

# The larva and female of *Perigomphus basicornis* Amaya-Vallejo, Novelo-Gutiérrez & Realpe, 2017, and the first record of *Perigomphus pallidistylus* (Belle, 1972) for Colombia (Insecta: Odonata: Gomphidae) (#25780)

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## Abstract

The larva and female of *Perigomphus basicornis* are described and illustrated, and compared with the larva and female of *P. pallidistylus*. The larva of *P. basicornis* differs from that of *P. pallidistylus* in having sternum 8 divided in 5 sternites, S8-9 with small, low protuberances, and male's epiproct as long as its basal width, mainly. The female of *P. basicornis* differs from that of *P. pallidistylus* in having the apical lobes of vulvar lamina wider, with divergent tips. *P. pallidistylus* is recorded for Colombia for the first time.

**Key words:** Description, Anisoptera, Larva, Female, Taxonomy, Valle del Cauca, Caldas, Colombia.

## Resumen

Se describen la larva y la hembra de *Perigomphus basicornis* y se comparan con la larva y la hembra de *P. pallidistylus*. La larva de *P. basicornis* difiere de la de *P. pallidistylus* por tener el esterno 8 dividido en 5 esternitos, S8-9 con pequeñas y bajas protuberancias dorsales y el epiprocto del macho tan largo como su anchura basal, principalmente. La hembra de *P. basicornis* difiere de la de *P. pallidistylus* por tener los lóbulos apicales de la lámina vulvar más anchos y con las puntas divergentes. Se registra a *P. pallidistylus* por primera vez para Colombia.

**Palabras clave:** Descripción, Anisoptera, Larva, Hembra, Taxonomía, Anchicayá, Colombia.

## Introduction

The Neotropical dragonfly genus *Perigomphus* has three described species: *P. pallidistylus* (Belle, 1972), known from Costa Rica and Panama (Garrison et al. 2006); *P. angularis* Tennessen, 2011, known from the Amazon headwaters of central Ecuador, and *P. basicornis* Amaya-Vallejo, Novelo-Gutiérrez & Realpe, 2017, endemic of the tropical rainforests of Anchicayá, Valle del Cauca department, Colombia. To the date, only the larva and female of *P. pallidistylus* had been described (Westfall 1989). Here we described the larva of *P. basicornis* from exuviae and mature larvae, as well as the female imago from a reared specimen collected in the field. Larvae of *P. pallidistylus* were collected in the Department of Caldas, Colombia.

## Materials & Methods

Larvae were collected from field. Field Research was approved by Parques Nacionales Nacionales de Colombia (PNN, Spanish abbreviation) office, Permit Number 005 of 2016. The mature larvae were kept alive and tried to be reared under laboratory conditions. An emerging specimen was collected in field, along with its exuvia. Some of the larva died and were preserved in 96% ethanol; some others were successfully reared until emergence (Amaya-Vallejo et. al., 2017) but only one turned out to be a female. Although only morphological

characters will be used for description in this paper, tissue samples were taken from specimens in order to generate genetic barcodes for a more accurate identification through the Taxonomic Circle Approach (Damm et. al. 2010).

Photographs of morphology were taken with a Nikon DS-U3 camera mounted on a stereomicroscope Nikon SMZ25, and processed with the program NIS elements AR version 4.5. Descriptions were made under a stereomicroscope Zeiss Stemi SV6, and measurements (in mm) taken with an ocular micrometer and a ruler. Wing nomenclature follows Riek & Kukalová-Peck (1984). Mandible nomenclature follows Watson (1956); labium nomenclature follows Corbet (1953). Abbreviations are as follows: AL, abdomen length; FwL, Forewing length; HwL, hindwing length; HfL, hind femur length; MWh, maximum width of head; Pt, pterostigma, CL, cerci length; S1–10, abdominal segments; TL, total length (including caudal appendages); IEXA, Colección Entomológica “Miguel El Morón Ríos” from Instituto de Ecología, A.C., Xalapa, and ANDES Entomology Museum, Universidad de Los Andes, Bogotá. Specimens are deposited at ANDES (holotype) and IEXA (allotypes)

