



First record of *Tettigettalna mariae* Quartau & Boulard, 1995 (Insecta: Hemiptera: Cicadoidea) in Spain

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Abstract

Tettigettalna mariae Quartau & Boulard 1995 is recorded for the first time in Spain. Thought to be endemic to Portugal (occurring in the southern province of Algarve), the present paper adds its distribution to southern Spain, being an Iberian endemism. The acoustic signals of the new specimens collected were recorded in different localities of Huelva province, in Andalusia during August 2012. According to their present known distribution, specimens of *T. mariae* tend to be sparsely distributed in small range populations in southern Iberian Peninsula, favouring wooded areas with *Pinus pinea*.

Keywords

Cicada, first record, *Tettigettalna mariae*, Spain

Introduction

Cicadas (Hemiptera: Cicadoidea) constitute a successful group of insects where males typically communicate during pair formation and courtship through acoustic distinctive

signals (Claridge 1985, Boulard and Mondon 1995, Simões et al. 2000, Quartau et al. 1999). Despite being common and with several thousands of species described worldwide, cicada's biodiversity is still poorly known. Recent work has drawn some concern to the diversity of species in the Iberian Peninsula (Boulard 1982, Boulard 2000, Puissant and Sueur 2010, Sueur et al. 2004, Quartau and Fonseca 1988), showing that this region is an important hotspot for Mediterranean cicada diversity. Particular attention was given recently to smaller species in southern Iberia with nine species assigned to the genus *Tettigettalna*, seven of which are believed to be endemic to southern Iberia (Puissant and Sueur 2010). Three species (*T. mariae*, *T. josei* and *T. estrellae*) have been described and recorded so far in Portugal only (Sueur et al. 2004) but their distribution range in other parts of the Iberia Peninsula has never been investigated before.

The current knowledge on the distribution boundaries of *Tettigettalna* species is far from being properly known and extensive field surveys for these cicadas are still missing. Moreover, some of these species are believed to have very restricted distribution ranges as is the case of *T. mariae*, a new species that was recently described (Quartau and Boulard 1995) and was thought to be endemic to the Algarve, the southern province of Portugal.

Materials and methods

As an outcome of intensive fieldwork in Portugal and Spain for species of the genus *Tettigettalna* during the summer of 2012, we report here the discovery of a new populations of *T. mariae* in Andalusia (Southern Spain). Identification was based on the collection of specimens and the recording of male acoustic signals typical of the species.

The field survey was conducted daily from 10:00 h to 19:00 h during sunny weather with temperatures ranging from 29° to 32° C. Searches were conducted by car while driving at a reduced speed, allowing the detection of the songs of calling males. Their acoustic signals were recorded at the collecting site using a Marantz PMD 661 Portable SD recorder (20 Hz – 24 kHz) connected to a Telinga Pro 7 Dat-mic microphone (Twin Science) following the procedures given in Simões et al. 2000. Specimens were then captured by hand or by means of a sweeping net.

Geographical coordinates were determined with a GPS (Garmin, Oregon series 550t) for each site where male songs were heard and where specimens were collected. Species confirmation was accomplished with time and frequency analysis of sound recordings using the software Avisoft Sas-Lab Pro (Specht 2012) as in previous analyses (e.g. Quartau et al. 1999, Simões et al. 2000). Acoustic recordings were analyzed with a sampling rate of 44.1 kHz and a resolution of 16 bits. Spectra were computed using FFT with a resolution of 512 points and a Hamming Window. For each male, recordings of about one minute were analysed. Song terminology follows that of Gogala and Trilar (1999) and Gogala and Trilar (2000). The examined material and acoustic recordings are deposited in the general data bank on insect data at the Department of Animal Biology in the Faculty of Sciences, University of Lisbon (FCUL). Collected specimens were stored dry and a front leg was preserved in 100% ethanol for DNA isolation.

