

## The true *Argia difficilis* Selys, 1865, with the description of *Argia yungensis* sp. nov. (Odonata: Coenagrionidae)

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### ABSTRACT

*Argia yungensis* sp. nov., a new species close to *Argia difficilis*, is described. Both species are illustrated and diagnosed and their distributions mapped. They can be distinguished by the morphology of male tori, cerci and paraproct, and female prothorax. Their distributions are allopatric, with *Argia yungensis* distributed along the foothill jungle of the Yungas rain forest from NW Argentina to Peru, and *A. difficilis* from Peru and Brazil to Venezuela across the lowland Amazon forest. *Argia extranea forficula* Fraser is synonymized with *A. difficilis*, and the latter is redescribed.

**Key Words:** Odonata, *Argia*, Coenagrionidae, Zygoptera, South America, Yungas.

### RESUMEN

*Argia yungensis* sp. nov., una nueva especie cercana a *Argia difficilis*, es descrita. Ambas especies son ilustradas y diagnosticadas y sus distribuciones mapeadas. Se distinguen por la morfología de los tori, cercos y paraproctos del macho, y del protórax de la hembra. Sus distribuciones son alopatricas, con *Argia yungensis* distribuida a lo largo de la selva pedemontana de las selvas nubladas de las Yungas desde el NO de Argentina hasta Perú, y *A. difficilis* desde Perú y Brasil hasta Venezuela a través de la selva baja Amazónica. *Argia extranea forficula* Fraser es sinonimizada con *A. difficilis*, y esta última es redescrita.

### INTRODUCTION

Ever since its original description (Selys 1865) from a single female from "Jurimangus au Pérou", the true status of *Argia difficilis* Selys has remained a mystery. In his original description Selys noted (translated from French): "By the raised plates of the thorax, which are barely perceptible, separated at the crest becoming obliterated outwardly and situated on the inner side touching a sunken part, they recall equally [*Argia*] *lilacina*." Calvert (1902) in his well-known *Biologia Centrali-Americana* assigned the name to females with large, foliar-like mesostigmal lobes from Panama (Bugaba), Colombia, Venezuela and Ecuador. Later (Calvert 1907) he provided a description and illustrations of the male based on a series of 17 males and 6 females from Surubres, Costa Rica. Calvert (1909) included a female from Colombia under this name, and commented on the close association of the male of *Argia difficilis* with his newly described *Argia hasemani* Calvert: "The male of [*Argia hasemani*] so closely resembles that of *A. difficilis*

Selys that I should hesitate to propose a distinct name for it were it not that the females (if I have correctly associated them) show a number of differences from *difficilis* females. Förster (1914) in discussing *A. difficilis*, noted (translated from German): "In the Synopsis des Agrionines DeSelys described a female from Jurimaguas in Peru as *A. difficilis*. Calvert identified with it an *Argia* of the *oculata*-type from Central-America, Colombia and Ecuador. However, I hold these for the typical *oculata*. Selys described the latter from Venezuela." Ris (1918), based on Calvert's concept of the name, included material from Panama south through Colombia under *Argia difficilis*.

Schmidt (1942) determined 4 males and 3 females from Sivia (Ayacucho dept.), Peru as *A. difficilis*, and stated (translated from German): "the material at my disposal differs from [*Argia mollis* Selys *sensu* Calvert 1909] by the color pattern of the abdomen and by the shape of the appendages, which besides do not agree with that of *difficilis* illustrated by Calvert (1901 [1907] Tab.8, fig. 42), because of this reason they are illustrated here . . ." Geijskes (1932) assigned specimens from Trinidad to this species but noted its similarity to *Argia oculata* Hagen *in* Selys.

Two other species were described which are now known to correspond to *Argia difficilis*. Förster (1914) described *Argia machadina* based on a male from Rio Machadina, Brazil. After examining the holotype we determined it to be a junior synonym of *A. difficilis* (Garrison *et al.* 2003). To leave no doubts as to its identity we include here illustrations of the holotype of *A. machadina*. Fraser (1946) described *Argia extranea forficula* based on two males from Balsapuerto, Peru. Examination of the types demonstrates they also correspond to *A. difficilis*. We illustrate here the types of *A. extranea forficula* and synonymyze that name with *A. difficilis*.

Thus, the name *Argia difficilis* has been applied to at least three or more different species in the literature although none of the authors had ever examined the holotype female. The late Leonora K. Gloyd, who examined the holotype of *A. difficilis* (Gloyd 1980), expressed opinions to several odonatologists as to the true identity of this species. During 2002, NE compared the holotype with material of both species discussed here.

As part of our on-going analysis of neotropical components of this genus, we clarify the status of *Argia difficilis* and describe another species which has been associated with this name for a number of years.

## MATERIALS AND METHODS

All characters were illustrated with the aid of a camera lucida and drawings are to scale except where indicated. Measurements were taken from 20 specimens (10 males and 10 females) from different localities and are in mm; total length and abdominal length do not include appendages. Abbreviations for structures used throughout the text are as follows: lig: genital ligula; mpl: mesostigmal plates; mp: map; FW: forewing; HW: hindwing; pthx: pterothorax; prx, prothorax; px: postnodal crossveins; s1-10: abdominal segments one to 10; l.v.: lateral view; m-d.v.: medio-dorsal view; d.v.: dorsal view; p.v.: posterior view. Wing terminology follows Riek & Kukalová-Peck (1984) as amended by Bechly (1996). Maps were created electronically from the Digital Chart of the World (1:1,000,000) using ArcView 9.1.

Acronyms for collections and collectors are as follows:

ABM	Angelo B. Machado personal collection, Minas Gerais, BRAZIL
BMNH	Natural History Museum, London, UK
DRP	Dennis R. Paulson personal collection, Seattle, WA, USA
FML	Instituto y Fundación Miguel Lillo, Tucumán, Argentina
FAL	Frederico A. Lencioni personal collection, São Paulo, Brazil
FSCA	Florida State Collection of Arthropods, Gainesville, FL, USA
FW	Felix Woytkowski
IRSNB	Institut royal des Sciences Naturelles de Belgique, Brussels, Belgium
IZA	Instituto de Zoología Agrícola, Maracay, Venezuela
JAL	Jerry A. Louton
KJT	Kenneth J. Tennessen personal collection, Wautoma, WI, USA
MCZ	Museum of Comparative Zoology, Harvard, MA, USA
MLP	Museo de la Plata, Buenos Aires, Argentina
NE	Natalia von Ellenrieder
OSF	Oliver S. Flint Jr.
RWG	Rosser W. Garrison personal collection, Sacramento, CA, USA
SWD	Sidney W. Dunkle personal collection, Tucson, AZ, USA
TWD	Thomas W. Donnelly personal collection, Binghamton, NY, USA
UMMZ	University of Michigan, Museum of Zoology, MI, USA
USNM	National Museum of Natural History, Washington D.C., USA
WCM	William Clarke-MacIntyre

## TAXONOMY

### *Argia difficilis* Selys, 1865

Fig. 1a-pthx, 2a-s1-5, 3a-s6-10, 5c-prx, 6b,d-mpl, 7c-g- male 10 l.v., 8a-f- male 10 m-d.v., 9c-g- male 10 d.v., 10- male 10 p.v., 11c-d-lig, 12-mp

*Argia difficilis* Selys, 1865: 413 (41 reprint) (description; Holotype in IRSNB [examined]).