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## Results

### *Perigomphus basicornis* Amaya-Vallejo, Novelo-Gutiérrez & Realpe (Figs. 1-4)

**Material.** Three exuviae (one male, two females, reared), 8 F-0 larvae (4 males, 4 females), one F-0 male larva. COLOMBIA: Alto Anchicayá, Anchicayá River Hydroelectric Central (CHIDRAL, Spanish abb.), elevation 630 m; La Loquita creek (3.5903056N, -76.88869444W), 3–4 February 2009 (2 males), 6 June 2016 (1 male, 2 females, two reared under lab conditions (1 male and 1 female, exuviae kept, imagos used for paratype description, respectively)); La Loca stream (3.57025N, -76.8781388888W), 10 January 2010 (1 male, 2 females); La Riqueza River (3.6094167N, -76.8845W), 10 September 2016 (2 male, 2 females, 1 female emerging *in situ* (exuvia kept, imago used for holotype description)); all V. Amaya leg. Paratypes deposited at ANDES, holotypes at IEXA.

**Description of the F-0 larva.** Small-size larva, body sturdy and entirely covered by minute scale-like setae giving it a granular aspect, with large, irregular, bare areas on occiput and pronotum; abdomen enlarged, parallel-sided, gently tapering caudad; body light brown to brown, lacking any particular color pattern (Fig. 1).

Head: Small, wider than long, narrower than thorax and abdomen (Fig. 1a). Labrum granulose, anterior border widely convex with an external row of long, white and grayish-white, stiff setae (Fig. 2a), flattened ventrally, ventrointernal margin concave, with a dense brush of long setae; anteclypeus bare; postclypeus, frons, vertex and occiput granulose; frons (Fig. 2b) slightly produced as a short shelf, with anterior margin slightly convex and anterolateral corners widely rounded, fronto-lateral margins of frons with a tuft of long, upturned golden setae; occiput granulose with large, bare, irregular areas, cephalic lobes bulging, occipital margin waiving. Antennae (Figs. 1a, 2b) 4-segmented, with abundant, minute, scale-like setae, scape and pedicel ring-like, 3<sup>rd</sup> segment the largest, plate-like, flattened dorso-ventrally, 0.10 longer than its widest part, in ventral view apical margin thick (Fig. 2a), with a series of long, stiff, upturned setae, in dorsal view (Fig. 2b) internal margin greatly expanded medially, external margin widely convex; 4<sup>th</sup> segment strongly reduced to a minute sphere; relative length of antennomeres: 0.2, 0.2, 1.0, 0.04. Compound eyes relatively small, ocelli white (Fig. 1a). Mandibles (Figs. 2c-d) with molar crest, mandibular formula: L 1234 0 a(m<sup>1,2,3,4</sup> or 5,6)b /R 1234 y a(m<sup>1</sup> or 2)b, in both mandibles tooth a > b. Maxillae: Galeolacinia (Fig. 2a) with seven moderately incurved, acute teeth; three dorsal teeth more or less of same length and robustness and four ventral teeth of different size, apical one the largest; maxillary palp thick and robust, setose. Ventral pad of hypopharynx (Fig. 2a) whitish, soft, anterior half covered with long, stiff setae, a pentagonal sclerite on basal half. Labium: Prementum-postmentum articulation slightly surpassing the level of procoxae. Prementum (Fig. 3) reddish-brown to brown, subquadrate, maximum width-length ratio 0.96:1, lateral margins slightly serrulated, subparallel on apical half, moderately converging on basal half, basal margin straight, without a longitudinal, central sulcus on ventral surface (Fig. 3a); dorsal surface (Fig. 3b) with a lateral, sub-basal group of small tubercles beset with small spiniform setae. Ligula (Fig. 3) convex, moderately prominent, one third the length of its base, distal margin very slightly serrate with a dorsal row of long pilliform setae (Fig. 3b) and two short, stout, blunt teeth on the middle (Fig. 3a); dorsal surface of ligula abundantly covered with long, stiff setae, some of them as long as pilliform setae. Labial palp (Fig. 3) the same color than prementum on basal half, distal half darker, dorsal surface bare, ventral surface with some long, delicate, hair-like setae and very minute spiniform setae, ending in a stout, incurved, sharp tooth, internal margin with 8-9 incurved, sharply pointed teeth decreasing in size from the tip to the base, last almost vestigial; movable hook reddish-brown, shorter than palp, sharp and moderately incurved.

