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Karyology of species belonging to the genera *Agriacris* Walker 1870 and *Staleochlora* (Roberts & Carbonell 1992) with some considerations of romaleid phallic structures (Orthoptera, Acridoidea)

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Abstract

An up-dated list of species of the genera *Agriacris* and *Staleochlora*, whose karyotypes were previously published, is accompanied by fresh information on the chromosomes of *A. jucunda* and *S. fruhstorferi*. The connection between cingulum and dorsal valves in the phallic structure of both species is discussed.

Key words

Grasshopper, chromosomes, male genitalia

Introduction

In 198 Mesa *et al*. published a list of the main karyological characters of nearly 300 Neotropical grasshopper species, 2/3 of them previously unknown cytologically. Among those species, 6 were included in the genus *Elaeochlora*. Ten years later Roberts & Carbonell (1992) published a revison of the genera *Agriacris* and *Elaeochlora*, considering the last genus a junior synonym of *Agriacris* and erecting for its species the new genus *Staleochlora*.

In the present paper, the identifications made in Mesa *et al*., (1982) are corrected according to the revision of Roberts and Carbonell. Information is also reported on 2 species previously unknown cytologically: *Agriacris jucunda* (Walker 1970) and *Staleocholora fruhstorferi* (Bolivar 1891). Drawings of the phallic sclerites and discussion of their connections in those species are given, as well as an illustration of the female of *S. fruhstorferi* (Fig. 1).

Materials and methods

In all cases cytological slides were prepared by conventional staining methods, previous fixation in Carnoy I, preservation under cold temperatures over several days and squashing in a drop of lacto-acetic orcein 0.5% after softening the tissues for a few minutes in acetic acid 45% aqueous solution.

Up-dated identification list of species of the genus *Agriacris* and *Staleochlora* cytologically studied by Mesa *et al.* (1982) with fresh information on 2 new species: *A. jucunda* and *S. fruhstorferi*

Agriacris jucunda (Walker 1870): Venezuela (Miranda) Colonia Tovar, 1800 m alt., 16.III.1995 — Mesa, A.; Garcia-Novo, P.C. (6073 to 6080).

Agriacris basalis (Bruner, 1913) n. comb.: Bolivia (Sta Cruz de la Sierra) Naranjales, 18.IV.1962 — Mesa, A.(2213 to 2200).

Staleochlora viridicata orientalis (Roberts & Carbone11 1992): Uruguay (Florida) Casupa, 12.XI.1956 — Mesa, A. (1151 to 1154); Uruguay (Florida) Casupa, 09.1.1955 — Mesa, A. (1101 to 1103); Uruguay (Tacuarembo) Caraguata, 26.I.1956 — Mesa, A. (1146 to 1150); Uruguay (Montevideo) Carrasco, 28.II.1956 — Mesa, A. (1149); Uruguay (Maldonado) Cerro de las Animas, 06.V.1951 — Mesa, A. (1025); Uruguay (Rivera) Cerro Batovi, 23.III.1963 — Mesa, A. (2289); Brasil (Rio Grande do Su1) Tramandai, 14.XI.1964 — Carbonell, C.S.; Mesa, A.; Monne, M.A. (3342*,3207,3220); Brasil (Rio Grande do Su1) Osorio, Barro Vermelho, 12.II.1964 — Carbonell, C.S.; Mesa, A.; Monne, M.A. (3555*); Brasil (Rio Grande do Sul) 33 km N de Passo Fundo, 25.II. 1964 — Carbonell, C.S.; Mesa, A.; Monne, M.A. (2675*).

Staleochlora viridicata viridicata (Roberts & Carbone11 1992): Argentina, Carcarana, 21.XI.1965 — Carbonell, C.S.; Mesa, A.; Monne, M.A (2947* — 2995*); Argentina (Chaco) Resistencia, 26.II.I965 — Carbonell, C.S.; Mesa, A.; Monne, M.A. (2989*).

Stalechlora viridicata paraguayensis (Roberts & Carbonell 1992): Paraguay, Central Luque, 03.III.1965 — Carbonell, C.S.; Mesa, A.; Monne, M.A. (2906*).

