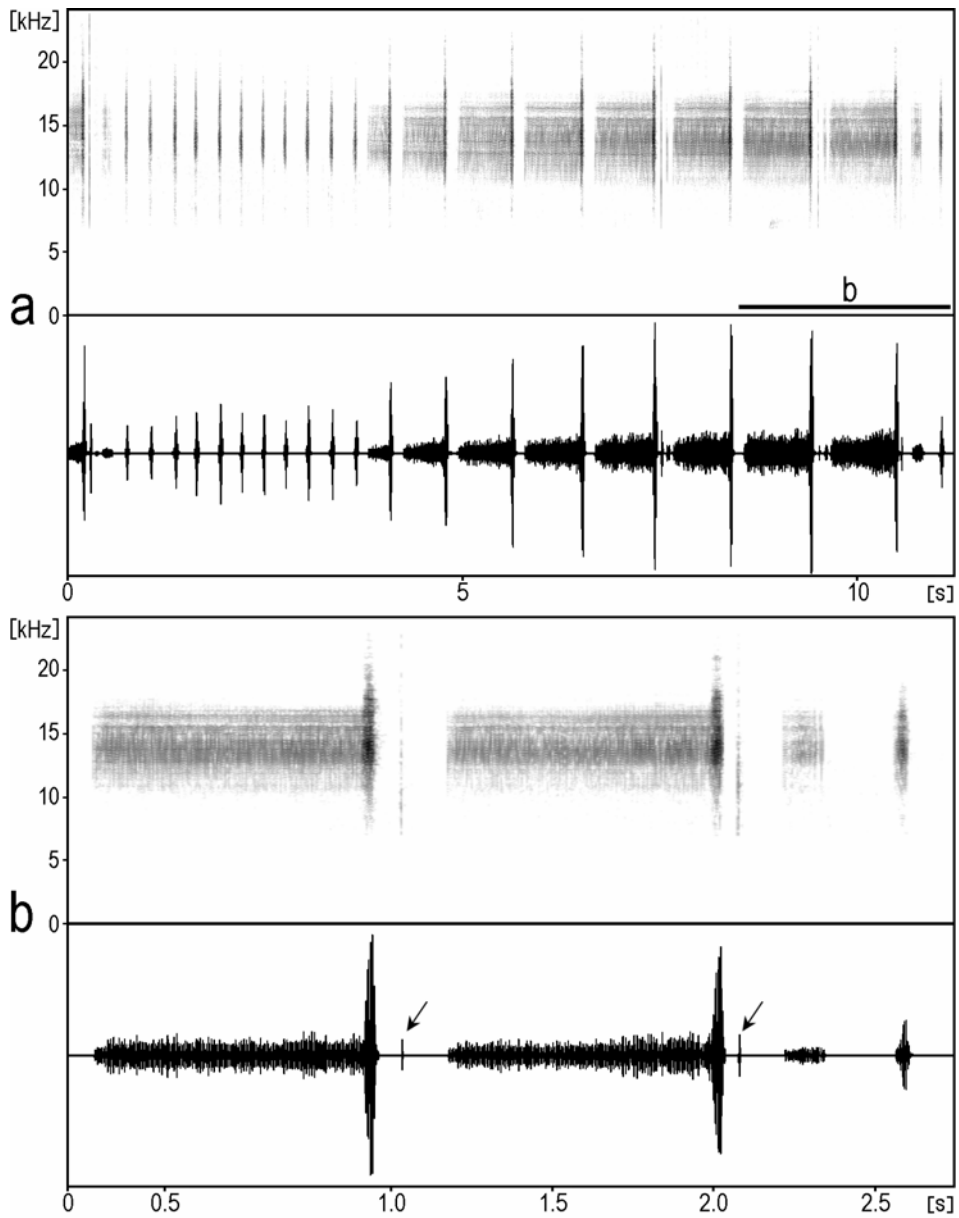
**Fig. 2.** Singing male of *Cicadetta cerdaniensis* from “Polana Polichno”.

## DISCUSSION

After detailed computer analyses of the songs recorded in Polana Polichno and Ojców National Park (Fig. 2) we find out that the pattern matches the song description of *C. cerdaniensis* given by PUISSANT & BOULARD (2000) as well as GOGALA & TRILAR (2004). The calling song (Fig. 3) of *C. cerdaniensis* consists of similar sequences following each



**Fig. 3.** Sonogram and oscillogram (a) of the end of the sequence of the calling song of *Cicadetta cerdaniensis* from Polana Polichno followed by the beginning of the next sequence; b) enlarged part of sonogram and oscillogram of double echeme (DE) from the end of the sequence with long low intensity part (LDE); c) enlarged part of sonogram and oscillogram of double echeme (DE) from the beginning of the sequence with short low intensity part (LDE). Since the microphone was not calibrated, there is no scale on oscillogram Y-axis (valid also for Fig. 4).



**Fig. 4.** Sonogram and oscillogram (a) of the courtship song of *Cicadetta cerdaniensis* from Polana Polichno; b) sonogram and oscillogram of the enlarged part of the end of the sequence with female wing click (arrow).

other (Fig. 3), or in some cases the cicadas fly away and start singing at a new spot. The duration of the sequence is from less than a minute to a few minutes. The sequence comprises double echemes (DE) with the initial low intensity part (LDE) and ending with the short high intensity pulse (HDE) (Fig. 3). The repetition frequency of DE is  $1.017 \pm 0.011\text{Hz}$  and repetition period  $972.6 \pm 176\text{ms}$  (min. 633.7 ms, max. 1588.3ms, n=833). Duration of LDE is variable, while the duration of HDE is constant ( $28.3 \pm 4.2$  ms, min. 20.2ms, max. 36.3ms, n=811). At the beginning of the sequence LDE is missing or LDE and HDE are of equal duration (Fig. 3c). Later the duration of LDE constantly increases and is the longest at the end of the sequence ( $521.9 \pm 36.2\text{ms}$ , min. 450.1ms, max. 615.6ms, n=38) (Fig. 3b). The given measurements are only preliminary and a comprehensive comparison of calling song of *C. cerdaniensis* from various locations in Europe should be made in the future.

