

A New Species of the Earwig Genus *Cranopygia* Burr, 1908 (Dermaptera, Pygidicranidae) from Borneo

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Received January 27, 2014

Abstract—A new species of the genus *Cranopygia* Burr, 1908 (Dermaptera, Pygidicranidae), *C. crockeri* sp. n., is described from North Borneo, Sabah State. *Cranopygia crockeri* sp. n. differs from the congeners in a peculiar structure of the virga and metaparameres and in strongly reduced wings. A detailed morphological description of the new species is given.

DOI: 10.1134/S0013873814090188

In the present paper, a new species of the earwig genus *Cranopygia* Burr. belonging to the basal family Pygidicranidae is described. The representatives of the genus *Cranopygia* sensu lato can be divided into two formal groups: the alate, widely distributed species (for example, *Cranopygia appendiculata* Hincks, 1955) and the apterous species with relatively narrow distribution ranges, which have lost the ability to fly. *C. crockeri* sp. n. described below belongs to the second group. Determination of the phylogenetic relationships between these groups, in particular, the answer to the question whether they are monophyletic groups, or loss of the wings resulted in their inability to fly has independently occurred in different parts of the second group, is important for understanding the peculiarities of the evolution of the earwigs and the insects as a whole.

MATERIALS AND METHODS

The material considered in the study, including slides of the male and female genitalia, was placed in 70% ethanol for constant deposition. Dissection and examination of the morphological structures were carried out in Petri dishes in alcohol. The male genitalia were alkalized using standard technique (during 12–24 h) for removal of soft tissues. The figures were sketched with a drawing tube of a Leica MZ 16 binocular microscope; further drawing and examination were made with a MBS-10 binocular microscope.

The author follows the suprageneric classification of the order proposed by M. Engel and F. Haas (Engel and Haas, 2007), but also includes the fossil Prote-

lytroptera in the group Dermaptera in the rank of a suborder, as it was first suggested by V. Hennig (1981) and later independently proposed by Gorochov and Anisyutkin (Gorochov and Anisyutkin, 1998). The nomenclature of structures of the female genitalia used in the study follows that by K.D. Klass (2003).

The whole material examined, including the holotype of the new species, is deposited in the collection of the Zoological Institute of the Russian Academy of Sciences in St. Petersburg (ZIN).

Suborder **NEODERMAPTERA** Engel, 2003

Infraorder **PROTODERMAPTERA** Zacher, 1910

Family **Pygidicranidae** Verhoeff, 1902

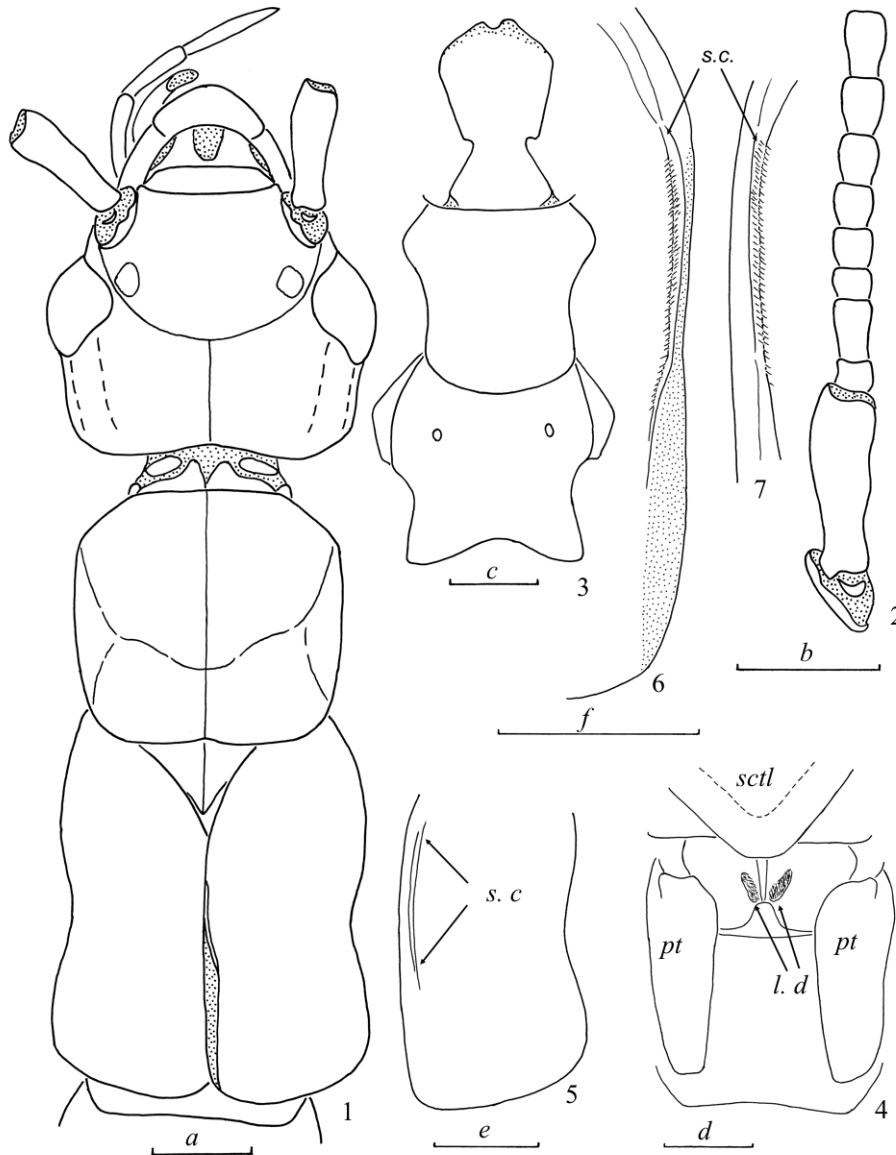
Subfamily **Pygidicraninae** Verhoeff, 1902

