

## SYSTEMATICS, MORPHOLOGY AND PHYSIOLOGY

### *Aeshna brasiliensis* sp. nov. (Odonata: Aeshnidae) from South and Southeastern Brazil, with a Redescription of its Larva

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*Aeshna brasiliensis* sp. nov. (Odonata: Aeshnidae) do Sul e Sudeste do Brasil, com Redescrição de sua Larva

RESUMO - *Aeshna brasiliensis* é descrita e ilustrada de 10 machos e 17 fêmeas do Sul e Sudeste do Brasil (holótipo-Rio Grande do Sul: Rio Tainha, 29°26'60" S 50°34'60" W, 900 m, MNRJ; alótipo- Rio de Janeiro: Itatiaia, Represa do Planalto de Itatiaia, 22°30'00" S 44°40'00" W, 2200 m, MNRJ; nove machos e 16 fêmeas parátipos). O último estágio larval é redescrito e caracteres diagnósticos são ilustrados. *A. brasiliensis* assemelha-se a *A. variegata* e *A. peralta* no padrão de cor da cabeça e abdome, porém difere delas no padrão de cor do tórax e forma dos cercos, e de *A. variegata* pela forma dos espinhos da lâmina anterior do macho, e de *A. peralta* por ser maior e pela forma dos cercos do macho. A larva se destaca por diferenciar-se de todas as outras congêneres conhecidas do Brasil pela ausência do espinho lateral no VI segmento do abdome.

PALAVRAS-CHAVE: Insecta, *Aeshna peralta*, *A. variegata*.

ABSTRACT - *Aeshna brasiliensis* (holotype ♂ Rio Grande do Sul: Rio Tainha, 29° 26' 60" S 50° 34' 60" W, 900 m, MNRJ; allotype ♀ Rio de Janeiro: Itatiaia, Represa do Planalto de Itatiaia, 22° 30' 00" S 44° 40' 00" W, 2200 m, MNRJ; nine males and 16 female paratypes) is described and illustrated from 10 males and 17 females from southeastern Brazil. The last larval instar is redescribed and diagnostic characters are illustrated. *A. brasiliensis* resembles *A. variegata* and *A. peralta* in the color pattern of head and abdomen, but differs from them in the thoracic color pattern and shape of cerci, from *A. variegata* in the shape of anterior lamina spines, and from *A. peralta* by its larger size and shape of male cerci. The larvae uniquely differ from all the other known Brazilian congeners by lacking lateral spines on abdominal segment VI.

KEY WORDS: Insecta, *Aeshna peralta*, *A. variegata*.

The new species herein described was previously recorded from Brazil as *Aeshna peralta* Ris by Calvert (1956) and Santos (1966b). The latter provided a description of the last larval instar and measurements of the adults, based on reared specimens from Brejo da Lapa (Itatiaia). Jurzitza (1990) synonymized *A. peralta* with *A. variegata* Fabricius, without examining these specimens from Brazil. Muzón & Ellenrieder (1997) described the larva of *A. variegata*, and noted some differences with the larva described by Santos (1966b) as *A. peralta*. Examination of the types of *A. peralta* revealed it to be a good species (von Ellenrieder, unpublished), related to *A. variegata* and *A. brasiliensis*.

#### Material and Methods

Wing terminology follows Riek & Kukulová-Peck (1984), and larval mandibular formula follows Watson (1956). Length of pterostigma was measured from anterior costal end to posterior anal end. All dimensions are in millimeters. Type

material of *A. brasiliensis* is deposited in the following collections: MNRJ: Museu Nacional de Rio de Janeiro, BRAZIL; MLP: Museo de La Plata, Departamento de Entomología, ARGENTINA; RWG: Dr. R. W. Garrison private collection, Azusa, USA.

#### *Aeshna brasiliensis* sp. nov.

*Aeshna peralta* Ris: Calvert (1956) (in part; ♂ from Itatiaia); Santos (1966a) (description of larval habitat); Santos (1966b) Figs. 1-3 (description of larva, comments and measurements of HW, abdomen and cerci length of adults); Santos (1988) (mention of larva); Muzón & Ellenrieder (1997) (comparison with larva of *variegata*); Carvalho & Nessimian (1998) (mention from Rio de Janeiro State); Costa *et al.* (2000) (mention from São Paulo State).

*Aeshna* sp. Ellenrieder (2001a, b)

Material examined - Holotype: ♂ Brazil: Rio Grande do Sul:

