An Audiospectrographic Study of Male Stridulation in the Genus *Corixa* Geoffr. (Hemiptera, Corixidae)

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The stridulation signals of three species of the Genus *Corixa* were investigated especially with respect to their spectral composition. Thee dominant frequencies are: 2.7 kHz for *C. panzeri*, 2.2 kHz for *C. dentipes* and 2.0 kHz for *C. punctata*. For *C. punctata* the threshold frequency responses, especially for one (A1) of both receptor units of the mesothoracic tympanic organ, correspond well to the frequency spectrum of the emitted sounds.

Introduction

Many species of the Corixids produce stridulatory signals under water, which are of importance in behaviour leading to successful copulations [1]. This study investigates the male stridulation signals of the three large, native (Central European) Corixids: *Corixa panzeri* Fieb. (body length 10,5–12 mm), *C. dentipes* Thms. (body length 13–14 mm) and *C. punctata* Ill. (body length 13–15 mm).

Methods

Experimental animals were caught immediately after the spring thaw. Isolated males, groups of males and males and females together were observed during stridulation in the laboratory. Stridulation signals of single males were recorded in a water filled styrofoam hollow cylinder (20 cm high, 18 cm inside diameter), which was shielded from noise in a sound-isolated room, with a LC 54 M1 Hydrophone (Atlantic Res. Comp., nearly flat from 1–30 kHz) at 18°–20 °C. The output was preamplified (Tektronix Type 122 A) and recorded at 38 cm/s with a Revox G 36 tape recorder, which had been modified to provide an appropriate signal to noise ratio. The recorded signals were analysed with audio-frequency spectrograph and sonagraph.

Results

The males of the species studied here stridulate whether isolated or together with males and/or females of the same species. Copulation also occurred without prior male stridulation. As is the case with other corixids (ref. see disc.), the calls in these species are produced with the help of stridulatory pegs, which are situated on the medial side of both prothoracic femora; they are rubbed against the sharp edges of the head between antennae and labium.

Corixa panzeri usually starts a call with alternating up and down movements of the forelegs. In the next, clearly louder phase of the call, which follows the first immediately, the forelegs move more rapidly. Several calls are often sung one immediately after the other (entrained) (Fig. 1). Some animals make an additional second call. These calls consist of chirps (pulse-train-groups) containing three pulsetrains. The interchirp interval is the same as the chirp duration. The dominant frequency range for both calls lies around 2.7 ± 0.3 kHz ($n = 22$) (Fig. 1 and 2 a).

The sound production by *Corixa dentipes* begins with alternatin up and down foreleg-movements, which can then cease. More often, however, immediately after the initial alternating movements a "whetting" sound is produced by a more rapid movement of one or both legs (Fig. 2 b). Often several of these long calls are entrained. The dominant frequency range for all calls lies around 2.2 ± 0.2 kHz ($n = 7$) (Fig. 2 b). This agrees with the results from Schulze [2].

The temporal patterns of the call of *Corixa punctata* are less regular than those of the other species studied here and elsewhere [1–3]. The males produce their sounds by moving both forelegs, often with different rapidity (*cf.* ref. 4). The dominant frequency range lies around 2.0 ± 0.2 kHz ($n = 3$) (Fig. 2 c).

Discussion

The dominant frequency ranges of the calls of the species studied here decrease with increasing body size as in the case with the smaller corixids studied

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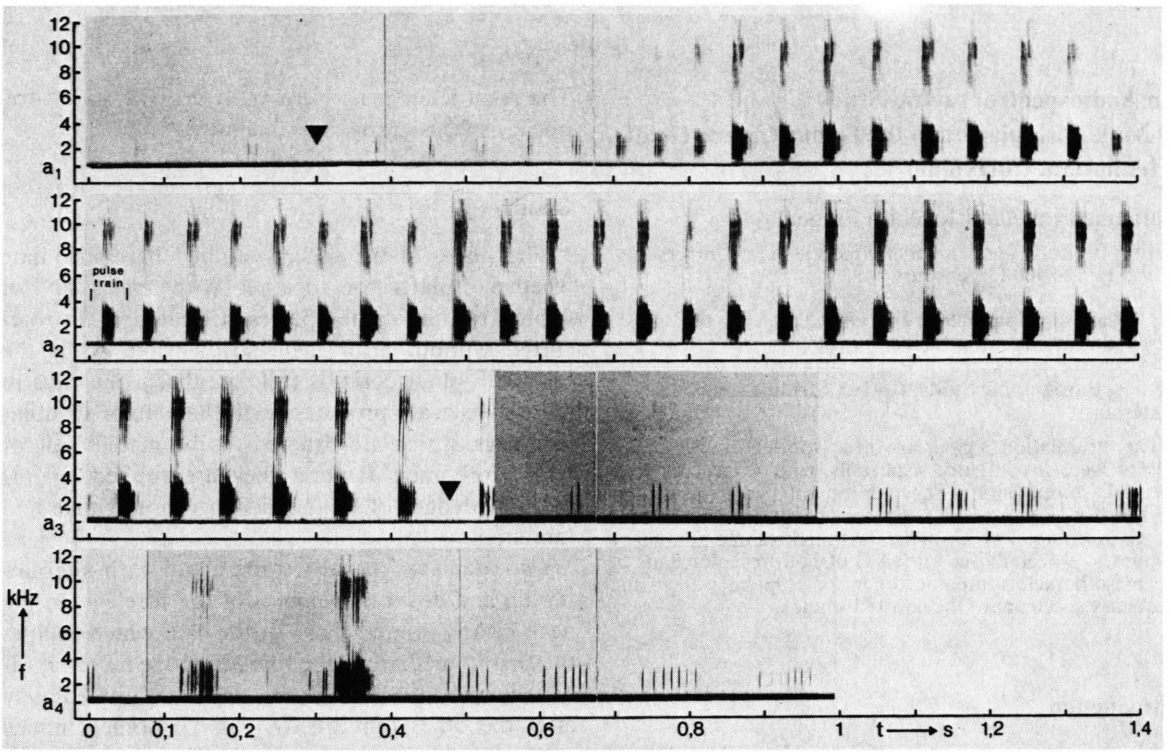