Genus ***Cranopygia*** Burr, 1908

Cranopygia crockeri Anisyutkin, sp. n. (Figs. 1–19)

Material. **Malaysia**, Borneo Island, Sabah State, environs of Keningau, “Crocker Range” National Park, h = 1000–1300 m, secondary, partly primary forest, 2–6.V.2013 (A. Gorochov, M. Berezin, V. Gorochov, E. Tkacheva), 2 males (holotype and paratype), 1 female (paratype).

Description. **Male** (holotype). Coloration. Head dorsally, labrum, mandibles, 2 distal segments of maxillary palps, distal segment of labial palps, and galea brown; head ventrally and partly laterally and mouthparts brownish yellow; eyes black; ocelli pale yellow; antennae in proximal part (about 8 basal segments)



Figs. 1–7. *Cranopygia crockeri* sp. n., holotype, male: (1) head and thorax, dorsal view, tegmina slightly moved apart; (2) proximal part of antenna; (3) sternites of thorax, ventral view; (4) meso- and metathorax, dorsal view (schematically), tegmina moved apart; (5) left tegmen, ventral view (contour); (6) posterior margin of right tegmen, ventral view; (7) spiny crest on posterior margin of left tegmen, ventral view. Punctate spots show membranous areas (1–3, 6); dashed line shows the area of the scutellum (4), which is visible from under the tegmina in repose; for *l. d.*, *pt.*, *s. c.*, and *sctl.*, see text. Scale (*a* to Fig. 1; *b* to Fig. 2; *c* to Fig. 3; *d* to Fig. 4; *e* to Fig. 5; *f* to Figs. 6, 7): 1 mm.

nearly black, then brownish. Pronotum brown, slightly darker in area of metazone; prozone with longitudinal yellow stripe along median groove; lateral margins yellowish. Scutellum brown, with wide pale yellow longitudinal stripe along longitudinal groove. Tegmina brown; right tegmen with transparent longitudinal stripe along posterior margin of (Fig. 1). Epimera brown; other structures of thorax yellow, except for slightly darkened caudal areas of meso- and meta-sterne. Legs pale yellow; tibiae medially and distal

parts of ultimate tarsomeres weakly darkened; distinct bands absent. Abdomen dark brown, with reddish tint; caudal segments and cerci nearly black.

Surfaces dull; only caudal abdominal segments and cerci shining, covered with large rather sparse setae. Sclerites of abdomen finely punctate; caudal part of genital plate scabrous.

Head about as long as wide (Fig. 1), dorsoventrally flattened, not convex; epicranial sutures distinct; dis-

tance between eyes about 1.4 times as long as scape; ocelli large; eye slightly longer than postocular space (gena, after: Hincks, 1955); postocular carinae hardly visible. Antennae with more than 25 segments, their apices broken off; scape slightly shorter than distance between antennal sockets; 2nd (pedicel) and 4th segments of antennae subequal in length and width; 3rd segment about twice as long as 2nd or 4th segments (Fig. 2); succeeding segments gradually becoming longer toward apex of antenna.

