GENITAL STRIDULATION IN *PSILOGRAMMA MENEPHRON* (SPHINGIDAE)

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Males of *Psilogramma menephron* (Cramer) and *Psilogramma jordana* Bethune-Baker produce sounds by rasping scales on the dorsal surfaces of the genitalic valves against needle like spines that are located on the posterior edge of the eighth tergite. There are no significant differences between the stridulatory structures of the 2 species. Temporal characteristics of the sound of *P. jordana* have been described by Robinson & Robinson (1972), and I recorded the sounds of *P. menephron* at the Bishop Museum Field Station (Wau Ecology Institute) at Wau, New Guinea.[1] Its sound differs from that reported for *P. jordana*. The conclusions of Robinson & Robinson (1972) regarding the frequency output of the stridulatory mechanism are incorrect.

The moths were taken at night at an incandescent bulb, and when grasped and manipulated in the hand, they produced sibilant tss tss sounds. These sounds were emitted in groups that were irregular in duration (from less than 1 to more than 4 seconds) and rhythm.

Analysis of the recorded sounds[2] reveals the following: each tss sound is composed of a variable number of acoustical units (pulses), and there is no structure within a pulse that would suggest the actual nature of the spine-scale stridulatory mechanism (Fig. 1A). The sound spectrum is continuous from 1 to about 14 kilohertz (Fig. 1B) and within this range there are no especially dominant frequencies. The time characteristics of the pulses and periods of portions of 3 pulse groups are given in Table 1. Pulse frequencies were 11.1–12.5 Hz (26.5°).

DISCUSSION

The sounds of the 2 species are similar though not identical. The pulses of *P. menephron* were emitted in groups, but no grouping is apparent in the pulse train figured by Robinson & Robinson (1972) for *P. jordana*. The pulse recurrence frequency of *P. menephron* (ca 12 Hz at 26.5°) is about 2× that of *P. jordana* (temperature unknown). Pulse length in *P. jordana* is about 2× that of *P. menephron* (0.14 versus 0.07 sec).

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[1] This research was performed during the 1969 Alpha Helix Expedition to New Guinea; the program was supported by the National Science Foundation under grant GB 8400 to the Scripps Institution of Oceanography.

[2] Recordings were made with a Uher 4000 Report-L tape recorder at 7.5 ips, and an Electro-Voice 655C dynamic microphone. Analysis was made with a Sona-Graph with an analyzing band width of 300 Hz.

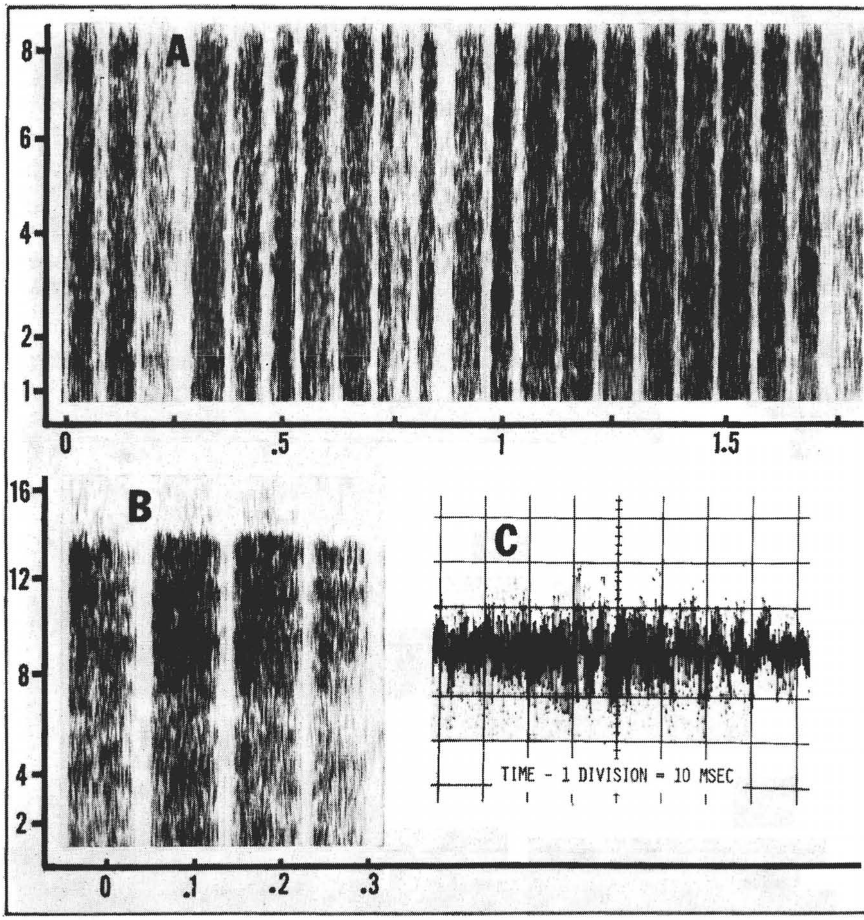

Fig. 1. Moth sounds: (A) audiospectrogram showing a long sequence of pulses (vertical axis = frequency in kilohertz; horizontal axis = time in seconds; (B) audiospectrogram with frequency and time axes doubled, showing the broad carrier frequency spectrum; (C) oscillogram showing pulse of sound with its beam deflection frequency of several thousand (estimated 10,000) per second. Recording temperature for all sounds figured was 26.5°C.

It is not possible to determine the actual mechanics of sound production at the level of spine-scale impact from simple tape recordings, as attempted by Robinson & Robinson (1972). They counted oscilloscopic beam deflections, compared this with counts of spines and scales, and suggested that each beam deflection was a spine-scale impact (they estimated an impact frequency of 1,430 Hz). The audiospectrogram (Fig. 1B) shows that the spectrum is continuous from 1 to at least 14

TABLE 1. Pulse characteristics of portions of three pulse groups.

Group No.	Pulse Length (sec)				Pulse Period (sec)			
	x̄	Range	s.d.	n.	x̄	Range	s.d.	n.
1	0.07	0.06–0.09	0.01	19	0.09	0.08–0.13	0.01	19
2	0.07	0.03–0.08	0.01	23	0.08	0.07–0.12	0.01	22
3	0.07	0.03–0.11	0.02	23	0.09	0.06–0.12	0.12	22

KHz, and no spine-scale impact frequency is evident amid the myriad of carrier frequencies. (1) The oscilloscope beam deflection is the result of averaging hundreds of frequencies at many different energy levels. (2) Even in the simple (by comparison) file and scraper stridulation of Tettigoniidae, a 1 to 1 relation does not exist between unit impact and sound output: the acoustical output of a single file-tooth impact is a complex wave of several cycles (Sugo, 1966). (3) Actually, the oscillogram given for *P. jordana* does not appear to be completely resolved into individual beam deflections. By using a fine, low-intensity beam, fast film, and a sweep speed of 100 cm/sec I was able to resolve the sound of *P. menephron* to an estimated 10,000 beam deflections/second (Fig. 1C),[3] a figure of no real meaning or descriptive significance when compared with the acoustical parameters that were determined audiospectrographically.

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[3] Tektronix oscilloscope 564, 3A72 amplifier, and 2B67 time base unit; Tektronix C30 camera.

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