Rio Tainha-900 m, N.D. Santos leg., 20-I-1958 (MNRJ); **Allotype**: ♀ Brazil: Rio de Janeiro: Itatiaia, Represa do Planalto de Itatiaia, N.D. Santos leg., 13-I-1953 (MNRJ # 21.958); **Paratypes**: Brazil: Rio de Janeiro: 1 ♂ 8 ♀ same data as allotype (MNRJ # 21.928-31, 21.951, 52, 54, 56) - 1 ♂ (MLP # 21.955), 2 ♂ 1 ♀ Itatiaia, Brejo da Lapa, 2200 m, N.D. Santos & J.P. Machado leg., 12-X-1967 (MNRJ) - 2 ♂ (MLP, RWG); 1 ♂ 1 ♀ same data except N.D.Santos & Duílio leg., 2-III-1976 (MNRJ); São Paulo: 1 ♂ Ypiranga, J.G. Fonseca leg., III-1927 (MNRJ # 21976); 1 ♂ Campos do Jordão, Umuarama, 1700 m, Ebert leg., I-1966 (MNRJ); Paraná: 1 ♀ Curitiba, XI-1941 (MNRJ # 22011); 1 ♀ União da Vitória, V. Staviarski leg., I-1952 (MNRJ # 22046), 1 ♀ Bituruna, V. Staviarski leg., III-1966 (MNRJ); Rio Grande do Sul: 1 ♂ Rio Grande, Rio Lajeado Grande, 30-I-1982, N.D. Santos, J.M. Costa, L.F. Netto & H. Mesquita leg., 30-I-1982 (MNRJ), 1 ♀ Riacho do Arroio, km 113 entre S. Francisco de Paula e Rio Tainha, N.D. Santos leg., 9-XI-1967 (MNRJ), 1 ♀ Rio Grande do Sul, S. Francisco de Paula, Rio

Tainha, J.A. Petersen leg., 5-X-1957 (RWG). **Larvae**: Brazil: Rio de Janeiro: Itatiaia, Brejo da Lapa - 2.200 m, 5 ♂ 1 ♀ (larvae), N.D. Santos, J.M. Costa & J.P.Machado leg., 4-VII-1966 (MNRJ); same data except 2 ♂ 1 ♀ (exuviae), 23.VII.1966 (MNRJ)- 2 ♀ (larvae), N.D.Santos & J.P.Machado leg., 12-X-1967 (MNRJ)- 1 ♂ 2 ♀ (exuviae), N.D. Santos leg., 29-VII-1968 (MNRJ)- 1 ♂ 2 ♀ (exuviae), N.D. Santos leg., 10.XI.1968 (MNRJ)- 7 ♂ 4 ♀ (larvae), N.D. Santos leg., 20-IV-1976 (MNRJ)- 1 ♂ 2 ♀ (larvae), N.D. Santos leg., 21-IV-1976 (MNRJ).

### Description

**Holotype Male.** Head. Labium pale brown; labrum yellow, with basal and distal margins dark brown; clypeus and frons yellow, top of frons with T-spot complete (Fig. 1A), with stem slightly widened basally; a narrower area of yellow followed by a dark-gray rounded spot on each side of the T-spot; wide black stripe along frontoclypeal groove (Fig. 1B); frontal carina

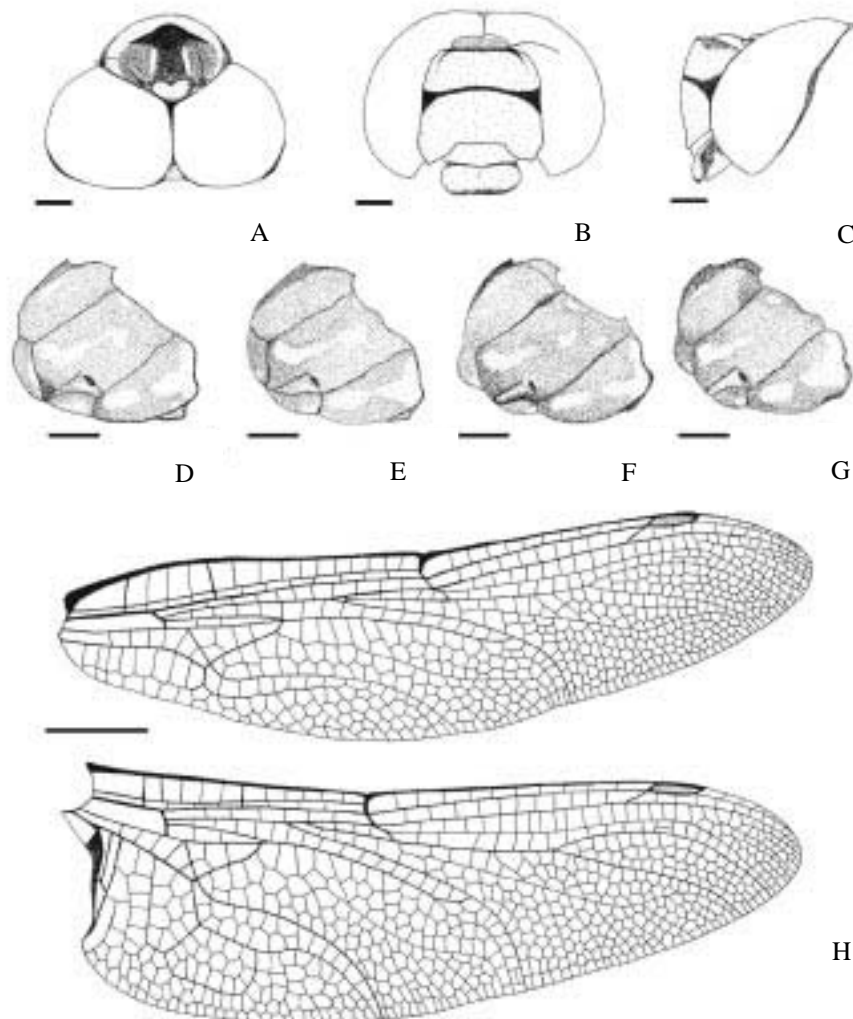


Fig. 1. *A. brasiliensis* sp. nov.: A-C, head, ♂ holotype, A: dorsal view, B: frontal view, C: lateral view; D-G, pterothorax, color pattern variation, D, ♂ holotype, E, ♀ allotype, F, ♂ paratype (Rio Lajeado), G, ♂ paratype (Planalto do Itatiaia); H, wings, ♂ holotype (scales= 3 mm).