Stalechlora viridicata (Serville 1839), specimen intermediate between ssp *orientalls* and *paraguayensls* (Carbonell, pers. com.). Paraguay (Caaguazu) Caaguazu, 12.III.1965 — Carbonell, C.S.; Mesa, A; Monne, M.A. (2777*).

Staleochlora arcuata arcutla (Rehn 1908) n. com.: Brasil (Itirapina) 8 km W de Itirapina, 8.V.1994 — Mesa, A.; Garcia-Novo, P.C.; Ribas, C.C. (6058.)

Staleochlora pulchella brachyptera (Brunner, 1913) comb. n. and stat n.: Bolivia (Sta. Cruz de La Sierra) Naranjales, 18.IV.1962 . Mesa, A. (2354*, 2432).

Staleochlora trilineata (Serville 1831): Brasil (Rio de Janeiro) Sernambetiba, Guanabara, 4.XI.1962 — Mesa, A.; Becker, J, (1882, 1877, 1889).

Stalechlora fruhstorferi (Bolivar, 1891): Brasil (Santa Catarina) 12 km NW of Corupa, 25.II. 2002 — Mesa, A.; Portugal, C.B.; Miyoshi, A.R. (1 male and 1 female with out identification numbers).

(Identification numbers followed by asterisks correspond to specimens photographed and sent to Prof. Carbonell in September 2002 for re-evaluation of the early Mesa *et al.*, 1982 identification).

Results

Phallic Structure .—The phallic structure of *S. fruhstorferi* is shown in Fig. 2 (a to e) as well as the cingulum and dorsal valves of *S. viridicata* (Figs 2f and g). The cingulum is relatively small and subtriangular in both species, with the caudal border truncated and with greatly reduced apodemes. The dorsal valves are independent parallel structures with the surface finely sculptured and with the basal flexed region connected to the caudal portion of a slightly more sclerotized bar running in the discal region of the cingulum.

The ventral valves connect with the distal extension of the endophallic plate in all the species studied of *Agriacris* and *Staleochlora* as shown in Figs 2a and f.

Karyology

Male meiotic cells of the species *S. fruhstorferi* and *A. jucunda* show similar characteristics, with 23 chromosomes arranged in 11 pairs of autosomes and a univalent X. The autosomes can be grouped as: 4 long pairs, 4 medium-size and 3 small. All 23 chromosomes are acrocentrics as seen in the first anaphase of Figs 3c and d of *S. fruhstorferi*. The long bivalents show 2 or 3 chiasmata, the medium size 1 or 2 and the small bivalents a single one. The 9th pair in decreasing order of size is rather heterochromatic during 1st prophase in both species (Figs 3a and e, arrows) and frequently appears in contact with the already condensed X chromosome as shown in the diplotene of Fig. 3a.

Species of *Agriacris* and *Stalaeochlora* previously studied have similar karyotypes.

Discussion

Until now all the species studied in the genera *Agriacris* and *Staleochlora* show the ancestral karyotype of the Cryptosacci Group (Roberts 1941) of Acridoidea (Saez 1930a, 1930b; Saez 1956a, 1956b; Mesa 1956; Mesa *et. al.* 1982) with 2n=23 (males) 2n=24 (females) karyotypes and a XO male XX female sex determining mechanism.

On the phallic sclerite of Romaleidae species, Roberts (1941, p. 217) says that the dorsal and ventral valves form 4 independently moving processes connected with the ends of the endophallic plates and notes the absence of a sclerotized connection between the base of the dorsal adeagal valves and the median portion of the zygoma.

Dirsh (1956) shows a schematic drawing of the *Romalea microptera* phallic structure and states (p.250): "apical valves small, thin, slightly upcurved with articulated appendices". The dorsal appendices are indeed the dorsal valves, but the basal connection of these valves are not clearly shown and definitely, the drawings do not show any connections with the cingulum, but with the ventral valves that appear as an extension of the endophallic plate.

Rehn and Grant (1959) do not mention which are the connections between the basal portion of the aedeagal valves with either the cingulum or the endophallic plates.

