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REDESCRIPTION AND TAXONOMIC POSITION OF *PAGDENIA RUFIPES* MILLER (ORTHOPTERA: ACRIDIDAE), WITH NEW RECORDS FROM SABAH, BORNEO

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ABSTRACT

The grasshopper species, *Pagdenia rufipes* Miller is newly recorded from Borneo. It is redescribed because description on female and genitalia of both sexes were not presented in the original description. The genus *Pagdenia* is considered to be most closely related to the genus *Traulia* and belonging to the tribe Trauliini judging from male characters such as articulated ancorae, medially divided male epiphallus and chitinized large basal fold on phallus.

ABSTRAK

Rekod baru belalang, *Pagdenia rufipes* Miller telah dicatatkan untuk pertama kalinya dari Borneo. Belalang ini telah diperihalkan semula kerana keperihalan mengenai betina dan genitalia kedua-

dua jantina tidak disediakan dalam keperihalan awal spesies. Genus *Pagdenia* adalah bersaudara rapat dengan genus *Traulia* dan tergolong dalam trib Trauliini berdasarkan cirri-ciri jantannya seperti ancorae teratikulasi, ephiphallus jantan di bahagian tengah terbahagi dan lipatan kitin basal pada phallus membesar.

INTRODUCTION

Pagdenia rufipes Miller, 1934 is the only representative of the genus Pagdenia Miller, 1934. Miller (1934) mentioned that it was "a member of the group Coptacrae" but "not closely related to any known genus". However, Pagdenia is now a member of the subfamily Catantopinae, and is assigned to no tribe (Otte, 1995). Catantopinae is highly heterogeneous (Dirsh, 1975), and thus to find a closely related genus with Pagdenia is the first step for revision of this genus.

The genus and species were described based on external morphology of only one male specimen from Kedah, Peninsular Malaysia. Up to now, no specimens of this species have been known except for the holotype male. We recognized one male and two females of grasshoppers from Sabah, Borneo from examination of specimens preserved in the BORNEENSIS, the insect collection of Institute for Tropical Biology and Conservation, Universiti Malaysia Sabah (ITBC, UMS). In addition, we also examined a specimen of macropterous female of this species collected from Endau Rompin, Pahang preserved in the Center for Insect Systematic, Universiti Kebangsaan Malaysia (UKM).

We redescribed this species including female and genitalia of both sexes, because genital morphology can provide important characters for acridid taxonomy. Using these characters, we infer its taxonomic position. Terms and abbreviations of male genital morphology adopted here are mainly based on Eades (2000).

REDESCRIPTION

Pagdenia rufipes Miller, 1934
(Figs. 1-13)

Pagdenia rufipes Miller, 1934: 546.
Pagdenia rufipes: C. Willemse, 1957: 372.

General morphology:
Whole body (Figs. 1-6) punctate densely and rugosely. Head irregulary punctate; fastigium of vertex strongly sloping downwards, broad and slightly concave; width between the compound eyes nearly twice width of the frontal costa between the antenna; frontal carinae parallel, distinct between the eyes and obscured downward; frontal costa evenly project between antennae; antennae filiform, slightly compressed, composed of 20-22 segments; compound eyes large and prominent, about half height of head in lateral view. Prosternal process conical, robust and short, obtuse at apex, not excessing sternal plate. Pronotum subcylindrical, shinning, uniformly and deeply punctate; longitudinal carina faintly present; three transverse sulci in parallel; ratio prozona length/metazoan length 1.5-1.6; hind margin slightly produced triangularly. Mesosternal lobe (Fig. 7) width longer than length; ventral angle rounded. In brachypterous form (Figs. 1-5), tegmina coriaceous, nearly reaching 3rd abdominal tergite, suddenly narrowing in apical 2/5, never overlapping each other; tip pointed. In macropterous form (Fig. 6), tegmina hyline, excessing tip of abdomen, rounded at apex. Fore and mid femora irregularly and weakly foveolate. Hind femora robust, serrate dorsally; length about 3.5 times its greatest width; genicular hood with or without a small apical spine; both inner and outer femoral flanges rounded. Hind tibiae with 6-7 outer and 9 inner marginal spines, and without apical spine on outer margin. Tympanal organs developed. Abdomen punctated distinctly; dorsal longitudinal carina distinct.