Thorax (Fig. 1a): Wider than head, setose on inferior margin of pleura. Anterior margin of pronotum straight, lateral margins rounded, posterior margin wavy. Pronotal disk granulose; a light brown, large, irregular, glabrous area on each side of midline. Posterolateral margin of propleura bulging. Anterior and posterior wing pads parallel, reaching posterior margin of S4, with light and dark areas without a regular pattern, anterior wing pads lighter. Legs granulose (Fig. 1), short (e.g.: hind legs, when fully extended, reaching posterior margin of S8); fore- and middle femora short and stout, dorsolateral margins with a tuft of long, stiff setae (Fig. 4a); hind femora cylindrical, slightly compressed laterally, with a row of long, stiff setae on dorsal and ventral margins; surfaces of fore- and middle tibiae covered with stout, conic tubercles (Fig. 4a) and long setae, ending apically in a well-developed burrowing hook; a subapical, short brush of short, stiff setae on ventral surface of protibiae; hind tibiae cylindrical, slightly compressed laterally, with a ventral row of long, stiff setae, distal margins spiny; tarsi pale, covered with some long, stiff setae on dorsum, fore- and middle tarsi with short tubercles on ventral surface, hind tarsi with rows of short, spiniform setae; tarsal claws simple, with a pulvilliform empodium.

Abdomen (Fig. 1): Fusiform, 1.7 times longer than its widest part, gently tapering caudad, brown on dorsum, yellowish-brown ventrally. S1–7 lacking dorsal protuberances, S8–9 with a very small, low protuberance on middle of posterior margin (Figs. 1a, 4b). Lateral margins of S2–3 slightly convex, straight on S4–7, slightly concave on S8–9; lateral margins of S2–6 with setae close to anterior margin, S7–9 without setae. All tergites with ill-defined color pattern, with small bare spots. Lateral spines on S6–9, reduced on S6, short on S7–9, tips rounded, increasing in size rearward (Figs. 1, 4c-d). **Sterna granulose (Figs. 4c-d), sterna 2, 5–7 and 9 divided into three sternites, sterna 3–4 and 8 divided into five sternites (Figs. 1b, 4c-d);** sutures on sterna 2–3 slightly convergent posteriorly, 4–6 parallel, divergent caudally on 7–9 (Fig. 1b). Male gonapophyses absent, (Fig. 4a), female gonapophyses highly reduced (Fig. 4b), digitiform, roundly pointed, convergent apically. Caudal appendages granulose (Fig. 4b), twice longer than tergite 10. Epiproct triangular, male's epiproct with two dorsal tubercles at basal 0.70 of its length (Fig. 4b), tip rounded. Cerci digitiform (Fig. 4b), acutely pointed. Paraprocts pyramidal (Figs. 4b-d), roundly pointed, with a basal, transversal row of long, white, stiff setae (Fig. 4c-d). Size proportions: epiproct 0.8, cerci 0.4, paraprocts 1.0.