According to observation of courtship of *C. cerdaniensis* in Polana Polichno male courtship song is not very different from the calling song. The difference is in shorter duration of sequences (normally less than a minute) and consequently smaller number of echemes in the sequence and in higher repetition rate of echemes (repetition frequency is approximately 2.105Hz and repetition period  $428.86 \pm 117.27\text{ms}$ , min. 274.58ms, max. 750.53ms, n=325). Very characteristic is beginning of the sequence with quick repetitions of pulses (Fig. 4) present in addition to the series of DE typical for the calling song. Three to five longest male's DE ( $909.90 \pm 58.16\text{ms}$ , min. 815.91ms, max. 985.89ms, n=17) at the end of the sequence are followed with females short clicks associated with wing flipping (Fig. 4b – marked with arrow). Between male HDE and female wing click is a short pause (duration  $49.68 \pm 5.68\text{ms}$ , min. 41.23ms, max. 61.85ms, n=55).

Similar observations were made also by JIM GRANT during the courtship behaviour of *C. montana* s.str. from England. PUISSANT (2001) described a distinct courtship song of *C. brevipennis* – under the name of *C. montana*. Similar courtship song patterns of the same species have also been recorded in Slovenia (GOGALA, TRILAR & KAPLA unpublished data). Exact observations are needed to clarify this behaviour in all species of *C. montana* group.

These are the first records of *C. cerdaniensis* for the fauna of Poland. The species is according to recent data distributed all over the Europe. Besides Poland it is reported from France (PUISSANT & BOULARD 2000), Switzerland (HERTACH 2004, SUEUR & PILLET unpublished data), Germany (ALOYSIUS STAUDT, personal communication), Austria (TRILAR & HOLZINGER 2004), Slovenia (GOGALA & TRILAR 2004), Montenegro (GOGALA & TRILAR unpublished data) and Macedonia (GOGALA et al. 2005).

Species of the *C. montana* complex were reported and collected from several localities in Poland (NAST 1976, DOBOSZ 1993 and unpublished data). The real identity of these specimens calls for further research by acoustic methods.

## REFERENCES

DOBOSZ R. 2003. Nowe stanowiska *Ledra aurita* (L.) i *Cicadeta montana* (SCOP.) z Górnego Śląska

- (Homoptera: Auchenorrhyncha). *Acta entomologica silesiana* **1**(1): 15.
- GĘBICKI C. 1987. Leafhopper Associations (Homoptera, Auchenorrhyncha) in xerothermic communities in the vicinity of Pińczów. *Prace Naukowe Uniwersytetu Śląskiego nr 868, Acta biologica silesiana* **6**: 23: 87–98.
- GOGALA M., TRILAR T. 2004. Bioacoustic investigations and taxonomic consideration on the *Cicadetta montana* species complex (Homoptera: Cicadoidea: Tibicinidae). *Anais de Academia Brasileira de Ciências* **76**(2): 316–324.
- GOGALA M., TRILAR T., KRPAČ V.T. 2005. Fauna of singing cicadas (Auchenorrhyncha: Cicadoidea) of Macedonia – a bioacoustic survey. *Acta entomologica slovenica* **13**(2): 103–1260.
- HERTACH T. 2004. Beitrag zur Klärung des Artkomplexes *Cicadetta montana* – Bergzikade (Hemiptera: Cicadidae): Entdeckung einer Singzikadenart mit ungewissem taxonomischen Status in der Nordschweiz. *Mitteilungen der Entomologischen Gesellschaft Basel* **54**(2): 58–66.
- NAST J. 1976. Piewiki. Auchenorrhyncha (Cicadodea). *Katalog fauny Polski, XXI* (1), **25**: 1–256.
- POPOV A.V., BEGANOVIC A., GOGALA M. 1997. Bioacoustics of singing cicadas of the western palae-arctic: *Tettigetia brullei* (FIEBER, 1876) (Cicadoidea: Tibicinidae). *Acta entomologica slovenica* **5**: 89–10.
- PUISSANT S. 2001: Eco-Ethologie de *Cicadetta montana* (SCOPOLI, 1772) en France (Auchenorrhyncha, Cicadidae, Cicadettini). *Ecole Pratique des Hautes Etudes, Biologie et Evolution des Insectes* **14**: 141–155.
- PUISSANT S., BOULARD M. 2000: *Cicadetta cerdaniensis*, espèce jumelle de *Cicadetta montana* décryptée par l'acoustique (Auchenorrhyncha, Cicadidae, Tibicinidae). *Ecole Pratique des Hautes Etudes, Biologie et Evolution des Insectes* **13**: 111–117.
- TRILAR T., HOLZINGER W. 2004: Bioakustische Nachweise von drei Arten des *Cicadetta montana*-Komplexes aus Österreich (Insecta: Hemiptera: Cicadoidea). *Linzer biologische Beiträge* **36**(2): 1383–1386.

Received 11 May 2006

Accepted: 8 June 2006