(anterior margin of T-spot) angulate in frontal view (Fig. 1B). Blackstripe along ocular groove, abruptly widening towards frontoclypeal groove (Fig. 1C); vertex yellow with black margins; occipital triangle yellow, rear of head black.

**Thorax.** Pterothorax reddish brown with pale stripes and spots (Fig. 1D): Mesepisternum with incomplete, yellow and narrow antehumeral stripe at basal 0.5, mesepimeron with a stripe at basal 0.75, yellow, sinuous, and narrowed at its medial length, and with a round small yellow spot at its upper anterior edge; metepimeron with a stripe divided into yellow basal round spot and distal T-shaped white spot. Venter reddish brown with a medial round yellow spot. Legs: black, basal 0.60 of femora red brown. Wings (Fig. 1H): Hyaline, venation black except for yellow costa. Pterostigma dark brown dorsally and yellow ventrally, covering three cells. Membranula basal half white, distal half black.

**Venation.** (range; holotype values in parenthesis). Antenodal crossveins FW: 12-17 (15); antenodal crossveins HW: 8-11 (11); cells triangle FW: 4-5 (5); cells triangle HW: 4-5 (4); crossveins supratriangle FW: 1-3 (2); crossveins supratriangle HW: 0-3 (2); cells subtriangle FW: 1-2 (2); cells subtriangle HW: 2; crossveins of Cu-A space FW: 3-4 (4); bridge crossveins FW: 2-4 (4 right, 3 left); bridge crossveins HW: 2-4 (3); row of cells enclosed in IRP2 fork at pterostigma level FW: 2-4; row of cells enclosed in IRP2 fork at pterostigma level HW: 2-4 (3-4); cells anal loop: 7-10 (9 right, 10 left); row of cells in anal loop: 3, 2 on costal side; cells anal triangle: 3.

**Abdomen.** Reddish brown with black areas and pale maculation (color not recognizable due to bad preservation), as shown in Fig. 2 A-B. Ventral terga as shown in Fig. 2E. Medial tubercle of sternum I well developed, bearing small denticles; auricles of segment II each with 2 teeth; genital