Amedegnato (1976, p. 12) says of species of Romaleidae and Ommexechidae: "sclerites superieurs de l'edeage separes, lorsque ce dernier est present". On page 6, her fig. 24, she presents a schematic drawing of the endophallic sclerites of *Elaeochlora* sp. where the dorsal valves appear connected with the endophallic plate and not with the cingulum, as shown in our drawing of Figs 2a and f.

Roberts and Carbonell (1992) say that the endophallus has "two pairs of apical valves, the upper ones in lateral view appearing as valves of the arch, but in superior view it can be observed there is no arch but paired separated structures, one at the base of each valve". The structure of the dorsal valves and ventral valves as figured in the present paper are in agreement with the last-mentioned authors, but according to the present observations, the dorsal valves are connected with the cingulum, and the ventral valves with the endophallus. In species of the genera *Agriacris* and *Staleochlora* and probably in all Romaleidae, the arch is not a single structure connected with the zygoma, but 2 independent upward flexed basal ends of the dorsal valves, connected with two bars, slightly more sclerotized than the rest of the cingulum, and running parallel to the discal portion of this sclerite.

Acknowledgements

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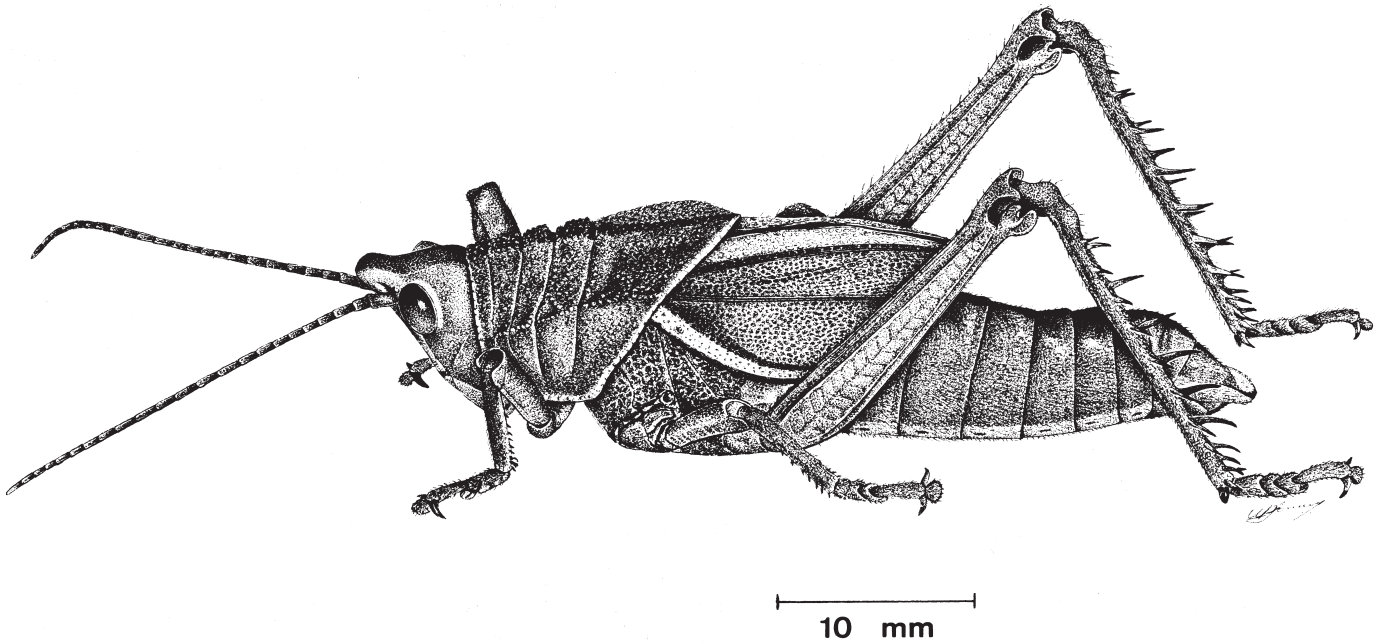

Fig. 1. *S. fruhstorferi* female, specimen from 12 km NW of Corupa (SC) Brasil. Illustrator Jaime Roberto Somera.

