SISTEMÁTICA DEL GÉNERO *POLYTHORE* CALVERT, 1917 (ODONATA: POLYTHORIDAE)

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RESUMEN GENERAL

El género Neotropical de caballitos del diablo *Polythore* se distribuye principalmente en el oeste de Sur América en la vertiente este de la cordillera de los Andes entre Bolivia y Venezuela y en la región Amazónica. En este estudio, se revisan las especies de *Polythore* reconocidas actualmente con base en caracteres morfológicos del macho adulto, incluyendo venación alar, patrón de coloración alar y lígula genital. Solo se mencionan aspectos generales de las hembras dado su polimorfismo y la poca disponibilidad de especímenes en las colecciones. Se encontró que la presencia de sectores suplementarios entre las venas RP_2 y IR_2 proximales al pterostigma define taxonómicamente al género. Basado en este carácter diagnóstico se propone la nueva combinación *P. chiribiquete.* Se evaluó el estatus de las poblaciones propuestas en la literatura para las especies del grupo picta a través de aproximaciones morfométricas y análisis multivariados. Solo las poblaciones de *P. procera* y *P. gigantea* se diferenciaron claramente; las poblaciones del resto de las especies solo se diferencian en los caracteres propuestos en la literatura pero no al incluir otros caracteres. Se proveen descripciones, ilustraciones y una clave de identificación para machos adultos. Se llevó a cabo un análisis filogenético de 49 especies, incluyendo todas las especies de *Polythore* y 29 especies del grupo externo, basado en coloración alar de macho y hembra y caracteres morfológicos de la lígula genital del macho. Los caracteres se codificaron y sistematizaron en el software DELTA. Se utilizó el método Ratchet usando NONA bajo el paquete WinClada. Se realizaron análisis particionados usando caracteres del macho y de la hembra, y sus resultados se compararon con un análisis de evidencia total. Asimismo, se estudió la relación entre la variabilidad morfológica intraespecífica y la señal filogenética en dos regiones corporales (alas y genitales) usando como modelo las especies de *Polythore*, y a través de aproximaciones de morfometría lineal y geométrica. El análisis de evidencia total presentó el menor porcentaje de homologías estrictas (22%), siendo muy cercano al del análisis particionado con los caracteres de la hembra (32%), mientras que el análisis particionado con los caracteres de machos presentó el mayor número de homologías estrictas con 37%. Se provee soporte estadístico para los clados individuales a través de Bootstrap y soporte de Bremer. Una homología soporta la monofilia de *Polythore*. De los seis grupos de especies propuestos en la literatura, solo tres resultaron ser monofiléticos. El grupo hermano de *Polythore* es *Euthore*. Se registra por primera vez para Colombia *P. williamsoni*.

GENERAL ABSTRACT

The Neotropical damselfly genus *Polythore* is mainly distributed in western South America, in the foothills of the eastern slope of the Andes between Bolivia and Venezuela and in the Amazon region. In the present study, the 19 species of *Polythore* are revised based on morphological adult male characters from wing venation, wing pattern coloration, and genital ligula. Only general characters of females are included due to their polymorphism and to the limited availability of specimens in collections. Presence of supplementary sectors between RP_2 and IR_2 proximal to the pterostigma was found as a character that taxonomically defines the genus. Based on this character the new combination *P. chiribiquete* is proposed. The status of the populations proposed in the literature for species of the picta group is assessed by morphometric and multivariate analyses. Clear differentiation was found in populations of *P. procera* and *P. gigantea*. Populations of the remaining species differ only by characters proposed in the literature but not by other characters studied. Descriptions, illustrations, and an identification key to adult males are provided. A phylogenetic analysis of 49 species, including all the species of *Polythore* plus 29 outgroup species, was performed based on wing venation, wing pattern coloration of male and female, and male genital ligula. Character coding and managing was conducted through DELTA package. Heuristic search tree was developed under the Ratchet method using NONA of the WinClada package. Partitioned analysis using male and female characters were designed and were compared with a total evidence analysis. Also, the relationship between morphological intraspecific variability and phylogenetic signal was studied using the species of *Polythore* as a model, through lineal and geometric morphometrics approach in two body regions: wings and genitalia. Total evidence analysis had the lowest percentage of strict homologies (22%), being near the percentage of partitioned analysis of female characters (32%), while partitioned analysis of male characters had the highest percentage of strict homologies with 37%. The statistical support for individual clades was assessed with Bootstrap and Bremer values. A strict homology as support of the monophyly of *Polythore* was found. Of the six species groups proposed in the literature, only three were found to be natural groups. The sister group of *Polythore* is *Euthore*. *Polythore williamsoni* is registred for the first time for Colombia.

GENERAL PREAMBLE

This thesis is organized in three chapters as independent scientific papers ready to be submitted for publication. Two additional sections are included: a general introduction that includes general considerations and the approach of the problem, and at the end of the thesis a brief section of conclusions.

INTRODUCTION

Dragonflies and damselflies are hemimetabolous insects, predatory through all the stages of their life cycle (Corbet, 1999; Donnelly, 1992) including their larvae. According to Corbet (1980) dragonflies and damselflies larvae inhabit rivers, streams, swamps, marshes, wells, and phytotelmata, which are small pools of water on the leaves of bromeliads or holes of bamboo trees (De Marmels, 1985), and an extreme case is that of *Erythrodiplax berenice* which inhabits saltwater mangroves (Corbet, 1999). Adults are aerial and are associated to aquatic environments; males of many species are territorial and they carefully guard a territory by making constant patrol flights or perching on a prominent place to chase off any intruders. This territory gives the male the advantage of access to females approaching the water body (McCafferty & Provonsha, 1981). According to Esquivel (2006) dragonflies consume large amounts of mosquitoes and therefore they may play an important role in controlling insects that may become pests.

Odonata comprises approximately 5,500 species worldwide, 1,727 species in the Neotropics and 332 recorded from Colombia (Pérez-Gutiérrez & Palacino-Rodríguez, 2011; von Ellenrieder, 2009). The order includes 29 families and is traditionally divided into three suborders: Anisoptera, Zygoptera, and Anisozygoptera. The first comprises 2,750 species; the second 2,600 species, and Anisozygoptera only two species. Recent studies propose that this last suborder should be grouped with Anisoptera (Bybee, *et al*., 2008; Dumont *et al*., 2010). Coenagrionidae (1,070 species) and Libellulidae (970 species) are the largest families. In Colombia there are 14 families of odonates recorded, 10 belong to Zygoptera and four to Anisoptera.

The zygopteran Neotropical family Polythoridae includes 57 species distributed in seven genera: *Chalcopteryx, Chalcothore, Cora, Euthore, Miocora, Polythore* and *Stenocora*, being *Polythore*

Calvert, 1917 the second largest with 19 species (Garrison *et al*. 2010). *Polythore* is distributed mainly in western South America, along the eastern foothills of the Andes, and in the Amazon region. Its altitudinal distribution ranges from sea level to 2,800 meters and it is best represented in the eastern foothills of the Peruvian Andes. Paulson (2010) mentions six species for Colombia: *Polythore beata, P. concinna, P. derivata, P. gigantea, P. mutata,* and *P. procera*.

Ecology and behavior of Polythoridae are little known (De Marmels, 1982) and only the larva of *Polythore spaeteri* has been described; it lives under rocks in small fast moving forest streams (Etscher *et al*., 2006).

Traditionally, taxonomy of Polythoridae has been based on venation characters (Fraser, 1957; Montgomery, 1967; Förster, 1999); although these characters are useful for determination of families within the Odonata and some genera, they show variability at the species level. Montgomery (1967) presented taxonomic keys for the eight genera of Polythoridae and their species, using venation and pattern color characters. His key to species of *Polythore* includes 14 of the 19 species currently known for the genus. However, his keys do not account for intraspecific variability because he based them only on type specimens.

Bick and Bick (1985) revised the picta group, which is composed by *Polythore derivata*, *P. gigantea, P. lamerceda, P. picta, P. procera, P. terminata,* and *P. neopicta*. The later species was described after the revision of the group was published. Picta group is found in the east foothills of the Andes, its altitudinal distribution ranging between 800 m and 1,300 m. In 1986, Bick and Bick revised the remaining species of the genus and divided it into five groups: batesi, boliviana, concinna, victoria, and vittata.

The main criterion used by Bick and Bick (1985, 1986) for species identification was color pattern of wings and shape of the horns of the genital ligula. They also suggested that characters usually diagnostic in Odonata, such as male anal appendages, female pronotum, mesostigmal lamina, and ovipositor, are not useful to separate species of *Polythore*, and that morphologic species-specific characters are scarce in the genus.

Phylogenetic studies carried out to date (Rehn, 2003; Bybee *et al.*, 2008) agreed upon the monophyly of Polythoridae although the intergeneric relationships found were different. No phylogenetic study of the genus *Polythore* has been conducted yet.

Regarding this overview, we consider that a revision of the genus and a phylogenetic analysis of its species are necessary in order to evaluate taxonomic characters traditionally used in diagnoses, test the monophyly of the genus, and propose a phylogenetic hypothesis for its species. Therefore, this project aims to answer the following questions: 1. What is the diagnostic value of characters traditionally used in genus *Polythore*?, 2. Is the genus *Polythore* monophyletic?, 3. What are the phylogenetic relationships of the genus *Polythore* within the family?, 4. Are the species groups proposed by Bick and Bick natural groups?, and 5. Are the characters with high intraspecific variability, that theoretically have a lower canalization, which provide less phylogenetic signal?.

OBJETIVES

General objectives

To carry out a systematic revision of the damselfly genus *Polythore*

Specific Objetives

1. To review the taxonomic status of the species of the genus
2. To test whether *Polythore* is a monophyletic taxon
3. To propose a hypothesis of phylogenetic relationships of the species of *Polythore*
4. To test whether species groups of *Polythore* are natural groups
5. To provide identification tools to the species of the genus such as taxonomic male keys and pictures.
6. To test whether the characters in *Polythore* with high morphological variability, provide less phylogenetic signal.

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CHAPTER 1

TAXONOMIC REVISION OF THE DAMSELFLY GENUS *Polythore* Calvert, 1917 (ODONATA: POLYTHORIDAE)

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ABSTRACT

The Neotropical damselfly genus *Polythore* is distributed mainly in western South America along the eastern foothills of the Andes, and in the Amazon region. This revision is based on morphological characters of male adults, from wing venation, wing pattern coloration, and genital ligula. A total of 19 species are recognized plus the new combination *P. chiribiquete*. Presence of supplementary sectors between RP_2 and IR_2 proximal to pterostigma was found as the diagnostic character for males of this genus. Status of populations proposed in the literature for species of the picta group is assessed by morphometric and multivariate analyses. Clear differentiation was found in populations of *P. procera* and *P. gigantea*; populations of the remaining species differ only by characters proposed in the literature but not by other characters studied here. *Polythore williamsoni* is recorded for the first time for Colombia. Descriptions, redescriptions, distribution maps, illustrations, and an identification key to adult males are provided.

Key words: damselflies, populations, variability, taxonomic key for males.

RESUMEN

El género Neotropical *Polythore* de caballitos del diablo se distribuye principalmente al oeste de Sur América, en las laderas este de la cordillera de los Andes y en la región Amazónica. En este estudio, se revisan las especies de *Polythore*, 19 reconocidas actualmente y la nueva combinación *P. chiribiquete*. La revisión se basó en caracteres morfológicos del macho adulto, incluyendo venación

alar, patrón de coloración alar y lígula genital. Se encontró que la presencia de sectores suplementarios entre las venas RP_2 y IR_2 proximal al pterostigma es un carácter diagnóstico para machos del género. Se evaluó el estatus de las poblaciones propuestas en la literatura para las especies del grupo picta a través de aproximaciones morfométricas y análisis multivariados. Solo las poblaciones de *P. procera* y *P. gigantea* se diferenciaron claramente; las poblaciones del resto de las especies solo se diferenciaron por los caracteres propuestos en la literatura pero no al incluir otros caracteres. Se registra por primera vez *P. williamsoni* para Colombia. Se proveen descripciones, redescripciones, mapas de distribución, ilustraciones y una clave de identificación para los machos adultos.

Palabras clave: caballitos del diablo, poblaciones, variabilidad, clave taxonómica para machos.

INTRODUCTION

Polythoridae includes 57 strictly Neotropical species distributed in seven genera: *Chalcopteryx*, *Chalcothore*, *Cora*, *Euthore*, *Miocora*, *Polythore*, and *Stenocora* (Garrison *et al*., 2010). Polythoridae are damselflies of medium to large size, with squarish pterothorax and short abdomen, wings with dense venation, a long pterostigma, and usually show colored patches which are sometimes iridescent in sunlight (Garrison *et al*., 2010). Polythoridae is considered a monophyletic family based on following synapomorphies: RP3 and IR2 begining closer to arculus than to nodus and postnodal crossveins of C-RA and RA-RP spaces not aligned (Rehn, 2003; Bybee *et al*., 2008)).

Polythore is the second largest genus of the family with 19 species; it is distributed mainly in western South America, along the eastern Andes foothills from sea level to 2,800 m, and in the Amazon region from sea level to about 200 m (Bick and Bick, 1986).

Bick and Bick (1985) revised the genus *Polythore* and summarized the studies of Fraser (1946; 1957) and Montgomery (1967) indicating the characters that distinguish the genus as follows: black body with pale markings in both sexes, male paraprocts reduced; black male cerci with conspicuous process extending ventro-medially; terminal segment of male genital ligula with lateral flagella and horns; females with dark, elongated, triangular mesostigmal lamina pointed ventrally and rimmed on all sides by a low elevation. These characters are shared with other genera of the family such as *Euthore*. Nevertheless, Bick and Bick (1992) later presented a key to genera of the family, in which

Euthore is separated of *Polythore* by the following characters: thickened antenodals, two in *Euthore* and one in *Polythore*; supplementary sectors between MA and MP none in *Euthore* and one to four in *Polythore*; and distance from base wing to nodus equal in *Euthore* and from nodus to pterostigma four to eight millimeters shorter in *Polythore*.

According to Bick and Bick (1985, 1986) *Polythore* is divided into six species groups: batesi, boliviana, concinna, picta, victoria, and vittata, which are defined by differences in HW length, wing color patterns, number of cells under pterostigma, length of distal lobes of male genital ligula, and segmentation of lateral lobe of male genital ligula. Also, these authors found variation in individuals of the species of the picta group: length of distal lobes of male genital ligula (penis horns according to Bick and Bick, 1985), extension of black and extension of white area of HW. Based on these differences these authors proposed following populations: *P. derivata*: Puyo, Limoncocha, Aguaytia, and Colombia; *P. gigantea*: Balsapamba and Antioquia; *P. neopicta*: Satipo, Tingo María, and Balsapuerto; *P. procera*: Puyo and Colombia; and *P. terminata*: Mangosiza and Zamora. It is worth mentioning that Bick and Bick (1985) pointed out that variation present in populations is insufficient for erection of subespecies.

The main criterion used by Bick and Bick (1985, 1986) for species identification was color pattern of wings and shape of penis horns, and they considered that other morphologic species-specific characters traditionally used in taxonomy of Odonata like male anal appendages, female pronotum, mesostigmal lamina, and ovipositor, are not useful to separate species of *Polythore*. Considering the above described situation and the lack of a diagnosis for the genus, this paper aims to: 1) conduct a taxonomic review of the genus *Polythore*, 2) explore new characters for diagnosis of the genus and its species, and 3) evaluate the status of the populations proposed for the species of the picta group.

MATERIALS AND METHODS

A total of 738 specimens were studied from the following collections, acronyms are provided within brackets: D. R. Paulson Collection, Seattle, Washington, USA (DRPC); Florida State Collection of Arthropods, Gainesville, Florida, USA (FSCA); Instituto de Ciencias Naturales, Bogotá, Colombia (ICN); K.W. Knopf Collection (KWKC); Museo de Historia Natural Universidad de los Andes (ANDES); Museo Entomológico Francisco Luis Gallego, Medellín, Colombia

(MEFLG); Museo Entomológico Universidad del Valle, Cali, Colombia (MUSENUV); N. v Ellenrieder Collection (NvEC); R.W. Garrison Collection, Sacramento, California, USA (RWGC); Royal Belgian Institute of Natural Sciences, Brussels, Belgium (RBINS); The Natural History Museum, London, UK (BMNH); United States National Museum, Washington D.C, USA (USNM); University of Michigan, Museum of Zoology, Ann Arbor, Michigan, USA (UMMZ); Zoologische Staatssammlung München, Germany (ZSM). Representatives of all described species were studied.

Taxonomy

This revision is based on morphological characters of male adult damselflies, including characters of wing venation; also special attention was paid to characters of wing pattern coloration and male genital ligula. Larval characters were not included because of the limited information of immature stages, with the larva of only one species of the genus described to date (Estcher and Burmeister, 2006). Riek and Kukalová-Peck´s (1984) system was used for the nomenclature of wing veins while Westfall and May´s (2006) nomenclature was used for body morphology. Abbreviations used throughout the text are as follows: FW: fore wing; HW: hind wing pt: pterostigma; Ax: antenodal crossvein; Px: postnodal crossveins. Male genital ligulae were prepared following Leonard's protocol (1977) with some modifications as follows: in order to soften internal tissues and facilitate ligula handling, a droplet of 7% ammonia was placed over the genital fossa and left there between 10 and 15 minutes depending on body quitinization; then, genital ligula was gently extruded using an entomological needle.