*Argia machadina* Förster, 1914: 63 (description; Holotype in UMMZ [examined]); Garrison *et al.* 2003: 34-35 (synonymy).

*Argia extranea forcifcula* Fraser, 1946: 456-457 (description). **syn. nov.**; Kimmins 1966: 103 (lectotype designated by Kimmins; in BMNH [not examined]).

*Specimens examined.*—65 males, 34 females. Brazil, Mato Grosso state: 1 male (**Holotype** *Argia machadina*), Rio Machadina [*sic* Rio Machado, probably at Ji-Paraná on route BR 36410°50'S 61°58'W, 191 m] (UMMZ); same but 2 males, 30-I-1961 ABM (RWG).—Peru, Loreto dept.: 1 female (**Holotype**) Jurimaguas [*sic* Yurimaguas], 5°54'0''S 76°4'60''W, 184 m (IRSNB); 3 females, Balsapuerto, Río Paranapura, 5°49'60''S 76°35'60''W, 220 m, I-1935, GG Klug (P Nagel vend.) (UMMZ); 2 males, 2 females same but (RWG); 1 female same but III-1933 (RWG); 1 female Iquitos, Río Amazonas, 3°51'S 73°13'W (UMMZ); 2 males, 1 female same but P Martin (UMMZ); 1 male, 2 females same but (RWG); 3 males, 1 female Explorama Inn, on Amazon River 25 mi NE Iquitos, 3°26'S 73°2'W, 20/21-VIII-1989 (SWD); 3 males, 3 females same but 7/8-VII-1990 (SWD); 1 male. 1 female same but 8-VII-1990 (FSCA); 2 males Explorama Lodge, 50 mi NE Iquitos on Amazon River at junction with Yanamono River,

3°21'59"S 72°47'56"W, 24/28-VIII-1989, SWD (SWD); 2 males same but 20-VIII-1989 (RWG); 1 male same but 10-VII-1990 (USNM); 1 male, 1 female same but 18-VII-1990 (SWD); 4 males, 1 female same but 12-VIII-1992 (SWD); 2 males, 1 female Explornapo Camp at junction of Sucusari River and Napo River at Llachapa, ca. 100 mi NE Iquitos, 3°16'33"S 72°56'18"W, 26/27-VIII-1989, SWD (SWD); 1 male same but (RWG); 3 males, 1 female same but 30-VI/14-VII-1990 (SWD); 2 females Aguas Negras, Terra Firme, NW to base camp, 0°31'22"S 75°15'24"W, 145 m, 5/6-III-1994, R Robins (USNM).—**Ecuador**, Morona Santiago prov.: 2 males Bomboiza, 17 km S Gualaquiza, 3°26'S 78°31'W, 880 m, 20 ix 1990, OSF (USNM); 1 female Mangosisa, Río Upano, 2°31'28"S 77°53'41"W, 708 m, received 28-IX-1945, L Gomez (UMMZ); 1 female same but (RWG).—Pastaza prov.: 1 male, 1 female Puyo, 1°28'S 77°59'W, 980 m, Staudinger Banghaus vend. (RWG).—Napo prov.: 5 males, 2 females Jatunyacu, Río Napo watershed, 1°1'S 77°50'W, 700 m, III-1937, WCM (UMMZ); 3 males, 2 females Jatunyacu, Río Napo watershed, 1°1'S 77°50'W, 700 m, III-1937, col. WCM (RWG); 2 males same but 5/11-IV-1935 (UMMZ); 2 males same but 5/19-IV-1935 (RWG); 1 male (juvenile) same but 21-III-1937 (UMMZ); 4 males, 2 females same but Río Jatunyacu, Ilupulin Creek (vicinity of Napo), I-1935 (RWG); 3 males, 1 female Concepción-Río Napo, 1°40'S 77°25'W, 400 m, 26/29-XII-1939, WCM (RWG).—Orellana prov.: 2 males La Selva, 100 km E Coca, Manicocha, shady forest rivulet, 0°32'24"S 76°32'24"W, 262 m, 12-X-1988, SWD (SWD); 1 female Yasuni National Park, stream 1.8 km W of Yasuni Road on PC 29-30, 0°42'48"S 76°18'0"W, 10-VI-1995, SWD (SWD); 1 male same but Yasuni National Park, grassy semi-shaded pools/stream, 5.6 km W Yasuni Rd on PC 29-30, 200 m (SWD); 1 female Parque Nacional Yasuni, small stream down Waorani Road, 0°42'S 76°28'W, 200 m, 10-VI-1995, KJT (FSCA); 1 male same but 1.8 km W of Waorani Reserve Rd., on Markus Oil Co. Rd. PC 29-30, 16-XI-1997, KJT (FSCA).—Sucumbios prov.: 1 male Limoncocha, forest stream, 0°24'S 76°36'W, 300 m, 24-VII-1977, DRP (RWG); 1 male same but Limoncocha on Río Napo, hunting trail in forest, 243 m, 5-XI-1980, MJ Westfall Jr (FSCA); 1 male same but Limoncocha on Río Napo, ravine in compound near Indian dwellings, 18-XI-1980, MJ Westfall Jr (FSCA); 1 male same but Lake Taracoa, an oxbow lake nr Limoncocha, 26-VIII-1980, SWD (SWD); 3 males, 2 females Tiputini Biodiversity Station, 0°38'S 76°9'W, 220 m, 20-IX-2000, K Jackson D Inward (BMNH); 2 males, 2 females same but (RWG).—**Venezuela**, Amazonas dept.: 1 male San Carlos de Río Negro, 1°55'N 67°4'W, 97 m, 14/21-III-1984, J De Marmels (RWG).

