

Calling songs of North African bush-crickets,
recorded by Albrecht FABER in 1965

Klaus-Gerhard Heller

Abstract

The calling songs of five North African tettigonioid species are described and illustrated on the basis of recordings made by Albrecht FABER in 1965. While that specimen of the North African endemic *Ephippigerida bifida*, which was recorded, is available in Staatliches Museum für Naturkunde Stuttgart, the other four species (*Pycnogaster finotii maroccana*, *Tettigonia viridissima*, *Platycleis albopunctata* and *Platycleis falx laticauda*) were identified according to their song pattern. The songs of *Ephippigerida bifida* and *Pycnogaster finotii maroccana* have not been described before.

Zusammenfassung

Gesänge nordafrikanischer Laubheuschrecken, aufgenommen im Jahr 1965 von Albrecht Faber.

Die Gesangsmuster fünf nordafrikanischer Laubheuschrecken werden anhand von Aufnahmen von Albrecht Faber aus dem Jahr 1965 beschrieben und abgebildet. Das Exemplar der in Nordafrika endemischen *Ephippigerida bifida*, das aufgenommen wurde, existiert als Beleg im Staatlichen Museum für Naturkunde Stuttgart, die anderen vier Arten (*Pycnogaster finotii maroccana*, *Tettigonia viridissima*, *Platycleis albopunctata* und *Platycleis falx laticauda*) wurden nach dem Gesang bestimmt. Die Gesänge von *Ephippigerida bifida* und *Pycnogaster finotii maroccana* werden hier zum erstenmal beschrieben.

Introduction

The German biologist Albrecht FABER (1903-1986) published several important papers about the bioacoustics of European Orthoptera. In his latest papers (FABER 1958, 1960) he described the stridulation of acridids of the *Chorthippus parallelus* group. He found that the Iberian populations differ distinctly from the central European ones and recognised them as a separate species, *Ch. erythropus*. Recently, the relationship between *Ch. erythropus* and *Ch. parallelus* has been intensively studied due to the hybrid zone found in the contact area between both forms (e.g. BUTLIN, 1998). However, although FABER did not publish about Orthoptera after 1960 (except two mainly theoretical papers in 1970 and 1971) he continued to record orthopteran songs.

In 1965 he made an expedition to North Africa together with his students. Judging from the amount of tape material, his main interest was focused on the be-

haviour of acridids (data from these tapes will be published later). In addition he recorded, partly accidentally, partly intentionally, a few bush-crickets. In the following these songs are described since only very few bioacoustic data are available from North Africa (only in GRZESCHIK 1969: *Ephippigerida taeniata*, RAGGE & REYNOLDS 1998: *Gryllus bimaculatus*, *Chorthippus maroccanus*). The songs of some species recorded by FABER are even not yet described.

Material and Methods

Faber collected only very few of the specimens he recorded because his main interests were in acridids. Fortunately the recordings of one species endemic to North Africa can be traced back to a specimen now in the Staatliches Museum für Naturkunde Stuttgart. The other species were identified from the song pattern. At <http://www.dorsa.de> all localities can be visualised on a map by a web-based GIS mapping tool. At the same site digitised sound records are available under the sound file names given below.

The songs were either recorded in the laboratory in Germany (*Ephippigerida bifida* only) or in the field (remaining records). Unfortunately, temperature data are not available. For indoor recordings, a room temperature of 20-25°C can be assumed, for field recordings the time of the day may give some indication. For all records a Nagra III PH (Kudelsky-Telefunken) tape recorder was used, operating at 38 cm/s (frequency response up to around 40 kHz; microphone unknown) or 19 cm/s respectively (frequency response up to around 20 kHz).

After digitising the songs on an Apple computer, oscillograms (after filtering) and sound analysis were made using a PC and the programs Turbolab, Amadeus (Apple) and CoolEdit.

Bioacoustic terminology:

Calling song: spontaneous song produced by an isolated male.

Syllable: the song produced by one opening-closing movement cycle of the tegmina.

Hemisyllable: the sound produced during one opening or closing movement.

Impulse: a simple, undivided, transient train of sound waves arising by the impact of one tooth of the stridulatory file.

Results

1) *Ephippigerida bifida* (Werner, 1932)

Locality: MOROCCO: hill above Azrou (Hügel oberhalb Azrou) (5° 13' W; 33° 26' N), 8 - 9 July 1965, coll. A. Faber; laboratory recordings between 3 p.m. and 7 p.m.

