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Description and bioacoustics of a new species of the new genus *Pterodichopetala* from Mexico (Insecta: Orthoptera: Tettigoniidae: Phaneropterinae)

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Abstract

Pterodichopetala cielo n. gen. n. sp. from Mexico is here described. The song of the male is outlined and affinities with the genera *Dichopetala* Brunner v. W., 1878 and *Marenestha* Brunner v. W., 1878 discussed.

Key words

Tettigoniidae, Mexico, new genus, new species, bioacoustics

Introduction

During recent expeditions in Mexico, new material was collected and during the determination process these specimens did not fit within the description of any described genus, though being superficially similar to both *Dichopetala* Brunner v. W., 1878 and *Marenestha* Brunner v. W., 1878. Since this new Mexican taxon is obviously different from the two genera mentioned above, a generic separation is needed and outlined below.

The Nearctic and Neotropical genus *Dichopetala* consists, to date, of 22 species mostly distributed in Mexico and the USA. Characteristic of the genus is the female subgenital plate more or less divided into two lobes and all the described species having reduced tegmina shorter than the abdomen. The only taxonomic revision of the genus is by Rehn & Hebard (1914), incorporating 14 species: after that, new species were simply described or transferred to this genus. The species to date assigned to *Dichopetala* show such a great variation in morphology and behavior, that their congeneric identity is strongly questionable. The actual polyphyletic status of the present composition of the genus *Dichopetala* is recently discussed by Buzzetti *et al.*, 2010 with regard to *Cohnia andeana* (Hebard, 1924) a South American species originally described in the genus *Dichopetala*.

Another taxon related to the one here described is the Neotropical genus *Marenestha* Brunner v. W., 1878, described on a single female from Chile as a monospecific genus including *M. inconspicua* Brunner v. W., 1878. Later Hebard (1924) mentions two females and one immature male from Ecuador, assigning that material to *M. inconspicua*, although doubting if the specimens he examined could belong to an undescribed species. More recently Elgueta *et al.* (1999) and Braun (2008) reported the genus from Chile and Ecuador respectively. According to Bruner (1915), this genus is characterized by having the "deflexed lobes of the pronotum attached by an acute angle, their posterior margin obliquely truncate, the humeral sinus nearly absent. Wings abortive. Anterior tibiae nearly spineless above".

Material and methods

Specimens were collected during day and night time, reared in captivity and fed with lettuce, peach leaves and host plants (*Stevia monardifolia* Kunth and *Tagetes lunulata* Ortega), then killed with potassium cyanide. After killing, all specimens were eviscerated, filled with blotting-paper and dry mounted on pins.

Sounds of 8 males were recorded during lab rearing in net cages (20×20×20 cm) framed of wood and surrounded by foam. Temperature was 24 °C; a Roland Edirol R09 digital recorder (frequency response 20 Hz to 22 kHz) was used for recording, then the tracks sampled with CoolEdit 2.0 at 44.1 kHz, 16 bit, FFT size 1024. No sound emission by females was observed.

Measurements (mm) were taken with a Digital Motic microscope. For each measurement min. and max. are given, followed by the holo- or allotype measurement and average between brackets.

Abbreviations

UNAM: Universidad Nacional Autónoma de México, Ciudad de México, México.

ITCV: Instituto Tecnológico de Cd. Victoria, Tamaulipas, México

ANSP: Academy of Natural Sciences of Philadelphia, USA.

FMB: Filippo Maria Buzzetti private collection, Arzignano, Italy.

PF: Paolo Fontana private collection, Isola Vicentina, Italy.

Pterodichopetala n. gen.

Type species.— *Pterodichopetala cielo* n. sp., described below.

Diagnosis.— This genus is similar to *Marenestha* Brunner v. W., 1878 and *Dichopetala* Brunner v. W., 1878, but its (so far) only member has the pronotum square in cross section with lateral lobes inserted to the disc at a right angle, forming lateral carinae slightly out-curved. The pronotal disc is pentagonal with fore margin straight and hind margin angulate. This combination of pronotal characters is the peculiar feature of this new genus and is not found in the other two compared genera. *Pterodichopetala* shares characters of both *Marenestha* and *Dichopetala*, such as wing development, leg spinulation and ovipositor shape, but the pronotal character states in combination with these are of *Pterodichopetala*.

Pterodichopetala cielo n. sp.