*Redescription*.—**Male**: medium-sized largely dark species with violaceous pale colors (blue in specimens from Rondônia State, Brazil) highly variable as to extent of dark markings. **Head**: labium dark grey, palps and apical teeth black; remainder of head entirely black except for anteclypeus, medial spot on postfrons, transverse bar across genae below antennae, and usual postocular and small diagonal spots bordering lateral ocelli; rear of head black except for narrow lateral light blue stripe along posterior margin of compound eye. Eyes of male in life black above, blue or gray-blue below (SWD *pers. comm.*).

**Thorax**: prothorax black medially, pale laterally below notopleural suture. Pterothorax with broad middorsal and humeral stripes each occupying anterior half of mesepisternum and mesepimeron respectively, and with narrow black stripe along second lateral suture (Fig. 1a); often with dusting of white pruinosity on

ventral margins of pleura as well as across dark metapleural suture and venter of thorax. Base of coxae and femora pale, remainder of legs black. Face and mesepisternum become darker with maturation (SWD *pers. comm.*). Wings hyaline to slightly smoky, venation black: FW Pnx 15-18; HW Pnx 13-15; RP2 in FW branching at Px 7-8, in HW at Px 6-7; IR1 in FW arising at level of Px 9-11, in HW at Px 8-9. Pterostigma brown bordered by narrow outer pale line.

**Abdomen** (Figs. 2a, 3a): black with pale areas as follows: posterior two thirds of s1 dorsolaterally; small pale longitudinal oval spot middorsally on s2; small isolated pair of dorsolateral spots at base of s3-6 and pair of spots dorsoventrally at basal tenth of each segment; s8-9 dorsally; one small middorsal spot or a pair of isolated dorsolateral spots on s10. Tori inflated, light blue, oval broader than space between them (Fig. 9). Cerci and paraprocts black; cerci relatively short, in lateral view extending to tip of dorsal branch of paraproct (Fig. 7c-g), in mediadorsal view cercus bifid with decumbent inner tooth (Fig. 8) appearing apical (Fig. 8b-c), subapical or slightly recessed (Figs. 8d-f) and with mesal margin distinctly (Figs. 8b-c) to gently (Fig. 8f-g) concave; in dorsal view, base of cerci broader than space separating them (Fig. 9). Paraproct bifid, with upper branch roundly triangular and with lower branch long, attenuate, and extending well beyond level of cercus (Fig. 7). Genital ligula (Figs. 11c, d) with laterodistal margin of basal segment covered with a fine minute bristles; distal segment broader at base and with a slightly recurved digit-like process extending laterally on each side; dorsally with a sclerotized triangular raised area; distally with a pair of long flagellae; ventrally with a semicircular partially transparent lobe.

**Female:** Similar to male but with more extensive pale areas. **Head:** as in male but pale transverse bar below antennae sometimes extending across antefrons or over its lateral portion; postfronts often entirely black. Eyes of female in life black above, green below (SWD *pers. comm.*).

**Thorax:** prothorax as in male but with anterior lobe pale and often with a small isolated spot above notopleural suture; a deep depression on each side of medial lobe (Fig. 5c); mesostigmal plates triangular, posterodistal margin unmodified, non-foliate; posteromedial margin forming a slightly raised low foliate lobe (Fig. 6b, d); pterothorax as in male but with more extensive pale areas along base of coxae and femora. FW Pnx 14-17; HW Pnx 12-14; RP2 in FW branching at Px 7-8, in HW at Px 6-7; IR1 in FW arising at level of Px 9-11, in HW at level of Px 8-9.

**Abdomen:** s1-7 marked as in male; s8 black except for irregular dorsal pale spot at distal third of segment; s9 all black except for poorly-defined dorsolateral spot at apical end of segment; s10, ovipositor and appendages black. During maturation s8 becomes black before s9 (SWD *pers. comm.*).

*Variation.*—Although *Argia difficilis* is probably the darkest species within the genus, it is highly variable as to extent of pale markings. Most preserved specimens are almost entirely dark with pale violaceous colors barely discernable. palest individuals have black middorsal stripe of pterothorax occupying medial half of mesepisterna, mesinfraepisternum and lower part of fourth of mesepimeron black. The remainder of thorax is pale with small dark spots at meso- and metapleural fossae; s2-3 with tapering middorsal stripes ending from apical fourth (s2) to basal fourth of segment (as in Figs. 2a, 3a). Some specimens, primarily from NE Ecuador, have middorsal and humeral stripes confluent so that thoracic black extends to obsolete second lateral suture; in others the pale antehumeral

stripe may be reduced to a wedge-shaped stripe along ventral half of mesepisternum. These differences do not correlate with locality. Morphological attributes are almost as variable: lower branch of paraproct is variable in length (Figs. 7d-g) and a male from Rondônia State approaches the condition for *A. yungensis* (7b).

**Dimensions** (average and standard deviation; range in square brackets): total length males:  $35.45 \pm 2.23$  [32.5-39], females:  $35.1 \pm 1.73$  [32-37]; abdomen length males  $27.75 \pm 1.55$  [25.5-30], females  $27.25 \pm 1.7$  [24-29]; Fw males  $21.85 \pm 1.63$  [18-24], females  $22.85 \pm 0.91$  [22-24.5]; Hw males  $20.9 \pm 1.51$  [17.5-23], females  $21.8 \pm 0.82$  [21-23].

**Diagnosis.**—Males of *A. difficilis* are easily recognizable from the species previously associated with it and described here as *A. yungensis* by their large and proximate tori, which are wider than the space separating them (Figs. 9c-g, 10; tori smaller and as wide as or narrower than space between them in *A. yungensis*, Figs. 9a-b). Despite the strong differences in male caudal appendages, female mesostigmal plates are remarkably similar, and we have been unable to discover any characters that consistently differentiate the two. However, females can be recognized by the extremely deep depressions of prothoracic medial lobe (Fig. 5c), which are shallower in *A. yungensis* (Figs. 5a-b).

**Remarks.**—During a visit to the BMNH in 1975, the late Leonora K. Gloyd, examined the types of *Argia extranea forficula* and confirmed the identity of this name with material in the UMMZ from Peru and Ecuador which she later determined to be the same as *A. difficilis*. During 2002, NE compared females of material known to be conspecific with *A. extranea forficula* with the holotype of *A. difficilis* and confirmed their synonymy.