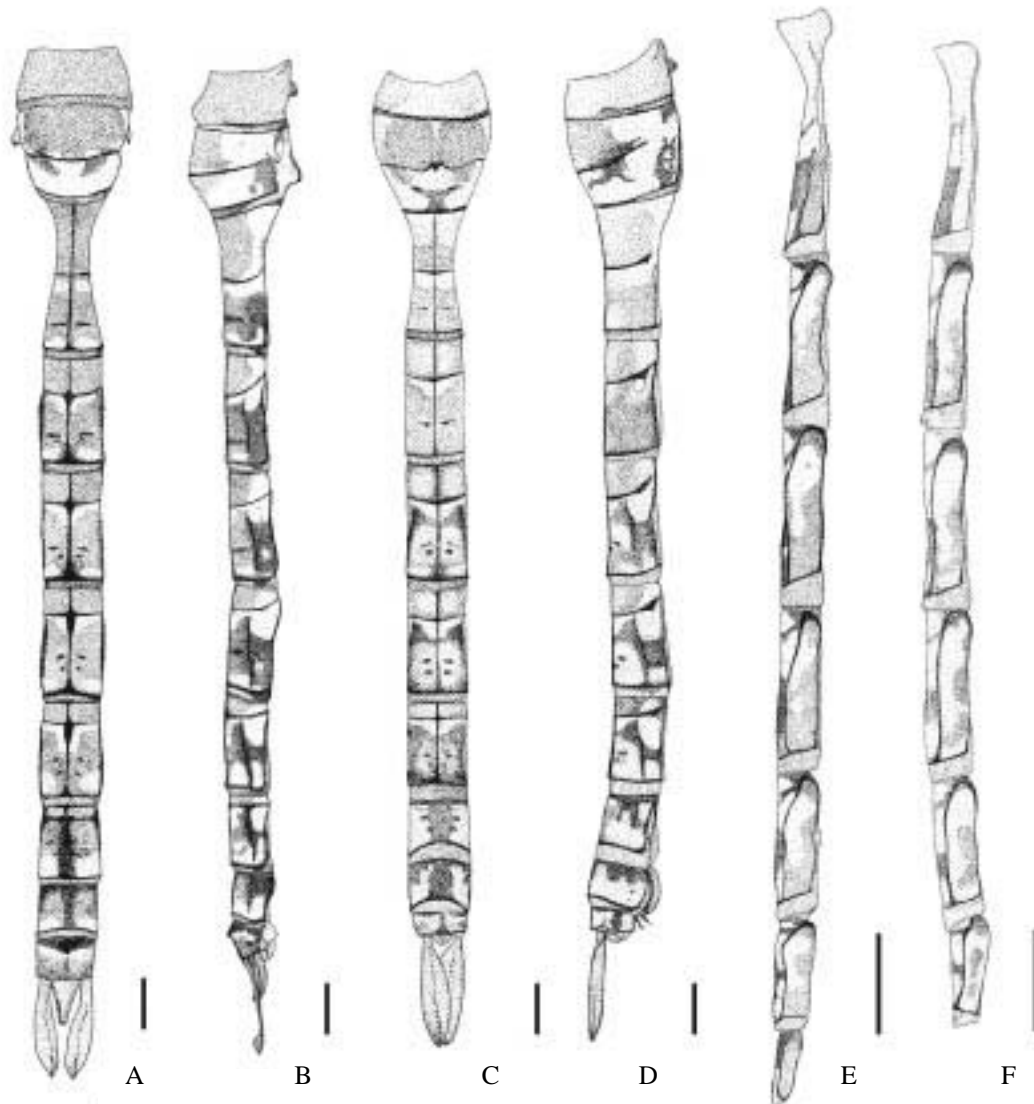


Fig. 2. *A. brasiliensis* sp. nov., abdominal color pattern: A-B, E ♂ holotype, A, dorsal view; B, lateral view; E, ventral view; C-D, F, ♀ allotype, C, dorsal view, D, lateral view, F, ventral view (scales = 2 mm).

lobes triangularly ridged, with 15-20 small denticles on posterior end (Fig. 3A); anterior process of anterior hamulus very short, forming a small mesally pointed tip (Fig. 3B paratype); spine of anterior lamina laterally compressed surpassing caudal end of hamular fold, with pointed tip and ventral margin approximately

linear (Fig. 3C paratype); distal segment of vesica spermalis with well developed latero-posterior and dorsal folds (Fig. 3E-F). Cerci gradually widening at 0.50 of length; maximum width at distal 0.30; tips mucronate (Fig. 4A); subbasal tooth small; dorsal crest well developed at distal 0.2 (Fig. 4B).

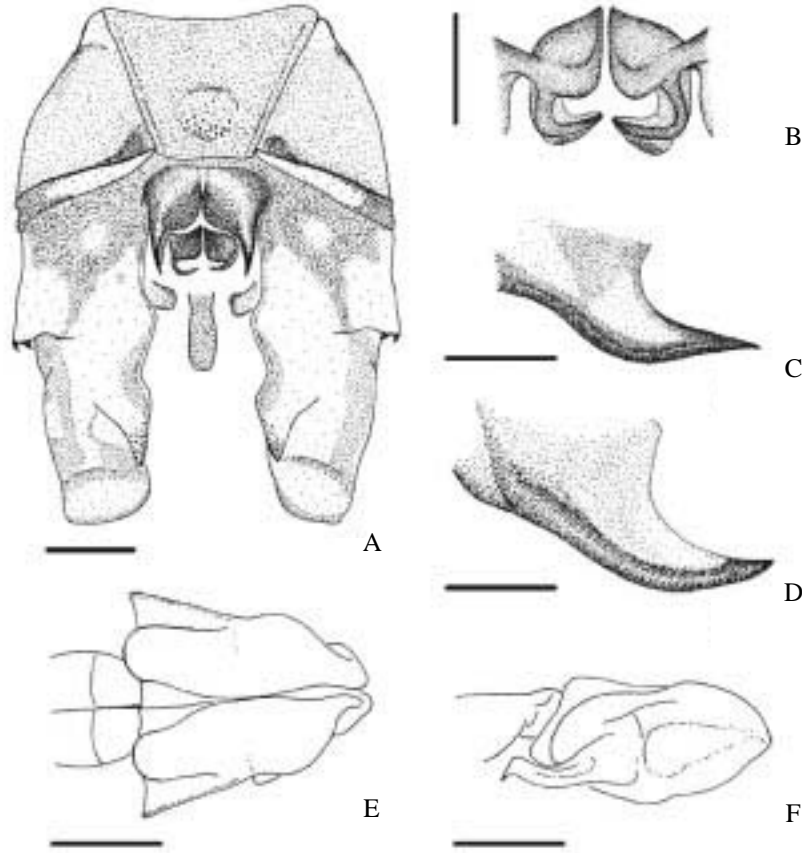


Fig. 3. Male secondary genitalia: A-C, E-F, paratype *A. brasiliensis* sp. nov. (Campos do Jordao), D, *A. variegata* (Chile, Puerto Ramirez); A, general view of sterna I-II (vesica spermalis omitted), B, hamuli anteriores, postero-ventral view, C-D, spine of anterior lamina, lateral view, E-F, distal segment of vesica spermalis, E, ventral view, F, lateral view (scales = 1 mm).