Taxon treatment

Tettigetalna mariae Quartau & Boulard, 1995

Materials

- a. country: Espana; stateProvince: Andaluzia; verbatimLocality: Cartaya; verbatimLatitude: 37°15'44.2"N; verbatimLongitude: 7°07'48.9"W; samplingProtocol: Acoustic recording; eventDate: 2012-08-15T17:00Z; individualCount: 3; sex: male; recordedBy: Raquel Mendes; collectionID: 3372;3373;3374; institutionCode: FCUL; collectionCode: Entomology_PCS
- b. country: Espana; stateProvince: Andaluzia; verbatimLocality: Cartaya; verbatimLatitude: 37°15'44.2"N; verbatimLongitude: 7°07'48.9"W; samplingProtocol: Acoustic recording; eventDate: 2012-08-15T18:00Z; individualCount: 3; sex: male; recordedBy: Raquel Mendes; Vera Nunes; collectionID: 3375;3376;3377; institutionCode: FCUL; collectionCode: Entomology_PCS
- c. country: Espana; stateProvince: Andaluzia; verbatimLocality: Cartaya; verbatimLatitude: 37°15'44.2"N; verbatimLongitude: 7°07'48.9"W; samplingProtocol: Sweep net capture; eventDate: 2012-08-15T17:45Z; individualCount: 1; sex: male; recordedBy: Vera Nunes; collectionID: 3378; institutionCode: FCUL; collectionCode: Entomology_PCS
- d. country: Espana; stateProvince: Andaluzia; verbatimLocality: Moguer; verbatimLatitude: 37°12'30.7"N; verbatimLongitude: 6°46'46.1"W; samplingProtocol: Acoustic recording; eventDate: 2012-08-16T11:50Z; individualCount: 1; sex: male; recordedBy: Raquel Mendes; Vera Nunes; collectionID: 3379; institutionCode: FCUL; collectionCode: Entomology_PCS
- e. country: Espana; stateProvince: Andaluzia; verbatimLocality: Moguer; verbatimLatitude: 37°12'30.7"N; verbatimLongitude: 6°46'46.1"W; samplingProtocol: Acoustic recording; eventDate: 2012-08-16T14:40Z; individualCount: 1; sex: male; recordedBy: Raquel Mendes; Vera Nunes; collectionID: 3380; institutionCode: FCUL; collectionCode: Entomology_PCS
- f. country: Espana; stateProvince: Andaluzia; verbatimLocality: Almonte; verbatimLatitude: 37°13'43.0"N; verbatimLongitude: 6°33'51.1"W; samplingProtocol: Acoustic recording; eventDate: 2012-08-16T15:45Z; individualCount: 1; sex: male; recordedBy: Vera Nunes; collectionID: 3382; institutionCode: FCUL; collectionCode: Entomology_PCS

Analysis

Our analysis of the morphological and acoustic data confirmed the presence of *T. mariae* specimens in Spain.

Specimens were collected and recorded in different locations from Huelva province in Andalusia around the following localities: Cartaya, Aljaraque, Moguer, Mazagón, Almonte and Hinojos (Table 1). Records were sparse, even within large patches of suitable habitat, and match its current habitat preference, with *T. mariae* tending to favour wooded areas of *Pinus pinea* near the sea in the southern Iberian Peninsula (Figs 1, 2).

Table 1.

List of localities from the province of Huelva (Andalusia, Spain) where specimens of *Tettigetta mariae* were detected. Type of observation: Ao = Audio only (sound heard but not recorded), Ar = Audio recording and C = Captured.

Locality	GPS coordinates (degrees minutes seconds)	Date	Type of observation	Specimen ID code	DNA sample code
Cartaya	37°15'44.2"N, 7°07'48.9"W	15/08/2012	Ar	3372	—
Cartaya	37°15'44.2"N, 7°07'48.9"W	15/08/2012	Ar	3373	—
Cartaya	37°15'44.2"N, 7°07'48.9"W	15/08/2012	Ar	3374	—
Cartaya	37°15'44.2"N, 7°07'48.9"W	15/08/2012	Ar	3375	—
Cartaya	37°15'44.2"N, 7°07'48.9"W	15/08/2012	Ar	3376	—
Cartaya	37°15'44.2"N, 7°07'48.9"W	15/08/2012	Ar	3377	—
Cartaya	37°15'44.2"N, 7°07'48.9"W	15/08/2012	C	3378	Tma3378
Aljaraque	37°15'50.1"N, 7°00'29.6"W	17/08/2012	Ao	—	—
Moguer	37°13'55.2"N, 6°47'48.7"W	16/08/2012	Ao	—	—
Moguer	37°12'30.7"N, 6°46'46.1"W	16/08/2012	Ar	3379	—
Moguer	37°12'30.7"N, 6°46'46.1"W	16/08/2012	Ar	3380	—
Mazagón	37°09'57.4"N, 6°48'23.8"W	16/08/2012	Ao	—	—
Almonte	37°13'43.0"N, 6°33'51.1"W	16/08/2012	Ar	3382	—
Hinojos	37°16'59.4"N, 6°23'36.1"W	16/08/2012	Ao	—	—



Figure 1.

Habitat of *Tettigetta mariae* in Cartaya (Huelva, Spain) corresponding to a typical wooded area of *Pinus pinea*. Males were usually singing on pine branches or leaves.