Study of morphology of damselflies was carried out using a stereoscope Leica S8AP0 and photographs were taken using a Leica camera D-LUX 3 (10 megapixels) attached to the Leica stereoscope. Scanning electron microscopy (SEM) images were taken for male genital ligula. Character coding and managing was conducted through DELTA package (Descriptive Language for Taxonomy, Dallwitz [2000]). Delta was also used to generate the key and descriptions of species. Species were identified using the key published by Bick and Bick (1986), and in several cases specimens at hand were compared with type material for confirmation.

Following information is included for each species: taxonomic history, type data and locality, redescription, variability with regards to original description, geographic distribution, and list of specimens examined (including type specimens). Redescriptions of species include measures of

length of HW and length of distal lobes of genital ligula, and description of color pattern of wings. Bick and Bick (1985, 1986, 1990a 1990b) did not provide a formal description of male genital ligula, they only refered to illustrations, which are not detailed enough. Therefore, descriptions of male genital ligula are also included in redescriptions presented here; where possible, these redescriptions were based upon type specimens.

Morphometric Analysis

Statistic tools provide clear criteria for determining degree of similarity between species using continuous characters as evidence, and whether these differences are statistically significant. Since variation is a fundamental aspect of modern concepts of species, its study in a taxonomic context is critical. For these reasons, multivariate analyses and variance were conducted at two levels: for populations proposed by Bick & Bick (1985) for species of the picta group, and for the species of the genus. Only males were studied because of availability of specimens.

Statistical analyses

Variation of characters and similarity of entities were studied through scatter plots of the first two factors of Principal Components Analysis (PCA); variable redundancy was detected through the same procedure plotting variables into components (Quinn and Keough, 2002). Discriminant power of characters and correct assignment of individuals to taxa were assessed using Discriminant Analysis (DA) (MacLeod *et al.*, 2007). Statistical difference between populations proposed by Bick and Bick (1985) was evaluated by analysis of variance (Anova). In the cases where differences between populations were significant, a post hoc test was conducted in order to determine specific significant differences between populations. Assumptions of normality and homocedasticity were tested previously to all analyses.

Analyses were repeated at two levels of study for both raw measurements and for data corrected for size. Correction for size was achieved as follows: once the PCA with raw measures was conducted, the character more associated with size was identified by looking at its closeness to the first component as size indicator (i. e. the character with both the highest factor score and closest location to axis of factor 1). All remaining variables were divided by that size indicator variable so that body size differences between species and individuals were controlled by that proportion. New analyses (PCA, DA, and Anova) were conducted with these new variables. All morphometric

analyses were performed using STATISTICA software version 8.0 (StatSoft, 2007). Previously described analyses were conducted for both species of the picta group and all species of the genus.

Species coverage

Population level study: Bick & Bick (1985) proposed as series of differentiated populations for five species of the picta group, and these were studied in order to test whether there is statistical support for them; there were samples of following populations: for *P. derivata* populations from Puyo and Limoncocha (Ecuador), and Aguaytia (Peru); for *P. gigantea* populations from Balsapamba (Ecuador) and Antioquia (Colombia); for *P. neopicta* populations from Satipo, Tingo Maria, and Balsapuerto (Peru); for *P. procera* populations from Puyo (Ecuador) and Colombia; for *P. terminata* populations from Mangosiza and Zamora (Ecuador). For *P. gigantea* and for *P. terminata* we found specimens from different localities of those mentioned by Bick and Bick (1985), in these cases the specimens were grouped in new populations: San Martín population for the first species and Loreto population for the last species. A total of 205 individuals were studied.

Species level study for genus *Polythore*: Specimens of all species were studied. However, for *P. picta*, *P. spaeteri*, *P. victoria*, and *P. williamsoni* number of available specimens was less than three; therefore, these species were included in the PCA only for the scatter plot and they were excluded from the statistical analyses. 419 individuals were studied.

Measurements

Following metric characters, proposed by Bick & Bick (1985) for differentiation of populations, were included (name given by these authors is provided in parenthesis): extension of iridescent black spot in HW (extent HW black), extension of white spot preceding iridescent black spot in HW (extensive milky white area proximal to the black), and distal lobes of male genital ligula (penis horns length) (Fig. 2b, c, d).

Other measurements were added into the analysis. Six of these have been proposed or included in descriptions but never have been analyzed in a statistical context; four measurements, related to genital ligulae, are proposed in this work. These nine measurements of HW are as follows: length of wing, taken from distal costal plate (DCP, according to Ninomiya and Yoshizawa, 2009) to point where RP_1 vein ends (Fig. 1); width of wing, measured from point where MP vein converges with posterior margin of wing up to Costal vein (Fig. 1); length and width of pterostigma (Fig. 2a); length from base of wing (DCP) to nodus; length from nodus to level where RP_1 vein ends (Fig. 1);

width of distal lobes of genital ligula, width of terminal segment of genital ligula at level of lateral lobes; width of terminal segment at terminal fold level; and length of terminal segment (Fig. 2).

In total 12 or 13 morphometric characters were included depending on the presence in the species; in *P. gigantea* and *P. terminata* only 12 characters were included because these species do not have the wing white spot or white band. Measurements of male genital ligula and pterostigma were taken using a Leica S8AP0 stereoscope with a micrometric ocular and measurements of HW with a digital caliper; all measurements are in millimeters.

RESULTS

TAXONOMY

Genus *Polythore* Calvert

Polythore Calvert, 1917: 263. Type species: *Thore gigantea* Selys, 1853 by original designation. Calvert (1917) proposed *Polythore* as replacement name for *Thore* Hagen in Selys, 1853 preoccupied by *Thore* Koch, 1850 in Arachnida.

Generic diagnosis

Hagen in Selys, 1853 described the genus from one male of *P. gigantea* using few and general characters of wings and thorax. Selys (1854) added other characters to the generic s. Currently, these characters do not diagnose the genus as they are shared by members of other genera of the family (eg. petiolate wings to middle of length to arculus, black body, and cerci with an inferior process). Later, other authors mentioned characteristics of the genus and included characters in keys that help to identify it, but these characters were not exclusive for this genus (Montgomery, 1967; Bick and Bick, 1985, 1986). Thus, there is no formal diagnosis of *Polythore* in the literature.

We found that presence of supplementary sectors between RP_2 and IR_2 beginning proximal to pterostigma in male HW defines taxonomically the genus *Polythore* (Fig. 3). This diagnostic character is supported by our phylogenetic study, where it was found to be a synapomorphy (see

chapter 2). Other useful characters for *Polythore* identification are: one thickened Ax at vicinity of arculus (shared with *Cora* and *Miocora*) differing from *Euthore*, which has two thickened Ax; four or more supplementary sectors between CuA and MP in HW (shared with *Euthore*); and two supplementary sectors between MP and MA in HW (shared with *Chalcopteryx* and *Chalcothore*) differing from *Cora* (Fig. 3).

Generic redescription

The original description of the genus was very short and based on general characters of venation that are shared with other genera of the family, therefore a new description is proposed based on Garrison *et al*. (2010) publication and on studied specimens.

- Male. Head. Black with two spots close to antennae and two in occiput adjacent to postocular lobes; labrum medially black or brown, bordered on either side by an ochre or yellow spot (Fig. 4a); postclypeus shinny black or brown; anteclypeus shinny black or brown with two ochre circular lateral spots; genal carena and base of mandible pale yellow or ochre. **Thorax**. **Prothorax**. Anterior lobe black or brown, rarely with yellow spots; medial lobe black or brown with pale medially interrupted transverse band; posterior lobe black (Fig. 4a). **Pterothorax**. Black with five yellow or ochre transverse stripes on either side: 1) a middorsal stripe almost parallel to middorsal carina usually bending to antealar crest; 2) a humeral stripe on mesopleural suture ending under mesopleural fossa; 3) a stripe on interpleural suture bending to antealar carina; 4) a stripe on metapleural suture, wider than previous stripes; 5) a Y-shaped stripe on metapleural carina (Fig. 4a). In *P. boliviana*, *P. concinna*, *P. chiribiquete*, *P. mutata*, and *P. vittata* there is an additional stripe on mesepisternum. **Wings**. FW and HW similar in shape and size. Usually with black or brown spots, which may show blue or purple iridescence in sunlight, and hyaline, white, ochre, and yellow spots or bands. In some species wing color pattern may change with age becoming more intensive. HW quadrangle approximately 1,2 to 1,8 times as long as FW quadrangle. Row delimited by anal vein and HW margin of HW comprising 22 o more cells (Fig. 5). **Abdomen**. Black with yellow or ochre lateral spots and lateral bands; dorsum of S10 lacking a strong upright horn longer than cercus; cercus longer than length of S10 with an inner-ventral tooth at mid-length; paracprocts vestigial and rounded (Fig. 4b, 4c). **Genital ligula**. First segment with very shorts hairs along lateral edge and some longer and stronger hairs near the apex; inner fold present; terminal segment with lateral lobes, each one with a tubular projection, in *P. aurora*, *P. batesi*, and *P. vittata* the

projections have hairs; terminal segment with distal lobes (Fig. 6).

Habitat

Streams, shady boggy brooks, and areas along small forest creeks from lowland Amazon to Andean cloud forest (Bick and Bick, 1985). According to Louton *et al.* (1996) species such as *P. boliviana* and *P. manua* mimic Ithomiinae butterflies in flight. There is information about copulation and oviposition only for *P. spaeteri* indicating that it takes place after a long raining period when the brooks have been filled with water. The only larva described for the genus is that of *P. spaeteri*; Estcher and Burmeister (2006) found their larvae clinging to lower surface of larger stones in a small forest stream with relatively strong current in Panguana (Peru).

Distribution

Polythore is distributed in the Neotropical region, primarily in western South America, but specimens from one species are recorded from Venezuela and Guyana. Its distribution ranges from Antioquia (Colombia) to Santa Cruz (Bolivia) at its southernmost recorded locality.

Illustrated key for taxonomic determination of males of *Polythore* (Odonata: Polythoridae)

1(0). Lacking an iridescent black or brown spot HW extending uninterrupted to apex of HW..... 2
With an iridescent black or brown spot HW extending uninterrupted to apex of HW (Fig. 5)…..... 16

2(1). Color pattern of FW and HW similar 3
Color pattern of FW and HW different..... . 12

3(2). Lacking amber coloration in FW and HW; distal lobes of genital ligula straight (Fig. 7a)..... 4
With amber coloration in FW and HW (Fig. 9); distal lobes of genital ligula divergent (Fig. 7b) ……..…… 11

4(3). Lacking a crescent-shaped spot in HW; lacking a lunula (*ln*) on axis of Costa in HW (Figs. 16-19); with antero-lateral lobes on genital ligula (Fig. 7a); apex of projection of lateral lobes of genital ligula globose (Fig. 8b) 5
With a crescent-shaped spot in HW (Fig. 10); with a lunula (*ln*) on axis of Costa in HW (Fig. 21, 23); lacking antero-lateral lobes ongenital ligula (Fig. 7b)..... .. 10

5(4). Lacking an iridescent brown spot starting at nodus and ending at proximal edge of pterostigma interrupted by a white band in FW and HW; terminal fold of genital ligula wider than terminal segment at level of lateral lobes (Fig. 13a)..... 6

With an iridescent brown spot starting at nodus and ending at proximal edge of pterostigma interrupted by a white band in FW and HW (Fig. 11); terminal fold of genital ligula almost as wide as terminal segment at level of lateral lobes (Fig 16)…..... ***P. vittata*** (Selys, 1869)

6(5). FW and HW with a white band (Fig. 12); FW lacking an iridescent brown spot 7

FW and HW lacking a white band; FW with an iridescent brown spot..... 9

7(6) FW and HW lacking an iridescent brown medial spot; distal lobes of genital ligula short (length 0.096 – 0.176 mm) 8

FW and HW with an iridescent light brown medial spot (Fig. 16); distal lobes of genital ligula long (length 0.198 – 0.272 mm) (Fig. 13a, b)..... (teneral) ***P. aurora*** (Selys, 1879)

8(7) FW and HW with an opaque white band beginning proximal to nodus and extending slightly distal to nodus (nodal band) (Fig. 12); lacking hairs in projections of lateral lobes of genital ligula (Fig. 51b) ..... ***P. mutata*** (McLachlan, 1881)

FW and HW with an opaque white band beginning distal to nodus (medial band) (Fig. 17); with hairs in projections of lateral lobes of genital ligula (Fig. 14c, d) ..... (teneral) ***P. batesi*** (Selys, 1869)

9(6). FW and HW with a pale yellow, ochre or orange nodal band beginning proximal to nodus (Fig. 18); length of distal lobes of male genital ligula: 0.198 - 0.272 mm (Fig. 13a, b)……..... ***P. aurora*** (Selys, 1879)

FW and HW with an ochre or orange band beginning slightly distal to nodus (Fig. 19); length of distal lobes of male genital ligula: 0.096 - 0.176 mm (Fig. 14a, b)……..…….. ..... ***P. batesi*** (Selys, 1869)

10(4). HWcrescent-shaped spot (*css*) beige (Fig. 22); HW RP of different color than rest of venation, light brown to proximal margin of pterostigma; FW and HW infumated (Fig. 20); apex of projection of lateral lobes of genital ligula globose (Fig. 8b)..... ***P. williamsoni*** (Förster, 1903)

HW crescent-shaped spot (*css*) ochre; HW RP of different color than rest of venation, yellow beyond distal margin of pterostigma; FW and HW infuscated (Fig. 21); apex of projection of lateral lobes of genital ligula elongated with short basal projection (Fig. 8a). .... ***P. manua*** Bick & Bick, 1990

11(3). Apex of FW and HW at level of pterostigma diffusely darkened to brownish (Fig. 9); apex of projection of lateral lobes of genital ligula elongated (Fig. 24); mesepisternum with fivepale stripes (Fig. 24c) ….. ..... ***P. spaeteri*** Burmeister & Börzsöny, 2003

Apex ofFW and HW at level of pterostigmaamber (Fig. 26); apex of projection of lateral lobes of genital ligula globose (Fig. 7b, 25c); mesepisternum with an additional sixth pale stripe extending for a quarter of its length (Fig. 25d) .....*P. concinna* (McLachlan, 1881)

12(2). FW lacking an iridescent black or brown apical spot; apex of projection of lateral lobes of male genital ligula undifferentiated (Fig. 30b) 13

FW with an iridescent black or brown apical spot; apex of projection of lateral lobes of male genital ligula elongated (Fig. 8a) 14

13(12). HW lacking a white nodal bandand with an ochre band; FW not hyaline, with an ochre round spot (Fig. 29)..... ***P. chiribiquete*** comb. nov.

HW with a white nodal band and lacking an ochre band; FW hyaline, lacking a circular ochre spot (Fig. 28)..... ***P. beata*** (McLachlan, 1869)

14(12). Proximal edge of FW black or brown apical spot oblique; HW lacking crescent-shaped spot; HW lacking lunula on axis of Costa; HW iridescent black or brown spot interrupted by a white band (Fig. 27)..... ***P. victoria*** (McLachlan, 1869)

Proximal edge of FW black or brown apical spot sinuous; HW with a crescent-shaped spot; HW with a lunula on axis of Costa; HW lacking white band interrupting iridescent black or brown spot 15

15(14). FW with a yellowish irregular spot; HWcrescent-shaped spot grayish; HW base grayish or infuscate (Fig. 10) …..... ***P. boliviana*** (McLachlan, 1878)

FW with a whitish irregular spot (*ws*); HW crescent-shaped spot (*scs*) white; HW base hyaline (Fig. 33)..... ***P. ornata*** (Selys, 1879)

16(1). FW and HW lacking white spots 17

FW and HW with white spots (*ws*) (Fig. 35) 20

17(16). HW iridescent black or brown spot (ibs) extending uninterrupted to apex beginning proximal to nodus (Fig. 37); HW percentage of extension of iridescent black or brown spot over 60; apex of projection of lateral lobes of genital ligula globose (Fig. 41c)..... ***P. gigantea*** (Selys, 1853)

HW iridescent black or brown spot in extending uninterrupted to apex beginning distal to nodus (Figs. 35, 36, 38, 39); HW percentage of extension of iridescent black or brown spot zero to 60; apex of projection of lateral lobes of genital ligula elongated (Figs. 41c, 42) 18

18(17). Distal lobes of genital ligula straight (Fig. 42); HW extension of iridescent black or brown spot between 50% and 58% (Fig. 36) ..... ***P. lamerceda*** Bick & Bick, 1985

Distal lobes of genital ligula divergent (Figs. 44-46); HW extension of iridescent black or brown spot less than 30% (Figs. 38, 39)..... 19

19(18). FW and HW lacking an apical white band preceding iridescent black or brown spot extending uninterrupted to apex (Fig. 38)..... ***P. terminata*** Fraser, 1946

FW and HW with an apical white band preceding iridescent black or brown spot extending uninterrupted to apex (Fig. 39)..... ***P. derivata*** (McLachlan, 1881)

20(16). FW and HW with an irregular white spot (*ws*) (Fig. 35); FW and HW lacking an apical white band preceding iridescent black or brown uninterrupted spot 21

FW and HW with a triangular white spot (Fig. 50); FW and HW with an apical white band preceding iridescent black or brown uninterrupted spot..... ***P. picta*** (Rambur, 1842)

21(20). Apex of projection of lateral lobes of genital ligula elongated with short basal projection (Figs. 48 a, b)…..... ***P. neopicta*** Bick & Bick, 1990

Apex of projection of lateral lobes of genital ligula globose (Fig. 47 c, d) .... ***P. procera*** (Selys, 1869)

***P. aurora* (Selys, 1879)**
(Figs. 8b, 13a-d, 16, 18)

Thore aurora Selys, 1879: 401-402 (2 ♂, 2 ♀ Río Napo, Ecuador); - Kirby, 1890: 117; - Campos, 1922; 14; -Schmidt, 1942: 242, Fig. K (thorax), 247 (Iquitos, Peru), III, figs 1, 2 (wings).
Polythore batesi: Kennedy (not Selys), 1919: I, figs 7, 8 (ligula drawings).
Thore batesi: Navas (not Selys), 1924: 319 (Yepisca, Peru); - Schmidt, 1942: 247 and Rácenis, 1959: 487.
Polythore aurora: Bick & Bick, 1986: 253-257, 259, 267 (male and female wings, male genital ligula, key).