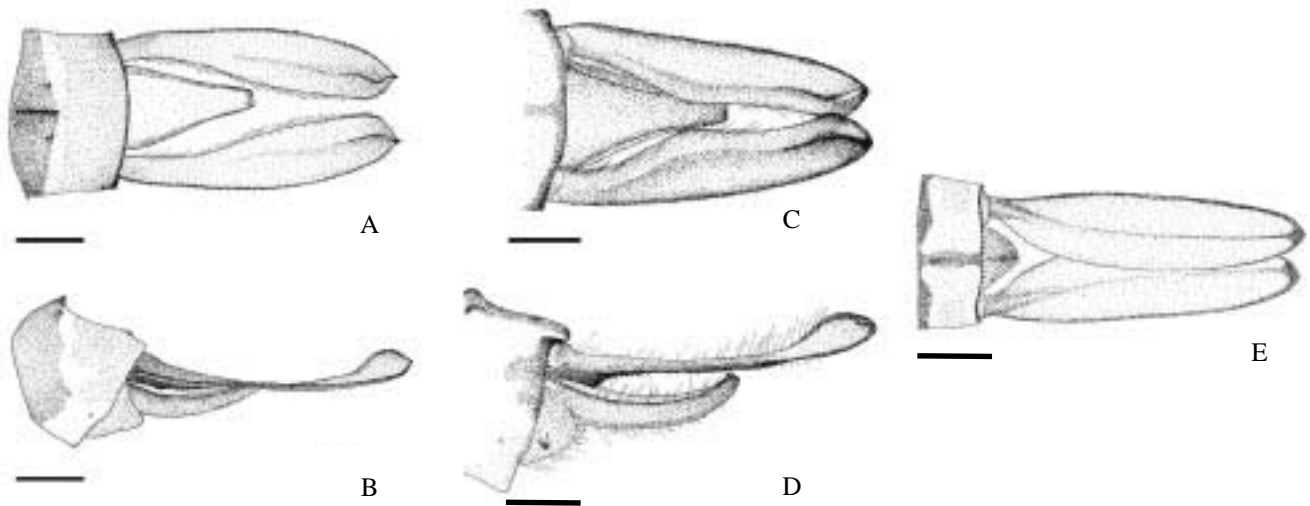


Fig. 4. Cerci: A-B, ♂ holotype, E, ♀ allotype of *A. brasiliensis* sp. nov., C-D, *A. variegata*, A, C, E, dorsal view, B, D, lateral view (scales = 1 mm).



**Variation (Paratypes).** Similar to holotype, pale stripes of pterothorax variable in extension (Fig. 1D, F, G), mesepisternal stripe extending from basal 0.25 to 0.50; mesepimeral from basal 0.50 to 0.75, and metepimeral continuous or divided into two spots. In some specimens the color of pale abdominal spots is recognizable: Dorsal spots light blue except those from abdominal segment X, which are yellow.

Measurements (mm) (Mean and standard deviation; number of specimens; range in square brackets; holotype values in parenthesis): Head maximum width:  $8.45 \pm 0.12$ , N=7 [8.3-8.6] (8.3); frons max. width:  $4.23 \pm 0.12$ , N=8 [4.1-4.5] (4.2); forewing length:  $39 \pm 0.97$ , N=9 [38-40] (40); hindwing length:  $37.73 \pm 1.03$ , N=9 [35.7-39.2] (38.5); forewing width:  $9.65 \pm 0.33$ , N=10 [9.3-10.2] (9.6); hindwing width:  $12.04 \pm 0.43$ , N=10 [11.5-12.7] (11.7); forewing pterostigma length:  $3.16 \pm 0.21$ , N=10 [2.8-3.4] (3.33); hindwing pterostigma length:  $3.04 \pm 0.18$ , N=10 [2.8-3.3] (3.1); cerci length:  $4.77 \pm 0.16$ , N=9 [4.58-5.1] (4.75); epiproct length:  $2.37 \pm 0.16$ , N=10 [2.16-2.66] (2.16); abdominal segment III length:  $7.02 \pm 0.36$ , N=9 [6.5-7.66] (7.66); total length:  $61.13 \pm 0.97$ , N=8 [59.9-63] (63).

**Female (Allotype).** Head and thorax as in holotype except mesepisternal stripe at basal 0.30, and metepimeral stripe narrow at mid-length but not divided into two spots, distal half light blue (Fig. 1E).

**Abdomen.** As in holotype (Fig. 2C-D); ventral terga as shown in Fig. 2F. Cerci lanceolate; maximum width at medial 0.30; tips mucronate (Fig. 4E).

**Variation (Paratypes).** Similar to allotype (Fig. 1E), pale stripes of pterothorax variable in extension, mesepisternal stripe extending from basal 0.25 to 0.50; mesepimeral from basal 0.50 to 0.75, and metepimeral continuous or divided into two spots. In some specimens the color of pale abdominal spots is recognizable: Dorsal spots are light blue and lateral spots yellow.

Measurements (mm) (Mean and standard deviation; number of specimens; range in square brackets; allotype values in parenthesis): Head maximum width:  $8.65 \pm 0.21$ , N=16 [8.3-9] (8.6); frons max. width:  $4.37 \pm 0.13$ , N=17 [4.1-4.5] (4.5); forewing length:  $41.02 \pm 0.9$ , N=17 [39.5-43] (40); hindwing length:  $39.37 \pm 0.84$ , N=17 [38-41] (39.5); forewing width:  $9.98 \pm 0.3$ , N=17 [9.24-10.7] (9.7); hind wingwidth:  $13.09 \pm 0.41$ , N=17 [12-14] (12.7); forewing pterostigma length:  $3.69 \pm 0.23$ , N=17 [3.2-4] (3.6); hindwing pterostigma length:  $3.5 \pm 0.25$ , N=[3.1-4]; cerci length:  $5.15 \pm 0.3$ , N=14 [4.6-5.6] (5.2); cerci max. width:  $1.21 \pm 0.04$ , N=14 [1.15-1.3] (1.2); abdominal segment III length:  $6.86 \pm 0.25$ , N=17 [6.5-7.4] (6.7); total length:  $63.03 \pm 1.61$ , N=13 [60.2-65.5] (62.3).