**Distribution.**— $1^{\circ}55'N$ - $10^{\circ}50'S$ ,  $61^{\circ}58'$ - $78^{\circ}31'W$ , 97-980 m.— Amazonas dept. in Venezuela to Loreto dept. in Peru and Mato Grosso state in Brazil (Fig. 12). Distribution range is within the Amazon biogeographic province of the Neotropical region, and preferred habitats are streams within rain forest.

**Biology.**—Adults found at small streams, rivulets and trails in forest, usually perched on the upper surfaces of leaves in sunspots in the rainforest understory 2-3 m above ground. No reproductive activity was seen, and no pairs in tandem or wheel were collected (SWD *pers. comm.*). Larva unknown.

***Argia yungensis* sp. nov.**

Fig. 1b-d-hd & pthx, 2b-c-s1-5, 3b-c-s6-10, 4-wi, 5a-b-prox, 6a-b-impl, 7a-b- male 10 l.v., 8h-i- male 10 m-d.v., 9a-b- male 10 d.v., 11a-b-lig, 12-mp

*Argia difficilis* Schmidt, 1942 (*nec* Selys): 233 (description).

**Type locality.**—Argentina, Salta prov., Río Anta Muerta, side shady creek ( $23^{\circ}7'0''S$   $64^{\circ}29'53''W$ , 496 m).

**Type status.**—Holotype male, Allotype female.

**Type depository.**—MLP.

**Etymology.**—We name this species *yungensis* (latinized adjective) in reference to its distribution range, restricted to the Yungas mountain rain forest.

**Specimens examined.**—245 males, 81 females.—**Holotype male:** 18-V-2006, NE (MLP). **Allotype females:** Same data as holotype.—**Paratypes** (244 males, 80 females): **Argentina**, Jujuy prov.: 1 male, 1 female narrow, stony, shaded stream

by prov. road 6 (to Palma Sola), 23°52'12''S 64°22'44''W, 534 m, 20-III-2006, NE & RWG (RWG).—Salta prov.: 2 males same data as holotype (FML); 2 males same but (MLP); 5 males same but (NE); 4 males same but (RWG); 1 male, 1 female in tandem, unnamed stream 15 km SE to Isla de Cañas, enclosed shady lateral streamlet, 23°7'0''S 64°29'53''W, 496 m, 18-V-2006, NE (NE); 1 female same but (MLP); 2 males 1 female stream at km 5.5 on road from Piquirenda Viejo to Yacimiento Macueta (PAE), 22°20'52''S 63°48'19''W, 582 m, 27-III-2007, NE (FML); 2 males, 1 female same but (BMNH); 1 male, 1 female same but (NE); 1 male Dique Itiyuro, small shaded stream affluent of river downstream to dam, 22°6'24''S 63°43'22''W, 543 m, 28-X-2005, NE RWG (RWG).—**Bolivia**, Cochabamba dept., Chapare prov.: 2 males Cristal Mayo, Yungas del Espiritu Santo, 30 km W of Paractito, on Espiritu Santo riverbank, 17°06'S 65°46'W, 10-IX-1994 (RWG); 1 B same but 25-IX-1949, LE PeÒa (RWG); 1 male same but 1800 m, 23-IX-1949 (RWG); 1 female same but 26-IX-1949 (RWG); 4 males, 3 females same but 2/31-X-1949 (UMMZ); 2 males 2 females same but 11/15-X-1949 (RWG); 1 male same but IV-1950 (UMMZ); 2 males same but 13/15-V-1950 (UMMZ).—Santa Cruz dept., Ichilo prov.: 2 males, 1 female Quebrada Oculita, 4 km S Buena Vista, near Laguna Curichi, 17°26'60''S 63°40'06''W, 6/8-VII-2001, KJT (KJT); 1 female same but Quebrada Pajita (KJT); 1 male Lagunas Curichi, 3.5 km S of Buena Vista, 8 II 2000, col. JJ Daigle (RWG); 1 male Buena Vista, 360 m, 17°27'S 63°40'W, 10-III-1960, Steinbach (FSCA); 6 females same but IX-1932/ XI-1934 (UMMZ); 1 male same but P. del Sara (FSCA); 1 male same but 22-III-1955, A Martinez (UMMZ); 2 males Parque Nacional Amboro, Yapacani, streams and tributaries along road to Matarao Encampment, S side of Río Yapacani, 457 m, 17°37'S 63°37'W, 12-XI-1998, W Mauffray (FSCA); 1 male same but (RWG); 1 male same but Mataracu, small stream, 609 m, 17°37'S 63°47'W, N Araujo (KJT); 1 male same but KJT (KJT).—Ñufló de Chavez prov.: 1 male San Ramón, 18 km E on rd to San Luis Hernán, sand and rock bottomed stream, 460 m, 16°37'9''S 62°23'1''W, 15-XI-1998, KJT (KJT).—La Paz dept., Sud Yungas prov.: 2 males 2 km E Chulumani, 1230 m, 16°24'S 67°31'W, 27-V-1989, TC Emmel (FSCA).—**Peru**, Madre de Dios dept.: 1 male Hotel Amazonia, across from Atalaya, in forest, 12°52'13''S 71°22'34''W, 414 m, 27-VI-1993, RWG (RWG); 7 males, 3 females same but 30-VI-1993 (RWG); 9 males 3 females same but (USNM); 1 male Manu, Erika, across Alto Madre de Dios from Salvación, 12°53'S 71°14'W, 550 m, OSF (RWG); 1 male, 1 female Parque Nacional Manu, Pakitza, 250 m, 11°55'48''S 71°15'18''W, 20/23-IX-1988, NE Adams (USNM); 1 female same but 14-IX-1988, OSF (USNM); 1 female same but small quebrada nr. forest, Zone 1, 29-IX-1987, JAL (RWG); 1 male same but seeps on trochas 1 2, 10-IX-88 (RWG); 1 male same but seeps on Trocha 2, base camp to S85 JAL89-012 (USNM); 3 males same but JAL88-007 (USNM); 1 female same but Trocha Castañal, 21-X-1987, TL Erwin (RWG); 1 female same but (USNM); 2 males, 1 male, 1 female in copula, same but trail 1, 12-IX-88, OSF (RWG); 1 male same but 21-IX-1988 (RWG); 1 male same but 21-IX-1988 (RWG); 1 male same but 10-IX-1988, JAL (RWG); 1 male same but OSF (USNM); 1 male same but 12-IX-1988 (USNM); 1 male same but trail 2, mkr. 50, NE Adams (RWG); 2 males same but mkr. 18, seeps, 12-IX-1989 (RGW); 1 male same but (USNM); 1 female same but 17-IX-1989 (RGW); 1 male same but trail 1, 18-IX-1988, OSF (RWG); 1 male, 2 females Pakitza Reserved Zone, approx 4.5 km E of Pakitza, Aguahal, 250 m, 11°55'48''S 71°15'18''W, 250 m, 5-VII-1993, RWG (RWG); 7

