Odonatologica 14 (3): 191-199 *September 1, 1985*

PHYLLOPETALIA PUDU SPEC. NOV., A NEW DRAGONFLY FROM CHILE, WITH A KEY TO THE FAMILY (ANISOPTERA: NEOPETALIIDAE)[1]

S.W. DUNKLE
Department of Entomology and Nematology, University of Florida, Gainesville, Florida 32611, United States

Received February 26, 1985 / Accepted March 12, 1985

P. pudu sp. n. is described and figured from 2 ♂, 1 ♀ from Chile (holotype ♂: Nuble Prov., Las Trancas, Dec. 1976, Luis E. Pena, in Florida State Collection of Arthropods, Gainesville; first ♀: Osorno Prov., Parc National Puyehue, Aguas Calientes, 7-8 Feb. 1978, Oliver S. Flint, Jr, in United States National Museum, Washington D.C.). *Austropetalia* is synonymized with *Phyllopetalia*, a key is presented to the 8 known spp. of the Neopetaliidae, and the known biology of the Chilean *Phyllopetalia* is summarized.

INTRODUCTION

Existing keys (FRASER, 1957; NEEDHAM & BULLOCK, 1943; SCHMIDT, 1941) are not adequate to diagnose the species of *Phyllopetalia*, and I found it necessary to refer to scattered descriptions in several languages while attempting to identify them. Among the specimens borrowed for this study were 3 of a new species which is described below.

DESCRIPTION

PHYLLOPETALIA PUDU SP. N.
Figure 1.

Material — ♂ holotype Chile, Nuble Prov., Las Trancas, December 1976 (exact date unknown), Luis E. Pena leg. Deposited in the Florida State Collection of Arthropods (FSCA) at Gainesville. First ♀ Chile, Osorno Prov., Aguas Calientes, Parc National Puyehue, 7 or 8 February 1978, Oliver S. Flint, Jr, leg. In the United States National Museum (USNM). Paratype ♂ Chile, Valdivia Prov.,

[1] Florida Agricultural Experiment Station Journal Series, No. 6195.

Pucura, January 1978 (exact date and collector unknown). In the Carl Cook Collection, Center, Kentucky.

Etymology — Named after the pudu, a small deer of the Andes Mountains, which has short spike-like antlers similar in form to the postocular spines of this dragonfly from the same region.

Diagnosis — This is the only known species of Neopetaliidae with spines or horns on the back of the head. It is also the blackest species of *Phyllopetalia,* and has a distinctive male cercus with a ventral tooth at 1/3 of its length from the base (Fig. 1).

Male — Notable differences of the paratype male from the holotype are given in parentheses.

Measurements (in mm): Total length including cerci 65 (66), abdomen 48 (50), hindwing 36.5 (38).

Head: Frons in anterior view 1.0X as high in the sagittal plane as the clypeus or 1.4X as high as the postclypeus alone (1.3 and 1.7X as high). Frons black with a wide yellow margin along the crest on the anterior surface. Postclypeus bright yellow, with 2 anterior crescentic pits and lateral lobes brown. Labrum yellow with slightly emarginate free edge brown. Vertex and antennae black. Occiput a 3-sided pyramid, projecting superiorly in a blunt point higher than the eyes, brown anteriorly, but with the posterior bulging yellow surface visible in dorsal view. Posterior surface of occiput has a shallow sagittal groove. Lateral surfaces of mandibles dull yellow, genae and labium brown. Rear of head mottled black, dull yellow laterally, with a conical black spine on each side of the occiput. These spines are convergent in dorsal view, gently curved upward in lateral view. They are like the postocular spines of some female *Ophiogomphus,* and though prominent, are obscured by the occipital hairs in dorsal view. Head very hairy, the hair-setae longest around the edges of the face and the occiput. Hairs mostly black, but blonde on the occiput and labium.

