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Two cases of gynandromorphs in Orthoptera Tettigoniidae (Insecta)

Abstract - The author reports the gynandromorphs of two small species of Tettigoniidae, *Leptophyes punctatissima* (Bosc, 1792) collected in Corsica and *Ctenodecticus siculus* (Ramme, 1927) collected in Sicily, and describe their morphological and biometrical characteristics.

Riassunto - *Due casi di ginandromorfi in Orthoptera Tettigoniidae (Insecta).*
L'autore riporta due casi di ginandromorfi di due piccole specie di Ortotteri Tettigoniidae, *Leptophyes punctatissima* (Bosc, 1792) raccolto in Corsica e *Ctenodecticus siculus* (Ramme, 1927) raccolto in Sicilia, descrivendo le loro caratteristiche morfologiche e biometriche.

Key-words: gynandromorph, *Leptophyes punctatissima*, *Ctenodecticus siculus*, biometry.

Gynandromorphism is the occurrence of individuals showing a phenotipic combination of male and female characters, with a distinct demarcation between male and female structures. According to Aw & Levin (2008), the remarkable phenomenon of gynandromorphism throws doubt onto the certainty of late establishment of the midline in a wide range of phyla. What is truly remarkable is that the male-female division takes place precisely at the left-right midline of the animal.

Gynandromorphs are found in Insecta (Lepidoptera, Diptera, Ephemeroptera, Blattodea, Phasmatodea, Orthoptera, Plecoptera, Hemiptera, Coleoptera, Hymenoptera, Megaloptera), as well as in Arachnida, Crustacea and Aves (Chopard, 1938; Nickle, 1983; Martini et al., 1999; Bowles et al., 2007; Aw & Levin, 2008).

Due to the evident sexual dimorphism, in Orthoptera gynandromorphism seems more frequent than in other taxa and rather numerous instances of this phenomenon have been reported (e.g.: Chopard, 1938; Friauf, 1947; Nickle, 1983; Maeno & Tanaka, 2007; Vlk, 2008). I had the chance to collect two gynandromorphs belonging to two species of Tettigoniidae, that I will describe here.

Material and methods

Collecting data of gynandromorphs: *Leptophyes punctatissima* (Bosc, 1792) (Phaneropterinae), Corsica, Vizzavona Forest, 24.VIII.1977, B. Massa. *Ctenodecticus siculus* (Ramme, 1927) (Tettogoniinae), Sicily, Is. Lunga (Trapani) 24.VI.2009, B.Massa (both preserved in the collection of the author, University of Palermo).

Series of images of specimens with different focal planes were taken using a Nikon Coolpix 4500 digital camera, mounted on a Stereomicroscope Optech EMX-210-2, and were integrated using the freeware CombineZP (Hadley, 2008). To compare gynandromorphs with males and females, measurements on mounted specimens of both sexes were taken using a digital calliper (preciseness 0.01 mm).