Type series data
2♂, 1♀ Río Napo, Ecuador. McLachlan Coll. (BMNH) now designated as Lectotype and Paralectotypes.

Comments. Selys (1879) described the species based on two males and two females from Río Napo, Ecuador. Montgomery (1967) mentioned that six out of the 10 specimens in Selys' collection in RBINS were from "S. Paulo de Olivença, Amazon" remaining four from "Río Napo, Ecuador" which therefore could be of the type series. Montgomery (1967) designated the two more mature specimens of that series as "Lectotypes" and added the respective "lectotype" labels to them. Later, Bick and Bick (1986) revised the specimens designated by Montgomery as lectotypes and mentioned that "the male is actually *batesi*, and the female bearing the almost indecipherable label, Iquitos, which is in Peru, could not be of the type series" Also, they discussed Montgomery's identification of the male specimen deposited in the RBINS collection, and concluded that this specimen, identified as *P. aurora*, belongs to *P. batesi* because it does not match the original description; therefore they disagreeed with his determination and added the label "*P. batesi*, det. G.H. Bick, 1985"to that specimen.

I had access to Selys'collection in BMNH and RBINS and based on this revision I concluded that six of the 10 specimens in RBINS labeled as *Thore aurora* have the label "S. Paulo" so, as Montgomery (1967) mentioned, these can not belong to the type series. The other four specimens have the label "*Thore aurora* LECTOTYPE selected by Montgomery, 1968"; two males and a female are from the type locality Río Napo, Ecuador, while the female is from Iquitos, Peru.

Therefore, the designation made by Montgomery in 1969 for that female as lectotype of *T. aurora* was incorrect because the specimen is implicitly excluded from the type series. In addition, the designation of those two males as lectotypes of *T. aurora* was invalid because these specimens do not match with the original description and these belong to *P. batesi* instead. Then, the following label "Invalid lectotype because it is not from locality type" was added to the female specimen, and the label "Invalid lectotype, *Polythore batesi* (Selys, 1869) ♂ det. N.C. Rojas 2010" was added to the male specimen.

Three specimens (two males and one female) of *T. aurora* from Río Napo, Ecuador were found in the BMNH matching the original description; thus I believe there are good reasons to consider them as syntypes. Therefore one of these males was designated as lectotype of *P. aurora* and the other two specimens as paralectotypes.

Redescription of male

HW length 26.2 - 31.1 mm; $\bar{x}$= 28.3 mm; N= 18. HW width 7.51- 8.77 mm; $\bar{x}$= 8.15 mm; N= 18. Ax FW 31 - 40; Ax HW 27 - 39; Px FW 38 - 50; Px HW 38 – 45. Complete cells under pt 3 - 6; $\bar{x}$= 4.3; N= 18. Length pt 1.69 - 2.04 mm; $\bar{x}$= 1.84 mm; N= 18. Width pt 0.62 – 0.90 mm; $\bar{x}$= 0.72 mm, N= 18. Length base to nodus 9.70 - 12.5 mm; $\bar{x}$= 10.4 mm; N= 18. **Wings**. Color pattern of FW and HW similar, infuscate. RP in HW of same color as remainder of venation. HW with an iridescent brown medial spot. FW and HW with a pale yellow nodal band (*nb*) beginning proximal to nodus (Fig. 18). HW lacking lunula on axis of Costa. Teneral individuals with different wing color pattern, in which iridescent medial spot is lighter and nodal bands in both wings are white (Fig. 16). Older individuals exhibit more vivid colors. **Thorax**. Color pattern of prothorax and pterothorax as described for genus. Additional mesepisternal pale stripe absent (Fig. 4a). **Genital ligula**. Length distal lobes 0.198 – 0.272 mm; $\bar{x}$= 0.228 mm; N= 18. Width distal lobes 0.032 – 0.057 mm; $\bar{x}$= 0.043; N= 18. Length of terminal segment without distal lobes 0.377 – 0.464 mm; $\bar{x}$= 0.423 mm; N= 18. Distal lobes long and straight (Fig. 13a). Apex of the distal lobes rounded. Antero-lateral lobes present (Figs. 13a-c). Posterior margin of lateral lobes not visible in ectal view. Hairs in projections of lateral lobes present. Apex of projection of lateral lobes globose (Fig. 13d). Lateral lobes lacking protuberance. Lateral edge of distal lobes straight. Tterminal fold wider than segment with at level of lateral lobes (Fig. 13a).

Variation with regards to original description

Male. HW length 26.2 – 31.1 mm. Complete cells under pt 3 – 6. Ax FW 31 - 40; Ax HW 27 - 39.

Distribution

NE Ecuador (Río Napo), NE Peru (Loreto Dept.), and NW Brazil (Amazonas State), in Amazon Region.

Diagnosis

Polythore aurora is close to *Polythore batesi*, with males sharing following characters: pale band in both wings, iridescent brown spot in both wings, and hairs in projections of lateral lobes of genital ligula. They differ in the position of the pale band, which in *P. aurora* begins proximal to nodus and ends slightly distal to nodus (Fig. 18), while in *P. batesi* it begins slightly distal to nodus (Fig. 19). Iridescent brown spot is medial and does not exceed half the length between nodus and pterostigma in *P. aurora*, while it is more extensive in *P. batesi*, sometimes reaching pterostigma or apex of wings. Another difference is that distal lobes of terminal segment of male genital ligula are longer in *P. aurora* (0.198 – 0.272 mm) (Fig. 13a) than *P. batesi* (0.096 – 0.176 mm) (Fig. 14a).

General wing coloration of female

Female color pattern similar to that of the male. FW and HW with a pale yellow nodal band (*nb*) beginning proximal to nodus; these bands change to ochre in older individuals (Fig. 83a). Nodal band is surrounded by light brown color. Teneral individuals with white nodal band (Fig. 83b).

Specimens examined

Lectotype: 1♂, **Ecuador**. Río Napo. McLachlan Coll. (BMNH); Paralectotypes: 1♂ 1♀, **Ecuador**. Same data as lectotype (BMNH) here designated. Other specimens (20♂, 14♀) : **Brazil**. 1♂ 1♀, Teffé. (RBINS). **Peru**. 1♂ 1♀, Loreto, Iquitos (RBINS); 1♂ 1♀, Loreto, Iquitos, 9 vii 1931, G. Klug from P. Nagel (FSCA); 4♂, same data, iv 1936, G. Klug (FSCA); 1♀, same data, 27 vi 1931 (UMMZ); 1♀, same data, 29 vi 1931 (UMMZ); 1♀, same data, 30 vi 1931 (UMMZ); 1♀, same data. 8 vii 1931 (UMMZ); 1♀, same data, 15 vii 1931 (UMMZ); 1♀, same data, vi 1939 (UMMZ); 1♀, same data, iv 1940 (UMMZ); 1♂, same data, v 1938, G. Klug (UMMZ); 1♂, same data, vii 1939, G. Klug (UMMZ); 1♂, same data, iv 1940, G. Klug (UMMZ); 1♂, same data, v 1940, G. Klug (UMMZ); 1♀, Loreto, Iquitos, Callicebus Res. Sta. Mishana, Río Nanay, 25 km. SW, Tropical wet forest, 120 m, 10-17 i 1980, J.B. Heppner (USNM); 2♂ 2♀, Loreto, Muenacaño, Río Amazonas, near Iquitos, viii 1939, José Schunke (FSCA); 1♂, Loreto, near Mishana along stream near old primate center, 7 xi 1974, P.A. Holzbauer (FSCA); 1♀, Loreto, Río Nanay, Mishana, Est. Biol. Callicebus, 150 m, 2 i 1980, G. Lamas (DRPC); 1♂, San Martín Dept., Mishuyacu, 7 vii 1931,

G. Klug from P. Nagel (FSCA); 1♂, same data, 29 vi 1931, G.G Klug (UMMZ).

***P. batesi* (Selys, 1869)**
(Figs. 3, 6, 14a-d, 17, 19)

Thore batesi Selys, 1869: 29 (2♂ 2♀ São Paulo de Oliviença, Brazil); - Kirby, 1890: 117; - Schmidt, 1942: 246 (key), III, figs 3, 4 (wings).
Thore batesi: Navas (not Selys), 1924: 319 (cf. *aurora*)
Polythore batesi: Kennedy (not Selys), 1919: 1, figs 7, 8 (ligula drawings, cf. *aurora*).
Polythore batesi: Fraser, 1946: 22 (key, color change); - Montgomery, 1967: 150 (type); - Bick & Bick, 1986: 253-257, 259, 265 (male and female wings, male genital ligula, key).

Type data
♂ (Lectotype), Brazil, São Paulo de Oliviença (RBINS). 3♂ (Paralectotypes) Brazil, São Paulo de Oliviença (RBINS).

Comments. Montgomery (1967) revised the type series in the Selys' collection in RBINS and designated one male as lectotype, and three other males as 'paratypes'. This last designation is invalid because once a lectotype is designated the remaining specimens of the type series become paralectotypes, not paratypes (Art. 74.1.3 ICZN).

Redescription of male
HW length 28.9 – 36.9 mm; $\bar{x}$= 31.3 mm; N= 26. HW width 7.83 – 10.28 mm; $\bar{x}$= 8.76 mm; N= 26. Ax FW 32 – 44; Ax HW 29 – 41; Px FW 44 – 54; Px HW 42 – 48. Complete cells under pt 5 – 9; $\bar{x}$=6.9; N= 26. Length pt 1.72 – 2.80 mm; $\bar{x}$= 2.34 mm; N= 26. Width pt 0.48 –1.05 mm; $\bar{x}$= 0.92; N= 26. Length base to nodus 10.0 – 14.7 mm; $\bar{x}$= 11.4 mm; N= 26. **Wings.** Color pattern of FW and HW similar. RP in HW of different color than rest of venation, yellow to proximal margin of pterostigma. Iridescent brown spot in FW present, medial or continuing to distal edge of pterostigma. Infuscate. Ochre or orange band in both wings present and beginning slightly distal to nodus (Fig. 19). Wing color pattern changes with age, in teneral individuals medial band is white and becomes, in mature individuals, yellow and ochre or orange. However, it always begins slightly distal to nodus. Also, in tenerals this band is narrower and rounded near posterior margin of wing.

Iridescent brown medial spot is lighter in tenerals and in mature individuals becomes more extensive and darker, reaching distal edge of pterostigma (Fig. 17). **Thorax.** Pattern coloration of prothorax and pterothorax as for genus. Additional mesepisternal pale stripe absent (Fig. 4a). **Genital ligula.** Length distal lobes 0.096 – 0.176 mm; $\bar{x}$= 0.137 mm; N=19. Width distal lobes 0.048 – 0.064 mm; $\bar{x}$= 0.052; N= 15. Length of terminal segment without distal lobes 0.358 – 0.496 mm; $\bar{x}$= 0.447 mm; N= 19. Distal lobes straight. Apex of distal lobes rounded (Fig. 14a). Antero-lateral lobes present (Fig. 14a-c). Posterior margin of lateral lobes not visible in ectal view. Hairs in projections of lateral lobes present (Fig. 14c, d). Apex of projection of lateral lobes globose. Protuberance in lateral lobes absent. Lateral edge of distal lobes straight. Terminal fold wider than segment at level of lateral lobes (Fig. 14a).

Variation with regards to original description

Male: HW length 28.9 – 36.9 mm. 5 – 9 complete cells under pt while Selys (1869) mentioned only 7 – 8 cells.

Distribution

NW Brazil (Amazonas State) and NE Peru (Loreto Dept.)

Diagnosis

Male of *P. batesi* is very similar to *P. aurora* but differs by wing color pattern of (see previous remarks under *P. aurora*). Teneral males of *P. batesi* (Fig. 17) are similar to male adults of *P. mutata* in having wing pattern coloration with white bands (Fig. 12), but differ in the position of these bands, which begin proximal to nodus in *P. mutata* and slightly distal to nodus in *P. batesi*. Also, tenerals of *P. batesi*, as well as adults, have hairs in projections of lateral lobes of male genital ligula (Fig. 14c, d), while tenerals of *P. mutata* do not have these hairs (Fig. 51b).

General wing coloration of female

Female color pattern similar to that of the male. Infuscate wings. Ochre or orange band in both wings present and beginning slightly distal to nodus (Fig. 85). Iridescent brown spot in both wings are narrower than this spot in male.

Specimens examined

Lectotype: ♂, **Brazil**, São Paulo. (RBINS). Paralectotypes: 3♂ tenerals, São Paulo. (RBINS). Other specimens (39♂, 7♀): **Brazil**, 1♂ 1♀, Amazonas State, São Paulo, iv 1923, S. Klages (FSCA); 3♀, Amazonas State, São Paulo (RBINS); 1♂, Amazonas State, S ão Paulo de Olivença, 1897, Staudinger (UMMZ); 6♂ 2♀, same data, i 1923, S. Klages (FSCA); 12♂, same data, xii 1931, F.Wucherpfennig (UMMZ); 4♂, same data, i 1932 (UMMZ); 2♂, same data, ii 1932, (UMMZ); 1♂, same data, iii 1932 (UMMZ); 3♂, same data, iv 1932 (UMMZ); 3♂, same data, v 1932 (UMMZ); 1♂, Amazonas State, São Paulo de Olivença (RBINS); 1♂, Amazonas State, São Paulo de Olivença, Alto Río Solimões, xii 1931, F.Wucherpfennig (FSCA); 3♂ 1♀, same data, ii 1932 (FSCA); 1♂, Chiriqui, no more data (RBINS).

***P. beata* (McLachlan, 1869)**
(Figs. 2d, 7a, 28, 30 a, b)

Thore beata McLachlan, 1869: 28 (many ♂, ♀, Pebas, Peru); - Selys, 1869: 30 (descr. ♂, ♀); - Hagen, 1875: 31; - Kirby, 1890: 117; - Campos, 1922: 14 (Ecuador); - Navas, 1924: 319 (Quindio, Colombia; "Río Ampiyan" = ? Río Ampiyacu, Peru); - Schmidt, 1942: 247 (Tonantins, Brazil), III, fig. 5 (♀ wings).

Thore batesi Race? *Thore inaequalis* Selys, 1869: 30 (1♀**,** Fonte Boa, Brazil); - Hagen, 1875: 31; - Montgomery, 1967: 127, 151 (synonym, type)

Polythore beata: Kennedy, 1919: 1, figs 3,4 (genital ligula drawings); - Fraser, 1946: 23 (key, color change); - Soukup, 1954: 14 (Iquitos, Peru); - Racenis, 1959: 487; - Montgomery, 1967: 150 (type); - Bick & Bick, 1986: 253-257, 259, 266 (male and female wings, male genital ligula, key).

Type data

♂ (Lectotype), Peru, Loreto, Pebas (BMNH). 10♂ 2♀ (Paralectotypes), Pebas (RBINS)

Redescription of male

HW length 26.5 – 32.2 mm; $\bar{x}$= 29.5; N=10. HW width 7.76 – 9.61 mm; $\bar{x}$= 8.40; N= 10. Ax FW 35 – 41; Ax HW28 – 34; Px FW 39 – 48; Px HW 36 – 45. Complete cells under pt 4 – 6; $\bar{x}$= 4.8; N= 11. Length pt 1.62 – 2.00 mm; $\bar{x}$= 1.83 mm; N= 11. Width pt 0.64 – 0.84 mm; $\bar{x}$= 0.70 mm; N= 11. Length base to nodus 9.72 – 11.8 mm; $\bar{x}$=10.8 mm; N=10. **Wings**. Color pattern of FW and HW

different (Fig. 28). **FW**. Hyaline, black venation. **HW**. Color of RP vein not differentiated, black. White nodal band present. As mentioned by Bick and Bick (1986), no change in wing coloration with age was found in specimens studied, with nodal band remaining white even in mature individuals. **Thorax**. Pattern coloration of prothorax and pterothorax as for genus. Additional mesepisternal pale stripe absent. **Genital ligula.** Length distal lobes 0.132 – 0.198 mm; $\bar{x}$= 0.166 mm; N= 10. Width distal lobes 0.048 – 0.104 mm; $\bar{x}$= 0.072 mm; N= 10. Length of terminal segment without distal lobes 0.358 – 0.464 mm; $\bar{x}$= 0.399; N=10. Distal lobes straight. Apex of distal lobes rounded. Antero-lateral lobes present (Fig. 7a, 30a, b). Posterior margin of lateral lobe not visible in ectal view. Hairs in projections of lateral lobes absent (Fig. 30b). Apex of projection of lateral lobes undifferentiated (Fig. 30b) or sometimes globose. Protuberance in lateral lobes absent. Lateral edge of distal lobes straight. Terminal fold as wide assegment at level of lateral lobes (Fig. 7a).