Thorax: Prothorax black, with the anterior margin and a pair of medial bumps on the middle lobe pale, and covered with pale hairs. Pterothorax black with bright yellow markings, hairy, the hairs pale on the front and rear, mostly black elsewhere. A mesepisternal parallel-sided yellow stripe 1 mm wide extends diagonally from the lateral edge of the collar to the slope of the antealar crest near the median carina (paratype with an additional separate short stripe between the upper end of the long stripe and the humeral suture). Sides of pterothorax with straight yellow stripes on the mesepimeron and metepimeron, the former about 1 mm wide, the latter slightly wider. A metepisternal stripe broken into 2 spots lies dorsal to the metathoracic spiracle. Legs mostly black, dark red at the base and on the tips of the claws and tibial spines. Wings nearly hyaline, with small dark red spots at the first and second primary antenodal crossveins, nodus, pseudo-brace vein of the pterostigma, and apex (spot on first antenodal absent in paratype). Veins dark brown, pterostigma dark red, membranule translucent, membrane brown at extreme base. Anal angle of hindwing acute and projecting proximally. Hindwing with anal triangle 3-celled, triangles 3-celled (2-celled), sub- and supra-

triangles 1-celled, basal subcostal crossvein present in left hindwing (none). Forewing with triangles 2-celled, subtriangles 1-2 celled (1-celled), supratriangles 2-celled (1-2 celled), 2 rows paranal cells for a distance of 3 cells. Pterostigma 2.4 mm long in forewing, 3.1-3.2 mm in hindwing, with 1 cell posterior to it (3.6 and 4.0 mm, and 2 cells posterior to it). Forewing antenodal crossveins 14 (12), postnodals 10-11 (10). Hindwing antenodals 9 (8-9), postnodals 7 (10). Hairs at base of forewing costa black, mixed black and white at base of hindwing costa.

Abdomen: Segments 7 and 8 have fin-like flanges 1 mm or more wide, but other segments lack lateral carinae. The flange of 7 is developed posterior to the transverse groove, that of 8 is full length, and both extend to the posterior margin of their segments. Abdomen mostly black, segment 1 with a yellow inferior basal bump and dorso-lateral spot. Segment 2 with yellow dorso-lateral stripes, dorsal surfaces of auricles, and antero-inferior margins. Segments 3--10 with interrupted dorso-lateral yellow stripes, that part of the stripe posterior to the transverse groove on each segment more lateral than the anterior part on 3-8, but poorly developed or absent posterior to the transverse groove on 3-7. Segments 3-9 with lateral yellow stripes proximal to the transverse groove on each segment, and posterior to the groove on 9 (pattern poorly preserved in paratype). Auricles and ventro--lateral margins of segment 2 roughened but without distinct denticles. No specific characters noted in secondary genitalia. Cerci foliate with a short rounded ventral keel at 1/3 length (Fig. 1). Epiproct as long as cerci, gently rounded distally with thick erect dorso--lateral spines at 3/4 length. Abdomen hairy, with mostly white hair-setae, which are especially long on the dorsum of segment 1, and with sparse black setae dorsally on 3-10.

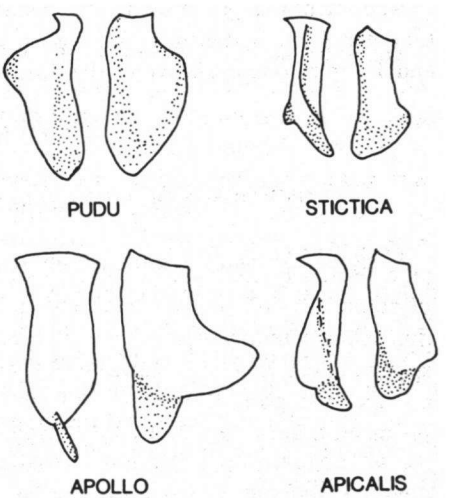

Fig. 1. Left cercus in male Chilean *Phyllopetalia*. For each species, the cercus is shown in dorso--lateral view on the left and dorso-medial view on the right. *P. apollo* was drawn at 50X, the others at 25X. Stippling indicates foliate or flange-like areas.