Recordings from specimen STEPDBIF01 (hand written label in addition to locality data: Männchen, schöne Aufnahme unter Bezeichnung "*Barbitistes* ähnliches M."). Another male and female with the same date and locality data in collection.

Sound files: EDBI6501-15

Determination:

In the tape protocols Faber called the animal *Barbitistes*-like bush-cricket. However, it clearly belongs the Bradyporidae/Ephippigerinae and to the species *Ephippigerida bifida* (Werner, 1932), already known from this locality (see NADIG, 1976). The unusually slender habit of this species compared to other Moroccan (NADIG, 1976) and European *Ephippigerida* species (own observations) may well justify a separate subgenus.

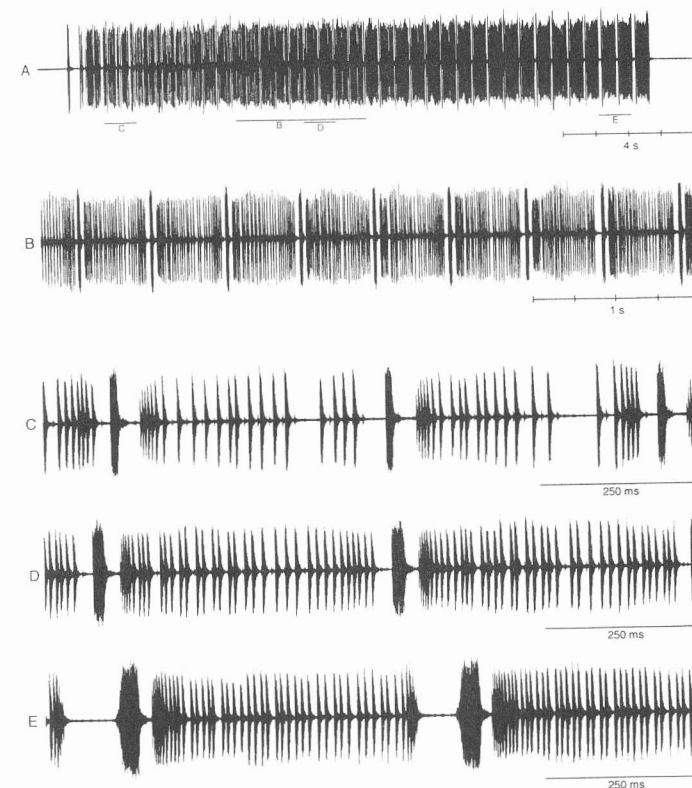


Fig. 1: Oscillograms of the calling song of *Ephippigerida bifida*

Song:

The calling song consists of syllable sequences with a duration of (4.9-)10-31 s containing (15-)28-73 syllables (n=14) (fig. 1). Within one sequence, the duration of the syllables slightly increases and their structure changes. The sequence starts with one hemisyllable, produced probably during the opening of the elytra. After a silent gap (mute wing closing?) or some irregular groups of impulses another short hemisyllable is produced followed by the first long hemisyllable resulting probably from the closing of the elytra. This regular pattern of short and

long hemisyllables continues until the sequence ends in a long hemisyllable. During the sequence both short and long hemisyllables increase in duration and impulse number (fig. 1C-D). The syllable sequences were heard only at intervals of some minutes (shortest interval about 2 min)

This type of song pattern is unique among all ephippigerines analysed up to now (HELLER 1988, RAGGE & REYNOLDS 1998).

The frequency spectrum shows a distinct peak at 20 kHz (fig. 2). Compared to some other *Ephippigerida* species (*E. zapaterii*, *E. taeniata*; HELLER, 1988) this result seems reasonable, although it indicates only that the maximum lies at or above this value, since the frequency response of the microphone may be not flat above 20 kHz.

When disturbed the animal produced short sounds similar in structure to one isolated syllable consisting of one short and one long hemisyllable.