Material examined.—México, Tamaulipas, Gómez Farías, Reserva de la Biosfera El Cielo, Ejido La Gloria, 1629 m., lat 23° 2' 51.7" N, long 99° 15' 2.9" W; 23 August 2009, 16♂♂ (adult) 7♀♀ (adult); 23



Fig. 1. *Pterodichopetala cielo* n. sp., living male from México, Tamaulipas, Gómez Farías, Reserva de la Biosfera El Cielo, Ejido La Gloria, 23 August 2009. For color version, see Plate VII.



Fig. 3. Male left cercus in external lateral view. For color version, see Plate VII.

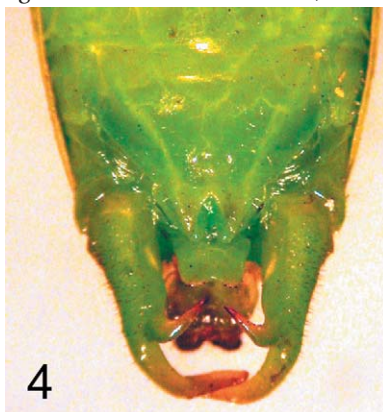


Fig. 4. Male terminalia in ventral view. For color version, see Plate VII.

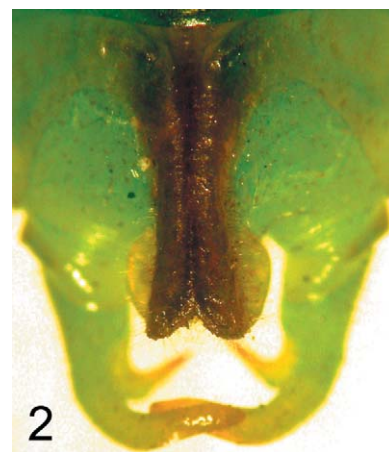


Fig. 2. Male terminalia in dorsal view. For color version, see Plate VII.

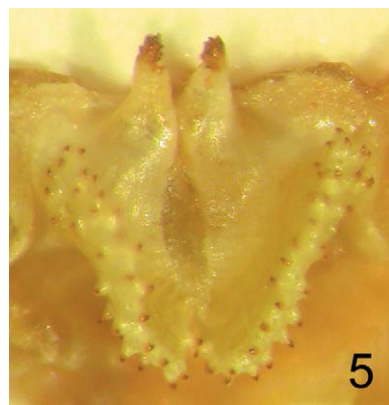


Fig. 5. Male titillators. For color version, see Plate VII.

Oct. 2009: 10 ♂♂ (adult), 6 ♀♀ (adult), 2 ♂♂ (nymphs), 2 ♀♀ (nymphs); 7 Nov. 2009: 20 MALES (adult), 26 ♀♀ (adult), 3 ♀♀ (nymphs). Specimens retained senior author's collection.

Type depository.—♂ Holotype: UNAM; ♀ Allotype: UNAM; Paratype: 6♂♂ 5♀♀.: ITCV; 7♂♂ 1♀: FMB; 1♂: ANSP; 1♂: PF.

Diagnosis.— General color green (Fig. 1); disc and lobes of pronotum squarish in transverse section; tegmina slightly longer than abdomen; male cerci specialized; male subgenital plate longitudinally constricted in middle by deep emargination on basal and distal margins; female ovipositor longer than head and pronotum together.

Holotype description.—General color green; antennae partly lacking, light brown; white stripe from hind margin of eyes to pronotum roughly marked; large dark marking on occiput behind eyes; pronotal disc brown dotted; fore and hind margins of pronotal disc brown; insertion of lateral pronotal lobes to pronotal disc white; basal margin of tegmina with two dark markings, the inner larger and more or less transverse, the outer smaller and approximately

longitudinal; edges of stridulatory apparatus brown; upper and lower margins of tegmina brown, black spotted; apex of cerci (apical and internal tooth) and last abdominal tergite process dark brown.

Fastigium of vertex compressed, short, tubercle-like, divided from the facial fastigium by a distance equal to its elevation. Pronotal disc pentagonal with fore margin weakly concave-straight and hind margin convex-angulate, divided by typical sulcus in prozona (more or less 2/3 of pronotum in the middle) and metazona (more or less 1/3 of pronotum in the middle). Typical sulcus on pronotal disc as wide U, deeply cutting the strongly developed lateral carinae of pronotum and extending onto middle of pronotum lateral lobes in form of a groove. Tegmina with prominent venation, ovately elongate, entirely covering the abdomen and extending over the last tergite process. Hind wings vestigial. Last abdominal tergite (Fig. 2) with long and stout process producing backward, longitudinally carinated above, with apex truncated and this surface medially impressed, laterally with apical side lobes produced ventrally. Cerci (Fig. 3) curved upward and inward on the distal half, tapering toward blunt spatulated apex and with a internal sharp hook-like process on basal third. Subgenital plate (Fig. 4) longitudinally constricted in the middle by deep emarginations on basal and distal margins,