**Measurements.** Exuviae (N= 2): TL 14.8–15.2 [15]; AL 9.0–9.1[9.05]; MWH 3.7–3.9 [3.8]; HfL 2.5; spine on S6 0.05, on S7 0.10, on S8 0.15, on S9 0.20. F-0 larvae (N= 8, mean in square brackets): TL 13.6–16.6 [15.1]; AL (ventral) 8.2–9.9 [9.0]; MWH 3.5–3.8 [3.7]; HfL 2.4–2.7 [2.5]; spine on S6 0.02–0.05 [0.04], on S7 0.05–0.10 [0.09], on S8 0.10–0.20 [0.13], on S9 0.15–0.24 [0.19].

**Habitat.** The larvae of *P. basicornis* were found inside a small seasonal creek (about 50 cm wide and 7 cm depth) and in the banks of second order streams, deep inside the forest. These water bodies are fast-flowing, pristine, surrounded by thick riparian vegetation providing shadow to the water course. Larvae preferred microhabitats with a bottom of pebbles, small rocks and coarse sand, pieces of fallen leaves and high dissolved oxygen concentrations (9.5 mg/L average) (Amaya-Vallejo et. al. 2017).

**Description of female imago:** Head (Fig. 5a). Eyes yellowish-brown, with pale yellow borders; labium cream colored, dark brown medially, with long pale setae; labrum cream colored on distal half, brown on basal half; anteclypeus and postclypeus dark brown, postclypeus with three white spots, one on each side and one on the middle; frons dark brown with a large, transversal, dorsal white spot on each side of midline, not contiguous; dorsal and anterior surfaces of frons divided by a transversal, incomplete, border; vertex, occiput and rear of head dark brown. Numerous long, dark brown setae on the face and dorsum of head and along the occiput; posterior margin of occiput, in frontal view (Fig. 5a) wavy, in dorsal view (Fig. 5b) strongly concave and irregular with a large lobe to each side of midline; antenna dark brown (Fig. 5).

Thorax. Prothorax mostly light brown, lateral lobes with pale yellow wide spots covered with long black setae. Synthorax with mid-dorsal carina brown, mesepisternum brown with two pale stripes, one dorsal and connected to pale collar anteriorly, not reaching the antealar crest posteriorly, the second one running parallel to humeral suture but only on distal 0.55 of the length of mesepisternum, widened at distal end, as described for the male (Amaya-Vallejo et. al. 2017); mesepimeron brown with a wide pale stripe full-length; metepisternum and metepimeron mostly pale with a fade brown stripe on metapleural suture, venter of pterothorax pale yellow. Coxae grayish yellow, prothoracic femora mostly dark brown, mesothoracic and metathoracic femora pale yellow, tibiae light to dark brown, tarsi and pretarsal claws blackish brown with



distinct supplementary tooth; methatoracic femora with sturdy, thick black spines, the distal ones about as long as space between bases of adjacent spines and about as wide as femur width. Wings clear, with a slight yellow basal wash at bases. Venation dark brown; width of hind wing almost 1/3 its length. **Second primary antenodal crossvein 7th in FW, 6th in HW.** Antenodal crossveins: Fw 14; Hw 8. Postnodal crossveins: Fw 12 (left), 11 (right); Hw 10 (left), 10 (right). Pterostigma gray, covering about 3.8 cells in Fw, 4.6 cells in HW. Abdomen. S1–8 slender, uniform in width. S1 pale yellow, S2–S4 blackish brown with narrow pale yellow mid-dorsal and lateral stripes; S5–7 with similar pattern but the mid-dorsal stripe shortens into a triangle reaching less than half the segment, and the lateral stripes appear discontinuous; S8–S10 all black (Fig. 5c). Cerci pale, yellow, almost doubling the size of S10, digitiform and parallel to each other, with short black and yellow bristles along entire length and slightly overpassing the epiproct, which is dark brown, rounded at the distal end and covered with long, black bristles (Fig. 5c). Paraprocts brown, round-shaped, extending half the length of cerci and covered with long, slender black setae. Vulvar lamina very wide at base, almost covering all the base of S8 and bulb-shaped, lobes also wide, with a width/length proportion of 0.71:1 and divergent tips (Fig. 5d). **Measurements (mm).** TL 35.0, AL 24.1, FwL 24.0, HwL 23.0, HWW at nodus 8.1, FW Pt 3.6, HW Pt 3.9, MWh 6.0, HfL 5.0, CL 1.10. **Habitat.** The female captured emerging *in situ* during the September 2016 field trip used the surface of a big round stone to emerge. The specimens reared under laboratory conditions, in an artificial habitat emulating the natural environment, preferred the sides of stones instead sticks or leaves. Then it is inferred that *P. basicornis* require stones protruding from water for emergence. As adults inhabit the canopy, riparian vegetation is of critical importance for their surviving and permanence.