**Venation** (range; allotype values in parenthesis): Antenodal crossveins FW: ♀: 13-17 (15 right, 14 left); antenodal crossveins HW: 8-12 (10); cells triangle FW: 3-5 (4); cells triangle HW: ♀: 4-6 (4); crossveins supratriangle FW: 0-3 (2 right, 3 left); crossveins supratriangle HW: 0-2 (1 right, 2 left); cells subtriangle FW: 1-2 (2); cells subtriangle HW: 1-2 (2);

crossveins of Cu-A space FW: ♂: 3-4 (4); ♀: 3-5 (4 right, 3 left); crossveins of Cu-A space HW: ♀: 2-4 (4 right, 3 left); bridge crossveins FW: 2-4 (3); bridge crossveins HW: 2-4 (3 right, 2 left); row of cells enclosed in IRP2 fork at pterostigma level FW: 2-4; row of cells enclosed in IRP2 fork at pterostigma level HW: 2-4 (3-4); cells anal loop: 7-13 (9 right, 10 left); row of cells in anal loop: 3, 2 on costal side.

### Redescription of the Last Larval Instar

**Head** (Fig. 5A): Approximately one and a half to two times wider than long. Occipital margin concave, with five pilose patches on each side. Antennae (Fig. 6E) 7-segmented, the third antennomere the longest. Labium reaching caudad posterior margin of second coxae; prementum as wide as 0.9 its length, border of medial lobe with fringe of setae and with two small tubercles, one on each side of median cleft, both shorter than setae. Labial palp (Fig. 6G) with a small infraapical tooth, inner margin serrated, with 16 denticles; movable hook 1.5 times as long as the inner margin. Mandibular formula (Fig. 6A-D): L 1234 0 a b k / R 1234 y a a' b k

**Thorax:** Prothoracic supracoxal processes with pointed apex, base of the anterior one as broad as posterior one (Fig. 5B-C); wing pads nearly parallel, the external reaching caudad basal third of abdominal segment V; femora and tibiae without dark annular bands (Fig. 5A).

**Abdomen:** Widest on segments V-VIII. Dorsal color pattern as in Fig. 5A. Lateral spines present on segments VII-IX, the VIII the longest. Female gonapophyses (Fig. 5E) not reaching the posterior margin of segment IX. Cerci (Fig. 5D) slightly shorter than epiproct, epiproct with middorsal ridge and two apical short spines; male basal lamina with blunt tip, as long as 0.45 of epiproct.

**Habitat:** The larvae were collected at small lotic pools formed by cascading waters characteristic of the highlands within the region of Itatiaia. These pools contained abundant aquatic vegetation, with abundant Amphipoda (*Hyallela* sp.) and larval Trichoptera, Ephemeroptera, *Aeshna punctata* Martin (Aeshnidae) and *Oxyagrion simile* Costa (Coenagrionidae).

Measurements (mm) (Mean and range in square brackets, N=17 ♂ 14 ♀; unless stated, measurements are for both ♂ and ♀): Total length (without caudal appendages): ♂ 27.5 [27-28]; ♀: 28.5 [27-30]; head maximum width: 7.5 [7-8], head maximum length: ♂ 4.5 [4-5], ♀ 4.25 [4-4.5]; prementum maximum length: 5.5 [5-6]; prementum maximum width: 4.75 [4.5-5]; palp movable hook: 1.8 [1.6-2]; antennomere I: 0.5; II: 0.7; III: 1.7; IV: 0.6; V: 0.8; VI: 0.6; VII: 1.0; femur I length: 3.52 [3.3-3.75], femur II: 4.75 [4.5-5], femur III: 6.1 [5.6-6.6]; tibia I length: 4.2 [4-4.4], tibia II: 4.65 [4.3-5], tibia III: 5.1 [5-5.2]; internal wing pads length: 7.9 [7.5-8.3], external: 7.7 [7.2-8.2]; maximum length of abdominal segment V: 1.8, VI: 1.7, VII: 1.7, VIII: 1.7, IX: 1.3, X: 1.2; lateral spines (inner margin) on segment VII: 0.5, VIII: 0.9, IX: 0.7; epiproct length: 3.1; cerci (external margin): 2.8; paraprocts: 4; inner gonapophyses (inner margin): 2.