males same but Pakitzta, on trail to Cocha Chica, in fine cobble next to stream in forest with dappled sunlight (RWG); 1 male, 1 female same but small wet-season Quebrada at Pakitzta, Trocha del Castañal, JAL87-012, 21-X-1987, JAL (USNM); 1 female same but T2-R2 to T1-base camp JAL89-019, 17-IX-1989, JAL (USNM); 1 male same but confluence to Río Manu and Río Panaqua JAL89-023, 20-IX-1989 (USNM); 1 male same but Trail 2, mkr. 53-54, 21-IX-1989, R Robins (USNM).— Cusco dept.: 2 males Camisea R. drainage, San Martín C (Shell Oil gas exploration site), 11°46'53"S 72°42'6"W, 431 m, 2-III-1997, JAL (RWG); 1 female same but 18-II-1997 (RWG); 1 female same but Lot 98, large stream E of COSAPI construction camp, 16-II-1997, G Valencia (USNM); 4 males, 1 female same but 17-II/ 2-III-1997, perched on vegetation over stream, in sun and in forest, JAL (USNM); 1 male, 3 females Vilcanota, det. as '*Argia peruana* Först.' by Förster, 14°28'60"S 71°01'60"W, O Staudinger vend. (UMMZ); 1 male same but det. as '*Argia oculata*' by Förster (UMMZ); 1 female same but (RWG).— Junín dept.: 2 males, 2 females Satipo, 11°16'00"S 74°40'60"W, 714 m, 21-V/ 25-VI-1940, P Paprzycki (RWG); 10 males same but 5-X-1940/V-1945 (RWG); 25 males same but 6-VI-1940/ IX-1945 (UMMZ); 1 male Sani Beni, 8 km E of Satipo, 11°14'S 74°37'W, 840 m, 9-X-1935, FW (RWG); 3 males 1 female same but 4-X/ 20-XI-1935 (UMMZ); 2 males vicinity of Sani Beni, 16-VIII-1935, FW (RWG); 4 males, 2 females same but 30-VII/ 27-IX-1935 (UMMZ); 3 males 1 female La Merced, 11°3'S 75°19'W, 756 m, 1932, P Martin (UMMZ); 1 male 1 female same but (RWG); 5 males La Merced, Hda. La Salud, III-1931, JD Rivas (UMMZ); 1 male Río Seco, 10°54'S 75°19'W, 721 m, XI-1934, GG Klug (UMMZ).— Huanuco dept.: 1 male 1 female vicinity of Afilador, road to Tingo María, jungle, 670 m, 22-V-1937, FW (RWG); 1 male Santa Rosa de Shapajilla, jungle, 700 m, 10-V-1938, FW (UMMZ); 1 male same but 21-XII-1938 (UMMZ); 1 female vicinity of Leonpampa, 110 km E of Huanuco, jungle, 9°49'54"S 75°14'54"W, 800 m, 21-XII-1937, FW (UMMZ); 1 female Villa Isabel, isla de Cucharas, Huallaga River valley, 9°18'S 75°59'W, 520 m, III-1954, FW (UMMZ); 1 male Tingo María, forest stream, 8°58'S 75°50'W, 440 m, 11-V-1974, ML Paulson (RWG); 1 male same but (FSCA); 2 females same but 14/22-I-1947, JC Pallister (FSCA); 1 male 1 female same but 5-VII-1937, FW (ABM); 1 male Pumahuasi, 20 km N of Tingo María, 8°46'48"S 75°49'48"W, 18-XII-1939 (UMMZ); 1 male San Antonio, 8°37'S 76°30'W, 1053 m, P Nagel vend. (UMMZ); 39 males, 6 females Campamiento Colonia del Perené, 10°58'S 75°13'W, 827 m, 5/25-VI-1920, JH Williamson (UMMZ); 15 males, 3 females same but (RWG).— San Martín dept.: 3 males Hera, 15 km SE Moyobamba, 6°3'S 76°58'W, 890 m, 9-VII/ 14-VIII-1947, FW (UMMZ); 1 male 20 km NE Moyobamba, Mishqui-yacu, 17-VIII-1947, FW (RWG); 1 female same but (UMMZ); 2 males, 1 female vicinity of Rioja, Soritor, in jungle, 6°2'S 77°10'W, 900 m, 5-IX/ 16-X-1936, FW (RWG); 4 males. 4 females same but 5-IX/17-X-1936 (UMMZ); 6 males. 5 females same but 24-V/ 10-VII-1937 (UMMZ); 3 males, 1 female same but 2/6-VII-1937 (RWG); 1 male 1 female Juanjui, 5°46'42"S 78°23'48"W, 520 m, IX-1934, GG Klug (RWG); 1 male 1 female same but (UMMZ); 1 male 1 female same but Staudinger vend. (UMMZ); 1 male Tarapoto, 6°30'55"S 76°21'56"W, 830 m, AJ Porter (UMMZ); 1 male 5 mi SW of Tarapoto, Rikuri-cocha, 6°31'S 76°22'W FW (UMMZ); 1 male Boquerón del Padre Abad, NE of Tingo María, 7°18'S 76°49'W, 440 m, 11-viii-1946, FW (UMMZ).

*Description.*—Male Holotype.—**Head** (Fig. 1b): labium light blue, with palps



and apical teeth black; labrum light blue bordered with black; clypeus light blue; frons black with a medial and two lateral light blue spots at anterior margin; vertex black with two light blue spots at anterior margin of lateral ocelli and two postocular spots; rear of head black except for narrow lateral light blue stripe along posterior margin of compound eye. Eyes in life black above, pale green below.

**Thorax** (Fig. 1b): prothorax black, with posterior half of anterior lobe and lateral margins of medial lobe light blue, and a small lateral light blue spot on laterodorsal surface of medial lobe. Mesepisternum and metepimeron black, with complete light blue antehumeral stripe. Metepisternum, metepimeron and venter of pterothorax pale. Dark diffuse irregular stripe along metepisternal-metepimeral carina, and dark spot along carina between metepimeron and venter of thorax. All coxae and extensor surface of meso and metatibiae pale, remainder of legs black. Wings (as in Fig. 4): Px 17 in Fw, 16 in Hw; RP2 branching at Px 7 in Fw, of Px 6 in Hw; IR1 arising at level of Px 8-10 in FW, of Px 8-9 in Hw. Pterostigma brown bordered by narrow outer pale line.