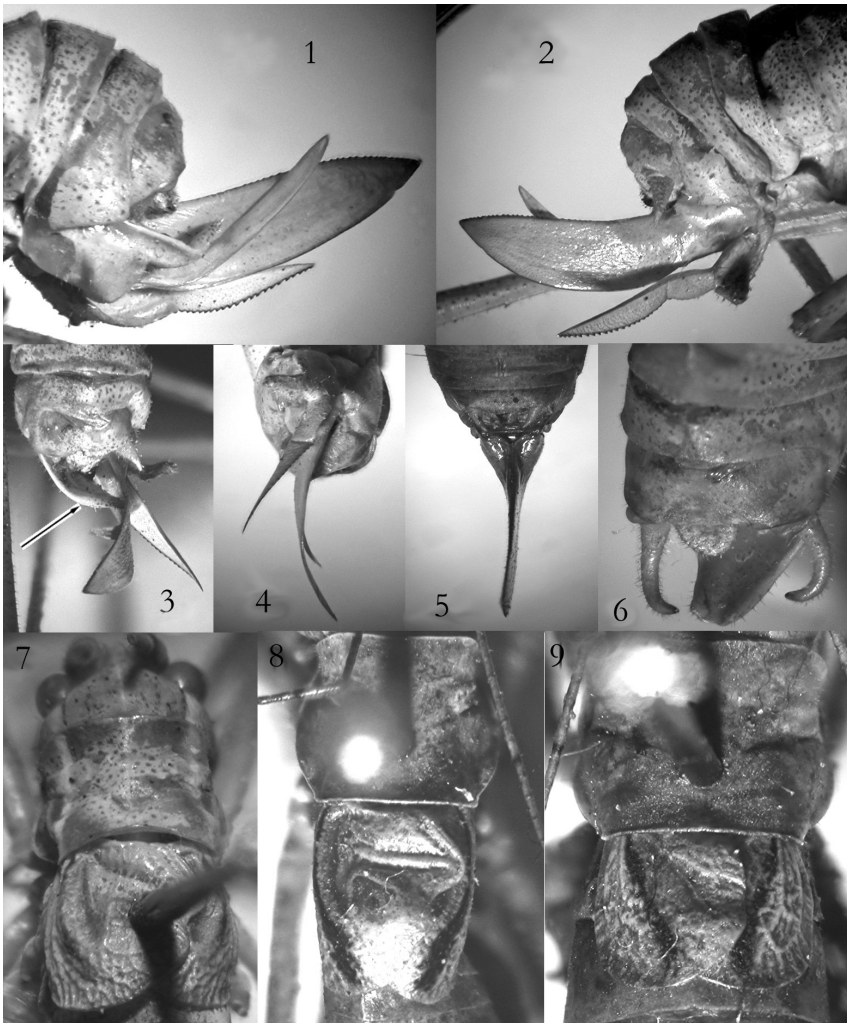
Results and discussion

Leptophyes punctatissima. The entire right side is female, the left side being male. Sexual male processes consist of an incomplete subgenital plate and a complete cercus (figs 1, 3; compare with a normal male in fig. 6). Half ovipositor and female cercus are present on the right (figs 1, 2, 3, 4; compare with a normal female in fig. 5). Tegmina show an intermediate pattern (fig. 7) between a normal male (fig. 8) and a normal female (fig. 9).

Biometrics. The gynandromorph is very small in size, less than a small male (table 1). In *L. punctatissima* the ratio between the length of pronotum and that of tegmina is reversed, males have 0.81 ± 0.07, females 1.55 ± 0.14; in the gynandromorph it is 0.83, that is similar to that of males. The incomplete ovipositor of the gynandromorph is very short; the ratio between the length of hind femurs and that of the ovipositor in normal females is 2.18 ± 0.11, while in the gynandromorph is 2.59.

Table 1. Biometrics of males, females and one gynandromorph of *Leptophyes punctatissima*. Specimens have been collected in Corsica and in Sicily.

Sex	Total length (from head to apex of abdomen)	Length of hind femurs	Pronotum length	Length of tegmina	Ovipositor length
Males (n = 10)	12.3 ± 0.46	13.3 ± 0.91	2.1 ± 0.14	2.6 ± 0.22	
Females (n = 10)	16.5 ± 1.34	16.1 ± 0.42	2.7 ± 0.14	1.7 ± 0.07	7.4 ± 0.57
Gynandromorph	11.6	11.9	1.9	2.3	4.6



Figs 1-9. *Leptophyes punctatissima*. 1-4 and 7: Gynandromorph. 1 - left side view of last male segments of abdomen; 2 - right side view of last female segments of abdomen; 3 - last segments of abdomen from above (arrow shows male cercus); 4 - last segments of abdomen from below; 5 - last segments of abdomen of a female from above; 6 - last segments of abdomen of a male from above; 7 - head, pronotum and tegmina of gynandromorph; 8 - pronotum and tegmina of a male; 9 - pronotum and tegmina of a female.