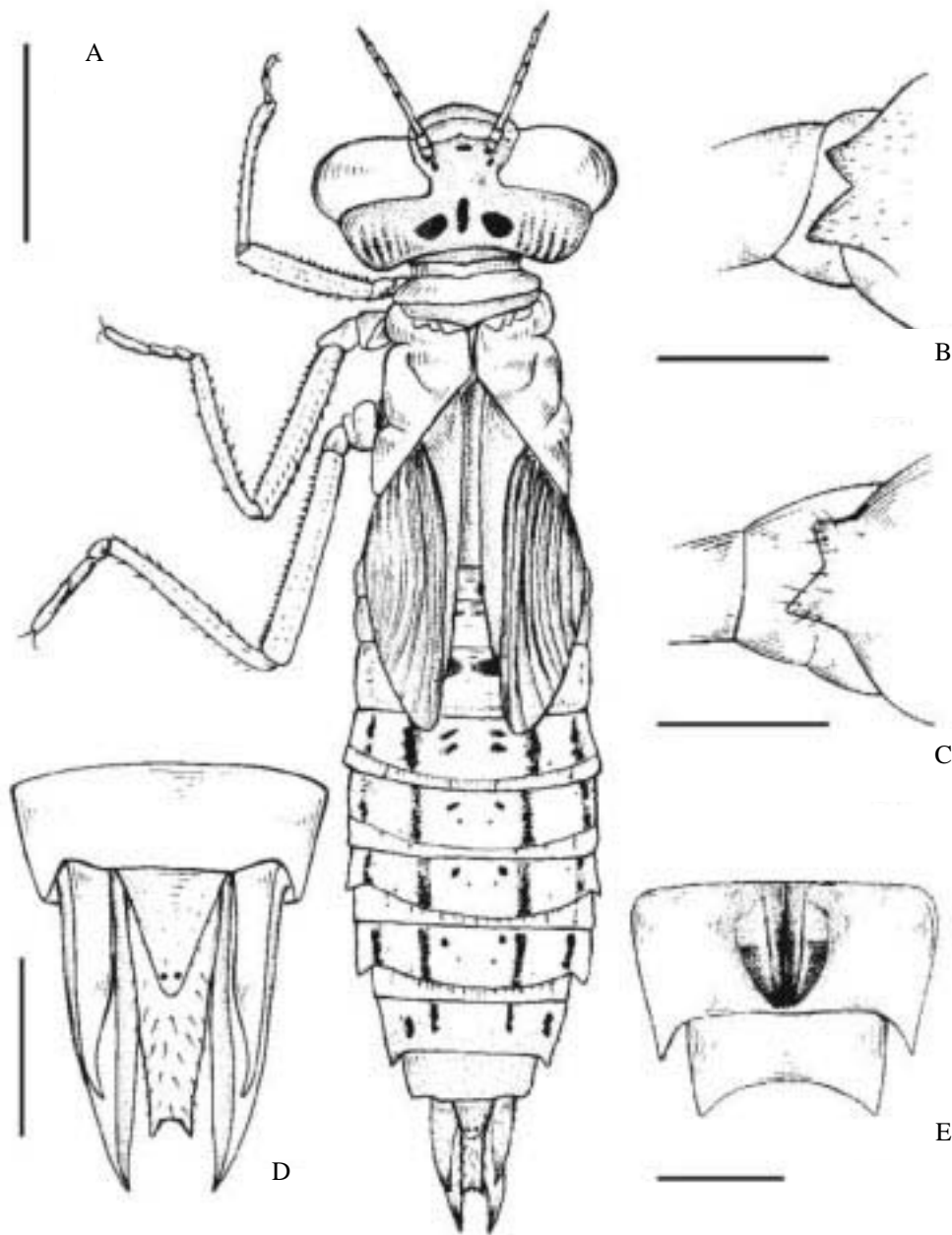


Fig. 5. *A. brasiliensis* sp. nov., last larval instar: A, ♂ general view (scale = 5 mm); B-C, prothoracic apophyses, dorsal view (scale = 1 mm), B, male, C, female; D, terminalia, dorsal view; E, female gonapophyses, ventral view (scales = 2 mm).

**Distribution** (Fig. 7): Brasil: Rio de Janeiro: Itatiaia, Represa do Planalto de Itatiaia; Itatiaia, Brejo da Lapa, 22°30'00"S 44°40'00"W, 2200 m. São Paulo: Ypiranga, 23°32'52"S 46°38'07"W, 760 m; Campos do Jordão, Umuarama, 22°44'45"S 45°34'47"W, 1700 m. Paraná: Curitiba, 25°25'00"S 49°15'00"W, 913 m; União da Vitória, 26°13'00"S 51°04'60"W, 752 m; Bituruna, 26°10'00"S 51°34'00"W, 914 m. Rio Grande do Sul: Rio Tainha-900 m; San Francisco de Paula, Rio Tainha; Riacho do Arroio, km 113 entre S. Francisco de Paula e Rio Tainha; Rio Lajeado Grande, 29°26'60"S 50°34'60"W, 900 - 922 m.

## Discussion

*Aeshna brasiliensis* was previously recorded as *Aeshna peralta* (Calvert 1956, Santos 1966b) probably because of their overall similarity. It is easily distinguished from *A. peralta* and *A. variegata* by the shape of male cerci (gradually widened in *brasiliensis* with maximum width at distal 0.30 - abruptly so in *peralta* and *variegata* with maximum width at basal 0.30; Fig. 4A, 4C), female cerci (tips mucronate in *brasiliensis* - rounded in *A. peralta* and *A. variegata*), and by the thoracic color pattern (mesepimeral and metepimeral