Variation with regards to original description

Male: HW length 26.5 – 32.2 mm

Distribution

NW Brazil (Amazonas State), S Colombia (Caquetá Dept.), and NE Peru (Loreto Dept.) in the Amazon Region. According to Navás (1924) *P. beata* occurs in Quindio, Colombia but as mentioned by Bick and Bick (1986) this record is doubtful because literature records and studied specimens are from the Amazon region, beyond the eastern foothills of the Andes.

Habitat

Specimens were collected by the authors in tropical rainforest in southern Colombia (Caquetá, Dept.) in the Amazon region, near a small stream at 250 m.

Diagnosis

Male of *P. beata* is similar to that of *P. mutata*, sharing a white nodal band in HW, but *P. beata* FW is entirely hyaline (Fig. 28) while *P. mutata* FW has a white nodal band (Fig. 12). Additional mesepisternal pale stripe of thorax is absent in *P. beata* but it is present in *P. mutata* (Fig. 54).

General wing coloration of female

Same color pattern of the male.

Specimens examined

Lectotype: **Peru**. ♂, Loreto, Pebas (BMNH). Paralectotypes: Peru, 10♂ 2♀, Pebas (RBINS). Other specimens (23♂, 11♀): 2♀, no data (RBINS). **Brazil**. 1♀, 7 xi 1906 (FSCA); 4♂, Amazon River, Tonatins, viii 1923, S. Klages (FSCA); **Colombia**, 1♂, Caquetá Dept., Río Orteguaza, 26 iv 1947, Richter, L. (ICN); 1♂, same data, 2 ix 1947 (ICN); 1♂, same data, 14 ix 1947 (ICN). 2♂ 1♀, Caquetá Dept., Municipio Solano, Inspección Araracuara, tropical rainforest, 250 m, vii 2007, Rojas, N. C. (ICN); 1♂, Putumayo Dept., Puerto Leguízamo, Río Cau cayá, xii 1948, Richter, L. (ICN); **Peru**. 1♂, Loreto, Explornapo Cap on Sucusari River near Napo River, about 100 mi NE Iquitos, 16 vii 1990, S.W. Dunkle (FSCA); 1♂, Loreto, Pebas, Río Arupujien, viii 1903, Morton (UMMZ); 1♀, Loreto, Iquitos (RBINS); 1♂, Amazon (RBINS); 8♂ 6♀, Pebas (RBINS); 2♂, Pebas, Amazon (RBINS).

***P. boliviana* (McLachlan, 1878)**
(Figs. 10, 58, 59)

Thore boliviana McLachlan, 1878: 89 (1♂, Chairo, Bolivia); - Selys, 1879: 53 (descr. ♂); - Kirby, 1890: 116; - Ris, 1918: 30, 32 (key, descr. ♀, PichisWeg, Peru).
Thore victoria: Selys (not McLachlan), 1873: 33 (1 ♀ doubtfully placed in *T. victoria* but assigned to *T. boliviana* by Ris, 1918: 32)
Polythore boliviana: Keneddy, 1919, I, figs 13, 14 (genital ligula drawings); - Montgomery, 1967: 150 (type); - Bick & Bick, 1986: 253-257, 259, 261 (male and female wings, male genital ligula, key).

Type data

♂ (Holotype), Chairo, Bolivia (BMNH).

Redescription of male

HW length 32.2 – 42.8 mm; $\bar{x}$= 37.6 mm; N=31. HW width 9.39 – 12.4 mm; $\bar{x}$= 10.9 mm; N= 31. Ax FW 31 – 51; Ax HW 33 – 45; Px FW 57 – 71; Px HW 55 – 70. Complete cells under pt 10 – 16; $\bar{x}$= 13.4; N= 31. Length pt 2.65 – 4.16 mm; $\bar{x}$= 3.55 mm; N=31. Width pt 0.95 – 1.28 mm; $\bar{x}$= 1.13 mm; N= 31. Length base to nodus 10.7 – 14.1 mm; $\bar{x}$= 12.6 mm; N=31. **Wings**. Color pattern of FW and HW different (Fig. 10). **FW.** Iridescent black or brown apical spot present. Yellowish

irregular spot present, beginning near to distal edge of quadrangle. Crescent-shaped spot pale yellow, sometimes not defined. Milky lunula on axis of the Costa vein present. **HW.** Color of RP vein differentiated from rest of venation, yellow until proximal margin of pterostigma (Fig. 59). Iridescent black or brown spot interrupted by a grayish crescent-shaped spot. Yellow milky lunula on axis of Costa present. In teneral individuals, iridescent spot in both wings light brown; irregular spot in FW absent, being the crescent-shaped spot more visible. In some mature specimens HWcrescent-shaped spot darker. **Thorax**. Pattern coloration of prothorax and pterothorax as for genus. Additional mesepisternal pale stripe absent (Figs. 52, 55). **Genital ligula**. Length distal lobes 0.048 – 0.170 mm; $\bar{x}$= 0.119 mm; N= 31. Width distal lobes 0.064 – 0.144 mm; $\bar{x}$= 0.101 mm; N= 31. Length of terminal segment without distal lobes 0.585 – 0.887 mm; $\bar{x}$= 0.733 mm; N= 31. Distal lobes straight. Apex of distal lobes rounded. Antero-lateral lobes absent. Posterior margin of lateral lobe visible in ectal view. Hairs in projections of lateral lobes absent (Fig. 58c). Apex of projection of lateral lobes elongated (Fig. 58c). Protuberance in lateral lobes present (Fig. 58). Lateral edge of distal lobes convex (Fig. 58a). Terminal fold almost as wide as segment width at level of lateral lobes.

Distribution

West-central Bolivia (Santa Cruz Dept.: Ichilo Prov., La Paz Dept.: Yungas, Cochabamba Dept.: Chapare Prov.) and S Peru (Cuzco Dept.: Paucartambo, Quispicanchi Dept.: Marcapata). Its altitudinal range goes from 400 m to 1,800 m, expanding the range stated by Bick and Bick (1986).

Diagnosis

Polythore boliviana approaches *P. ornata* by color pattern of male wings. They share a FW black or brown apical spot with sinuous proximal edge, presence of HW crescent-shaped spot, presence of lunula on axis of HW Costa, and HW RP not differentiated in color from remainder of venation. *Polythore boliviana* can be diagnosed from *P. ornata* by HW crescent-shaped spot grayish (white in *P. ornata*), FW irregular spot yellowish (whitish in *P. ornata*), and base of HW grayish or infuscate (hyaline in *P. ornata*).

General wing coloration of female

Yellow band with cuved edges in FW slightly distal to nodus followed by a wide dark brown band. Narrow light brown band with curve edges in HW followed by a wide dark brown band (Fig. 84 a, b). In some specimens, the pale band in FW may be light brown. In tenerals individuals the yellow

band in FW and HW becomes whitish (Fig. 84c).

Specimens examined

Holotype: **Bolivia**. ♂, Chairo (BMNH). Other specimens (36♂, 8♀): **Bolivia**. 1♂ 1♀, no more data, 24 – 31 xi (UMMZ); 2♂ 1♀, no more data (RBINS); 1♂, Cochabamba Dept., Chapare Prov., Alto Palmar, 1100m, 15 ii 1962 (FSCA); 2♂ 1♀, Cochabamba Dept., Chapare Prov., Cristal Mayu, 600m (UMMZ); 1♂, Cochabamba Dept., Chapare Prov., El Palmar, xi 1950, Fr. Steinbach (UMMZ); 1♂, Cochabamba Dept., El Palmar, 900m, 8-15 ix 1956, Luis E. Pena G (UMMZ); 2♂, Cochabamba Dept., Chapare Prov., Cristal Mayu - located from Yungas in Yungas del Espiritu Santo 30 km west of Paractito on the Espiritu Santo riverbank, 1800 m, x 1949, Luis E. Pena G (UMMZ); 1♂, same data, xi 1949 (UMMZ); 1♂, same data, xii 1949 (UMMZ); 1♂, Cochabamba Dept., Chapare Prov., Cristal Mayu - located from Yungas in Yungas del Espiritu Santo, 1800 m, 6 x 1949 (UMMZ); 1♂, same data, 28 x 1949 (UMZ); 1♂, same data, 10 xi 1949 (UMMZ); 1♂, same data, 22 xi 1949 (UMMZ); 1♂, Santa Cruz Dept., Ichilo Prov., Buena Vista, 400 m, Roy Steinbach (FSCA); 2♂ 1♀, La Paz Dept., Coroico, 1897, Staudinger (UMMZ); 1♂ 1♀, La Paz Dept., Coroico (Las Yungas Mountains), 1800 m, 3 – 5 xii 1955, L.E. Pena (FSCA); 8♂, same data, 3 – 8 xii 1955, L.E. Pena (UMMZ); 1♂, La Paz Dept., Nor Yungas Prov., Coroico Río Los Vagantes, 1200 m, 16°10'47"S – 67°41'8"W, 14 ii 2000, N. v. Ellenrieder (NvE); 1♂ 1♀, La Paz Dept., NR Puente Villa, Sud Yungas Prov., Río Taquesi & Río Jankho Uma, 1372 m, 21 v 1989, T. Emmel (FSCA); 1♂ 1♀, same data, 24 v 1989 (FSCA); **Peru**. 1♂, Cuzco Dept., Paucartambo Prov., Puente San Pedro, near 50 km NW Pilcopata, 1600 m, 3 ix 1988, O.S. Flint Jr. (USNM); 2♂, Cuzco Dept., Paucartambo Prov., Callanga, in the valley of the river Callanga, 1300 m, 14 ii 1953, F.L. Woytkowski (UMMZ); 1♂ 1♀, Cuzco Dept., Marcapata, 1890, O. Garlepp (UMMZ); 1♂ Cuzco Dept., Marcapata, 1900, O. Garlepp (UMMZ).

***P. concinna* (McLachlan, 1881)**
(Figs. 2a, c, 7b, 25 a-d, 26)

Thore concinna McLachlan, 1881: 28 (15♂, 14♀, Río Bobonaza, Ecuador); - Kirby, 1890: 117; - Campos, 1922: 14.

Sapho pulchella Kirby, 1889: 300 (♂, ♀, Cameroons); - Karsch, 1891: 456 (synonym, corrected locality to Colombia, South America); - Montgomery, 1967: 127, 150 (synonym)

Polythore concinna: Fraser, 1946: 22 (key, descr., Umbria, Colombia); - Montgomery, 1967: 150 (types); - Bick & Bick, 1986: 253-257, 259, 270 (male and female wings, male genital ligula, key).

Type data

♂ (Lectotype), Ecuador, Río Bobonaza. Buckley. D.E., Kimmins det., 1968 (BMNH).♂41♀ (Paralectotypes), Ecuador, Río Bobonaza (RBINS).

Comments. McLachlan (1881) included 15 males and 14 females in the type series of this species. Latter, Kimmins (1970) designated a male specimen of this series deposited in BMNH as Lectotype. Another five specimens of that series are deposited in RBINS and identified with the label type; thus, these are paralectotypes according to the International Code of Zoological Nomenclature (Art. 74.1.3), and a label "Paralectotype" was added. Unfortunately we did not find the other 23 type specimens in the examined collections.

Redescription of male

HW length 27.8 – 39.8 mm; $\bar{x}$= 33.4 mm; N= 43. HW width 7.72 – 11.8 mm; $\bar{x}$= 9.84; N= 43. Ax FW 34 – 56; Ax HW 27 – 55; Px FW 53 – 77; Px HW 49 – 73. Complete cells under pt 8 – 17; $\bar{x}$= 12.2; N= 43. Length pt 2.24 – 4.24 mm; $\bar{x}$= 3.16 mm; N= 43. Width pt 0.64 – 1.52 mm; $\bar{x}$= 0.94 mm; N= 43. Length base to nodus 8.97 –13.5 mm; $\bar{x}$= 10.9 mm; N= 43. **Wings**. Color pattern of FW and HW similar; amber uniform coloration, no dark areas or other spots (Fig. 26). RP in HW of same color as remainder of venation, brown light. **Thorax.** Pattern coloration of prothorax and pterothorax as for genus. Additional mesepisternal pale stripe present, occupying a quarter of its length (Fig. 25d). **Genital ligula**. Length distal lobes 0.136 – 0.240 mm; $\bar{x}$= 0.199 mm; N= 43. Width distal lobes 0.064 – 0.104 mm; $\bar{x}$= 0.076 mm; N= 43. Length of terminal segment without distal lobes 0.622 – 0.784 mm; $\bar{x}$= 0.675 mm; N= 43. Distal lobes divergent and its lateral edges are concave (Fig. 25a). Apex of distal lobes rounded, or elongated, or with a hook (Fig. 25 a, b). Antero lateral lobes absent. Posterior margin of lateral lobe visible in ectal view. Hairs in projections of lateral lobes absent (Fig. 25c). Apex of projection of lateral lobes globose (Fig. 25c). Protuberance in lateral lobes present. Terminal fold as wide as segment at level of lateral lobes.

Variation with regards to original description

Male. HW length 27.8 – 39.8 mm. Complete cells under pterostigma in HW 8 – 17. Length pt 2.24 – 4.24 mm. Ax FW 34 – 56; Ax HW 27 – 55.

Distribution

Colombia (Caquetá Dept.), E of Andes in Ecuador (Morona-Santiago Prov., Napo Prov., Pastaza Prov., Pichincha Prov., Tungurahua Prov.) and Peru (Junin Dept. and Pasco Dept.)

Diagnosis

Polythore concinna is similar to *P. spaeteri* in having amber coloration in both male wings, but coloration is uniform in *P. concinna* (Fig. 26) while apex is diffusely darkened to brownish in *P. spaeteri* (Fig. 9). The first species has an additional mesepisternal pale stripe (Fig. 25d), which is absent in *P. spaeteri* (Fig. 24c). Also, apex of projection of lateral lobes of male genital ligula is globose in *P. concinna* (Fig. 25c) and elongated in *P. spaeteri* (Fig. 24a).

General wing coloration of female

Color pattern different from the male. Traslucent wings uniformely dark yellow. FW with a narrow brown band. And HW with a dark brown crescent-shaped spot (Fig. 86).

Specimens examined

Lectotype: **Ecuador**. ♂, Río Bobonaza, Buckley (BMNH). Paralectotypes: Ecuador. 4♂ 1♀, same data as lectotype (RBINS) Other specimens (45♂, 15♀): 1♂, South America, no more data, A.F. Porter (UMMZ). **Colombia**. 1♂, Caquetá, 10 km S. of Florencia, 23 i 1969, R. E. Dietz (USNM). **Ecuador**. 1♂, no more data (UMMZ); 1♂ 1♀, Río Bombaini – Yacu, 24 iii 1941, W.C. – Macintyre (UMMZ); 1♀, Churiyacu, 900m, 22 iii 1941, W.C. – Macintyre (UMMZ); 1♀, same data, 31 iii 1941 (UMMZ); 1♂, Pastaza Watershed Río Shicai - yacu = Río Chaca - yacu, NE of Tena, 900 m, vi 1941, W.C. – Macintyre (UMMZ); 1♀, Río Bobonaza, Buckley (RBINS); 1♂ 1♀ (copula), Morona-Santiago Prov., small stream 10 km S of Comunidad Chuwitayo, 800 m, 01° 57.0' S - 77° 51.5' W, 10 xi 1997, K.J. Tennessen (FSCA); 1♂, Napo Prov., Archidona, 675 m, 3 x 1976, Herman G. Real (RWGC); 1♂, Napo Prov., Cotos, 400 m, 27 ii 1934, W.C. – Macintyre (UMMZ); 1♀, same data, 9 v 1934, (UMMZ); 2♂, Napo Prov., Hacienda Ila on Río Anzu, 18 xii 1936, W.C. – Macintyre (UMMZ); 1♂, Napo Prov., Las Palmas, 16 viii 1935, W.C. – Macintyre (UMMZ); 1♂, Napo Prov., Loreto, 3.5 km E on Coca Rd. rocky gravely stream, 14 xi 1997, Bill Mauffray (USNM); 1♀, Napo Prov., Napo Watershed, W.C. – Macintyre (UMMZ); 1♂, Napo Prov., Río Anzu, 5 viii 1934, W.C. – Macintyre (UMMZ); 1♀, same data, 6 viii 1934 (UMMZ); 1♂, same data, 10 viii 1934 (UMMZ); 1♂, same data, 12 viii 1934 (UMMZ); 2♂, same data, 24 ix 1934 (UMMZ); 2♂, Napo Prov., Río Anzu, 1000 m, vi 1937, W.C. – Macintyre (UMMZ); 2♂ 1♀, Napo

Prov., Río Chucapi, 700 m, 26 ix 1934, W.C. – Macintyre (UMMZ); 1♂ 1♀, Napo Prov., Río Ila, 3 xi 1934, W.C. – Macintyre (UMMZ); 1♂, same data, 21 xi 1934 (UMMZ); 1♂, Napo Prov., Río Shicai - yacu = Río Chaca - yacu, NE of Tena, 900 m, 14 iv 1941, W.C. – Macintyre (UMMZ); 1♂, same data, 16 vi 1941 (UMMZ); 1♂, same data, vi 1941 (UMMZ); 2♂, Napo Prov., Río Shicai - yacu = Río Chaca - yacu, NE of Tena, 16 vi 1941, W.C. – Macintyre (UMMZ); 2♂, Napo Prov., Tacota – yacu, Puerto Misahualli, just east of Tena, 550 m, 3 iii 1942 (UMMZ); 1♂, same data, 28 v 1942 (UMMZ); 1♀, Napo Prov., Yanamaca, W.C. – Macintyre (UMMZ); 2♂, Pastaza Prov., Canelos, 12 xii 1938, W.C. – Macintyre (UMMZ); 1♂, same data, 15 xii 1938 (UMMZ); 1♂, Pastaza Prov., Canelos, 500 m, 12 xii 1938, W.C. – Macintyre (UMMZ); 1♂, Pastaza Prov., Cuasha, just N of Río Pastaza crossing (90.5 km N of Sucua) forested stream, 9 xi 1997, Bill Mauffray (FSCA); 1♂, Pastaza Prov., Headwaters of Río Arajuno, 29 iv 1941, W.C. – Macintyre (UMMZ); 1♂, same data, 1000 m, 26 iv 1941 (UMMZ); 1♂, Pastaza Prov., Partidero on Río Anzu, 8 ii 1936, W.C. – Macintyre (UMMZ); 1♂, Pastaza Prov., Partidero-Puyo trail, 24 vii 1935, W.C. – Macintyre (UMMZ); 1♂, same data, 1 xi 1935 (UMMZ); 1♂, Pastaza Prov., Puyo, 1000 m, 28 xi 1936 W.C. – Macintyre (UMMZ); 1♂, same data, 20 xi 1936 (UMMZ); 3♂, 1Pastaza Prov., Sarayacu on Río Bobonaza, M. Velasco (UMMZ); 1♂ 2♀, Pichincha Prov., Quito, L.G. Alonzo (UMMZ); 1♀, same data, 2819 m (UMMZ); 1♂ 1♀, Tungurahua Prov., Guamo Yacu = Agoyan, 9 xi 1935, W.C. – Macintyre (UMMZ).