Female — Colored like male except as noted below.

Measurements: Total length 62 mm, abdomen 45, hindwing 39.

Head: Frons 0.9X as high as clypeus or 1.3X as high as postclypeus. Scars indicate that male epiproct spines grip the head at the anterior margin of the

compound eyes lateral to the lateral ocelli.

Thorax: Mesepisternal stripes slightly spindle-shaped. An additional short mesepisternal stripe present as in paratype male. Legs red-brown from base to near the distal end of the femora. Wings with spots a little larger than in male, and with an additional red spot on the anterior arculus and touches of red along some nodal crossveins. Triangles and subtriangles in both wings 2-celled, supratriangles 1-celled in left wings, 2-celled in right wings. Pterostigma 3.1 mm long in forewings, 3.5 in hindwings, with 1 cell posterior to it, but 2 cells posterior to it in left hindwing. Forewing antenodal crossveins 15, postnodals 10-11. Hindwing antenodals 10, postnodals 8-10. Hairs at base of hindwing costa all white.

Abdomen: Flanges of segments 7-8 smaller than in male, 0.4 mm wide on 7, 0.8 mm on 8. Cerci flattened, 1.1X longer than segment 10. Ovipositor stylets slender and 1.3 mm long exclusive of the distal tuft of pale hairs.

DISCUSSION

COMPARISON OF *PHYLLOPETALIA PUDU* AND *P. STICTICA*

Phyllopetalia pudu is most closely related to *P. stictica* Hagen, but is easily differentiated from it by the characters given in the key below. I examined the holotype male of *P. stictica,* in the Museum of Comparative Zoology, Cambridge, Massachusetts. It is pinned with the wings spread and the left hind tarsus and the antennal flagella are missing. The abdomen has been glued to the thorax at the base, and it appears that the dragonfly chewed on its anal appendages at the time of capture. It bears 3 labels: "Valdivia", "Type 12396", and "P. stictica Hagen a renvoyen".

I found some inconsistencies between the holotype of *P. stictica* and the original description (HAGEN in SELYS, 1858). Some of Hagen's measurements were greater than mine (mine in parentheses): Total length 60 mm (56), abdomen 46 (42), head width 9 (8), hind femur 8 (6), forewing 38 (36), hindwing 35.5 (34), and forewing width 8 (7). Hagen states that the forewings have 11-13 postnodal crossveins (there are 10 in the right forewing), and that the occiput and anal appendages are as in *P. apicalis* Selys. He apparently did not see the dorsal point of the occiput among the occipital hairs, and did not note the ventral tooth of the cerci in their twisted condition. He also did not allow for parallax when he measured the cerci as 1 mm long (they are 2 mm long). Thus the anal appendages are not like those of *P. apicalis* (cf. Fig. 1 and key below). FRASER (1933) probably did not see the holotype of *P. stictica,* the only male known at that time, and essentially repeats the original description.

In addition to the holotype of *P. stictica,* I studied 3 ♂♂ 3 ♀♀ from Chile, Arauca Prov., Caramavida, 17-18 Oct 1969, Flint and Barria leg., 1 ♀ FSCA, the rest USNM. Differences beyond those given in the key below between *P. pudu*

and *P. stictica* are that *stictica* has only a narrow yellow border along the crest of the frons, the femora are red-brown in both sexes, only a tiny yellow spot is present near the metathoracic spiracle, the antero-lateral yellow abdominal stripes taper to a point posteriorly on each segment, the male genital lobe is more triangular and bears definite denticles, the female wingspots are larger, and the ovipositor stylets are slenderer. Finally, the holotype of *stictica* has 5 paranal cells (= postcostal cells) with 1 double cell in each forewing, whereas the Caramavida specimens have 5-6 paranals with 2 rows at least 3 cells long in at least 1 forewing; thus the Caramavida *stictica* are like *pudu* in this character.