***Perigomphus pallidistylus* (Belle, 1972), new record**  
(Figs. 6a-d)

**Material.** Two F-0 larvae (male and female), one probably F-3 larvae (female). COLOMBIA: Department of Caldas; Municipality of Norcasia, Río Manso, elevation 672 m (5.6093667N, -74.95555W), 17 March 2016 (F-0 female), R.W. Sites leg., among marginal vegetation and rocks above dam. Same data but: Río Las Pavas, 664 m (5.5867N, -74.89215W), 18 March 2016 (F-0 male), R.W. Sites leg., rocky cobble; Quebrada Santa Rita, 544 m (5.6174833N, -74.910033W), 18 March 2016 (F-3 female), R.W. Sites leg., rock/gravel cascade.

This is the first published record of *P. pallidistylus* for Colombia, increasing southward its range extension.

**Discussion**

*Perigomphus* remained as monotypic genus for almost 40 years since the original description of *P. pallidistylus* by Belle (1972). Some years ago, Tennessen (2011) described the male of *P. angularis*, and recently Amaya-Vallejo et al. (2017) described the male of *P. basicornis*. Likewise, only the larva and female of *P. pallidistylus* were known to date (Westfall 1989). After 28 years, the second larva and female for the genus are described, the larva and female of *P.*

*angularis* remaining to be discovered. As it is a genus with only three described species and the differentiating morphological characters are clearly conspicuous, the taxonomic description is the approach of main concern. It is expected to complement it with genetic barcodes as soon as the sample numbers are increased.

The larvae of *P. basicornis* and *P. pallidistylus* can be differentiated by the following features (those of *P. pallidistylus* in parentheses): Anterior border of labrum with a dense brush of long, whitish, stiff setae (anterior border of labrum with a row of grayish-brown, setae ); third antennal segment lacking small, white holes (with numerous, small, white holes on dorsal surface); prementum with a maximum width-length ratio of 0.96:1 (maximum width-length ratio of 0.84:1); S8–9 with small, low, mound-like dorsal protuberances (no dorsal protuberances on S8–9); **sternum 8 divided into 5 sternites (sternum 8 divided into 3 sternites)**; male's epiproct with dorsal tubercles at basal 0.70 its length (male's epiproct with dorsal tubercles at basal 0.50 its length); tips of male cerci not reaching the epiproct's tubercles (tips of male cerci reaching the epiproct's tubercles).

### Key to the known F-0 larvae of *Perigomphus*

1. **Sternum 8 divided into 3 sternites** (Fig. 6a); anterior border of labrum with a row of grayish-brown, setae (Fig. 6b); no dorsal protuberances on S8–9 (Fig. 6c); male epiproct little longer than its basal width, with dorsal tubercles at basal 0.50 the length of epiproct, tips of cerci reaching such tubercles (Fig. 6c); 3rd antennal segment with numerous, small, white holes on dorsal surface (Fig. 6b) ..... *pallidistylus*
- **Sternum 8 divided into 5 sternites** (Figs. 1b, 4c-d); anterior border of labrum with a brush of white setae (Fig. 2a); small, low, mound-like dorsal protuberances on S8–9 (Figs. 1a, 4b); male epiproct as long as its basal width, with dorsal tubercles at basal 0.70 the length of epiproct, tips of cerci not reaching such tubercles (Fig. 4b); 3rd antennal segment lacking white holes on dorsal surface (Fig. 2b) ..... *basicornis*

### Key to the known females of *Perigomphus*

1. Lobes of vulvar lamina narrow, parallel, in a width/length proportion of 0.38:1 ...  
..... *pallidistylus*\*
- Lobes of vulvar lamina wide, divergent, in a width/length proportion of 0.71:1 (Fig. 5d)  
..... *basicornis*

\* Note: Females of *P. pallidistylus* were not available for comparison. The key was built based on the Westfall's (1989, Fig. 3) drawing.