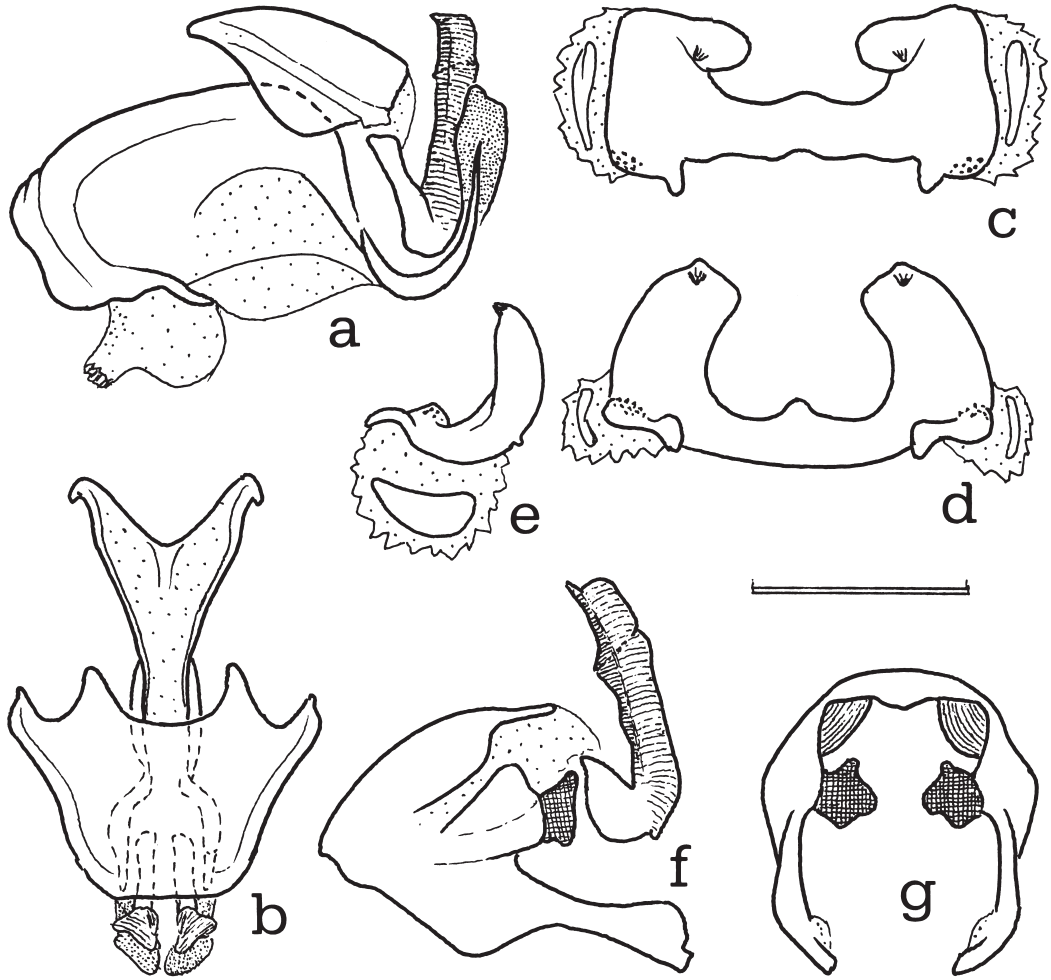

Fig. 2. Phallic sclerites of *S. fruhstorferi* a) lateral view; b) dorsal view; c) epiphallus in dorsal view; d) *idem* in rear view; e) *idem* in lateral view. *S. viridicata orientalis,* specimen from Tramandai (RS) Brasil. f) lateral view of cingulum and dorsal valves; g) rear view of cingulum showing with cross-hatch lines the contact zones with the base of the dorsal valves. (Scale bar = 1 mm).