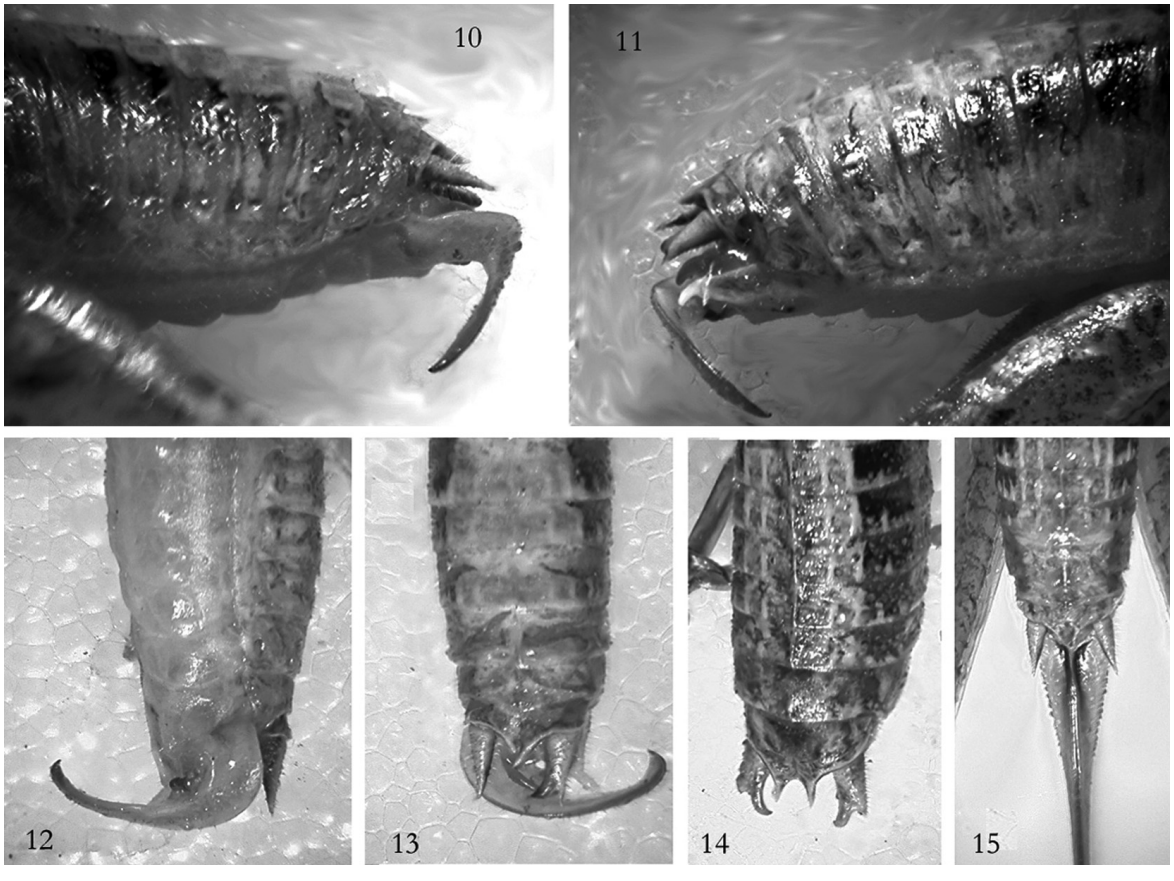
Ctenodecticus siculus. The entire right side is male, the left side being female. Sexual male processes consist of an incomplete subgenital plate, a complete cercus and an incomplete 10th tergum (figs 11, 13; compare with a normal male in fig. 14). Half ovipositor folded on the right, half 10th tergum and a complete female cercus are present on the left (figs 10, 11, 12, 13; compare with a normal female in fig. 15). Within the abdomen I found both male and female gonads, but I was not able to find male titillators. The individual was kept in captivity, but any particular behaviour towards it both by males and females placed in the same cage was observed. While males were singing and trying to attract a female and females showed to accept this behaviour, the gynandromorph appeared not interested to them.

Table 2. Biometrics of males, females and one gynandromorph of *Ctenodecticus siculus*.

Sex	Total length (from head to apex of abdomen)	Length of hind femurs	Pronotum length	Length of tegmina	Ovipositor length
Males (n = 10)	12.0 ± 1.22	11.1 ± 0.83	3.9 ± 0.29	0.95 ± 0.47	
Females (n = 10)	12.0 ± 1.03	12.2 ± 0.51	4.1 ± 0.25	0.59 ± 0.24	10.28 ± 0.42
Gynandromorph	8.5	9.3	3.1	-	2.0

Biometrics. The gynandromorph is much smaller than a small male; its tegmina are completely concealed below the pronotum, the incomplete ovipositor is very short, in comparison with that of a female (table 2).

White (1968), describing an individual of the large grasshopper *Valanga irregularis* (Walker), which exhibited bilateral gynandromorphism, observed that the gonad was an undeveloped ovotestis, the testicular part being XO (2n = 23), proposing that the gynandromorph arose from a binucleate egg, as a result of double fertilization. Nevertheless, according to Barranco et al. (1995) and Bowles et al. (2007), in Orthoptera, bilateral gynandromorphs are thought to result when one of the X chromosomes in an XX zygote is eliminated at the first cleavage division, resulting in an animal that is part phenotypically and genotypically male and part female, including secondary sexual characteristics.



Figs 10-15. *Ctenodecticus siculus*. 10-13: Gynandromorph. 10 - left side view of last female segments of abdomen; 11 - right side view of last male segments of abdomen; 12 - last segments of abdomen from below; 13 - last segments of abdomen from above (note the female cercus on the left and the male cercus on the right); 14 - last segments of abdomen of a male from above; 15 - last segments of abdomen and ovipositor of a female from above.

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