### Conclusions

*Perigomphus* is still a poorly known genus. Based upon the recent new species described (Tennessen 2011; Amaya-Vallejo et al. 2017), there is a high potential for more new species, mainly in primary tropical rain forest of South America. With the description here provided of

the larva of *P. basicornis*, we reach the 66% of the larvae known for the genus.

*Perigomphus* could be considered as vulnerable because of its preference for pristine habitats, although searches for other populations and new species are needed, in order to implement protection and conservation measures and to increase the number of samples for the developing of complimentary identification approaches, such as genetic barcodes.

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# FIGURE CAPTIONS

Fig. 1. Habitus of *Perigomphus basicornis*, F-0 larva: (a) dorsal; (b) ventral.

Fig. 2. Details of the morphology of *Perigomphus basicornis*: (a) ventral view of head showing mouthparts (labium removed); (b) head, dorsal view; (c) right mandible; (d) left mandible, both in ventrointernal view.

Fig. 3. Prementum of *Perigomphus basicornis*: (a) ventral; (b) dorsal.

Fig. 4. Details of the morphology of *Perigomphus basicornis*: (a) right foreleg; (b) tergita 8-10 and caudal appendages of male larva; (c) sterna 6-10 of male larva; (d) sterna 7-10 of female larva.

Fig. 5. Details of the morphology of *Perigomphus basicornis*, female imago: (a) head, frontodorsal view; (b) head, dorsal view; (c) abdominal segments 8-10 and cerci, dorsal view; (d) ventral view of vulvar lamina and caudal appendages.

Fig. 6. Details of the morphology of *Perigomphus pallidistylus* larva: (a) sterna 3-10 of male larva; (b) labrum, ventral view, showing row of gray setae; (c) tergita 8-10 and caudal appendages of male larva; (d) antennae, dorsal view, showing small holes on 3<sup>rd</sup> antennomeres.

**Figure 1**(on next page)

Habitus of *Perigomphus basicornis*, F-0 larva: (a) dorsal; (b) ventral.

a

PeerJ



b

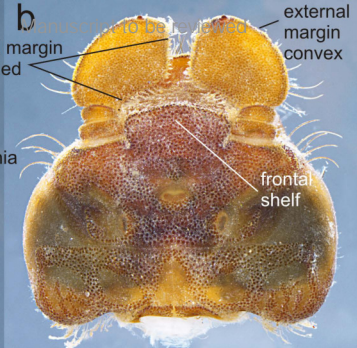
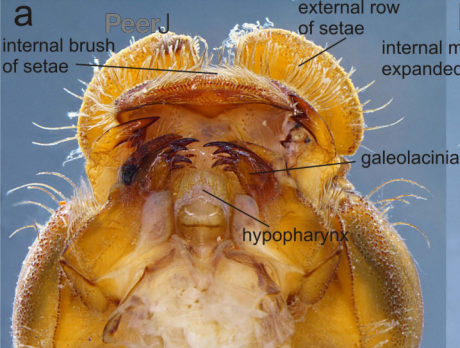
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## Figure 2 (on next page)

Details of the morphology of *Perigomphus basicornis*.