Male terminalia.
Tenth tergum (Fig. 8) divided into two with a small furcula shaped

equilateral triangle. Epiproct (Fig. 8) triangular, flat, with a small tubercle on each lateral margin; median furrow shallow, present in basal 1/3. Cerci (Fig. 9) tapering, but the tip slightly broad; apical half compressed laterally and slightly incurved, excessing apex of epiproct. Subgenital plate (Fig. 9) short and globose. Epiphallus (Figs. 10, 11) divided in the middle; ancorae large, articulated with lateral plate, pointed downward, and slightly excurved at apex; lophi small and granulated, situated near the middle, strongly become thin at the half height in anterior view (Fig. 11), slightly twisted in apical half; oval sclerites narrowly oblong. Phallus (Figs. 12) with large chitinized basal fold, formed like triangle prism; dorsal and ventral aedeagal valves slightly upcurved, tapered toward apex. Cingulum with short apodeme; zygoma narrow; rami partly articulated with cingulum, rounded in basal 4/5; central membrane triangular as seen from above.

Female terminalia.
Subgenital plate smooth, without projection in hind margin except egg guide. Comstok-Kellog organ present. Spermathecal vestibule (Fig. 13) small, without any sclerite, gradually narrowed, not excess anterior basivalvular sclerite of ovipositor. Spermathecal caecum (Fig. 13) strongly bent, obtuse apically; a short diverticulm present.

Coloration.
General colour uniformly dark brown. Antennae generally dark brown, ocher on the two apical segments and on the upper part of several basal segments. Maxillary and labial palpi pale yellow, but faintly dark brown apically. Pronotum uniformly dark brown. Posterior part of third epimeron pale yellow. Fore and mid legs generally brownish green or green. Hind femora generally brownish green or green; in male, knee wholly dark brown, and in female, knee dark brown but genicular hood brownish green. Hind tibiae bright red, with a yellowish green pre-genicular band; basal part dark brown; spines with black tip. Hind tarsi bright red. Tegmina dark brown. Sternal plate dark brown. Abdominal sternite light brown. Abdominal tergite generally dark brown; posterior

margin light brown or ocher; lateral and ventral margin ocher. Male subgenital plate ocher at distal subsegment

Measurements (mm).
Male: body length, 17.5-18.0; head width, 4.3-4.6; antenna length, 8.1-8.4; pronotum length, 4.6-4.9; tegmen length, 4.4; hind femur length, 9.6-10.6. Female: body length, 25.5-26.8; head width, 4.8-5.0; antenna length, 9.3; pronotum length, 5.8-6.0; tegmen length, 5.7-6.6 (brachypterous form), 18.8 (macropterous form); hind femur length, 11.8-14.5.

Holotype. Male, (1st label) MALAYSIA / Kedah Peak / 3300-3600 ft. / 19. iv. 1930. / H. T. Pagden; (Second label) Pagdenia rufipes / sp. n. / Det. N. C. E. Miller. (It is preserved in Natural History Museum, London, UK.).

General specimens examined. Male, MALAYSIA, Sabah / KK, Kionsom / 14, vii 2001 / Fredoline Making leg.; female, UKM 5 April 1987 / Han Kwai Hin leg.; female, Weston / 18. VIII. 1986 / leg: Shatol (unclear handwriting); female, PAHANG: Endau Rompin / 19 vii 2002 / M-Shahril-Lizan. All specimens except macropterous female (preserved in UKM) are stored in the collection BORNEENSIS, UMS.

Remarks. According to Miller (1934), the holotype specimen was collected in the place of relatively high elevation (alt. 1000m), while collection sites in Sabah were at low elevations (UKM, about 0m and Kionsom, about 300m). This species seems to be widely distributed in Peninsular Malaysia and Borneo in various elevations.

DISCUSSION

Traluia Stal, 1873 is most closely related to *Pagdenia*, considering the following common characters: Male epiphallus (Figs. 14-15) divided in the middle; ancorae large, excurved and articulated with lateral plate; lophi or a pair of dorsal projecdtions present near the middle of lateral plate; basal fold of phallus enlarged and

chitinized. *Pagdenia* can be distinguished from *Traulia* by the following characters: Lateral stripes are absent on head and pronotum; male 10th abdominal tergite with a pair of furcula.
The genus *Traluia* is a member of the tribe Trauliini Willemse, 1921, and thus *Pagdenia* should be placed in Trauliini. According to Otte (1995), Trauliini comprises only two genera: *Traulia* and *Pseudotraulia* Laosinchai & Jago, 1980. But as mentioned by Laosinchai & Jago (1980), *Pseudotraulia* is not close to *Traulia*, judging from the following characters: Male epiphallus (Fig. 17) not divided in the middle; ancorae not articulated with lateral plate; lobiform lophi present near the lateral sides of epiphallus, basal fold of epiphallus not chitinised like Trauliini. *Pseudotaulia* should be placed into another tribe of Catantopinae. Considering epiphallic characters mentioned above, *Pseudotraulia* seems to be more closely related to Catantopini (Fig. 16, *Xenocatantops*) than to Traulini. But we could not determine which tribe it belongs, because Catantopinae is highly heterogeneous subfamily (Dirsh, 1975) and still contains many genera not assigned into any tribe.