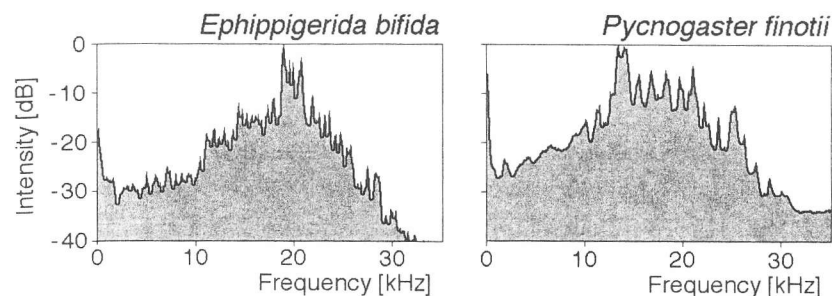


Fig. 2: Frequency spectra of the calling songs of *Ephippigerida bifida* and *Pycnogaster finotii maroccana*

2) *Pycnogaster finotii maroccana* Bolivar, 1907

Locality: MOROCCO: lake near Timhadit (See bei Timhadit) (5° 5' W; 33° 14' N), 4 July 1965, recording time 6 p.m.

Sound files: PZFI6501-03

Determination:

In this case the identification must be indirect since that animal which was recorded was not collected and probably not even seen (see below). In contrast to the three species following below, however, the song was recorded intentionally. The students who made the recording mentioned that they have seen a green "Elefantenheuschrecke" in which no parts could be seen moving during stridulation. In addition, the animal was said to have a long spine. In my opinion the most likely explanation is that they have seen a female of *Pycnogaster* and that the male was singing nearby.

Another species is unlikely to be involved, because the song characteristics are typical for the genus *Pycnogaster* (see below; HELLER 1988, PFAU 1988). From

this genus only *P. (Bradygaster) finotii* is known from North Africa with the subspecies *P. f. maroccana* from Morocco. A member of the genus *Eugaster* (Heterodinae) which could be assumed from the word 'spine' used by the students is very unlikely; all Moroccan species examined up to now have the same song pattern, which is very different from that found here (GRZESCHIK 1969).

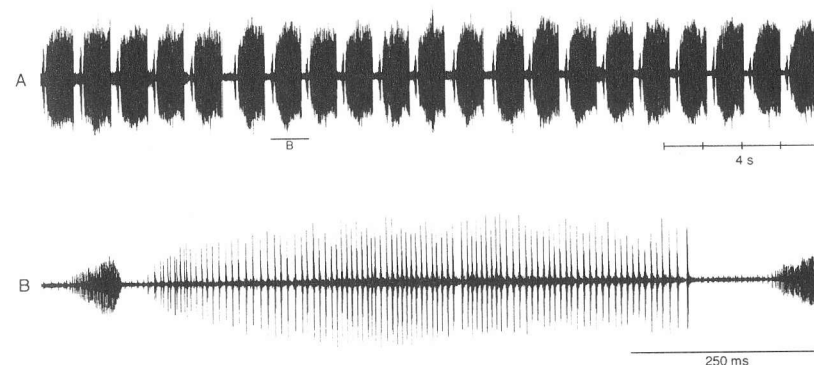


Fig. 3: Oscillograms of the calling song of *Pycnogaster finotii maroccana*

Song:

The three recorded songs consist of long syllable sequences (fig. 3) (55s, >48s, 98s), the last one sometimes containing short gaps of around 1 s. Each syllable consists of a short opening hemisyllable and a much longer closing hemisyllable (fig. 3). Due to the low stridulation frequency of slightly above 1 Hz syllable number and duration in seconds have nearly the same value. The song structure is qualitatively similar to that of other *Pycnogaster* species (see PFAU, 1988), a quantitative comparison, however, is difficult because the temperature during the recording is not known. With a duration of the closing hemisyllable of around 650 ms *P. finotii* comes close to the long duration of *P. gaditana*, its supposed sister species (see fig. 5 in PFAU, 1988). If the temperature was higher than 18°C (easily to imagine for 6 p. m. in July), *P. finotii* may even stridulate slower than *P. gaditana*. Interestingly, PFAU (1988) assumed a reduced stridulatory speed in the ancestor of these two species without knowing the song of *P. finotii*. However, the distinct opening hemisyllables of *P. finotii* indicate that missing opening hemisyllables are not to be considered as an autapomorphy of the subgenus *Bradygaster* as assumed by PFAU (1988). Although they are certainly not so pronounced as in the subgenus *Pycnogaster*, they are much louder than in any other species of the subgenus *Bradygaster* where they are generally lacking. The results of PFAU & PFAU (1995) presenting songs without opening hemisyllables also for species of the subgenus *Pycnogaster* support this view.