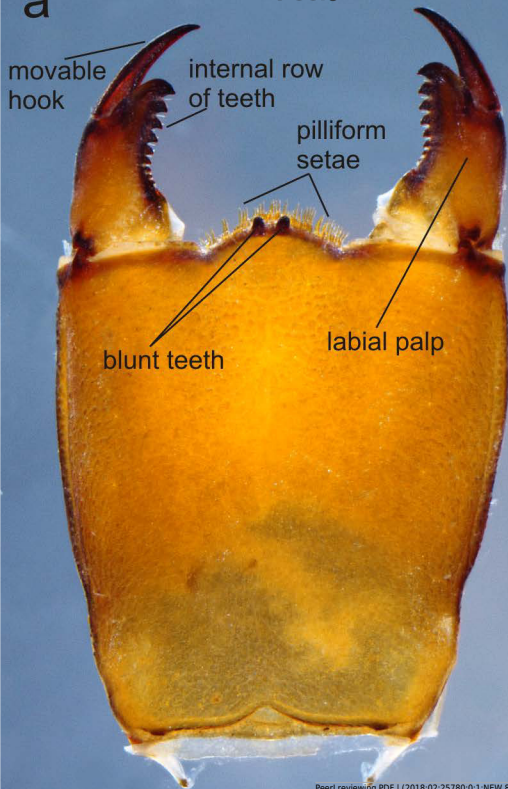
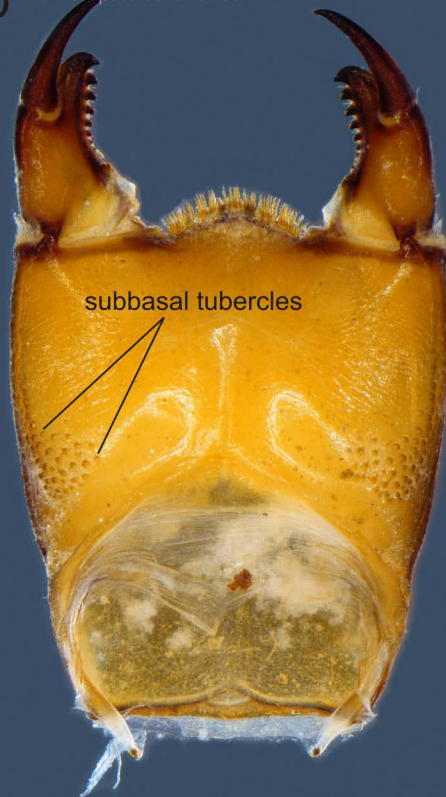
(a) ventral view of head showing mouthparts (labium removed); (b) head, dorsal view; (c) right mandible; (d) left mandible, both in ventrointernal view.





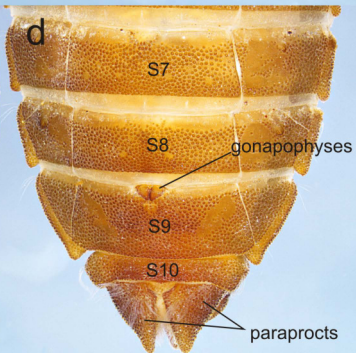
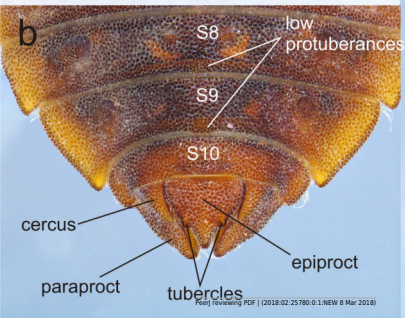
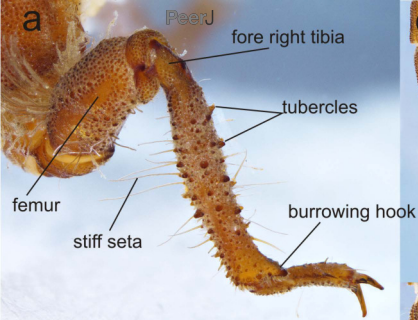
**Figure 3**(on next page)

Prementum of *Perigomphus basicornis*: (a) ventral; (b) dorsal.