Pronotum about as long as wide (Fig. 1); sides rounded; posterior margin emarginate medially; division into pro- and metazone ill-defined; median groove distinct. Scutellum large, triangular, with distinct median groove (Fig. 1, 4, *sctl*). Metanotum with well-developed locking device (after: Haas, 1995) in shape of pair of V-like situated tubercles densely covered with setae directed medially and forming no regular rows (Fig. 4, *l. d*). Thoracic sternites (Fig. 3): prosternum elongate, with membranous and emarginate anterior margin; mesosternum about as long as wide, with widely rounded posterior margin; metasternum wider than long, with emarginate posterior margin, with paired depressions.

Tegmina entirely developed, asymmetrical (after: Haas, 1995); with rounded, non-truncate posterior margin; lateral carinae absent; posterior margin of ventral side of tegmina with well-developed spiny crest (after: Giles, 1963) bearing rows of laterally directed setae (Figs. 5–7, *s. c*); right tegmen with longitudinal membranous area (translucent overlapping margin, after: Haas, 1995) along inner margin (Fig. 1, 6), this area overlapped by left tegmen in repose. Wings rudimentary, entirely concealed by tegmina (Fig. 4, *pt*). Femora slightly thickened, becoming finer from fore to hind ones; carinae on femora and tibiae inconspicuous. Abdomen elongate, cylindrical, weakly widened caudally; tergites III and IV without tubercles. Last abdominal tergite large (Figs. 8, 9), about as long as wide, subparallel-sided; posterolateral angles clearly attenuate backwards; posterior margin projecting; median groove inconspicuous; lateral carinae absent (Fig. 9). Cerci asymmetrical (Fig. 8), slightly up-curved (Fig. 9), finely serrate along inner margins. Penultimate sternite wide (Fig. 10), emarginate along posterior margin, with 3 inconspicuous longitudinal depressions.

Male genitalia (Figs. 11–15) symmetrical. Metaparamere relatively short (Figs. 11, 12), with shallowly