FRASER (1933) in his characterization of the family "Petaliidae" states that no basal incomplete antenodal crossvein (= basal subcostal) is present and that a single bristle is located under the ovipositor stylet. I found that 1-2 basal subcostal crossveins were present in at least 1 wing of 1/3 *pudu*, 5/7 *stictica*, 13/14 *apicalis*, 19/20 apollo Selys, and 10/10 *Hypopetalia pestilens* McLachlan. A tuft of hair-setae was present ventrally on the ovipositor in all females of these species that I examined.

NOTES ON *PHYLLOPETALIA APICALIS* AND *P. APOLLO*

FRASER (1933) wrote that *P. apicalis* had abdominal segment 7 flanged, 3-celled anal triangles, and the thorax and abdomen patterned like *stictica*. As FRASER (1957) pointed out, segment 8 is flanged instead of 7, the error having been copied from SELYS' (1858, pp. 360, 362) original description. The anal triangle was 3-9 celled in *apicalis* I examined. The antehumeral yellow stripe is short and spindle-shaped in *apicalis*, long and parallel-sided in *stictica*. The dorso-lateral abdominal stripes on segments 3-7 in *apicalis* are wider than in *stictica* and are only narrowly separated dorsally.

SELYS (1878) described *P. apollo* from 2 males, but did not discuss the wing pattern. This is puzzling because FRASER (1933) apparently saw these same 2 males plus 2 females, and implies that they all had prominent red-brown spots between nodus and pterostigma, unlike any other Chilean *Phyllopetalia*. All of the 12 males and 8 females from 5 localities of *apollo* that I studied had no trace of a spot between nodus and pterostigma. The labrum is yellow, not cupreous as in FRASER (1933). Claw color, used as a key character by NEEDHAM & BULLOCK (1943), is not useful because all the *Phyllopetalia* I saw had brown-red claw tips.

STATUS OF *AUSTROPETALIA*

TILLYARD (1907) reported a neopetaliid from Australia as *Petalia apollo* Selys. In 1910 he described it from a female holotype as a new species, *Phyllopetalia patricia* Tillyard. In 1916 he described the allotype male and placed it in a new

genus *Austropetalia*. He gave the following differentiating characters between *Austropetalia* and *Phyllopetalia:* (1) *Austropetalia* with wing spots red instead of brown, (2) a spot present between nodus and pterostigma, (3) larger membranule, (4) broader labium, (5) straighter male cerci, (6) longer male epiproct, and (7) no lateral flanges on abdominal segments 7 or 8. In 1917 he added that (8) *Austropetalia* has close-set setae (= an eye brush) on the foretibiae. FRASER's (1933) key characters for these genera were the color of the wing spots and geographical distribution.

I evaluated the above characters individually: (1) I examined a male *Austropetalia* (New South Wales, Fitzroy Falls near Robertson, 3 Nov. 1951, R. Dobsen leg., USNM) and found that the wing spots are red with brown margins, practically identical in color to those of Chilean *Phyllopetalia*. (2) FRASER (1933, text fig. 10) shows that *P. apollo* can have a colored spot between nodus and pterostigma. (3) The membranule of *P. apicalis* is relatively larger than in *Austropetalia*. (4) The labium is similar in both genera; its apparent width in ventral view depends on the position of the palps. (5) The shape of the male cerci is a specific rather than a generic character. (6) The male epiproct of *P. apicalis* extends as far beyond the cerci as that of *Austropetalia*. (7) Male *Austropetalia* do lack lateral carinae on the abdomen, but TILLYARD (1910, p. 700) states that the female has segments "...8-9, slightly dilated below in lateral folds...". Chilean *Phyllopetalia* have segments 7-10 with variously developed lateral carinae. (8) All species of Chilean *Phyllopetalia* have eye brushes on the fore tibiae. Other possible generic traits for *Austropetalia* are the green rather than yellow body markings, and the pointed genital lobe of the male. The colors of Chilean *Phyllopetalia* in life are poorly known (cf. below) and in the author's opinion are not a generic character. The genital lobe of *P. apollo* is triangular, approaching the shape of the lobe in *Austropetalia*. The secondary genitalia and wing venation are essentially identical in both genera. The spines of the anterior lamina shown by TILLYARD (1916, fig. 4) are actually the edges of the lamina, and no *Phyllopetalia* has laminal spines.