P. chiribiquete Zloty & Pritchard, 2001 comb. nov.

(Figs. 29, 31)

Cora chiribiquete Zloty & Pritchard, 2001: 227-232 (description of a male and female; illustration of head, prothorax, pterothorax, abdomen, cerci, genital ligula, and wings).

Type data

♂ (Holotype), Colombia, Sierra de Chiribiquete, Puerto Abeja, 0°4’44”N - 72°26’50”W, 5 vii 1996 (USNM). ♀ (Allotype), same data as holotype but 4 vii 1996.

Comments

Cora chiribiquete was described from a male and a female from Colombia. Zloty and Pritchard (2001) mentioned morphological characters of both sexes and included this taxon in the modesta

group of *Cora* without explaining assignment of *C. chiribiquete* to this genus. The diagnostic character we found for males of *Polythore*, supplementary sectors between RP_2 and IR_2 beginning proximal to pterostigma, is present in this species, indicating that it should be considered a *Polythore* and not a *Cora*. In addition, other traits characteristic of *Polythore* are also present, such as more than four supplementary sectors between MP and CuA veins in HW (zero to three in *Cora*), and more than two supplementary sectors between MP and MA veins in HW (zero in *Cora*).

Revision of the holotype of *C. chiribiquete*, corroborated that all of these diagnostic characters of *Polythore* are present in this species. A phylogenetic analysis (see chapter II) showed resulted in this species inclusion within the genus *Polythore* as sister species of *P. beata*. Because of these reasons, the new combination *Polythore chiribiquete* is proposed.

Redescription of male

HW length 27.8 – 29.5 mm; $\bar{x}$= 28.7 mm; N= 2. HW width 6.97 – 7.49 mm; $\bar{x}$= 7.23; N= 2. Ax FW 36; Ax HW 27 – 29; Px FW 36 – 38; Px HW 34 – 37. Complete cells under pt 4; $\bar{x}$= 4; N= 2. Length pt 1.44 – 1.60 mm; $\bar{x}$= 1.52 mm; N= 2. Width pt 0.72 – 0.80 mm; $\bar{x}$= 0.76 mm; N= 2. Length base to nodus 10.2 – 10.7 mm; $\bar{x}$= 10.5 mm; N= 2. **Wings**. Color pattern of FW and HW different (Fig. 29). Amber coloration in both wings absent. Smoky gold coloration in both wings absent. **FW**. Ochre round spot present, located proximal to nodus between RP_1 and MA veins. **HW**. Ochre band present and beginning proximal to nodus, its proximal edge slightly oblique. Color of RP vein undifferentiated. Crescent-shaped spot absent. Lunula on axis of Costa absent. **Thorax.** Pattern coloration of prothorax and pterothorax as for genus. Additional mesepisternal pale stripe present, occupying half of its length. **Genital ligula.** Length distal lobes 0.144 –0.152 mm; $\bar{x}$= 0.148 mm; N= 2. Width distal lobes 0.064 mm; $\bar{x}$= 0.064 mm; N= 2. Length of terminal segment without distal lobes 0.400 – 0.432 mm; $\bar{x}$= 0.416 mm; N= 2. Distal lobes straight. Apex of distal lobes rounded. Antero-lateral lobes present. Posterior margin of lateral lobe visible in ectal view. Hairs in projections of lateral lobes absent. Apex of projection of lateral lobes globose. Protuberance in lateral lobes absent. Lateral edge of distal lobes straight. Width of terminal fold equal to width at level of lateral lobes (Fig. 30).

Variation with regards to original description

Male: HW length 27.8 – 29.5 mm. HW width 6.97 – 7.49 mm. Length base to nodus 10.2 – 10.7 mm. Ax FW 36; Ax HW 27 – 29; Px FW 36 – 38; Px HW 34 – 37. Length pt 1.44 – 1.60 mm.

Complete cells under pt 4.

Diagnosis

Male of *P. chiribiquete* is similar to that of *P. beata*, sharing a nodal band in HW but in *P. chibiquete* this band is ochre while in *P. beata* is white (Fig. 29). *P. chiribiquete* FW has an ochre round spot while *P. beata* FW is entirely hyaline (Fig. 28).

Distribution

Colombia (Caquetá Dept. and Vaupes Dept.) in the amazon region.

Specimens examined

Holotype: **Colombia.** ♂, Amazonia, Puerto Abeja, stream #2 Sierra Chiribiquete, 80 km N Araracuara, Colombian Amazonia. 0°4'44"N - 72°26'50"W, 5 vii 1996, G. Prichard & J. Zloty (USNM). Other specimens: **Colombia**. 2♂, Vaupes Dept., Mitu, Cucura, small stream, 2005, Hollman Miller (MUSENUV).

***P. derivata* (McLachlan, 1881)**
(Figs. 39, 44, 45)

Thore derivata McLachlan, 1881: 27 (♂, ♀, Río Bobonaza, Ecuador; Brit. Mus.); - Kirby, 1890: 117.
Thore picta derivata: Schmidt, 1942: 250, pl, IV (new synonymy).
Polythore derivata: Fraser, 1946: 16, fig 1a; - Soukup, 1954: 14; - Montgomery, 1967: 127, 150; - Bick & Bick, 1985: 10, 13, 17, 21 (male and female wings, male genital ligula).
Polythore derivata race *adjunta* Fraser, 1946: 18, fig. 1c; - Montgomery, 1967: 127, 150 (new synonymy).
Polythore derivata race *originata* Fraser, 1946: 18, fig. 1b; - Soukup, 1954: 14; - Montgomery, 1967: 127, 151 (new synonymy).
Polythore derivata race *ambigua* Fraser, 1946:19; - Soukup, 1954: 14; Montgomery, 1967: 127, 150 (new synonymy).
Polythore picta derivata: Racenis, 1959: 488.
Polythore picta race *ambigua*: Racenis, 1959: 488 (new synonymy).
Polythore derivata race *originata*: Racenis, 1959: 488 (new synonymy).

Type data

♂ (Lectotype), Ecuador, Río Bobonaza (BMNH). 2♂ (Paralectotypes), Ecuador, Río Bobonaza (RBINS).

Redescription of male

HW length 31.2 –44.5 mm; x̄= 37.7 mm; N= 27. HW width 8.34 –12.2 mm; x̄= 10.1 mm; N= 27. Ax FW 28 – 50; Ax HW 30 – 38; Px FW 42 – 63 Px HW 45 – 62. Complete cells under pt 10 –17; x̄= 13.1; N= 27. Length pt 2.72 – 4.48 mm; x̄= 3.51 mm; N= 27. Width pt 0.88 –1.40 mm; x̄= 1.05 mm; N= 27. Length base to nodus 10.6 – 15.3 mm; x̄= 13.0 mm; N= 27. **Wings**. Color pattern of FW and HW similar. Color of RP vein in HW none differentiated, being black. Iridescent black or brown spot in both wings that extends continuously to the apex and beginning distal to nodus (Fig. 39). Apical white band preceding the iridescent black or brown spot present. Percentage of extension of iridescent black or brown spot in HW that extends continuously to the apex 12.6 – 27.0%; x̄= 18.7%; N= 27. Percentage of extension of white spot in HW 5.76 –18.5%; x̄= 11.13%; N= 27. **Thorax**. Pattern coloration of the prothorax and pterothorax as the genus. Additional mesepisternal pale stripe absent. **Genital ligula**. Length distal lobes 0.176 – 0.288 mm; x̄= 0.225 mm; N= 27. Width distal lobes 0.048 – 0.088 mm; x̄= 0.068 mm; N= 27. Length of terminal segment without distal lobes 0.480 – 0.720 mm; x̄= 0.618 mm; N= 27. Distal lobes divergent (Fig. 44, 45). Apex of the distal lobes rounded, or elongated. Antero-lateral lobes absent. Posterior margin of lateral lobe visible in ectal view. Hairs in the projections of lateral lobes absent (Fig. 44d). Apex of projection of the lateral lobes elongated in L-shaped. Protuberance in lateral lobes present (Fig. 44c). Lateral edge of the distal lobes concave. Width of terminal fold equal to the width at level of the lateral lobes.

Variation with regards to original description

Male. Percentual extension of the iridescent black or brown spot in HW that extends continuously to the apex 12.6 – 27.0%. HW length 31.2 – 44.5 mm.

Distribution

S Colombia (Caquetá Dept.), central and NE Ecuador (Napo Prov., Pastaza Prov., and Tungurahua Prov.), and NE Peru (Loreto Dept. and San Martin Dept.).

Diagnosis

Within the picta group, which species are characterized by presence of black spot extending uninterrupted to wing apex, *P. derivata* and *P. terminata* are the only species with divergent distal lobes in male genital ligula. However, these two species can be separated by presence of a white apical band preceding iridescent black or brown spot in *P. derivata* (Fig. 39), while this band is absent in *P. terminata* (Fig. 38).

General wing coloration of female

Polythore terminata is a polychromatic species with female androchromes (coloured like the conspecific male) and gynochromes (different from the male coloration). Gynochromes have a FW and HW pattern similar, with a white band distal to nodus followed by a brown band (Fig. 87). The brown band ends at proximal side of pterostigma or beyond without the apex of the wing.

Specimens examined

Lectotype: **Ecuador**. ♂, Río Bobonaza, (BMNH). Paralectotypes: 2♂, same data as lectotype (RBINS). Other specimens (28♂, 13♀): **Colombia**. 1♂ 1♀, Caquetá, Morelia, Río Bodoquero, 1300 m, 22 i 1969, W.D. Duckwoth & R. E. Dietz (USNM); **Ecuador**. 1♂, Napo Prov., 20 km. from Limoncocha, Jiveno River, 24 vi 1965, C.R. Patrick (RWGC); 1♂, Napo Prov., Conception, Río Napo, 400 m, 30 xii 1939, W.C. – Macintyre (UMMZ); 1♂, Napo Prov., Jatun Yacu, 700 m, 1 iii 1937 (UMMZ); 2♀, Napo Prov., Jatun Yacu, Iluplin Creek, i 1935, W.C. – Macintyre (UMMZ); 1♂, same data, 8 iii 1938 (UMMZ); 1♀, Napo Prov., Limoncocha, 3 vi 1977, D. L. Vicent (USNM); 1♂, same data, Paul J. Spangler & Don R. Givens (USNM); 1♂, 1 Napo Prov., Limoncocha, on Río Napo 300 m, 18 xi 1980, M.J. Westfall, Jr. (FSCA); 1♀, same data, 24 xi 1980 (FSCA); 2♀, Napo Prov., Napo Watershed, headwaters of Arajuno, 1000 m, 26 iv1941, W.C. – Macintyre (UMMZ); 2♀, Napo Prov., Napo Watershed, 10 iii 1934 (UM MZ); 1♀, Napo Prov., Napo Watershed, 25 xii 1935, W.C. – Macintyre (UMMZ); 1♀, same data, 24 xii 1935, W.C. – Macintyre (UMMZ); 1♂, Napo Prov., Río Aguarico, bei San Pedro, 450 m, 9 – 10 vii 1977, W. Schacht (ZSM); 1♂, Napo Prov., Río Cotopino, between the Río Napo & Río Aguarita, 3 iii 1950, W.C. – Macintyre (UMMZ); 1♂, Pastaza Prov., Abitagua, Río Pastaza, 2 x 1936 (UMMZ); 1♂, Pastaza Prov., Abitagua, Río Pastaza, 1000 m, 3 xi 1936, W.C. – Macintyre (UMMZ); 1♂, Pastaza Prov., Abitagua, 23 viii 1939, W.C. – Macintyre (UMMZ); 1♂, same data, 29 v 1939 (UMMZ); 1♂, Pastaza Prov., Partidero, 6 ix 1935, W.C. – Macintyre (UMMZ); 2♂, Pastaza Prov., Partidero-Las Palmas trail, 3 viii 1935, W.C. – Macintyre (UMMZ); 1♂, Pastaza Prov., Partidero-Puyo trail,

24 vii 1935, W.C. – Macintyre (UMMZ); 1♂, Pastaza Prov., Río Challuayacu, 15 ix 1935, W.C. – Macintyre (UMMZ); 2♂, Tungurahua Prov., Río Topo, iii 1950, W.C. – Macintyre (UMMZ). **Peru**. 1♂, Loreto Dept., 1700 m, 27 ix 1946 (UMMZ); 1♂, Loreto Dept., Boqueron del Padre Abad, 9 viii 1946, F. Woytkowski (UMMZ); ♀, Loreto Dept., Pebas, 1899, Staudinger (UMMZ); 1♂, San Martin Dept., Moyobamba Region, iii 1936, G.G Klug (UMMZ); 1♂, same data, iv 1936 (UMMZ); 2♂, San Martin Dept., Tarapoto, A. F. Porter (UMMZ); 1♂, same data, 830 m (UMMZ).

P. gigantea **(Selys, 1853)**
(Figs. 37, 41)

Thore gigantea Selys, 1853: 69 (♂, Colombia; Collect. Selys. Belg. Mus.); 1854: 254; 1869: 26; 1873: 35; - Hagen, 1861: 307; 1875: 30; - McLachlan, 1878: 88; - Kirby, 1890: 116; - Needham, 1903: 746; - Ris, 1918: 31, 38; - Kennedy, 1920: 29, figs. 16-17.
Polythore gigantea: Kennedy, 1919: pl. 1, figs. 1-2; - Munz (not Selys, 1853), 1919: pl. 1, fig. 2; - Fraser, 1946: 15; - Soukup, 1954: 14; - Racenis, 1959:488; - Montgomery, 1967: 127, 151; - Bick & Bick, 1985: 9, 10, 13, 17 (male and female wings, male genital ligula).

Type data

♂ (Holotype) "Colombie, aux environs de Bogotá" (around Bogotá)

Comments

Selys (1953) described this species based on a male from Colombia. Later, Selys (1854) complemented type locality information adding "aux environs de Bogotá" meaning around Bogotá. There is no specimen in RBINS matching this locality information, we only found one male from Cauca, Colombia, and we did not find the type elsewhere either.