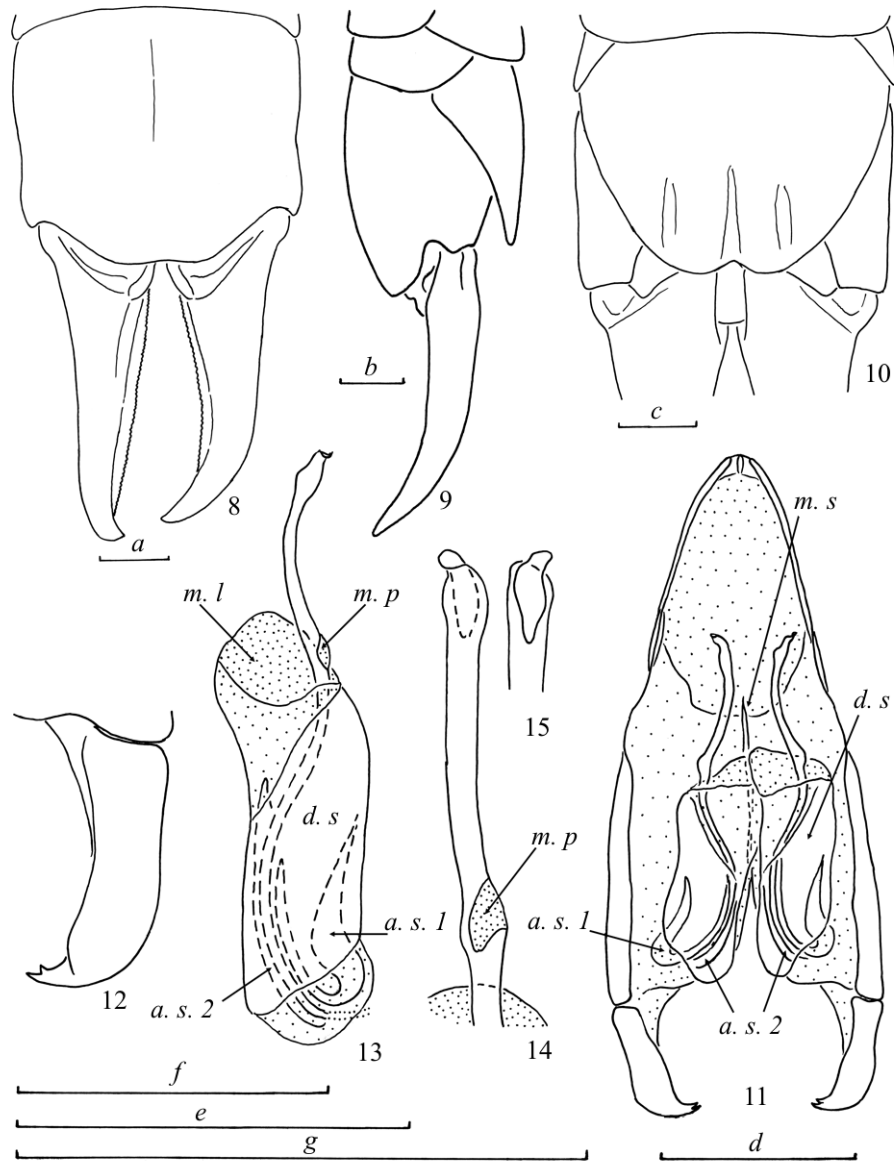
concave outer margin and with 1 bifurcate inner tooth directed medially (outer tooth absent), straight in lateral view. Proparameres separated along about 1/3 of their length, with sclerite situated along line of junction (Fig. 11, *m. s*). Genital lobes with fine sclerite occupying most part of their dorsal side (Figs. 11, 13, *d. s*) (fine sclerite indistinct, visible in view at different angles), distal ends of genital lobes with moderate membranous processes (Fig. 13, *m. l*). Virga relatively short and thick (Figs. 11, 13–15), slightly helically-coiled; swollen membranous patch situated approximately in distal 1/3, near to outlet from genital lobe (Figs. 13, 14, *m. p*); apex of virga asymmetrical (Figs. 14, 15). Accessory sclerites situated at base of virga: large and curved sclerite, laterally (Figs. 11, 13, *a. s. 1*), and elongate one, medially (Figs. 11, 13, *a. s. 2*).

Variability (male, paratype). Paratype similar to holotype. Right scape slightly shorter than left one, 3rd segment of right antenna about 2.5 times as long as 2nd segment. Right hind leg abnormal: about half as long as left one, weakly sclerotized, without carinae; tarsus 2-segmented. The structure of the right antenna and the right hind tarsus may be caused by a damage at the larval stage.

Female (paratype) similar to male. Coloration slightly paler, head pale brown. Head longer than wide. Cerci subsymmetrical (Figs. 16, 17). Genital plate caudally projecting, rounded (Fig. 18).

Female genitalia (Fig. 19). Gonapophyses of segment VIII long, whip-shaped, basally widened and accrete (Fig. 19, *gp 8*); their proximal widened part membranous, ventrally bearing curved sclerite (Fig. 19, *c. s*) jointed with laterocoxite of segment IX (Fig. 19, *LC 9*); distal whip-shaped part of gonapophyses heavily sclerotized. Gonapophyses of segment IX short, weakly sclerotized (Fig. 19, *gp 9*), almost entirely concealed under gonapophyses of segment VIII, bearing narrow sclerite on outer margin (Fig. 19, *l. s*). Anal plate, or mesal part of paraprocts (after: Klass, 2003), in shape of elongate membranous lobes (Fig. 19, *Par*).

Measurements (mm) (those of holotype given in parentheses). Length of head: male 3.2–3.9 (3.2), female 3.4; width of head: male 3.2–3.9 (3.2), female 3.1; length of pronotum: male 2.5–2.7 (2.5), female 2.5; width of pronotum: male 2.6–2.7 (2.6), female 2.6; length of tegmen: male 3.8–3.9 (3.9), female 3.8; width of tegmen: male 1.4–1.7 (1.7), female 1.6;