The peak of the frequency spectrum is situated between 13.5 and 16 kHz, similar to that of *Pycnogaster jugicola* (LATIMER & BROUGHTON 1984, HELLER 1988) (Fig. 2).

3) *Tettigonia viridissima* (Linnaeus, 1758)

Localities:

MOROCCO: hill above Azrou (Hügel oberhalb Azrou) (5° 13' W; 33° 26' N), 8 - 9 July 1965, recording time 9.30 a.m.

Sound file: TTVI6502-03

MOROCCO: south of Ifrane, near spring of creek (südlich Ifrane am Quellbach) (5° 6' W; 33° 32' N; Ifrane is a common name in Morocco; the coordinates are based on in my opinion the most likely place without direct support from Faber's data), 6 July 1965, recording time 11.20 a.m.

Sound file: TTVI6501

Determination:

The song of this species was found in the background noise of two acridid field records.

A song pattern consisting of fast repeated syllable pairs with a peak of the carrier frequency around 10 kHz is characteristic for *Tettigonia viridissima* (HELLER 1988, RAGGE & REYNOLDS 1998).

Song: The record shows the typical pattern of this species (fig. 4A). Short bursts of about one second can be often heard during the daytime activity of this mainly crepuscular and nocturnal species.



Fig. 4: Oscillograms of the calling songs of
A *Tettigonia viridissima* (sound file TTVI 6503) and
B, C *Platycleis albopunctata*

4) *Platycleis albopunctata* (Goeze, 1778)

Locality: MOROCCO: hill above Azrou (Hügel oberhalb Azrou) (5° 13' W; 33° 26' N), 8 - 9 July 1965, recording time 9.30 a.m.

Sound file: PLAL6501

Determination:

The song of this species was found in the background noise of an acridid field record.

A long uninterrupted sequence of syllable groups is typical for tettigoniine bush-crickets. Carrier frequencies around 20 kHz indicate a species with medium sized wings. Among the species known from North Africa (CHOPARD 1943) the most likely candidate for the song recorded here is *Platycleis albopunctata* from which a similar song pattern is known. It shall be mentioned, however, that some other North African tettigoniine species (especially large *Pterolepis* (including genus *Rhacocleis*) species) cannot be excluded.

Song: The record shows the typical pattern of this species (fig. 4B, C).

5) *Platycleis falx laticauda* Brunner v. Wattenwyl, 1882

Locality: MOROCCO: south of Ifrane, near spring of creek (südlich Ifrane am Quellbach) (5° 6' W; 33° 32' N; Ifrane is a common name in Morocco; the coordinates are based on the in my opinion most likely place without direct support from Faber's data), 6 July 1965, recording time 10.30 a.m.

Sound file: PLFA6501

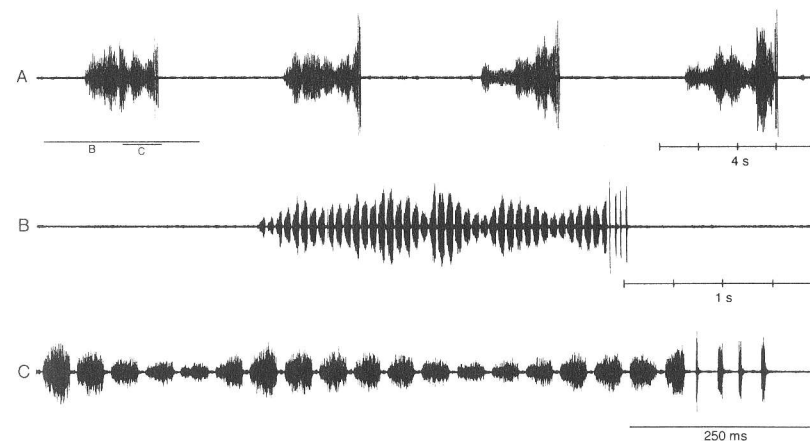


Fig. 5: Oscillograms of the calling song of *Platycleis falx laticauda*

Determination:

The song of this species was found in the background noise of an acridid field record.

A song pattern consisting of a long sequence of so-called macrosyllables followed by some microsyllables with a peak of the carrier frequency around 15 kHz is characteristic for some *Platycleis* (*Platycleis*) species (HELLER 1988, RAGGE & REYNOLDS 1998). In North Africa it is produced only by *P. affinis* and *P.*

falx laticauda (Chopard 1943). Judging from the regular repetition of long syllable series, *P. f. laticauda* is more likely than *P. affinis* (see song descriptions by RAGGE & REYNOLDS 1998).