Among the characters given above, the only ones of possible generic worth are the lack of lateral abdominal carinae in the male, and the pointed male genital lobe. Since these differences are in only one sex, and because the genital lobe is a reproductive feature (which are often the most variable characters in a genus), I conclude that *Austropetalia* should be synonymized with *Phyllopetalia*.

DISTRIBUTION AND BIOLOGY OF CHILEAN *PHYLLOPETALIA*

The little that is known about this subject is summarized below. South American *Phyllopetalia* all occur on the Pacific slope of the Andes in central Chile between approximately 31-41° S. As noted above, *P. pudu* occurs in Nuble, Osorno, and Valdivia Provinces between about 35° S (Nuble Prov., Las Trancas)

and about 40.5° S (Osorno Prov., Puyehue National Park, Aguas Calientes). *P. apicalis* is found in Arauco, Aconcagua, Bio Bio, Coquimbo, Curico, Linares, Santiago, Talca, Valdivia, and Valparaiso Provinces between about 31° S (Coquimbo Prov., 5 mi N Laguna Dam, in FSCA) and 39°48′S (Valdivia Prov., Valdivia; SELYS, 1858). *P. apollo* is found in Arauco, Cautin, and Malleco Provinces, in a narrow range between 37°41′ S (Arauco Prov., Caramavida, in FSCA and USNM) and 38°36′S (Cautin Prov., Cholchol, in FSCA). *P. stictica* is found in Arauco, O'Higgins, and Valdivia Provinces between 34°10′S (O'Higgins Prov., Rancagua; SCHMIDT, 1941) and 39°48′S (Valdivia Prov., Valdivia; SELYS, 1858). I was not able to determine the province for 2 localities: *apicalis* "Bell Mtn." FSCA; *stictica* "Comudes" given by SCHMIDT (1941). FRASER (1933) gives a doubtful record of *apollo* from "Peru". It is worth noting that *stictica* occurs together with *apicalis* at Valdivia (SELYS, 1858) and Contulmo (SCHMIDT, 1941). *P. stictica* was also collected concurrently with *apollo* at Caramavida by Flint and Barria (USNM).

The recorded flight seasons of Chilean *Phyllopetalia* are in the early spring and summer. That of *P. apicalis* is from September (Aconcagua Prov., Los Andes, in FSCA) to 10 January (Linares Prov., Tranque de Bullileo, 800 m, in USNM). The flight season of *P. apollo* is from 20 September (Cautin Prov., Cholchol, in FSCA) to 26 November (Malleco Prov., Angol, in FSCA). *P. pudu* flies from December (Nuble Prov.) to 7 February (Osorno Prov.). *P. stictica* flies from 5 September to 23 January (Arauco Prov., Contulmo; SCHMIDT, 1941).

Nothing has been recorded in the literature on the behavior of Chilean *Phyllopetalia,* but Carl Cook (pers. comm.) gives the following information on *P. apicalis:* "I collected a small series of males from the Rio Los Molies SE of Ovalle, Coquimbo Province. The river here was too swift and deep to ford, many large rocks in the stream bed, and icy cold from snow melt. The dragonflies fly fast and close to the water surface, ...I would compare their flying speed to a *Macromia*.... They also like to fly along roads and trails through heavy forest... both over water and along trails, after passing in one direction it may be a half hour before (supposedly the same individual) returns in the other direction.... I have seen them flying when the temperature was as low as 9° C.... All my material seems to have been collected at altitudes of 1000-2000 m.... The eyes are bluish green, the yellow on pterothorax and abdomen is usually well preserved in specimens, but there is some blue or grey on the basal abdominal segments which fades". Oliver Flint, Jr. (pers. comm.) relates the following on *P. apollo* and *P. stictica,* which he collected for most of an hour at Caramavida, Arauco Prov. "This series was collected as they were feeding late in the afternoon in an abandoned pasture. The pasture was growing up to brush and small trees,... several would start to work the lee of a larger (perhaps 15-20 foot high) tree, obviously picking off small swarming insects...". Thus both the sex patrols and feeding behavior of the *Phyllopetalia* above resemble those of certain Aeshnidae

such as *Basiaeschna janata* (Say).