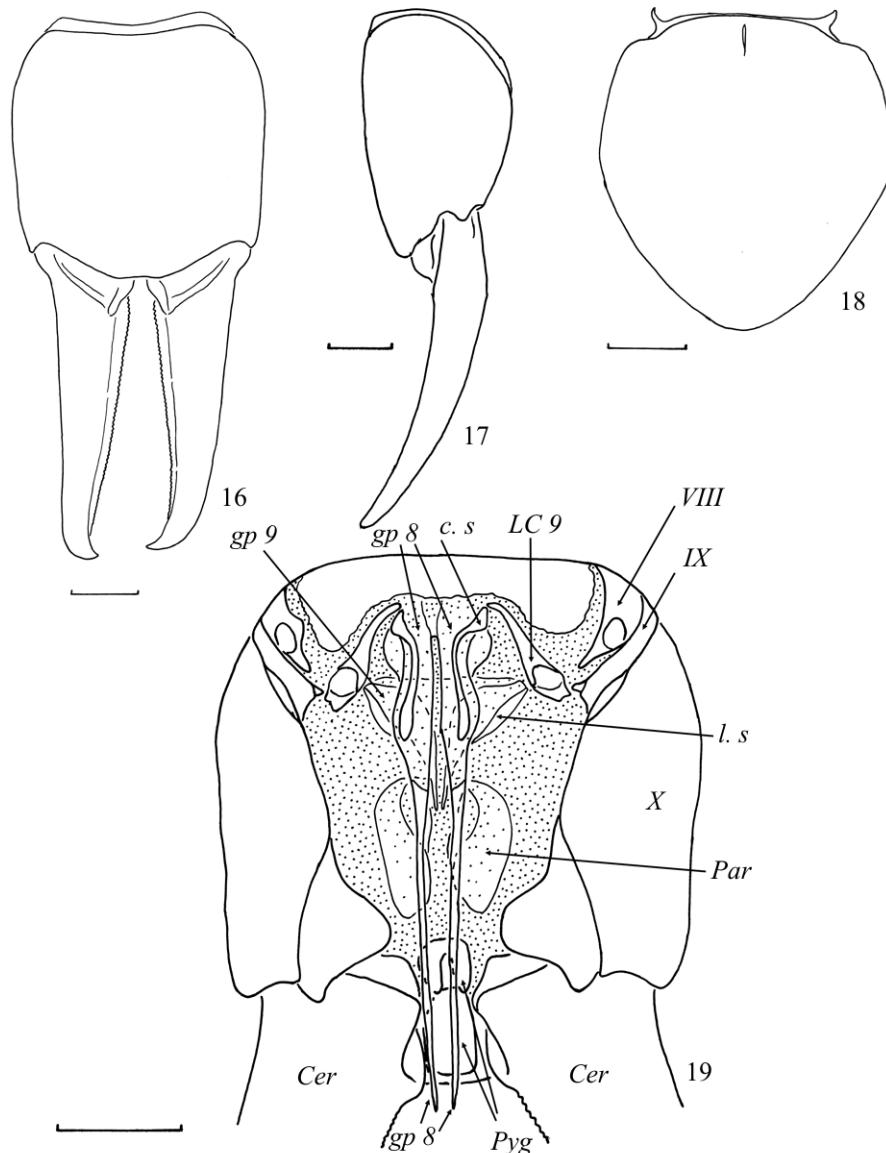
Figs. 8–15. *Cranopygia crockeri* sp. n., holotype, male: (8) apex of abdomen, dorsal view; (9) apex of abdomen, lateral view; (10) apex of abdomen, ventral view, only bases of cerci are shown; (11) male genitalia, dorsal general view; (12) right metaparamere, dorsal view; (13) right genital lobe, dorsal view; (14, 15) distal part of virga. Punctures show membranous areas (11, 13, 14); *a. s. 1*, *a. s. 2*, *d. s*, *m. l*, *m. p*, *m. s*, structures of male genitalia (see text). Scale (*a* to Fig. 8; *b* to Fig. 9; *c* to Fig. 10; *d* to Fig. 11; *e* to Fig. 12; *f* to Fig. 13; *g* to Figs. 14, 15): 1 mm.

length of fore / middle / hind femora: male 2.5 / 2.7–2.9 / 3.6–3.9. (2.5 / 2.9 / 3.9), female 2.5 / 2.8 / 3.6; length of fore / middle / hind tibiae 2.5–2.6 / 2.7 / 3.6–3.7 (2.5 / 2.7 / 3.7), female 2.5 / 2.6–2.8 / 3.5; length of cerci: male 4.8 (4.8), female 5.0. Measurements of abnormal right hind tarsus of paratype of male not indicated.