Fig. 6. *Pterodichopetala cielo* n. sp., living female from México, Tamaulipas, Gómez Farías, Reserva de la Biosfera El Cielo, Ejido La Gloria, 23 August 2009. For color version, see Plate VII.

the basal wider and deeper, the distal smaller and V-shaped. Hind coxae with laminate, blunt, downward-curved process on hind margin. Femoral genicular lobes bidentate with one spine on each side, spine very small on outer lobes of hind femora. Ventral femoral margins unarmed. Fore tibiae with dorso-external margin armed with 3 spines, not including the distal spine. Internal genitalia (Fig. 5) compound of two approximately triangular specular parts, each part bearing a row of black denticles distally and a tuft of black denticles proximally.

Measurement ranges of males in mm; within parens are given measurements of holotype followed by averages; body length (from frons to tip of hind femora) 17.40-21.51 (21.51, 19.46); midline pronotum length 3.08-3.60 (3.60, 3.29); caudal pronotal width 3.27-3.65 (3.65, 3.46); length of tegmen 11.77-11.94 (11.94, 11.87); length of hind femur 12.90-16.65 (16.65, 14.31); length of subgenital plate (in the middle) 1.05-1.23 (1.23, 1.12).

Allotype description.—Similar to holotype, differs in body color being completely green, lighter on head, limbs, ventral abdomen surface and ventral margin of tegmina, smaller dark marking on occiput. Humeral sinus absent. Ovipositor (Fig. 6) longer than head and

pronotum together, evenly curved upward, lower margin straight on basal half, distal third crenulated on upper and lower margins. Subgenital plate with central portion weakly chitinous, more chitinous on sides.

Measurements ranges of females in mm; within parens are given measurements of allotype followed by averages; body length (from frons to tip of ovipositor) 17.45-21.14 (20.99, 19.62); midline pronotum length 3.11-3.43 (3.33, 3.22); caudal pronotal width 2.86-3.82 (3.82, 3.53); length of tegmen 11.05-13.05 (13.05, 12.38); ovipositor length 7.19-8.31 (7.49, 7.67); hind femur length 11.70-14.83 (14.83, 13.29).

Derivatio nominis.—*Pterodichopetala cielo* n. sp. is named after the Reserva de la Biosfera El Cielo, the protected natural area of Tamaulipas where this new species was collected. The generic name derives from the greek *pterón* = wing and *dichopetala*, recalling the superficial similarity with the genus *Dichopetala*.

Bioacoustics.—Sounds of males were recorded under the following conditions: male alone, male and female in the same cage, singing male and another male in the same cage. Only the song form as

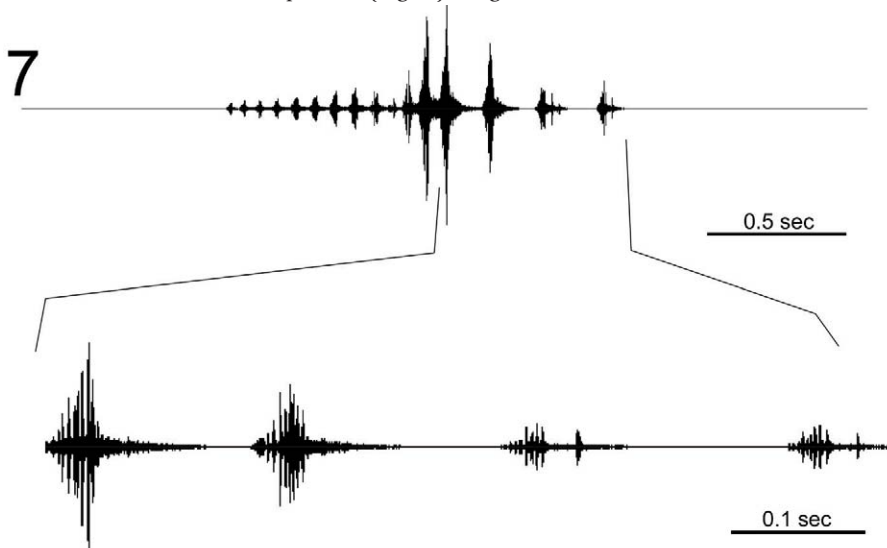


Fig. 7. *P. cielo* n. sp., male calling song time-domain pattern, one echeme with terminal region at higher time resolution.