Description

- **Male**. HW length 29.4 – 47.5 mm; $\bar{x}$= 38.6 mm; N= 45. HW width 8.21 – 13.8 mm; $\bar{x}$= 11.3 mm; N= 45. Ax FW 42 – 57; Ax HW 29 – 42; Px FW 60 – 85; Px HW 55 – 81. Complete cells under pt 10 –18; $\bar{x}$= 13.4; N= 45. Length pt 2.80 – 4.64 mm; $\bar{x}$= 3.68 mm; N= 45. Width pt 0.72 – 1.44 mm; $\bar{x}$= 1.09 mm; N= 45. Length base to nodus 9.95 –14.9 mm; $\bar{x}$= 12.5 mm; N= 45. **Wings**. Color pattern of FW and HW similar. Iridescent black or brown spot in both wings that extends

continuously to apex beginning proximal to nodus. Percentage of extension of this iridescent black or brown spot in HW 63.0 – 79.9%; $\bar{x}$= 70.1%; N= 45. Color of RP vein in HW none differentiated of the rest of venation. White spot in both wings absent. Lunula on axis of Costa in HW absent (Fig. 37). **Thorax**. Pattern coloration of prothorax and pterothorax as for genus. Additional mesepisternal pale stripe absent. **Genital ligula**. Length distal lobes 0.032 – 0.112 mm; $\bar{x}$= 0.064 mm; N= 45. Width distal lobes 0.048 – 0.112 mm; $\bar{x}$= 0.077 mm; N= 45. Length of terminal segment without distal lobes 0.528 –0.704 mm; $\bar{x}$= 0.632 mm; N= 45. Distal lobes straight. Apex of distal lobes rounded (Fig. 41c). Antero-lateral lobes absent. Posterior margin of lateral lobe visible in ectal view. Hairs in projections of lateral lobes absent (Fig. 41c). Apex of projection of lateral lobes globose. Protuberance in lateral lobes present (Fig. 41a). Lateral edge of distal lobes straight. Width of terminal fold equal to width at level of lateral lobes.

Variation with regards to original description

HW length 29.4 – 47.5 mm. Ax FW 42 – 57; Ax HW 29 – 42; Px FW 60 – 85; Px HW 55 – 81.

Distribution

Colombia (Antioquia Dept., Meta Dept., Nariño Dept., Risaralda Dept.), Ecuador (Bolivar Prov., Cotopaxi Prov., Imbaburra Prov., Pichincha Prov., Tungurahua Prov.), and Peru (San Martin Dept.)

Diagnosis

P. gigantea male characterizes by iridescent black or brown spot extending uninterrupted to apex of both wings as well as other species of the picta group. However, males of *P. gigantea* are easily recognized by this spot begins proximal to nodus (Fig. 37) while in the remaining species of picta group it begins distal to nodus.

General wing coloration of female

Gynochromes were revised, these females have an iridescent brown spot begins slightly proximal to nodus and extends to proximal side of pterostigma; also the apex of the wing is brown coloured (Fig. 88).

Specimens examined

47♂, 12♀. **Colombia**. 1♂, Antioquia Dept., Andes, Vereda Itaca, 2000 m, 5,6667000°N - 75,8833000°W, 17 ix 2005, Forero, M (MEFLG); 1♂, Antioquia Dept., Caldas, Quebrada La

Valeria, 2200 m, 6°06'50"N - 75°40'4"W, 03 iii 2009, Sanchez, M; Garzon, C; Altamiranda, M (ANDES-E); 1♂, Antioquia Dept., Envigado, El Salado, 2200 m, 7,1000000°N - 74,0833000°W, 05 x 2007, Valencia, H (MEFLG); 1♂, same data, Velez, A (MEFLG); 1♂, Antioquia Dept., Envigado, Quebrada Ayurá, 1900 m, 7 v 2002, Patricia Duque (MEFLG); 2♀, Antioquia Dept., Envigado, Quebrada El Salado, 1735 m , 6°07'44''N - 75°36'11''W, 28 ii 2009, Sanchez, M; Garzon, C; Altamiranda, M (ANDES-E); 1♂ 1♀, same data but 1573 m, 21 xii 1999, Monica Restrepo & Alejandro Botero (MEFLG); 1♂, same data but 1900 m, 7 v 2002, Patricia Duque (MEFLG); 1♂, same data, Carlos Esquivel (MEFLG); 1♂, Antioquia Dept., Envigado, Vereda La Clara, 1575 m, 7,2500000°N - 74,4500000°W, 18 vii 2007, Urrego Vargas, Natali (MEFLG); 6♂ 2♀, Antioquia Dept., Sabaneta, La Doctora, 1573 m, 23 iii 2000, Monica Restrepo & Alejandro Botero (MEFLG); 1♂ 1♀, same data but 1700 m, 6°08'05"N - 75°36'17"W, 2 iii 2009, Sanchez, M; Garzon, C; Altamiranda, M (ANDES-E); 1♀, Antioquia Dept., Santafe de Antioquia, Paisandu, 550 m, 0,0000000°N -76,6500000°W, 09 x 2007, Roa, V (MEFLG); 1♂, Meta Dept., Villavicencio, Río Guatiquia, 467 m 24 vi 1987, Vargas, G (ICN); 1♀, Nariño Dept., Barbacoas, Altaquer, Reserva Ñambí, 1440 m, 11 x 2009, E.Florez & Est. Tax. Animal (ICN); 1♂, Risaralda Dept., Mpio. Mistrató, San Antonio del Chamí. W. de alto Pisones-Geguaduas, 1500 m, 13 iv 1993, Andrade-C, G (ICN); 2♂, Risaralda Dept., Mpio. Mistrató, Vereda Mampay, sitio Sutú, Qda. La Calerara, carretera a Costa Rica, 1660 m, 5°21'36" N - 75°52'47"W, 6 iv 1992, G. Andrade-C& S. Velazquez (ICN); 1♂, Risaralda Dept., Santuario, Vda. Cundina. Qda. Acueducto pueblo vano, x: 0390360 y: 0558530, 30 iii 2007, Cardona W. (MUSENUV). **Ecuador**. 1♂, Bolivar Prov., Balzapamba, 26 iv 1938 (FSCA); 3♂, same data (UMMZ); 1♂, same data, 8 v 1938 (UMMZ); 1♂, Bolivar Prov., Balzapamba, 700 m, v 1938 (UMMZ); 2♂ 1♀, same data, 2 v 1938 (UMMZ); 1♂, same data, 16 v 1938 (UMMZ); 1♂, Bolivar Prov., Balzapamba, 750 m, 29 iv 1938 (UMMZ); 1♂ 1♀, Cotopaxi Prov., 113 km W. of Latacunga, 1450 m, vii 1975, A. Langley & J. Cohen (USNM); 1♂, Cotopaxi Prov., Las Pampas, Otonga, 1700 m, 15 ii 1997, Elicio Tapia (FSCA); 1♂, Imbabura Prov., Guayupe, 6ii 1946, L.G. Alonzo (UMMZ); 1♀, Imbabura Prov., Guayupe, norwest of Quito, L.G. Alonzo (FSCA); 3♂, same data (UMMZ); 1♂, Pichincha Prov., Santo Domingo de los Colorados, 500 m, vii 1939, W.C. – Macintyre (FSCA); 1♂ 1♀, same data (UMMZ); 1♂, Pichincha Prov., Tinalandia, vii 1986, T. C. Emmel (FSCA); 1♂, same data, 17 v 1985 (FSCA); 1♂, Pichincha Prov., Tinalandia (Hotel) 12 km E of Santo Domingo de los Colorados, 747 m, 13 v 1988, T.C. Emmel (FSCA); 1♂, Tungurahua Prov., Banos, 1985, T.C. Emmel (FSCA). **Peru**. 1♂, San Martin, Ekin 3 mi. ne Tarapoto, 950 m, iii 1947, F. Woytkowski (UMMZ); 1♂, same data, 10 iii 1947 (UMMZ); 2♂, same data, 11 iii 1947 (UMMZ).

***P. lamerceda* Bick & Bick, 1985**
(Figs. 36, 42)

Polythore lamerceda Bick & Bick, 1985: 15 ♂ Holotype ♀ Allotype, Peru, La Merced, Hacienda La Salud, 1067 m – UMMZ)

Type data

♂ (Holotype), Peru, Junin, La Merced, Hacienda La Salud, 1067 m, J.D. Rivas, 13 vi 1931 (UMMZ). ♀ (Allotype - Heteromorph), same data as holotype (UMMZ). 15♂ 5♀ (Paratypes), Peru, Junin, La Merced, JR, 15 i 1931 (AMNH, FSCA, UMMZ).

Redescription of male

HW length 34.6 – 44.2 mm; $\bar{x}$= 39.5 mm; N= 11. HW width 9.98 –13.5 mm; $\bar{x}$= 11.7 mm; N= 11. Ax FW 44 – 53; Ax HW 33 – 40; Px FW 44 – 74; Px HW 57 – 75. Complete cells under pt 11 –16; $\bar{x}$= 13.4; N= 11. Length pt 3.60 – 4.68 mm; $\bar{x}$= 4.15 mm; N= 11. Width pt 0.90 –1.28 mm; $\bar{x}$= 1.11 mm; N= 11. Length base to nodus 11.4 –14.4 mm; $\bar{x}$= 13.0 mm; N= 11. **Wings**. Color pattern of FW and HW similar. Color of RP in HW not differentiated. Iridescent black or brown spot in HW that extends continuously to apex beginning distal to nodus (Fig. 36). Percentage of extension of this spot in HW 50.4 –58.5%; $\bar{x}$= 52.8%; N= 11. White band disrupting iridescent black or brown spot in FW absent. Apical white band preceding iridescent black or brown spot absent. Lunula on axis of Costa in HW absent. **Thorax.** Pattern coloration of prothorax and pterothorax as for genus. Additional mesepisternal pale stripe absent. **Genital ligula**. Length distal lobes 0.088 – 0.184 mm; $\bar{x}$= 0.143 mm; N= 11. Width distal lobes 0.064 – 0.104 mm; $\bar{x}$= 0.076 mm; N= 11. Length of terminal segment of genitla ligula without distal lobes 0.656 – 0.811 mm; $\bar{x}$= 0.711 mm; N=11. Distal lobes straight. Apex of the distal lobes rounded. Antero-lateral lobes absent. Posterior margin of lateral lobe visible in ectal view. Hairs in projections of lateral lobes absent. Apex of projection of lateral lobes elongated. Protuberance in lateral lobes present. Lateral edge of distal lobes straight. Terminal fold as wide as segment width at level of lateral lobes (Fig. 42).

Variation with regards to original description

Male: HW length 34.6 – 44.2 mm. Ax FW 44 – 53. Px FW 44 – 74. Complete cells under pt 11 – 16. Percentage of extension of iridescent black or brown spot in HW that extends continuously to the apex 50.4 – 58.5%. Length of distal lobes 0.088 – 0.184 mm.

Distribution

Peru (Junin Dept.)

Specimens examined

Paratypes (11♂, 4♀): **Peru**. 5♂, Junin Dept., La Merced, J.D. Rivas (UMMZ); 1♂, Junin Dept., La Merced, Hacienda La Salud, 1067 m, 15 i 1931, J. D. Rivas (UMMZ); 2♂, Junin Dept., La Merced, Hacienda La Salud, 15 iii 1931, J.D. Rivas (UMMZ); 1♂, Junin Dept., La Merced, Hacienda La Salud, 18 iii 1937, J.D. Rivas (FSCA); 1♂, same data, 25 iii 1931 (UMMZ); 1♀, same data, 14 iv 1905 (UMMZ); 1♀, Junin Dept., La Merced, P.C. Biol. Serv., J. D. Rivas (UMMZ); 1♂, Junin Dept., Satipo, 700 m, P. Paprzycki (UMMZ); 1♂ 1♀, same data, 9 vi 1940 (UMMZ).

***P. manua* Bick & Bick, 1990**
(Figs. 21, 23, 60, 88)

Polythore manua Bick & Bick, 1990: 367-373 (♂ Holotype ♀ Allotype, Peru, Madre de Dios, Manu, Pakitza, 12°7'S: 70°58'W, 250 m – MUSM)

Type data

♂ (Holotype) Peru, Madre de Dios, Manu, Pakitza, 12°7'S: 70°58'W, 250 m (MUSM). ♀ (Allotype) Peru, Madre de Dios, Manu, Pakitza, 12°7'S: 70°58'W, 250 m (MUSM). 6♂, 1♀ (Paratypes), same locality as holotype (BMNH, FSCA, MUSM, RWGC, UMMZ).

Redescription of male

HW length 32.5 –40.9 mm; $\bar{x}$= 37.4 mm; N= 8. HW width 8.72 –11.0 mm; $\bar{x}$= 10.1 mm; N= 8. Ax FW 40 – 52; Ax HW 29 – 39; Px FW 51 – 72; Px HW 53 – 67. Complete cells under pt 9 –16; $\bar{x}$= 12.4; N= 8. Length pt 3.00 –4.48 mm; $\bar{x}$= 3.71 mm; N= 8. Width pt 0.86 –1.23 mm; $\bar{x}$= 1.12 mm; N= 8. Length base to nodus 11.5 –14.7 mm; $\bar{x}$= 12.7; N=8. **Wings**. Color pattern of FW and HWHW similar (Fig. 21). Infuscate. Color of RP in HW differentiated from rest of venation, being yellow beyond distal margin of pterostigma (Fig. 23). Crescent-shaped spot in FW ochre and darker ochre in HW ; around crescent-shaped spot wings are brownish transparent, darker than the rest (Fig. 21, 23). Lunula on axis of Costa in HW present (Fig. 23). Bick and Bick (1990) mentioned wing color change due to maturation especially by crescent-shaped spot being white in tenerals.

Thorax. Pattern coloration of prothorax and pterothorax as for genus. Additional mesepisternal pale stripe absent. **Genital ligula**. Length distal lobes 0.08 –0.113 mm; $\bar{x}$= 0.097 mm; N= 8. Width distal lobes 0.075 –0.096 mm; $\bar{x}$= 0.080 mm; N= 8. Length of terminal segment without distal lobes 0.603 –0.752 mm; $\bar{x}$= 0.666 mm; N=8. Distal lobes straight. Apex of distal lobes rounded (Fig. 60a). Antero-lateral lobes absent. Posterior margin of lateral lobe not visible in ectal view. Hairs in projections of lateral lobes absent. Apex of projection of lateral lobes elongated (Fig. 60 a-c). Protuberance in lateral lobes absent (Fig. 60c). Lateral edge of distal lobes convex. Terminal fold as wide as segment width at level of lateral lobes.

Variation with regards to original description

Male. HW length 32.5 –40.9 mm. Ax FW 40 – 52; Ax HW 29 – 39; Px FW 51 – 72; Px HW 53 – 67. Complete cells under pt 9 –16.

Distribution

SE Peru (Madre de Dios Dept.)

Diagnosis

Polythore manua belongs to boliviana group. Its male resembles to males of *P. boliviana*, *P. ornata*, and *P. williamsoni* in presence of lunule in HW and cresent-shaped spot in HW (Figs. 10, 20-23, 33, 59). Color pattern of FW and HW is similar in *P. manua* (Fig. 21) while in *P. boliviana* and *P. ornata* is different (Figs. 10, 33). *P. manua* and *P. williamsoni* differ in HW RP of different color than rest of venation, being yellow in the first and light brown in the last (Figs. 22, 23).

Habitat

Small streams and along forest trails in tropical rainforest. Specimens have been collected in the last month of the dry season (May to September) (Bick and Bick 1990).

General wing coloration of female

Infuscate wings. FW with ochre or orange band followed by dark brown band; the ochre band begins distal to nodus. HW with a light brown band wider than that in FW (Fig. 88a). In teneral individuals the clear bands are white and the dark band are narrower (Fig. 88b).

Specimens examined

Paratypes (8♂, 7♀)**: Peru.** 2♀, Madre de Dios Prov., Manu, Pakitza, 12°7' S-70°58'W, 250 m, 12 ix 1988, O.S. Flint Jr. (USNM, UMMZ); 1♂, same data but 9 ix 1988 (UMMZ); 1♀, same data but 20 ix 1988 (FSCA); 1♂, Madre de Dios Prov., Manu, Pakitza, small Quebrada near forest zone 1, 4 x 1987, Louton (UMMZ); 1♀, Madre de Dios Prov., Manu, Pakitza, 12°7'S -70°58'W, 23 ix 1988, N.E. Adams (UMMZ); 1♂, Madre de Dios Prov., Manu, Pakitza trail 2, mkr 11, 11°56'S-71°18'W, 23 ix 1989, Jon Gelhaus (FSCA); 1♂, same data b ut trail 1, mkr 4 (nr. tents), 11°56'S-71°18'W, 19 ix 1989, Nancy E. Adams (FSCA); 1♂, same data but trail 2, mkr 18, stream, 19 ix 1989, Robert Robbins (FSCA); 1♀, same data but trail 2, mkr. 15 (1st str.), 11°56'S -71°18'W, 18 ix 1989, Jon Gelhaus (FSCA); 1♂, same data but 21 ix 1989 (RWGC); 1♀, Madre de Dios Prov., P.N. Manu, Pakitza seeps on Trochas Uno & Dos, 12°7'S-70°58'W, 10 ix 1988, J. Louton (FSCA); 1♂, Madre de Dios Prov., Pakitza, Res. Zone, Parque Nac. Manu, T1 Zone 2 to basecamp, 11°56'S-71°18'W, 11 ix 1989, Louton JAL89-013 (FSCA); 1♀, Madre de Dios Prov., Pakitza, Res. Zone, Parque Nac. Manu, T2 to R2 to T1, 11°56'S-71°18'W, 18 ix 1989, Louton JAL89-020 (FSCA); 1♂, Madre de Dios Prov., Quebrada at Pakitza (Trocha del Castanal), small wet-season, 21 x 1987, Louton (USNM).

P. mutata (McLachlan, 1881)

(Figs. 12, 51 a-c, 54)

Thore mutata McLachlan, 1881: 29 (8 ♂ 1 ♀ Río Bobonaza, Ecuador); - Kirby, 1890: 117; - Campos, 1922: 13; - Schmidt, 1942: 242, fig. L (thorax), 246 (Umbria, Colombia).