Comparison. *Cranopygia crockeri* sp. n. can be easily distinguished from the other species of the genus *Cranopygia*, including *C. steineri* Srivastava, 1991

described from the Sabah State (Srivastava, 1991), owing to the following complex of characters: rudimentary wings, absence of an outer tooth at the apex of the metaparamere, and a characteristic structure of the virga.

The new species is similar in habitus and in the structure of the metaparameres to *C. vietnamensis* Gorochov et Anisytukin, 1993 and *C. beybienkoi* Gorochov et Anisytukin, 1993 described from Northern Vietnam (Vinh Phu Prov., Tam Dao) and Southern



Figs. 16–19. *Cranopygia crockeri* sp. n., paratype, female: (16) apex of abdomen, dorsal view; (17) apex of abdomen, lateral view; (18) genital plate, ventral view; (19) apex of abdomen, ventral view, genital plate is removed, only bases of cerci are shown. Punctures show membranous areas (19); VIII, IX, X, abdominal tergites; Cer, cerci; Pyg, pygidium; c. s, LC 9, l. s, gp 8, gp 9, Par, structures of female genitalia (see text). Scale: 1 mm.

China (Yunnan, environs of Symao), respectively (Gorochov and Anisyutkin, 1993); however, it clearly differs from both species in better developed tegmina, in the absence of an outer tooth at the apex of the metaparamere, and in a short virga (cf. Figs. 11–15 in the present study and figs. 1–8 in: Gorochov and Anisyutkin, 1993). *Cranopygia crockeri* sp. n. is most similar to *C. corymbifera* Anisyutkin, 1997 described from the Malayan Peninsula (Anisyutkin, 1997), but clearly differs in the brown pronotum and scutellum (bright yellow in *C. corymbifera*), in a non-elongate apex of the metaparameres (cf. Figs. 11, 12 and figs. 1,

2 in: Anisyutkin, 1997) and, most of all, in a short virga which is less than twice as long as the genital lobe (Figs. 11, 13), whereas in *C. corymbifera*, even the remaining part of the virga (the apices are broken off) is about 3 times as long as the genital lobe (see fig. 1 in: Anisyutkin, 1997).

The new species differs from the insufficiently described *C. vanderdoesi* (Boeseman, 1954), for which the structure of the male genitalia and the collecting site are unknown [“The present locality (Malacca—the author) seems likely as Van der Does de Bye seems to

have collected principally on the Malay Peninsula (and a few specimens on Borneo)—Boeseman, 1954, p. 16], in rounded tegminal apices (truncate in *C. vanderdoesi*—Boeseman, 1954, fig. 5a), in the shape of the cerci, and in a relatively longer penultimate abdominal sternite (cf. Figs. 8, 10 in the present study and fig. 5b in: Boeseman, 1954).

DISCUSSION

The presence of both a well-developed locking device on the metanotum (Fig. 4, *l. d*) and spiny crests on the tegmina (Fig. 5–7, *s. c*), in combination with the reduced wings, seems strange, though a similar structure was found in many earwigs, including *Cranopygia* sp. (Haas, 1995). F. Haas assumed that the overlapped tegmina protect not only the wings, but also other structures of the thorax, including the thoracic stigmata (Haas, 1995). Unfortunately, at present, the morphology of these structures has been studied only in a few earwig taxa (Haas, 1995).

The longitudinal membranous patch along the posterior margin of the tegmen, which is overlapped by the opposite tegmen in repose, was found in earwigs of various families (Haas, 1995; unpublished data of the author). This structure may be a homolog of “sutural area” (“sutural margin” of the extinct Protelytroptera: “... most species [of Protelytroptera—the author] with submarginal thickening (sutural margin) parallel to posterior margin of elytron” [= tegmen—the author]—Carpenter, 1992, pp. 143, 144).

In the process of dissection, the crushed chitinous remains were found in the proctodeum of the female paratype; some of them were identified as fragments of compound eyes and, probably, wings, which testified that they belonged to adult alate insects.

ACKNOWLEDGMENTS

The author is sincerely grateful to A.V. Gorochov, V. Gorochova, M. Berezin, and E. Tkacheva for the material collected, and also to Dr. M. Engel and

Dr. M. Nishikawa for their help at obtaining the necessary literature. The study was performed within the framework of the program of the Presidium of the Russian Academy of Sciences “The Origin and Evolution of the Biosphere.”

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