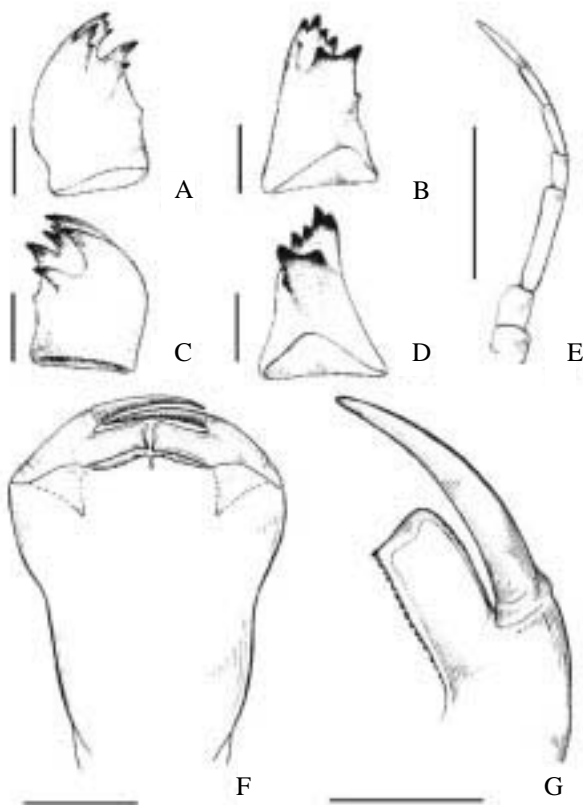


Fig. 6. *A. brasiliensis* sp. nov., last larval instar: A-B, right mandible, A, posterior view, B, inner view; C-D, left mandible, C, posterior view, D, inner view; E, antenna (scales = 1 mm); F, prementum (scales = 2 mm); G, labial palp (scale = 1 mm).

stripes narrowed or interrupted at mid-length and pale spot at upper anterior edge of mesepimeron in *brasiliensis* - stripes not narrowed at midlength in *peralta* and *variegata* and no pale mesepimeral spot). It differs also from *A. peralta* by its larger size (Ellenrieder, unpublished): Total length ♂ 59.9-63 versus 51.75-56.5, ♀ 60.2-65.5 versus 51.5-57; cerci length ♂ 4.58-5.1 versus 3.75-4.5; cerci length ♀ 4.6-5.6 versus 3-4.5, and by the shape of female cerci (inner and outer margins converging gradually in distal half in *peralta*, approx. parallel in *brasiliensis*). The shape of the spines of the male anterior lamina separate it also from *A. variegata* (ventral margin straight in *brasiliensis*, convex in *variegata*; Fig. 3C-E), as well as the degree of development of the subbasal tooth of the male cerci (small in *brasiliensis* - prominent in *variegata*; Figs 4B, 4D). The last larval instar of *Aeshna brasiliensis* differs from that of all the other known *Aeshna* larvae from Brazil (*A. bonariensis*, *A. confusa*, *A. cornigera* and *A. punctata*) and from *A. variegata* by the absence of lateral spines on abdominal segment VI; it differs from *A. variegata* also by the absence of dark annular bands in the legs (present in *variegata*); its smaller size (body length 32.8/37 mm in *variegata* - 27/30 mm in *brasiliensis*), shorter cerci (2-2.55 mm in *variegata* - 2.8 mm in *brasiliensis*) and length of anterior/posterior ocular margin (0.66-0.8 in *variegata* - 0.8/0.82 in *brasiliensis*). The larva of *A. peralta* is still unknown.

*Aeshna brasiliensis* is thus far known from southeasternt and south Brazilian localities (Fig. 7), all within the Paranaense biogeographic province (Cabrera & Willink 1980). Records comprise a south-eastern strip from 22°30' to 29° 26' S and 44°40' to 51°34'W, between 750 and 2200 m above sea level.

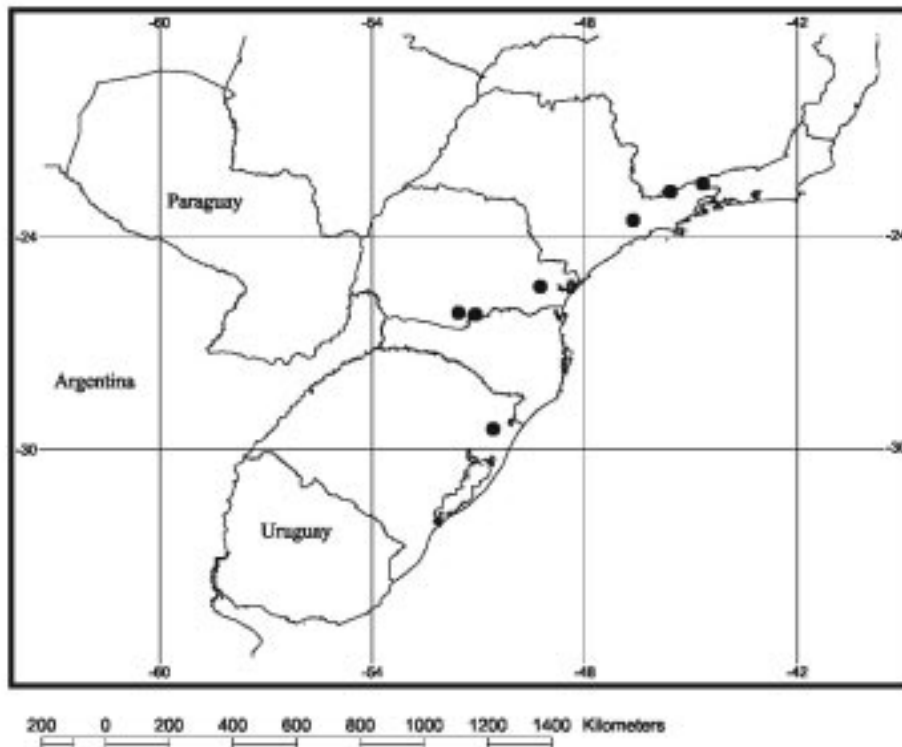


Fig. 7. Map of Brazil showing the distribution area of *A. brasiliensis* sp. nov.

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