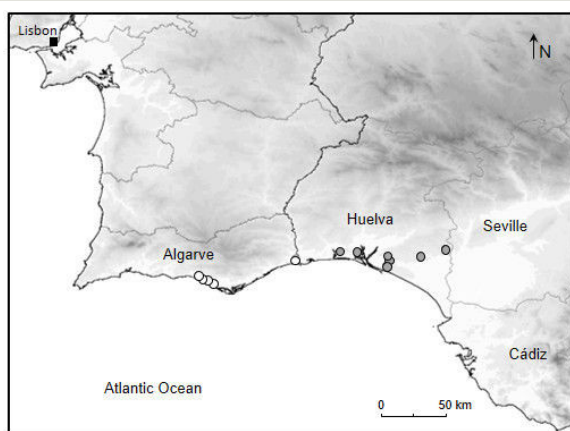


Figure 2.

Map of occurrence of *Tettigetta mariae* in the south of the Iberian Peninsula, showing former documented populations in Algarve (Portugal) according to Sueur et al. (2004) (white circles) and the new populations recorded in August 2012 (grey circles) in the province of Huelva, Andalusia (Spain).

Acoustic analysis (Table 2, Fig. 3) showed the profile of the calling song in agreement with previous studies (Quartau and Boulard 1995, Fonseca 1991, unpublished data). *T. mariae* specimens have a broad spectrum near 6 - 16.5 kHz with maximum energy around 12 kHz. For time domain variables, our results indicated an echeme duration ranging from 0.02 to 0.10s, with an average value of 0.06s. For the echeme period we found a range of 0.16 to 0.54s and average of 0.32s.

Table 2.

Descriptive statistics of the acoustic variables for *Tettigettalna mariae* specimens. Time variables in seconds and frequency variables in Hz.

	Ech/s	Echeme duration	Inter-echeme interval	Echeme period	Echeme rate	Peak frequency	Minimum frequency	Maximum frequency
Average	4.41	0.06	0.26	0.32	0.27	12049	5808	16380
Minimum	1.86	0.02	0.14	0.16	0.14	11569	5195	15860
Maximum	8.98	0.10	0.46	0.54	0.42	12411	7741	17244

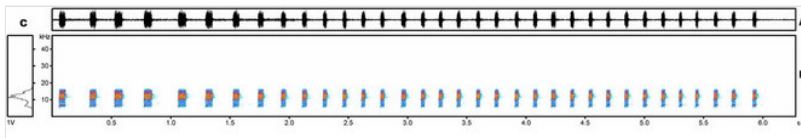


Figure 3.

Calling song profile of a *Tettigettalna mariae* specimen recorded in Cartaya (Huelva, Spain). A - Oscillogram (amplitude vs. time), B - sonagram or spectrogram (frequency vs. time) and C - mean amplitude spectrum (frequency vs. amplitude).

Discussion

Previous studies suggested that *T. mariae* was a Portuguese endemic cicada, seeming to be confined to central Algarve, close to the sea (Sueur et al. 2004) which is an area under increasing human pressure. The coastline of Algarve is heavily urbanized, with many touristic villages and golf courses covering most of Vilamoura, Vale do Lobo and Quinta do Lago. This raises concerns about the conservation of *T. mariae* given the restricted habitat range of the known populations. The discovery of *T. mariae* populations in Spain means that the species is not confined to the central wooded area of Algarve, close to the sea, having instead a wider distribution extending to Andalusia. The new populations of *T. mariae* reported here constitute an important addition to the scarce knowledge of this rare species. However, *T. mariae* distribution remains heavily fragmented and discontinuous. Consequently the species is still vulnerable to habitat loss caused by changes in land use or forest fires that often jeopardize *Pinus pinea* woods during the summer, when cicada adult males are active. These threats may cause the decline and eventual extinction of local populations of cicadas and are especially worrying for small range species such as *T. mariae* (Quartau and Mathias 2010).

With the present data, obtained through our 2012 fieldwork, a new cicada species is listed for Spain and a new endemism for Iberia.

Moreover, the current species list available for the cicadas from Iberian Peninsula are likely to still be incomplete. As the male acoustic signals in cicadas are highly diagnostic for the separation of closely related species (Claridge 1985, Boulard and Mondon 1995, Gogala et al. 2008, Gogala et al. 2011), it is quite possible that to the same specific name may correspond in fact two or more independent sibling species as has happened in other genera, such as *Cicadetta* (e.g. Gogala et al. 2008, Gogala et al. 2011). All this suggests the presence of a larger number of species in the Iberian Peninsula than those already recorded and calls for further cicada surveys in the area, as well as a better knowledge of cicada biology and ecology, which is the key to the conservation of these interesting insects in the Mediterranean area.