Polythore mutata: Fraser, 1946: 22, 24 (key, descr., color change); - Montgomery, 1967: 151 (types); - Bick & Bick, 1986: 253-257, 259, 269 (male and female wings, male genital ligula, key).

Type data

♂ (Lectotype) Ecuador, Río Bobonaza (BMNH). 2♂ (Paralectotypes) same locality as Lectotype (RBINS).

Type comments. McLachlan described *P.mutata* based on eight males and one female from Río Bobonaza (Ecuador). In 1968, Kimmins designated a male from the type series in BMNH as lectotype. Therefore, according to the International Code of Zoological Nomenclature (Article 74

ICZN, 1999), the remaining males of the type series are paralectotypes, and the following label "Paralectotype, N.C.Rojas designated" ws added to the two males in RBINS.

Redescription of male

HW length 24.9 –32.3 mm; $\bar{x}$= 28.8 mm; N= 27. HW width 7.26 –8.98 mm; $\bar{x}$= 8.22 mm; N= 27. Ax FW 34 – 46; Ax HW 26 – 36; Px FW 39 – 47; Px HW 34 – 46. Complete cells under pt 3 – 6; $\bar{x}$= 4.7; N= 25. Length pt 1.48 –2.33 mm; $\bar{x}$= 1.82 mm; N= 27. Width pt 0.52 –0.800 mm; $\bar{x}$= 0.653 mm; N= 27. Length base to nodus 8.88 –12.13 mm; $\bar{x}$= 10.5; N= 27. **Wings**. Color pattern of FW and HW similar. FW not hyaline, infuscate. Color of RP in HW undifferentiated, black. Opaque white nodal band in both wings present; in some specimens its edges slightly convex. Ochre round spot in FW absent. Lunula on axis of Costa in HW absent. No black or brown spot in any wing, only a diffuse transparent gray around crescent-shaped spot in both wings and near apex of wings (Fig. 12). As mentioned by McLachlan (1881), nodal bands remains milky opaque white in tenerals. **Thorax.** Pattern coloration of prothorax and pterothorax as for genus. Additional mesepisternal pale stripe present, occupying a quarter or half of its length (Fig. 54). **Genital ligula.** Length distal lobes 0.112 –0.160 mm; $\bar{x}$= 0.132 mm; N= 27. Width distal lobes 0.056 –0.132 mm; $\bar{x}$= 0.101 mm; N=27. Length of terminal segment without distal lobes 0.336 –0.472 mm; $\bar{x}$= 0.401 mm; N= 27. Distal lobes straight. Apex of distal lobes rounded. Antero-lateral lobes present (Fig. 54). Posterior margin of lateral lobe not visible in ectal view. Hairs in projections of lateral lobes absent (Fig. 54b). Apex of projection of lateral lobes undifferentiated or rarely globose. Protuberance in lateral lobes absent. Lateral edge of distal lobes straight. Width of terminal fold of genital ligula bigger than width at level of lateral lobes (Fig. 54a).

Variation with regards to original description

Male. HW length 24.9 –32.3 mm.

Distribution

S Colombia (Putumayo Dept.), E and central Ecuador (Napo Prov. and Pastaza Prov.) and Peru (Loreto Dept.).

Diagnosis

Male of *P. mutata* is similar to that of *P. beata*, sharing a white nodal band in HW, but *P. mutata* has a white nodal band in both wings (Fig. 12) while *P. beata* has this band only in HW, FW is

entirely hyaline (Fig. 28). Additional mesepisternal pale stripe of thorax is present in *P. mutata* (Fig. 54) while it is absent in *P. beata*.

Habitat

Polythore mutata has been collected in tropical rainforest, at a seepage area near a small stream. Fraser (1946) stated that the species has a short flying season, November to February, but we, as did Bick and Bick (1986), found specimens collected during several months of the year in the examined collections.

General wing coloration of female

Infuscate wings. Both wings with a pale yellow or creamy yellow nodal band (Fig. 89).

Specimens examined

Lectotype: **Ecuador**. ♂, Río Bobonaza, (BMNH). Paralectotypes: 2♂, same data as lectotype (RBINS). Other specimens (28♂, 6♀): **Ecuador**. 1♂, no more data, 20 ii 2000, Haensch (UMMZ); 1♂, Napo Pastaza, Santa Cecilia, Río Aguarico, 25-31 iii 1969, P.M. & P. J. Spangler (USNM); 1♂, Pastaza Prov., Río Bobonazo, i 1940, W.C. – Macintyre (UMMZ); 1♂, Napo Prov., Hacienda Ila on Río Anzu, 18 viii 1934, W.C. – Macintyre (UMMZ); 1♂, same data but 18 xii 1936 (UMMZ); 1♂ 2♀, Napo Prov., Jatun Sacha Biological Station, near Tena, 1.5 m up ca 5m from stream, 450 m, 9 vi 1994, Alvaro Jaramillo (DRPC); 1♂, Napo Prov., La Selva Lodge, forest, 200 m, 00°29.9'S - 76°22.4'W, 25 xi 1997, T.W. Donnelly 97 (FSCA); 1♂, Napo Prov., La Selva, 100 km E Coca, Manicocha, 12 x 1988, S.W.Dunkle (FSCA); 3♂ 1♀, Napo Prov., Limoncocha, 20 v 1976, T.E. Rogers (FSCA); 1♂ 1♀ (in copula), Napo Prov., Limoncocha, Lakeshore, and nearby areas 0°24'S - 76°36'W, 11 vii 1977, S.M. & K.W. Knopf (FSCA); 1♂, Napo Prov., Limoncocha on Río Napo 300 m, 12 x 1974, Boyce A. Drummond III (FSCA); 1♂, same data but 17 xi 1980, M.J. Westfall Jr. (FSCA); 1♂, same data but 18 xi 1980, M.J. Westfall Jr. (FSCA); 1♂, same data but 21 vii 1974, Boyce A. Drummond III (FSCA); 2♂, same data but 25 xi 1980 , M.J. Westfall Jr. (FSCA); 3♂, 2 same data but 28 xi 1980, M.J. Westfall Jr. (FSCA); 1♂, same data but 3 xi 1980, M.J. Westfall Jr. & David G. Robinson (FSCA); 1♂, same data but 31 xii 1973, Boyce A. Drummond III (FSCA); 2♀, same data but 5 xi 1980, M.J. Westfall Jr. & David G. Robinson (FSCA); 3♂, same data but 7 xi 1980, M.J. Westfall Jr. (FSCA); 2♂, Napo Prov., Napo Watershed, v 1940, W.C. – Macintyre (UMMZ); 1♂, same data but 500 m, viii 1939, W.C. – Macintyre (UMMZ).

***P. neopicta* Bick and Bick, 1990**
(Figs. 48a-c, 49)

Polythore neopicta Bick & Bick, 1990a: 2♂ Holotype ♀ Allotype, Peru, Huanuco Dept., Tingo Maria – FSCA)

Type data

♂ (Holotype) Peru, Huanuco Dept., Tingo Maria, 21-vi-1985, T. Emmel leg. (FSCA). ♀ (Allotype) Peru, Huanuco Dept., Tingo Maria, 21-vii-1937, F.Woytkowski leg. (FSCA). 39♂ 22♀ (Paratypes) same data as holotype, (FSCA, MNHP).

Redescription of male

HW length 32.9 –42.6 mm; $\bar{x}$= 40.6 mm; N= 64. HW width 8.34 –13.2 mm; $\bar{x}$= 10.9 mm; N= 64. Ax FW 37 – 55; Ax HW 29 – 41; Px FW 48 – 71; Px HW 48 – 72. Complete cells under pt 9 –18; $\bar{x}$= 13.4; N= 64. Length pt 2.96 –4.88 mm; $\bar{x}$= 3.92 mm; N= 64. Width pt 0.88 –1.44 m; $\bar{x}$= 1.17 mm; N= 64. Length base to nodus 11.1 –15.8 mm; $\bar{x}$= 13.4 mm; N= 64. **Wings**. Color pattern of FW and HW similar. Color of RP vein in HW none differentiated, but in some specimens this vein is differentiated from rest of venation, being yellow to proximal margin of pterostigma. Iridescent black or brown spot in both wings that extends continuously to apex present and beginning distal to nodus (Fig. 49). Percentage of extension of iridescent black or brown spot in HW 19.7 –46.2%; $\bar{x}$= 27.29%; N= 64. In some specimens there is a milky white irregular spot in both wings of variable length. Percentage of extension of white spot in HW 0 –37.23%; $\bar{x}$= 4.27%; N= 64. Lunula on the axis of the Costa vein in HW absent. **Thorax.** Pattern coloration of prothorax and pterothorax as for genus. Additional mesepisternal pale stripe absent. **Genital ligula.** Length distal lobes 0.08 –0.20 mm; $\bar{x}$= 0.154 mm; N= 64. Width distal lobes 0.048 –0.096 mm; $\bar{x}$= 0.073 mm; N= 64. Length of terminal segment without distal lobes 0.576 –0.752 mm; $\bar{x}$= 0.678 mm; N= 64. Distal lobes straight. Apex of distal lobes rounded (Fig. 48a). Antero-lateral lobes absent (Fig. 48b). Posterior margin of lateral lobe visible in ectal view. Hairs in the projections of lateral lobes absent. Apex of projection of lateral lobes elongated. Protuberance in lateral lobes present (Fig. 48c). Lateral edge of distal lobes straight. Terminal fold as wide as segment width at level of lateral lobes.

Variation with regards to original description

Male. HW length 32.9 –42.6 mm. Length base to nodus 11.1 –15.8 mm. Ax HW 29 – 41, Px HW

48 – 72. Complete cells under pt 9 –18. Length pt 2.96 –4.88 mm. Percentage of extension of iridescent black or brown spot in HW that extends continuously to apex 19.7 –46.2%. Milky white irregular spot in both wings of variable length present. Lateral stripe in S3 variable length, to distal edge of segment, half or even ¾ of length of the segment; circular yellow small spot in S4 present or absent; S6 with a small circular yellow spot in its proximal edge. Length of terminal segment without distal lobes 0.576 –0.752 mm. Length distal lobes 0.08 –0.20 mm.

Distribution

Peru (Ayacucho Dept., Huanuco Dept., Junin Dept., Loreto Dept., San Martin Dept.)

General wing coloration of female

FW and HW color pattern similar. Difusse whitish curved band followed by a iridescent black biconcave band (Fig. 91).

Specimens examined

Holotype: **Peru**. ♂, Huanuco Department, Tingo Maria, 21 vi 1985, T. C. Emmel (FSCA). Allotype: ♀, same data as holotype but 27 vii 1937, F. Woytkowski (FSCA). Paratypes. 2♂ 1♀, **Peru.** Junin Dept., Campamiento, Colonia del Perene, 21 vi 1920, J.H. Williamson (UMMZ). Other specimens (72♂, 8♀) : **Peru**. 1♂, Ayacucho Dept., Sivia, Río Apurimac, 10 vi 1941, F. Woytkowski (UMMZ); 1♂, Huanuco Dept., Leonpampa, 22 xii 1937, F. Woytkowski (UMMZ); 1♂, same data but 800 m, 18 xii 1937 (UMMZ); 2♂, Huanuco Dept., Tingo Maria, 671 m, 28 xii 1946, J.C. Pallister (UMMZ); 2♂, Huanuco Dept., Tingo Maria, Monson Valley, 16 xi 1954, E.I . Schlinger & E.S. Ross (UMMZ); 3♂, 1Huanuco Dept., Vicinity of Afilador, 12 v 1937, F. Woytkowski (UMMZ); 1♂, same data but 27 v 1937 (UMMZ); 1♂, Huanuco Dept., Vicinity of Leonpampa, 800 m, 26 xi 1937, F. Woytkowski (UMMZ); 1♂, same data but 18 xii 1937 (UMMZ); 1♂, Junin Dept., Campamiento, Colonia del Perene, 6 vi 1920, J. H. Williamson (UMMZ); 5♂ 2♀, same data but 10 vi 1920, 11 vi 1920, 12 vi 1920, 19 vi 1920, 21 vi 1920 (UMMZ); 2♂ 1♀, Junin Dept., La Merced, J. D. Rivas (UMMZ); 3♂, Junin Dept., La Merc ed, Hacienda La Salud, 20 iii 1930 (UMMZ); 1♀, same data but 9 iv 1930 (UMMZ); 1♂, same data but 2 vi 1930 (UMMZ); 1♂, Junin Dept., San Pedro, 900 m, 15-18 v 1935, F. Woytkowski (UMMZ); 3♂, Junin Dept., Sani Beni, 840 m, 10 viii 1935, F. Woytkowski (UMMZ); 2♂, same data but 21 viii 1935 and 25 ix 1935 (UMMZ); 1♂, Junin Dept., Satipo, 30 iii 1940, P. Paprzycki (UMMZ); 16 ♂ 1♀, same data but iii 1940, iv 1940, 4 vi 1940, 31 vi 1940, vii 1940, 7 xii 1940, 11 xii 1940, vi 1941, xii 1941, iv 1945, v

1945, vi 1945 (UMMZ); 1♀, Loreto Dept., Balsapuerto, ii 1939, G.G Klug (UMMZ); 1♂, same data but iii 1939 (UMMZ);♂1, Loreto Dept., Balsapuerto , Río Paranapura, ii 1939, G.G Klug (UMMZ); 3♂, same data but iii 1939, ii 1940 (UMMZ); 1♂, Loreto Dept., Yurimaguas, ii 1940, G.G Klug (UMMZ); 2♂, same data but iii 1940, v 1940 (UMMZ); 1♂, San Martin Dept., Hera, 15 km SE of Moyobamba, F. Woytkowski (UMMZ); 2♂, San Martin Dept., Moyobamba, iv 1940, G.G Klug (UMMZ); 1♂, San Martin Dept., Moyobamba 20 km near Misqui-yacu, 1400 m, 1 viii 1947, F. Woytkowski (UMMZ); 1♂, San Martin Dept., Moyobamba, Río Seco, v 1938, G.G Klug (UMMZ); 5♂, same data but v 1939, iv 1940 (UMMZ); 1♂, San Martin Dept., Moyobamba, Río Seco, 950 m, vi 1939, G.G Klug (UMMZ); 1♂, San Martin Dept., Ríoja, 29 ix 1936, F. Woytkowski (UMMZ); 1♂, San Martin Dept., Ríoja, Mina de sal, 27 ix 1936, F. Woytkowski (UMMZ); 1♂, same data but 900 m, 30 ix 1936 (UMMZ); 4♂ 1♀, San Martin Dept., Tarapoto, A.F. Porter (UMMZ); 2♂, same data but 1933 (UMMZ); 1♂, same data but 356 m, iv 1940 (UMMZ); 1♂, same data but 830 m, 14 ii 1947, F. Woytkowski (UMMZ); 1♂, same data but 830 m, A. F. Porter (UMMZ); 1♂, San Martin Dept., Zepelacio, near Moyobamba, 1100 m, v 1939, G.G Klug (UMMZ).

***P. ornata* (Selys, 1879)**

(Figs. 33, 34, 40a-d, 93 a-d)

Thore ornata Selys, 1879: 54 (2♂, Peru); - Kirby, 1890: 116; - Ris, 1918: 30, 34 (key, Peru, Chanchamayo).

Thore pozuzina Förster, 1914: 59 (4♂, Peru, Pozuzo).

Thore montana Förster, 1914: 60 (1♀, Peru, Pozuzo); - Schmidt, 1942: 248 (synonym *T. ornata puzuzina*).

Thore ornata ornata: Schmidt, 1942: 247 (Peru, Ayna, Esperanza, Oxapampa).

Thore ornata pozuzina: Racenis, 1942

Polythore ornata ornata: Racenis, 1959: 488.

Polythore ornata puzuzina: Racenis, 1959: 488.

Polythore montana: Racenis, 1959: 488 (synonym of *Polythore ornata puzuzina*); - Montgomery, 1967: 151 (type).

Polythore puzuzina: Montgomery, 1967: 152 (type).

Polythore ornata: Montgomery, 1967: 151 (type); - Bick & Bick, 1986: 253-257, 259, 262 (male and female wings, male genital ligula, key).

Type data

♂ (Lectotype), Peru (RBINS).