Fig. 1. Sonagram of a stridulation signal from *C. panzeri.* Excerpt from a series of entrained calls (each pulse train represents a single stroke of the stridulatory pegs over the edge of the head); a_1 transition to rapid movement (indicated by arrow), a_3 transition to slow movement (indicated by arrow).

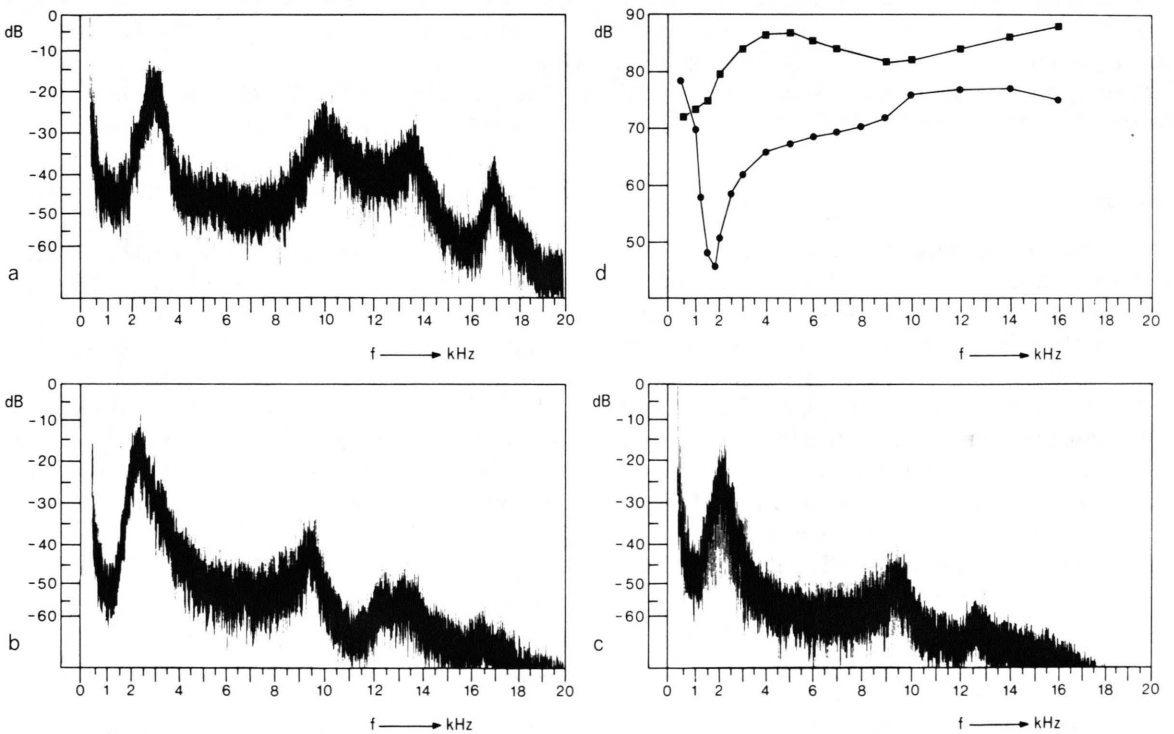

Fig. 2 a–c. Audiospectrographs of calls of *C. panzeri* (a), *C. dentipes* (b), and *C. punctata* (c). 2 d. Threshold curves of both receptor units of the right mesothoracic tympanic organ of *C. punctata* (8). The ordinates in a–c are given in relative rather than absolute units. For d, 0 dB = $2 \cdot 10^{-5}$ N/m^2.

by Jansson [1, 5]. As expected the frequencies are lower than those of the smaller species studied to date (3–5 kHz; [1, 3, 5]). The course of the threshold curves of both receptor units of the mesothoracic tympanic organ of *Corixa punctata* [6, 7] is, especially in the case of receptor unit A1, well fitted to the frequency spectrum of the emitted sounds (Fig. 2c and d). Like the males of a few species of the Genera *Cenocorixa, Palmacorixa* and *Sigara* [1, 3, 5, 8] the males of *Corixa panzeri* can also stridulate calls with different temporal patterns. For males of some species of the genus *Cenocorixa* a complete call serves as a calling signal faciliating pair formation, the initial part of the same call as an agonistic signal. A similar function may possibly by served for *Corixa dentipes.*

In contrast to the genus *Cenocorixa* [1, 5] there is no clarity about the role stridulation plays in the mating behaviour of the central European Corixids. Copulation also occurs without prior stridulation in the species studied here, by Schaller [9] and by Finke [3]. In the species *Sigara striata* [3, 9], *Corixa panzeri* and *Corixa dentipes* several males as a rule stridulate together. An analysis of these chorus stridulations and of the bioacoustic behaviour in the field is in preparation.

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