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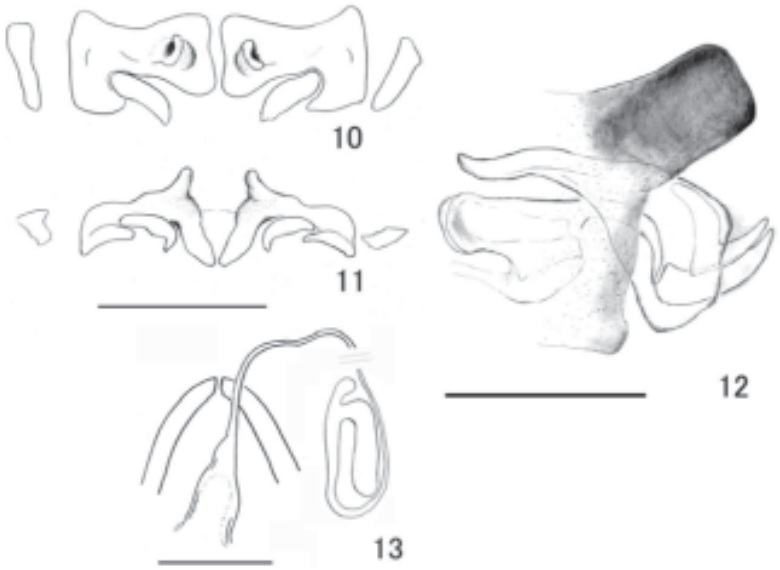
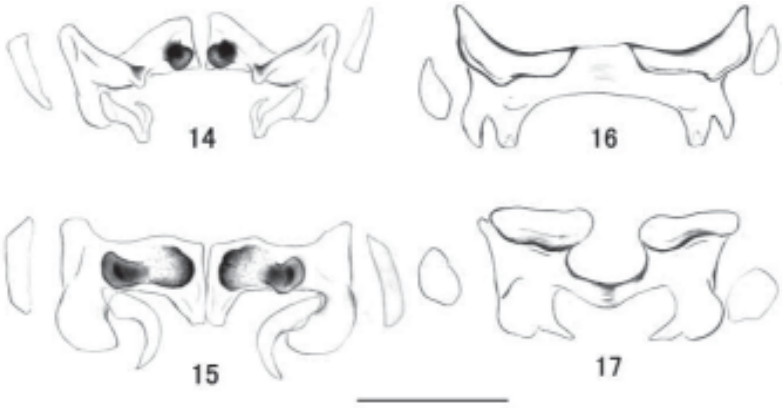
Figs. 1-9 *Pagdenia rufipes* Miller, 1934. 1, male, lateral view; 2, male, dorsal view; 3, female, lateral view; 4, female, dorsal view; 5, holotype male, dorso-lateral view; 6, macropterous female, dorso-lateral view; 7, male sternal plate, ventral view; 8, male terminalia, dorsal view; 9, male terminalia, lateral view. Scale: 1mm.



Figs. 10-13 *Pagdenia rufipes* Miller, 1934. 10, male epiphallus, lateral view; 11, male epiphallus, posterior view; 12, male phallus, lateral view; 13, female spermatheca, dorsal view. Abbreviation in the figures are as follows: Abs, anterior basivalvular sclerite of ovipositor; Sc, spermathecal caecum; Sv, spermathecal vestibule. Scale: 1mm.



Figs. 14-17 Male epiphalli of four catantopine species, dorsal view. 14, *Traulia bimaculata* Willemse, 1932 (Danum Valley, Lahad Datu, Sabah); 15, *Traulia ornata ornata* Shiraki, 1910 (Nanshanhsi, Nantou, Taiwan); 16, *Xenocatantops humilis* Serville, 1839 (Kota Kinabalu, Sabah); 17, *Pseudotraulia cornuata* Laosinchai and Jago, 1980 (Paratype from Fang, Chiangmai, Thailand). Scale: 1mm.