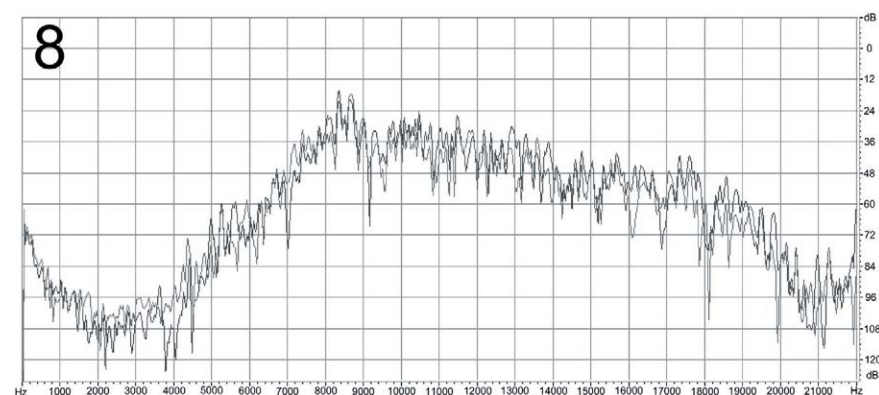


Fig. 8. Spectral composition of the calling song of *P. cielo*.

here presented was observed.

The calling song of *P. cielo* n. sp. consists of echemes (0.94 to 1.48 s, average 1.31 s) emitted at variable intervals. Each echeme (Fig. 7) is composed of 9 syllables of increasing volume followed by 4 louder syllables and ending with a last isolated syllable similar to the first nine. Spectral composition of the song (Fig. 8) was taken from the center of the loudest syllable and shows there is little sound energy below 5 kHz. The spectrum extends close to the ultrasonic boundary, but the equipment used does not allow verification of any potential ultrasonic component.

Song activity starts during the evening and lasts the whole night, ending at first daylight. The singing male perches on the vegetation and then emits the song. No responding females were observed.

Two male nymphs were reared in captivity and fed with lettuce and peach leaves. They reached adulthood simultaneously on September 7th 2009. One started singing during the evening of September 9th.

Discussion

The generic assignment of this new taxon was questioned among the authors of the present note on the basis of the possible presence of a South American genus new to Mexico (*i.e.*, *Marenestha*) and the presence in Mexico of a very diversified and mostly Central American genus, *i.e.*, *Dichopetala* Brunner v. W., 1878.

The humeral sinus is nearly absent, although present and recognizable in *M. inconspicua* Brunner v. W. In *P. cielo* this character is scarcely detectable, if not completely absent. In males of this species, a light sinuation is present on the upper part of the hind margin of the pronotal lateral lobes (here considered as humeral sinus), while completely absent in females.

The shape of male cerci in *P. cielo* n. sp. resembles, in some ways, the shape of those of *Dichopetala cultricerca* Strohecker 1945, of which the female is unknown. Furthermore, *D. cultricerca* is a striking taxon, being to date the only species of that genus with forewings longer than head and pronotum together.

Nevertheless, differences between *P. cielo* and *Dichopetala* spp. can be detected in the shape of the pronotum, "in *Dichopetala* spp not at all, or more or less constricted mesad, dorsum more or less arcuate in transverse section; caudal margins of lateral lobes more or less arcuate or subtruncate" (Rehn & Hebard 1914). In *Marenestha* pronotum lateral lobes are acutely inserted on the pronotal disc. Differences occur also in the development of the forewings, not covering the entire abdomen in *D. cultricerca*, while extending beyond the abdomen tip in *P. cielo*. There are differences in the spination of the genicular lobes: *Dichopetala* spp. bear one spine on fore internal and external genicular lobes plus two spines on each genicular lobe of the mid and hind legs, while all genicular lobes

are two-spined in *P. cielo*.

The ovipositor of *Pterodichopetala cielo* n. sp. is different from that of *Marenestha inconspicua*, being longer and evenly up-curved instead of short and suddenly up-curved, with different crenulation of dorsal and ventral margins, more similar to the ovipositor of some species of *Dichopetala*.

For all these differences, the new taxon here described is assigned to the new genus *Pterodichopetala*, and it is here postulated that *P. cielo* n. sp. may represent an annectant taxon linking the genus *Dichopetala* to the genus *Marenestha*.

Pterodichopetala cielo n. sp. lives on annual grasses of the Compositae family. Its main host plants are as follows: *Stevia monardifolia* Kunth, *Tagetes lunulata* Ortega and *T. patula* L. Host plants are considered indigenous to Mexico and Central America. Its distribution ranges from 1400 to 3000 m. Females lay the eggs in the soil from September to November-December; they overwinter as eggs and hatch from May to July; the species exhibits one generation per year.

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