SCHMIDT (1941) described the larva of *P. stictica* by supposition, but gave no habitat data. FRASER (1960) said that the larvae of the Australian *P. patricia* cling to rock faces beneath waterfalls, and that the adults fly slowly in open spaces on the tops of plateaus. TILLYARD (1916) found *P. patricia* flying slowly from 0530-0700 in forest, and resting on the twigs or leaves of bushes. They dropped nearly to the ground before rising to a perch.

A male *P. apollo* in the USNM has a hymenopteran in its mouth. TILLYARD (1916) illustrates the egg of *P. patricia;* eggs from a dry *P. apollo* in the USNM are similar though thicker and less acuminately pointed (0.5 x 2.2 mm). Mating marks similar to those mentioned above for *P. pudu* were seen in 3/6 female *apicalis,* 3/8 *apollo,* and 3/3 *stictica.*

KEY TO ADULT NEOPETALIIDAE

1A Compound eyes not touching dorsally, Tasmania .... ***Archipetalia auriculata*** Tillyard

1B Compound eyes in contact dorsally, mainland Australia and Chile 2

2A(1B) Wingvein M2 not undulate, 2 cubito-anal crossveins proximal to the subtriangles, male epiproct shorter than cerci and with a triangular middle lobe, female with a degenerate ovipositor but segment 10 expanded into a large circular plate, female cerci decurved and as long as segments 9 + 10, wings without apical spots, frons with 4 yellow spots on dorsal surface, Chile..... ***Neopetalia punctata*** (Selys)

2B M2 undulate, 1 cubito-anal crossvein, male epiproct equal to or longer than cerci and with a rounded or truncate middle lobe, female with normal ovipositor and segment 10, female cerci straight and little if any longer than 10, wings with apical spots, frons without dorsal spots, Australia and Chile 3

3A(2B) Brace vein proximal to pterostigma, postclypeus brown, thorax without mesepisternal stripes, sides of thorax with 3 white spots, Chile ... ***Hypopetalia pestilens*** McLachlan

3B Brace vein underneath stigma or at proximal end, postclypeus yellow, mesepisternal stripes present, sides of thorax with yellow or green stripes, Australia and Chile ..... ***Phyllopetalia*** 4

4A(3B) No fin-like lateral abdominal flanges, wing with a red spot between nodus and stigma, green thoracic and abdominal markings, male genital lobe pointed, eastern Australia ..... ***Phyllopetalia patricia*** Tillyard

4B Fin-like lateral flanges on at least segment 8, wings seldom with a red spot between nodus and stigma, yellow thoracic and abdominal markings, male genital lobe rounded ..5

5A(4B) Abdominal segment 7 with a narrow rim-like lateral carina, 8 with a triangular fin-like lateral flange; labrum brown with a yellow basal median spot and darker anterior border; yellow mesepisternal stripe spindle-shaped, widest at its middle, its dorsal point not reaching the anterior slope of the ante-alar sinus; occipital hair blonde (rarely grey or black); hair at base of forewing costa white ..... ***Phyllopetalia apicalis*** Selys

5B Both segments 7 and 8 with fin-like lateral flanges; labrum yellow or yellowish brown, with a narrow brown anterior border; yellow mesepisternal stripe parallel-sided (rarely widened in the middle), extending nearly the full length of the mesepisternum and blunt-ended dorsally; occipital hair black, orange, or blonde; hair at base of forewing costa black (rarely grey).....6