Acknowledgements

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References

- Boulard M (1982) Les cigales du Portugal, contribution à leur étude (Hom. Cicadidae). Annales de la Société entomologique de France 18 (2): 181-198.
- Boulard M (2000) Description de quatre *Tettigettna* ibériques nouvelles (Auchenorrhynca, Cicadidae, Tibicininae). EPHE Biologie et Évolution des Insectes 13: 133-143.
- Boulard M, Mondon B (1995) Vies et mémoires de cigales - Provence languedoc méditerranée. Équinoxe, Barbentane, 159 pp.
- Claridge M (1985) Acoustic signals in the Homoptera: behavior, taxonomy, and evolution. Annual Review of Entomology 30: 297-317. DOI: [10.1146/annurev.en.30.010185.001501](https://doi.org/10.1146/annurev.en.30.010185.001501)
- Fonseca P (1991) Characteristics of the acoustica signals in nine species of cicadas (Homoptera, Cicadidae). Bioacoustics 3: 173-192. DOI: [10.1080/09524622.1991.9753178](https://doi.org/10.1080/09524622.1991.9753178)
- Gogala M, Trilar T (1999) The song structure of *Cicadetta montana macedonica* Schedl with remarks on songs of related singing cicadas (Hemiptera: Auchenorrhyncha: Cicadomorpha: Tibicinidae). Reichenbachia Staatliches Museum fur Tierkunde Dresden 33 (11): 91-97.
- Gogala M, Trilar T (2000) Sound emissions of *Pagiphora annulata* (Homoptera: Cicadoidea: Tibicinidae) - A preliminary report. Acta Entomologica Slovenica 8 (1): 21-26.
- Gogala M, Drosopoulos S, Trilar T (2008) *Cicadetta montana* complex (Hemiptera, Cicadidae) in Greece - a new species and new records based on bioacoustics. Deutsche Entomologische Zeitschrift 55 (1): 91-100. DOI: [10.1002/mmnd.200800006](https://doi.org/10.1002/mmnd.200800006)
- Gogala M, Trilar T, Drosopoulos S (2011) Two new species and a new genus of Cicadettini (Hemiptera, Cicadidae) from the Greek island of Evia. Deutsche Entomologische Zeitschrift 58 (1): 105-117. DOI: [10.1002/mmnd.201100007](https://doi.org/10.1002/mmnd.201100007)
- Puissant S, Sueur J (2010) A hotspot for Mediterranean cicadas (Insecta: Hemiptera: Cicadidae): new genera, species and songs from southern Spain. Systematics and Biodiversity 8 (4): 555-574. DOI: [10.1080/14772000.2010.532832](https://doi.org/10.1080/14772000.2010.532832)
- Quartau J, Boulard M (1995) *Tettigettna mariae*, nouvelle Cigale lusitanienne (Homoptera Cicadoidea Tibicinidae). EPHE Biologie et Évolution des Insectes 7/8: 105-110.

- Quartau J, Fonseca P (1988) Proceedings of the Sixth Auchenorrhyncha Meeting, Turin. Sixth Auchenorrhyncha Meeting, Italy, 7-11 September 1987. Turin, 267-375 pp.
- Quartau J, Mathias M (2010) Insects of the understorey in western mediterranean forest landscapes: a rich biodiversity under threat. In: Harris E, Davies N (Ed.) Insect habitats: Characteristics, diversity and management. Nova Science Publishers Inc., New York, 133-142 pp.
- Quartau J, Rebelo M, Simões P (1999) Cicadídeos (Insectos, Homópteros). In: Santos-Reis M, Correia A (Ed.) Caracterização da flora e fauna do montado da Herdade da Ribeira Abaixo (Grândola-Baixo-Alentejo). Centro de Biologia Ambiental, Lisboa, 69-74 pp.
- Simões P, Boulard M, Rebelo M, Drosopoulos S, Claridge M, Morgan J, Quartau J (2000) Differences in the male calling songs of two sibling species of Cicada (Hemiptera: Cicadoidea) in Greece. *European Journal of Entomology* 97: 437-440.
- Specht R (2012) Avisoft-SASLab Pro.
- Sueur J, Puissant S, Simões P, Seabra S, Boulard M, Quartau J (2004) Cicadas from Portugal: revised list of species with eco-ethological data (Hemiptera: Cicadidae). *Insect Systematics and Evolution* 35: 177-187. DOI: [10.1163/187631204788912373](https://doi.org/10.1163/187631204788912373)

Supplementary material

Suppl. material 1: *Tettigetta mariaae* calling song

Authors: Raquel Mendes; Vera Nunes

Data type: sound file

Brief description: Calling song of a *Tettigetta mariaae* specimen recorded in Cartaya (Huelva, Spain).

Filename: Tmariae.mp3 - [Download file](#) (274.73 kb)