**Abdomen** (Figs. 2b, 3b): black with light blue areas as follows: posterior two thirds of s1, two latero-longitudinal stripes and a dorsal medio-longitudinal stripe widened anteriorly on s2; narrow transverse stripes along anterior margin of s3-7; dorsal surface of s8-10, except for anterior black margin of s10 (Fig. 3b). Tori light blue, oval and elongated transversally, occupying the entire torifer width, and with space between them at least as wide as their width (Fig. 9a). Cerci and paraprocts black; cerci distinctly longer than wide, in lateral view surpassing tip of dorsal branch of paraproct (Fig. 7a), in dorsal view (Fig. 9a) distinctly wider at base than at apex, bifid at tip with inner apical branch distinctly smaller than outer branch and apical concavity between them slightly marked (Fig. 9a); paraproct bifid, with base of dorsal branch wider than that of posterior branch (Figs. 7a, 8h). Genital ligula (Fig. 11a-b) with laterodistal margin of basal segment covered with a fine minute bristles; distal segment broader at base and with a slightly recurved digit-like process extending laterally on each side; dorsally with a sclerotized triangular raised area; distally with a pair of long flagellae; ventrally with a semicircular partially transparent lobe.

**Dimensions:** total length 42; abdomen length 33.2; Fw 27.5; Hw 26.5; costal side of Fw Pt 1.

Female allotype.—**Head:** as in holotype male but dorsal surface of clypeus black, and spots on anterior margin of frons fused into complete transverse light blue stripe.

**Thorax:** color as in holotype but with a narrow light blue stripe on posterior fourth of mesepimeron (Fig. 1c), and trochanters, base of femora and extensor surface of protibiae pale. Prothorax with moderately deep depression on each side of medial lobe (Fig. 5b). Mesostigmal plates triangular with unmodified, non-foliate posterodistal margin; posteromedial margin forming a slightly raised low foliate lobe (Fig. 6a). Wings as in holotype but Px 15-16 in Fw, 13-14 in Hw; RP2 branching at Px 6-7 in Fw, 5 in Hw; IR1 arising at level of Px 8 in FW and Hw.

**Abdomen** (Figs. 2c, 3c): color pattern as in male holotype, except for medio-dorsal pale area on s2 as a rounded spot on basal half, a narrow medio-longitudinal stripe on dorsum and along lateral margin of basal half of s3, s6-7 entirely black, and pale areas on s8-10 extended only along posterior half of segment.

Ovipositor black with tip of outer valvae pale, and a single row of denticles along its ventral margin; sub-basal plate of ovipositor triangular.

**Dimensions:** total length 42.4; abdomen length 33.4; Fw 28; Hw 27; costal side of Fw Pt 1.1.

*Variation in paratypes.*—Males: As holotype but narrow light blue stripe of mesepimeron might be present (as in allotype, Fig. 1c). Females: As allotype but narrow light blue stripe of mesepimeron might be completely fused to antehumeral stripe; and s6-7 might have narrow pale transverse stripe along anterior margin (as in holotype, Fig. 3b). FW Pnx 16-21 in males, 14-18 in females; HW Pnx 15-19 in males, 12-15 in females; RP2 in FW branching at Px 7-9 in males, 6-8 in females; RP2 in HW branching at Px 6-7 in males, 5-7 in females; IR1 in FW arising at level of Px 8-11 in males, 8-11 in females; IR1 in HW arising at level of Px 8-11 in males, and 8-10 in females.

**Dimensions** (average and standard deviation; range in square brackets): total length males:  $39.8 \pm 1.74$  [37-42], females:  $38.19 \pm 2.51$  [36-42.2]; abdomen length males  $31.43 \pm 1.42$  [29.5-33.2], females  $29.96 \pm 1.97$  [27-33.4]; Fw males  $25.51 \pm 1.39$  [24-27.5], females  $25.61 \pm 1.6$  [24-28]; Hw males  $24.41 \pm 1.30$  [23-25.8], females  $24.46 \pm 1.79$  [22-27].

*Diagnosis.*—Males recognizable from *A. difficilis* by (characters of *A. difficilis* in parenthesis) cerci distinctly longer than wide (Figs. 9a-b; slightly longer than wide, Figs. 9c-g), in lateral view surpassing tip of dorsal branch of paraproct (Figs. 7a-b; only reaching it or shorter; Figs. 7c-g); oval, transversely elongated tori (Figs. 8h-i, 9a-b; rounded, Figs. 8c-d, f, 9c-g, 10), and space between them as wide as or wider than their width (narrower than their width); cerci in dorsal view distinctly wider at base than at apex (Figs. 9a-b; approximately as wide at base as at apex, Figs. 9c-g), with inner apical branch distinctly smaller than outer branch and apical cleft between them shallow (approximately as wide as outer one and apical cleft pronounced). Female depressions of prothoracic medial lobe moderately deep (Figs. 5a-b; with extremely deep depressions, Fig. 5c).

*Distribution.*— $23^{\circ}52'0^{\circ}31'S$ ,  $62^{\circ}23'-78^{\circ}23'W$ , 119-1800 m.—Jujuy prov. in Argentina to San Martin dept. in Peru (Fig. 12). Distribution range occupies foothill jungle (ca. 300-900 m) within the Yungas biogeographic province of the Neotropical region. Preferred environments are shady and narrow streams or creeks enclosed within forest.

*Biology.*—As in other *Argia* species, adults open and close their wings two or three times after landing. Adults perch on leaves in small sunlit patches in forest. Reproductive activity not observed, and larva is still unknown.

## DISCUSSION

*Argia difficilis*, described from a single female and with no illustrations, is a highly variable species in color pattern; these factors might account for its misidentification and misapplication of its name in the past. Thus, the males described as *Argia machadina*, although morphologically identical to other specimens of *A. difficilis*, are blue rather than violaceous as most specimens. This color variability is not commonplace in *Argia* but it does occur within some other species (e. g. *A. oenea*, Hagen, Garrison 1994; *A. indicatrix* Calvert, RWG pers. obs.; *A. extranea*, DRP pers. comm.), and we consider it as part of its intraspecific variability.