**a****b**

# Figure 4(on next page)

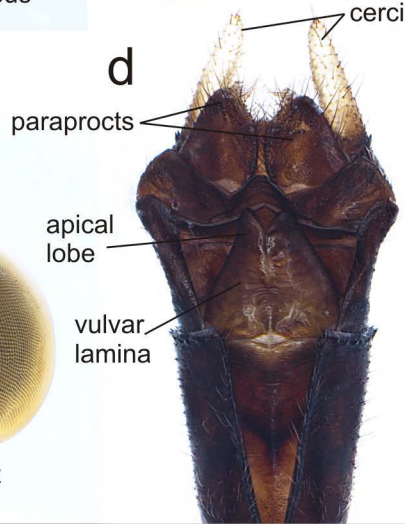
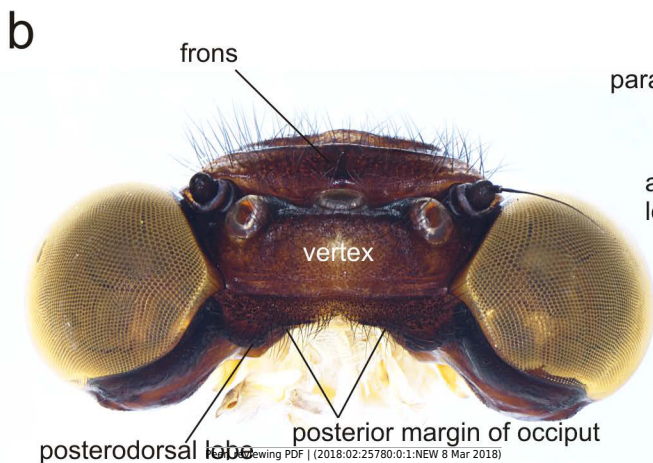
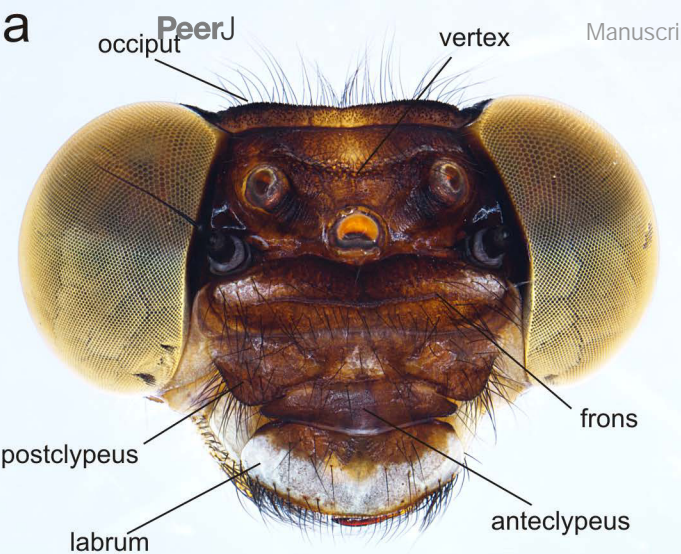
Details of the morphology of *Perigomphus basicornis*: (a) right foreleg; (b) tergita 8-10 and caudal appendages of male larva; (c) sterna 6-10 of male larva; (d) sterna 7-10 of female larva.



# **Figure 5**(on next page)

Details of the morphology of *Perigomphus basicornis*, female imago.

(a) head, frontodorsal view; (b) head, dorsal view; (c) abdominal segments 8-10 and cerci, dorsal view; (d) ventral view of vulvar lamina and caudal appendages.



# Figure 6(on next page)

Details of the morphology of *Perigomphus pallidistylus* larva

(a) sterna 3-10 of male larva; (b) labrum, ventral view, showing row of gray setae; (c) tergita 8-10 and caudal appendages of male larva; (d) antennae, dorsal view, showing small holes on 3<sup>rd</sup> antennomeres.