6A(5B) Frons in front view 1.0-1.2X higher than postclypeus; occiput not pointed and with

coppery-orange hair, wings may have a red spot between nodus and stigma; male cerci in dorsal view with a huge medial tooth, appearing 2-branched ***Phyllopetalia apollo*** Selys

6B Frons 1.3-2.1X higher than postclypeus; occiput pointed dorsally and with black or blonde (rarely orange) hair; no spot between nodus and stigma; male cerci in dorsal view with a medial angle but no tooth, appearing unbranched 7

7A(6B) Prominent black postocular spines present; frons 1.3X (females) or 1.4-1.7X (males) higher than postclypeus; occipital hair blonde; labrum yellow; body mostly black; dorso-lateral yellow stripes on abdominal segments 3-6 separated dorsally by 2 stripe-widths; male cerci with ventral tooth at 1/3 length from base; male abdominal flanges 1 mm or more wide and extending to posterior margin of segments 7-8; female abdominal flange on 7 about 1/2 the width of that on 8..... ***Phyllopetalia pudu*** sp. n.

7B No postocular spines present; frons 1.7-1.8X (females) or 1.9-2.1X (males) higher than postclypeus; occipital hair black (sometimes orange); labrum yellowish brown; body mostly dark red-brown; dorso-lateral stripes separated by 1 stripe-width on 3-6; male cerci with ventral tooth at 2/3 length; male abdominal flanges 0.8 mm wide or less and not quite extending to the posterior margins of segments 7-8; female abdominal flange on 7 as large or larger than that on 8..... ***Phyllopetalia stictica*** Hagen

ACKNOWLEDGEMENTS

The generous loan of specimens and data by CARL COOK and OLIVER S. FLINT, Jr is greatly appreciated. I also applaud CHARLES VOGT who persistently searched until the holotype of *P. stictica* was found, and I thank MINTER J. WESTFALL, Jr for answering some of my numerous questions.

REFERENCES

FRASER, F.C., 1933. A revision of the Fissilabioidea (Cordulegastridae, Petaliidae and Petaluridae) (order Odonata) Part II. Petaliidae and Petaluridae and Appendix to Part I. *Mem. Indian Mus.* 9: 205-260.

FRASER, F.C., 1957. A revision of the Odonata of Chile. *Revta univ., Santiago* 42: 153-166.

FRASER, F.C., 1960. *A handbook of the dragonflies of Australasia.* Roy. Soc. N.S.W., Sydney.

NEEDHAM, J.G. & D.S. BULLOCK, 1943. The Odonata of Chile. *Zool. Ser. Fld Mus. nat. Hist.* 24: 357-373.

SCHMIDT, E., 1941. Petaluridae, Gomphidae und Petaliidae der Schonemannschen Sammlung aus Chile (Ordnung Odonata). *Arch. Naturg.* 10: 231-258.

SELYS, LONGCHAMPS, E. de, 1858. *Monographie des Gomphines.* Roret, Paris.

SELYS, LONGCHAMPS, E. de, 1878. Quatrièmes additions au synopsis des Gomphines. *Bull. Acad. roy. Belg.* 46: 1-106.

TILLYARD, R.J., 1907. New Australian species of the family Aeschnidae (Neuroptera: Odonata). *Proc. Linn. Soc. N.S.W.* 31: 721-730.

TILLYARD, R.J., 1910. Studies in the life-histories of Australian Odonata. No. 3. Notes on a new species of Phyllopetalia; with descriptions of nymph and imago. *Proc. Linn. Soc. N.S.W.* 34: 697-708.

TILLYARD, R.J., 1916. Life histories and descriptions of Australian Aeschninae with a description of a new form of Telephlebia by Herbert Campion. *Linn. Soc. J. Zool.* 33: 1-83.

TILLYARD, R.J., 1917. On some new dragonflies from Australia and Tasmania (order Odonata). *Proc. Linn. Soc. N.S.W.* 42: 449-479.