Confusion over the identity of *Argia difficilis* began with the assignment of this name to Central American specimens of the *Argia eliptica-oculata* complex by Calvert (1902, 1907, 1909). The taxonomy within this cluster of similar taxa is difficult (Gloyd 1948; Dunkle 1988; Donnelly 1992; Westfall & May 2006). NE has examined the holotype of *A. eliptica* (Minas Gerais) and RWG a syntype of *A. oculata* (Venezuela); their relationship is still unsolved but females of both possess foliate mesostigmal plates which are different from the reduced plates found in *A. difficilis* and *A. yungensis*. Calvert's (1902) illustration of the mesostigmal plate of the supposed female of *A. difficilis* (Tab. 4, Fig. 15) from Bugaba, Panama, most likely represents a member of the *A. eliptica-oculata* complex. Males of the *Argia eliptica-oculata* complex have a bifid cercus similar to that illustrated here for *A. difficilis*, and their paraproct is a simple forked process similar to that illustrated for *A. yungensis*.

Förster (1914) was right in pointing out that Calvert had incorrectly assigned *A. difficilis* to members of the *Argia eliptica-oculata* complex. Except for Schmidt (1942), whose illustrations of *A. difficilis* correspond to specimens of what we have described here as *A. yungensis*, all subsequent authors have followed Calvert in associating *A. difficilis* with members of the *A. eliptica-oculata* complex. Thus, all subsequent records (Ris 1918; Geijskes 1932; Paulson 1982; Shelly 1982; Boomsma & Dunkle 1996; Ramírez *et al.* 2000; Förster 2001; Esquivel 2005) of *A. difficilis* do not correspond to this species. *Argia difficilis* is absent from Central America; it appears to be a species of the Amazon plain, distributed from N Peru and Ecuador to W Brazil and S Venezuela (Fig. 12). Its distribution is allopatric to that of *A. yungensis*, which is endemic to the foothills of the Yungas, and almost parapatric with *A. difficilis* only along its northern boundary in Peru.