Song: The record shows the typical pattern of this species (fig. 5). The irregular amplitude pattern results from strong wind during the recording.

Acknowledgements

Many thanks go to Dr. F. WOOG and Dr. J. HOLSTEIN (Staatliches Museum für Naturkunde Stuttgart) for their time-consuming efforts to handle the FABER tape collection and specimen collection. I also wish to thank the DORSA (Deutsche ORthoperen SAmmlungen) project for financial support during digitizing the tape recordings and Dr. H.-K. PFAU for helpful comments.

Author
Dr. K.-G. Heller
Grillenstieg 18
39120 Magdeburg
Email: heller.volleth@t-online.de

References

- BUTLIN, R. (1998): What do hybrid zones in general and the *Chorthippus parallelus* zone in particular, tell us about speciation? – In: HOWARD, D. J.; BERLOCHER, S. H. [Eds]. Endless forms: species and speciation. Oxford University Press, New York, Oxford etc. : I-XII, 1-470. Chapter Pagination: 367-378.
- CHOPARD, L. (1943): Orthopteroides de l'Afrique du Nord. – Faune de l'empire français 1. Paris (Librairie Larose).. 450 pp.
- FABER, A. (1958): *Chorthippus erythropus* n.sp., ein nächster Verwandter der gemeinen Grashrecke (*Ch. longicornis* (Latr.); Orthopt., Acrid.). – Stuttg. Beitr. Naturk. 16: 1–8; Stuttgart.
- FABER, A. (1960): Form, Ableitung und Bedeutung von Stridulationsweisen in Verwandtschaftskreis um *Chorthippus longicornis* (Latr.) als grundsätzliches Beispiel der Vergleichung. *Chorthippus caffer*, eine selbständige Art (Orthoptera, Acrididae). – Stuttg. Beitr. Naturk. 32: 1–12; Stuttgart.
- FABER, A. (1970): Über Besonderheiten der Formen femori-elytraler Stridulationsbewegungen bei Acrididen (Orth., Saltatoria) und ihre Phylogenese. – Forschungsstelle für Bioakustik in der Max-Planck-Gesellschaft, Heft 2: 1-17. Tübingen.
- FABER, A. (1971): Zur Evolution der Lautäusserungen. – Forschungsstelle für Bioakustik in der Max-Planck-Gesellschaft, Heft 5: 1-30. Tübingen.
- GRZESCHIK, K.H. (1969): Untersuchungen zur Systematik, Biologie und Ethologie von *Eugaster Serville* (Orthoptera: Tettigoniidae). – Forma et Functio 1: 46–110.
- HELLER, K.-G. (1988): Bioakustik der europäischen Laubheuschrecken. 1–358; (Josef Margraf), Weikersheim.
- LATIMER, W. & BROUGHTON, W.B. (1984): Acoustic interference in bush crickets; a factor in the evolution of singing insects? – J. Nat. Hist. 18: 599–616.
- NADIG, A. (1976): Beiträge zur Kenntnis der Orthopteren Marokkos: I. Die marokkanischen Arten der Gattung *Ephippigerida* I. Bolivar, 1903 und die "Gruppe *cockerelli*" der

Gattung *Uromenus* (*Steropleurus*) I. Bolivar, 1878. – Rev. Suisse Zool. 83: 329–348; Genève.

- PFAU, H.K. (1988): Untersuchungen zur Stridulation und Phylogenie der Gattung *Pycnogaster* Graells, 1851 (Orthoptera, Tettigoniidae, Pycnogastrinae). – Mitt. Schweiz. Entomol. Ges. 61: 167–183.
- PFAU, H.K. & PFAU, B. (1995): Zur Bioakustik und Evolution der Pycnogastrinae (Orthoptera, Tettigoniidae): *Pycnogaster valentini* Pinedo & Llorente, 1986 und *Pycnogaster cucullata* (Charpentier, 1825). – Mitt. Schweiz. Entomol. Ges. 68: 465–478.
- RAGGE, D.R. & REYNOLDS, W.J. (1998): The songs of the grasshoppers and crickets of western Europe. i–x, 1–591; Colchester, Essex (Harley Books).