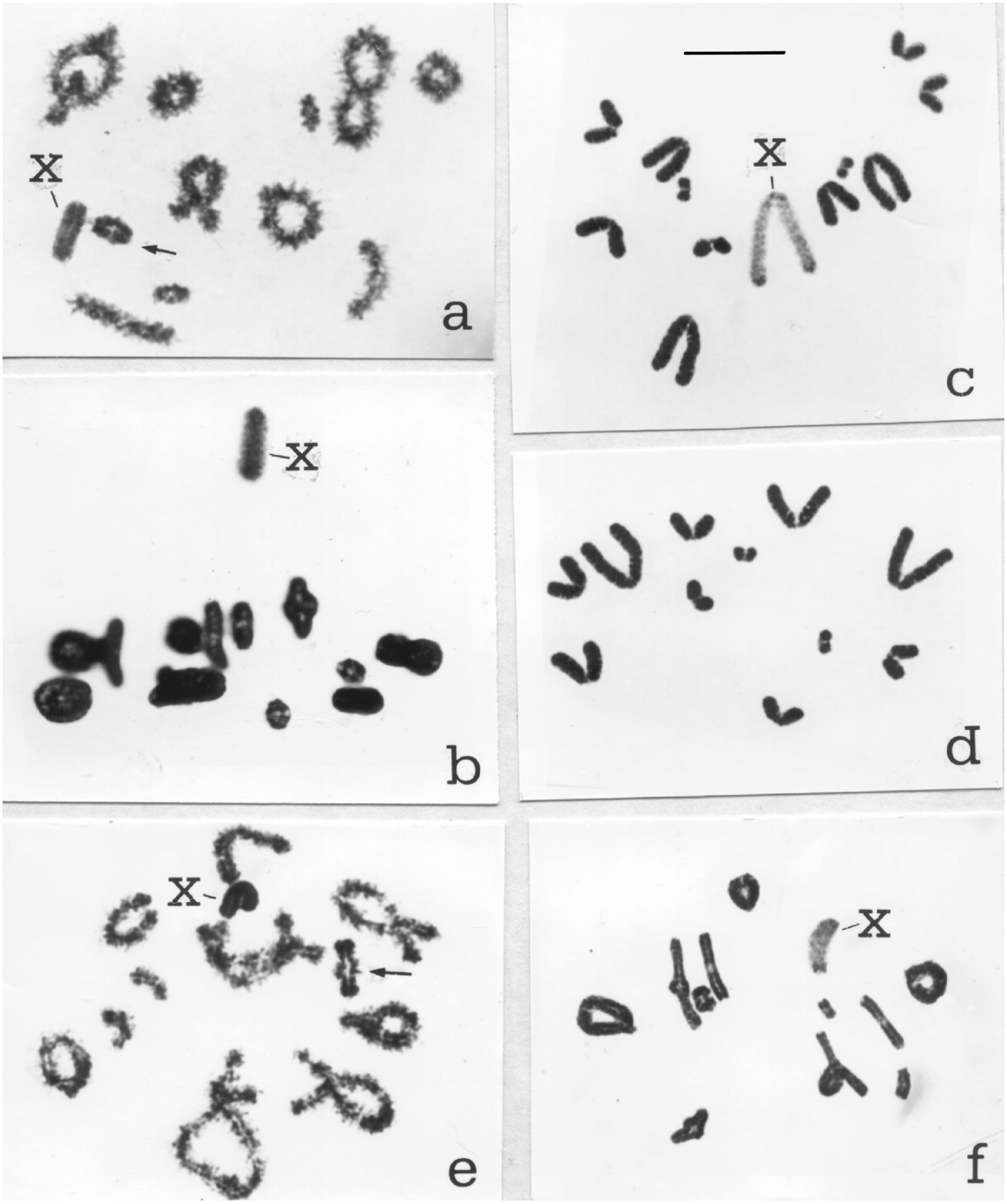

Fig. 3 Meiotic cells. *S. fruhstorferi,* from 12 km NW of Corupa (SC) Brasil: a) diplotene; b) first metaphase; c and d) opposing groups of chromosomes of a single first anaphase. *A.jucunda,* specimen 6073 collected in Colonia Tovar (Miranda) Venezuela: e) diplotene; f) first metaphase. (Scale bar = 10 μ*m)*.