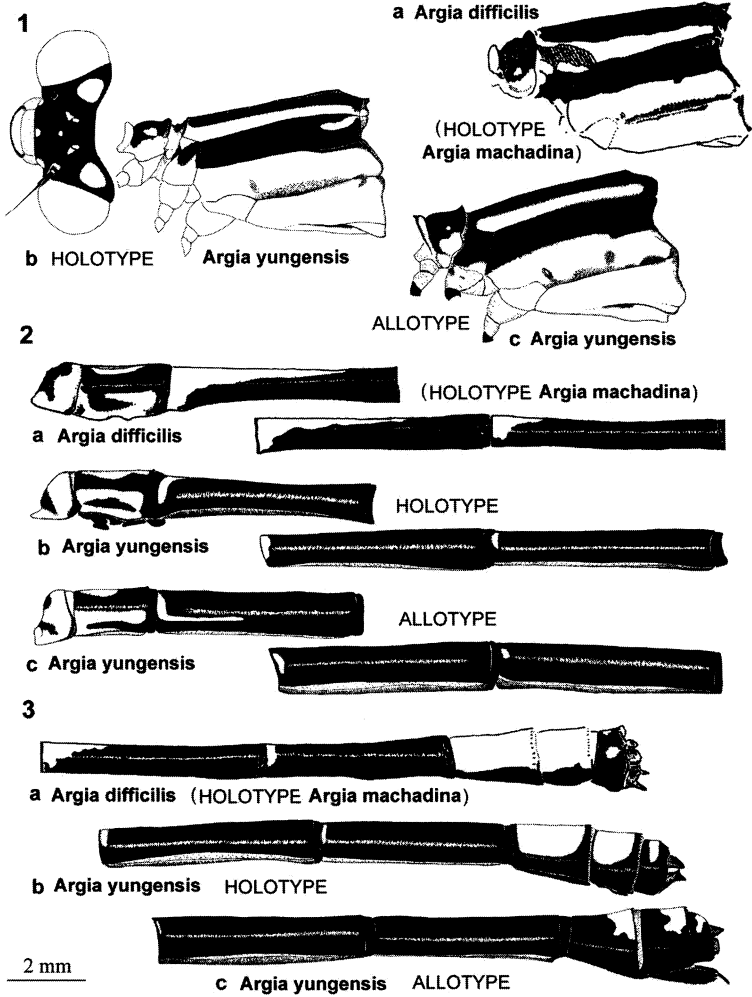
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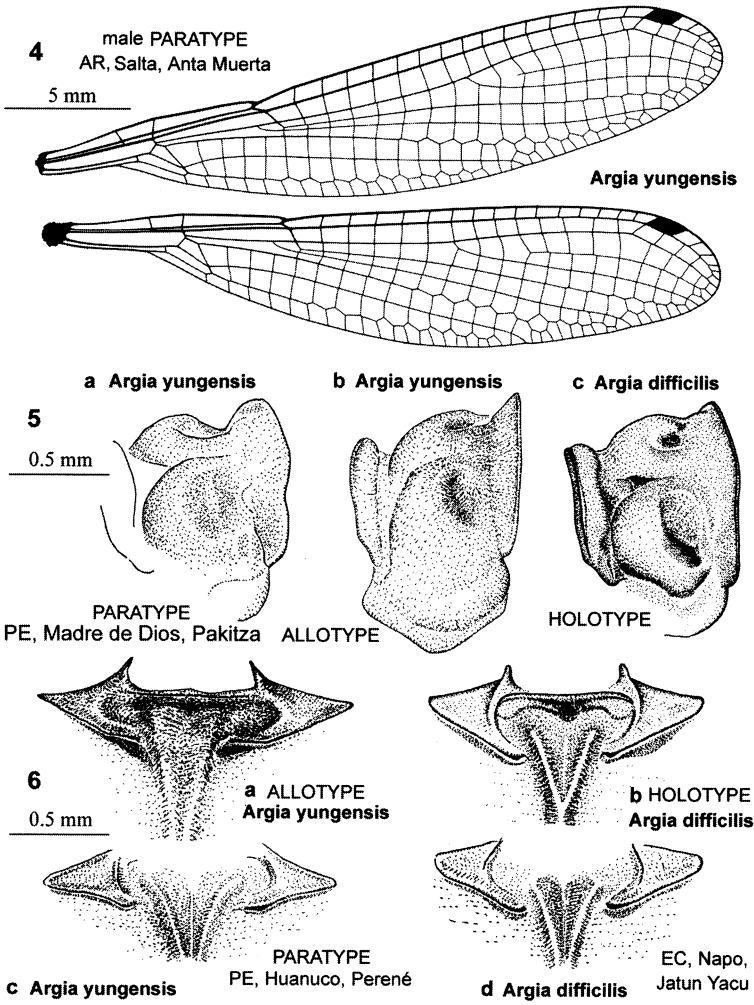
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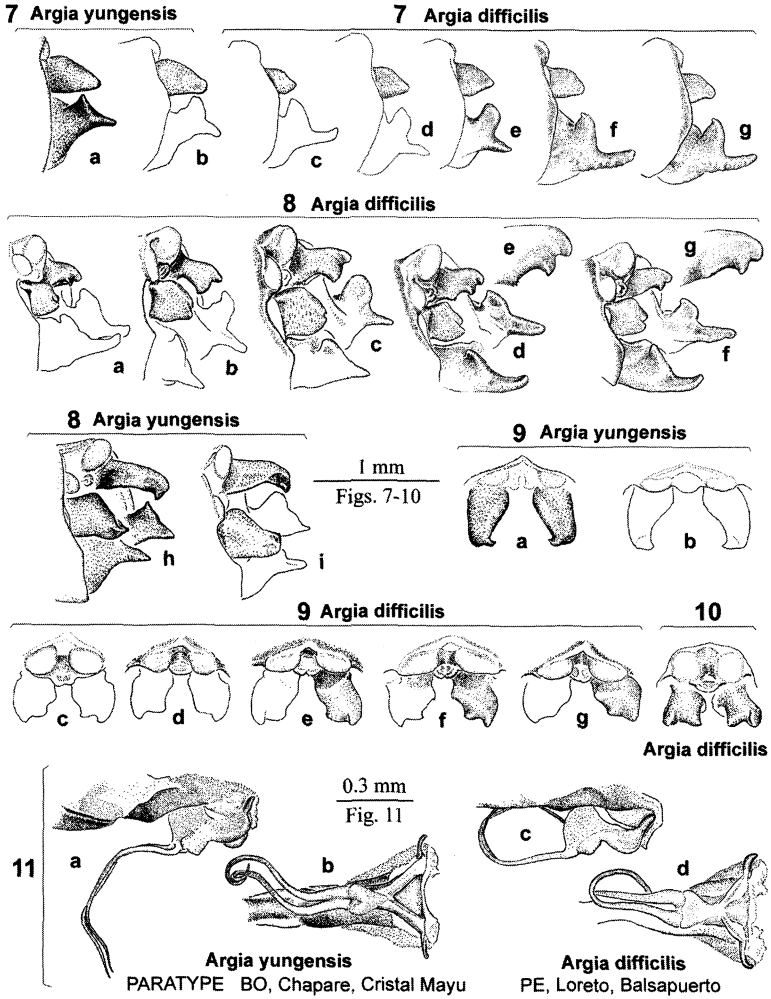
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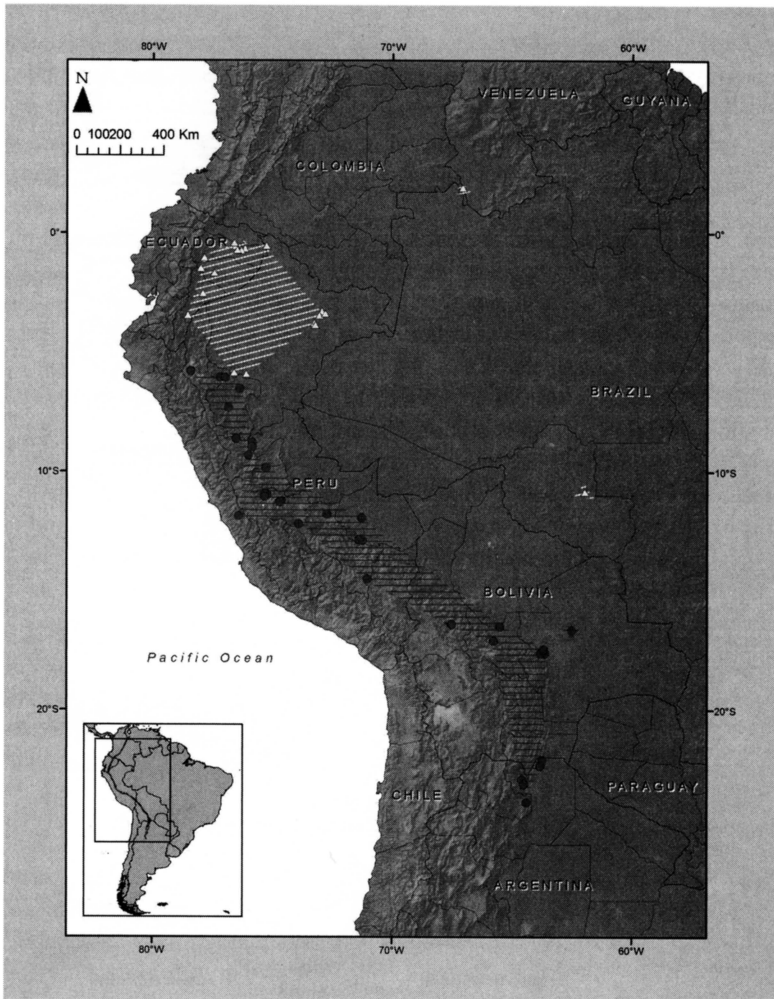
Figs 1-3. Color pattern. 1, head, dorsal view (only for b), and pterothorax, lateral view (a-c). 2, s1-3 and 4-5, lateral view. 3, s6-10, lateral view.



Figs 4-6. 4, right pair of wings. 5, female prothorax, medio-dorsal view. 6, female mesostigmal plates, dorsal view.



Figs 7-11. 7, male cercus and paraproct, lateral view. 8a-d, f, h-i, male S10, medio-dorsal view, e, g, detail cercus tip. 9, posterior area of male S10, dorsal view. 10, male S10, posterior view. 11, male genital ligula, a, c, lateral view, b, d dorsal view. 7a, 8h, 9a, HOLOTYPE; 7b, 8i, 9b, PARATYPE Peru, Huanuco, Perené; 7c, 8a, 9c, SYNTYPE *Argia extranea forficula*; 7d, 8b, 9d, 10, HOLOTYPE *Argia machadina*, 7e, 8c, 9e, Venezuela, Amazonas, San Carlos de Río Negro; 7f, 8d-e, 9f, Ecuador, Napo, Jatun Yacu; 7g, 8f-g, 9g, Peru, Loreto, Balsapuerto.



Figs 12. Map showing localities for *Argia difficilis* (triangles) and *A. yungensis* n. sp. (circles). Extension of the Yungas forest in South America is shown in black in inset map.