Description

- **Male**. HW length 31.8 –41.7 mm; $\bar{x}$= 36.1 mm; N= 24. HW width 8.93 –12.4 mm; $\bar{x}$= 10.1 mm; N= 24. Ax FW 34 – 48; Ax HW 29 – 39; Px FW 46 – 67; Px HW 46 – 67. Complete cells under pt 8-14; $\bar{x}$= 10.4; N= 24. Length pt 2.4 –3.76 mm; $\bar{x}$= 3.08 mm; N= 24. Width pt 0.57 –1.72 mm; $\bar{x}$= 0.96 mm; N= 24. Length base to nodus 11.0 –14.3 mm; $\bar{x}$= 12.3 mm; N=24. **Wings**. Color pattern of FW and HW different. Amber coloration in both wings absent. Smoky gold coloration in both wings absent (Fig. 33). **FW.** Iridescent black or brown spot continues to apex preceded by a white amorphous spot, that begins between quadrangle and nodus. Proximal edge of iridescent spot generally sinuous. **HW.** Color of RP differentiated from rest of venation, being yellow to proximal margin of pterostigma (Fig. 34). Iridescent black spot beginning between quadrangle and nodus, extending to apex, and with a crescent-shaped white spot between nodus and pterostigma. Lunula on axis of Costa present (Fig. 33). **Thorax.** Pattern coloration of prothorax and pterothorax as for genus. Additional mesepisternal pale stripe absent. **Genital ligula.** Length distal lobes 0.072 –0.144 mm; $\bar{x}$= 0.101 mm; N= 24. Width distal lobes 0.064 –0.113 mm; $\bar{x}$= 0.919 mm; N= 24. Length of terminal segment of genital ligula without distal lobes 0.592 –0.768 mm; $\bar{x}$= 0.682 mm; N= 24. Distal lobes straight, its apex is rounded. Antero-lateral lobes absent (Fig. 40a). Posterior margin of lateral lobe visible in ectal view. Hairs in projections of lateral lobes absent (Fig. 40c, d). Apex of projection of lateral lobes elongated Fig. 40d). Protuberance in lateral lobes present (Fig. 40c). Lateral edge of distal lobes convex. Terminal fold as wide as segment width at level of lateral lobes.

Variation with regards to original description

Male. HW length 31.8 –41.7 mm. Ax FW 34 – 48; Ax HW 29 – 39.

Distribution

Central and S Peru (Ayacucho Dept., Huanuco Dept., Junin Dept., Oxapampa Prov.) in E foothills of the Andes between 350 m and 1900 m.

Diagnosis

Color pattern of male wings of *P. ornata* is similar to *P. boliviana*. They share a FW black or brown

apical spot with sinuous proximal edge, presence of HW crescent-shaped spot, presence of lunula on axis of HW Costa, and HW RP not differentiated in color from remainder of venation. *P. ornata* differs from *P.boliviana* by HW crescent-shaped white (spot grayish in *P. boliviana*), FW irregular spot whitish (yellowish in *P. boliviana*), and base of HW hyaline (grayish or infuscate in *P. boliviana*).

Habitat

Field notes mentioned that individuals of *P. ornata* have been collected in shady spots in the forest in Pampa Hermosa (Peru) exclusively along brooks, especially where they form pools and where there are small clearings (Bick and Bick, 1986).

General wing coloration of female

Only gynochromes females were revised. Two morphs were found; the montana morph (Foerster, 1914) with both wings hyaline (Fig. 93a). The other form with FW transparent or sigthly infuscate, a narrow light brown band distal to nodus; HW with white band wider than that in FW followed by light brown band (Fig. 93b-d).

Specimens examined

Lectotype: **Peru**. ♂, no more data (RBINS). Other specimens (33♂, 16♀): **Peru**. 1♂ 1♀ (in copula), Ayacucho Dept., Ayna, 13 v 1941, F. Woytkowski (UMMZ); 1♂, same data but 10 v 1941 (UMMZ); 1♀, Ayacucho Dept., Ayna, La Mar Prov., 10 v 1941, F. Woytkowski (UMMZ); 2♂, same data but 13 v 1941, 14 v 1941 (UMMZ); 1♀, Ayacucho Dept., La Mar Prov., Caudalosa, vi 1941, F. Woytkowski (UMMZ); 1♀, Ayacucho Dept. , La Mar Prov., Sivia, Río Apurimac, 25 vi 1941, F. Woytkowski (UMMZ); 1♂, Ayacucho Dept., Sivia, 12 vi 1941, F. Woytkowski (UMMZ); 2♂, same data but 16 vi 1941 (UMMZ); 2♂, Ayacucho Dept., Sivia, Río Apurimac, 22 vi 1941, F. Woytkowski (UMMZ); 1♀, Ayacucho Dept., Yanamonte, LaMar Prov., 7 ix 1940, F. Woytkowski (UMMZ); 1♀, same data but 15 ix 1940 (UMMZ); 1♂, same data but 17 ix 1940 (UMMZ); 1♂, Huanuco Dept. Pozuzo , 1904, Rolle (UMMZ); 1♀, Huanuco Dept., Divisoria, 1700 m, 4 x 1946, F. Woytkowski (UMMZ); 8♂ 3♀, Junin Dept., La Merced, J.D. Rivas (UMMZ); 1♂ 1♀, Junin Dept., Pampa Hermosa, 1-5 v 1935, F. Woytkowski (UMMZ); 1♂, same data but 1600 m (UMMZ); 1♀, same data but (FSCA); 1♂ 1♀, same data but 6-11 v 1935 (UMMZ); 1♀, Junin Dept., San Pedro, 900 m, 29-31 v 1935, F. Woytkowski (UMMZ); 1♂, Junin Dept., Satipo, 19 vii 1940, P. Paprzycki (UMMZ); 2♂, Junin Dept., La Merced, Hacienda La Salud, J.D. Rivas (UMMZ); 5♂,

same data but 7 iii 1931, 10 iii 1931, 11 iii 1931, 31 iii 1931, 1931 (UMMZ); 1♂, same data but 1067 m, 9 iv 1931 (UMMZ); 2♂, Oxapampa, 1800 m, Le Moult (RBINS); 1♂, La Salud, 20 iii 1930 (FSCA).

P. picta (Rambur, 1842)

(Figs. 43a-b, 50)

Euphaea picta Rambur, 1842: 231 (type ♂, "Cayenne" Hope Coll. Oxford).

Thore picta: Selys, 1853: 70; 1854, 256; - Hagen, 1861: 307; 1875, 30; - Kirby, 1890: 116.

Thore saundersii Selys, 1853: 70; 1854: 257: - Hagen, 1861: 307;- Selys, 1869: 27; 1873: 36, 65, 66 (synonym); - Kirby, 1890: 117; - Campos, 1922: 14; - Fraser, 1946: 14; - Montgomery, 1967: 128.

Thore picturata (race of *T. saundersii*) Selys, 1873: 66 (synonym); - Fraser, 1946: 14; - Montgomery, 1967: 128.

Polythore picta: Kennedy, 1919: pl.1, figs 9-10; - Fraser, 1946: 14, 35, 46 (photograph of the male type, *T. procera* Selys treated as a junior synonym of *T. picta* Rambur); - Soukup, 1954: 14; - Montgomery, 1967: 128, 151; - Bick & Bick, 1990a: 1-7 (male genital ligula drawings).

Thore picta picta: Schmidt, 1942: 242, 248, pl. IV.

Polythore picta picta: Racenis, 1959: 488

Polythore picta: (not Rambur) Bick & Bick, 1985: 10, 13, 17 (male and female wings, male genital ligula)

Type data

♂ (Holotype), French Guiana, Cayenne (OUMNH).

Redescription of male

HW length 33.2 mm; N= 1. HW width 8.81 mm; N= 1. Ax FW 45; Ax HW 35; Px FW 59; Px HW 65. Complete cells under pt 12; N= 1. Length pt 3.24 mm; N= 1. Width pt 0.81 mm; N= 1. Length base to nodus 11.2 mm; N= 1. **Wings**. Color pattern of FW and HW similar. Color of RP in HW undifferentiated. Iridescent black or brown spot in both wings that extends continuously to apex present and beginning distal to nodus. Percentage of extension of iridescent black or brown spot in HW 36%; N= 1. Crescent-shaped spot in HW absent. Apical white band preceeding iridescent black or brown spot present and with a bright white triangular spot in both wings (Fig. 50). **Thorax.**

Pattern coloration of prothorax and pterothorax as for genus. Additional mesepisternal pale stripe absent. **Genital ligula.** Length distal lobes 0.245 mm; N= 1. Length of terminal segment without distal lobes 0.622; N= 1. Distal lobes straight. Apex of distal lobes rounded. Antero-lateral lobes absent (Fig. 43). Posterior margin of lateral lobe visible in ectal view. Hairs in projections of lateral lobes absent. Apex of projection of lateral lobes globose. Protuberance in lateral lobes present. Lateral edge of distal lobes straight. Width of terminal fold equal to width at level of lateral lobes.

Distribution

French Guiana

Diagnosis

P. picta belongs to picta group; it is characterized by the bright white triangular spot on the white band in both wings.

General wing coloration of female

FW and HW color pattern similar, bright white triangular spot on white band, this followed by a iridescent brown biconcave band; apex of the wings darker (Fig. 90).

Specimens examined

French Guiana. 1♀ 1♂, Montage -des-Chevaux, 15 viii 1989, C. Brevignon (FSCA);

***P. procera* (Selys, 1869)**
(Figs. 2b, 35, 47)

Thore gigantea Race? *procera* Selys, 1869: 27 (types ♂♀, Bogotá, Coll. Selys, Belg. Mus).

Thore gigantea Race: *procera* Selys, 1873: 34

Thore procera: McLachlan, 1878: 88; - Kirby, 1890: 116; - Ris, 1918: 30, 34 (*picta* Rambur treated as a junior synonym of *procera* Selys); - Schmidt, 1942: 248, pl. IV.

Polythore procera: Kennedy, 1919: pl. 1, figs. 15, 16; - Fraser, 1946: 15 (*procera* Selys treated as a junior synonym of *picta* Rambur); - Montgomery, 1967: 128, 152; - Bick & Bick, 1985: 10, 11, 13, 17 (male and female wings, male genital ligula).

Type data

1♂ 1♀ (syntypes) Bogotá. Coll. Selys (RBINS).

Redescription of male

-HW length 29.2 –45,4 mm; x̄= 36.2 mm; N= 53. HW width 8.25 –13.7 mm; x̄= 10.8 mm; N= 53. Ax FW 34 – 53; Ax HW 28 – 44; Px FW 53 – 77; Px HW 51 – 72. Complete cells under pt 8 –16; x̄= 10.9; N= 53. Length pt 2.48 –4.72 mm; x̄= 3.28 mm; N= 53. Width pt 0.64 –1.28 mm; x̄= 0.93 mm; N= 53. Length base to nodus 10.3 –15.0 mm; x̄= 12.1 mm; N= 53. **Wings**. Color pattern of FW and HW similar. Amber coloration in both wings absent. Smoky gold coloration in both wings absent. Color of RP vein in HW undifferentiated, being black. Iridescent black or brown spot in both wings continues to apex. Iridescent black or brown spot in HW that extends continuously to apex present and beginning distal to nodus (Fig. 35). Percentage of extension of iridescent black or brown spot in HW 36.5 –57.5%; x̄= 50.1%; N= 53. White band disrupting iridescent black or brown spot in FW absent. Spot crescent-shaped in HW absent. Pale yellow nodal band in both wings absent. White irregular spot (*ws*) in both wings present. Percentage of extension of white spot in HW 5.01 –47.9%; x̄= 27.9%; N= 53. Lunula on axis of Costa in HW absent. **Thorax.** Pattern coloration of prothorax and pterothorax as for genus. Additional mesepisternal pale stripe absent. **Genital ligula.** Length distal lobes 0.032 –0.128 mm; x̄= 0.07 mm; N= 52. Width distal lobes 0.048 –0.096 mm; x̄= 0.07 mm; N= 52. Length of terminal segment without distal lobes 0.576 –0.792 mm; x̄= 0.656 mm; N= 52. Distal lobes straight (Fig. 47a). Apex of distal lobes rounded. Antero-lateral lobes absent. Posterior margin of lateral lobe visible in ectal view. Hairs in projections of lateral lobes absent (Fig. 47c). Apex of projection of lateral lobes globose (Fig. 47c, d). Protuberance in lateral lobes present (Fig. 47a, c). Lateral edge of distal lobes straight. Width of terminal fold equal to width at level of lateral lobes.

Variation with regards to original description

Male. HW length 29.2 –45.4 mm. Ax FW 34 – 53; Ax HW 28 – 44.

Distribution

E Cordillera of Colombia (Boyacá Dept., Meta Dept., Santander Dept.) and E of Andes in Ecuador (Morona-Santiago Prov., Pastaza Prov., Pichincha Prov., Tungurahua Prov.). Its altitudinal range extends from 200 m to 1400 m.

Habitat

Specimens of *P. procera* have been collected in tropical rainforest in the eastern Andes. In Ecuador, it was collected near creeks and rivers and it was most abundant during October – December (Bick and Bick, 1985). In Colombia, several specimens have been collected in tropical rainforest, but in the rainy season few adults have been observed; while in this period larval populations may have increased because greater numbers of emerging tenerals observed. Females lay their eggs during the limit between dry and wet seasons, when the streams have higher levels of water (Sánchez-Herrera and Realpe, 2010).

General wing coloration of female

Polythore procera is a polychromatic species (Fig. 96). Gynochrome females have FW and HW color pattern similar, with a white band followed by a wide iridescent black band that ends at proximal side of pterostigma; the HW apex is sighly darker than that FW (Fig. 96a).

Specimens examined

Syntypes: 1♂ 1♀, Colombia, Bogotá, Coll. Selys (RBINS). Other specimens (99♂, 23♀): 1♂, Boyacá Dept., Mpio. Santa María, Camino La Almenara, Bosque La Almenara por la carretra Santa Maria-San Luis de Gaceno, 880 m, 4°51'16"N - 73°14'0"W (ICN); 1♂, Boyacá Dept., Mpio. Santa María, Hacienda Cachipay, 310 m, 8 x 2005, G. Andrade-C (ICN); 1♂, Boyacá Dept., Mpio. Santa María, Reserva La Almenara, 2 v 2009, Angelica Camacho (ICN); 1♂, same data but 1200 m, Julián Vega (ICN); 3♂ 1♀, Cundinamarca Dept., Guayabetal, Cementerio, 1272 m, 4°12´46´´N- 73°48´38´´W, 11 xii 2004, León Pérez (ANDES-E); 1♂ 5♀, Cundinamarca Dept., Guayabetal, Monteredondo, 1276 m, 20 vi 2005, León Pérez, Melissa Sanchez & M. Lila Barrios (ANDES-E); 9♂ 1♀, same data but 4°15'45"N - 73°49'34"W, 9 xii 2004, León Pérez (ANDES-E); 1♂, same data 5 xi 2005, L.Pérez & E.Realpe (ANDES-E); 1♂ 1♀ (copula), Cundinamarca Dept., Guayabetal, Monteredondo, Quebrada La Catira, 1276 m, 4°15'45"N - 73°49'34"W, 5 xi 2005, L. Pérez & E.Realpe (ANDES-E); 10♂ 1♀, Cundinamarca Dept., Guayabetal, Monteredondo, Quebrada La Catira, 1276 m, 4°15'45"N - 73°49'34"W, 5 xi 2005, L.Pérez & E.Realpe (ANDES-E); 4♀, Cundinamarca Dept., Guayabetal, Quebrada Chirajara, 1115 m, 4°12'31"N - 73°48'02"W, 3-4 xi 2006, M. Sánchez & E. Ortiz (ANDES-E); 2♀, same data but 10 ix 2006 (ANDES-E); 2♂, Cundinamarca Dept., Guayabetal, Quebrada La Catira, 1246 m, 4°15'45"N - 73°49'34"W, 24-25 vi 2006, Sánchez Melissa (ANDES-E); 1♂ 2♀, Cundinamarca Dept., Guayabetal, 1242 m, 4°12’59’’N- 73°48’48’’W, 24 vi 2006, Sánchez, M (ANDES-E); 1♂, Meta Dept., PNN Macarena, i

1950, Richter, L. (ICN); 1♂, same data but 380-420 m, i 1951 (ICN); 1♂, Meta Dept., Puerto López, 210 m, 4°5'6"N - 72°57'19"W, 4 vi 1946 (ICN); 1♂, Meta Dept., Restrepo, 740 m, 30 iv 1988, I. de Arévalo (ICN); 1♂, Meta Dept., Rio Ocoa?, Caño Grande, 28 v 1945, Richter, L. (ICN); 1♂, Meta Dept., Villavicencio, Bosque Bavaria, 7 x 2005, Gonzáles, C. (ICN); 1♂, same data but 8 x 2005, Bermúdez, A. (ICN); 2♂, Meta Dept., Villavicencio, Bosque Bavaria, 525 m, 4°10.46'N - 73°39.23'W, 13 iii 2009, Sánchez, M (ANDES-E); 3♂, Meta Dept., Villavicencio, Vereda La Argentina, 594 m, 4°13'22"N - 73°38'18"W, 11 xii 2004, León Pérez (ANDES-E); 1♂, Santander Dept., Alto Rio Opón, 850 m, 1948, Richter, L. (ICN); 1♂, Santander Dept., Sabana de Torres?, Río Manzanares, 900 m, x 1944 (ICN). **Ecuador**. 2♂ 1♀, Morona-Santiago Prov., Macas, Rio Upano, 1050 m, L.G. Alonzo (UMMZ); 3♂, Morona -Santiago Prov., Macas; 22.9 km W on Guamote Rd, 3.3 km W on Río Albanico, Rocky stream and flowing roadside ditches, 1690 m, 2°14'3.2" S - 78°13'4.6" W, 18 ix 2005, Bill Mauffray (FSCA); 3♂, 3Morona -Santiago Prov., Mangosisa, Río Upano, 850 m, L. G. Alonzo (UMMZ); 1♂, same data but 1050 m (UMMZ); 1♂, Morona-Santiago Prov., Río Upano, Giulca, 1400 m, L.G. Alonzo (UMMZ); 2♂, Pastaza Prov., Abitagua, 1000 m, 10 x 1939, W.C. – Macintyre (UMMZ); 2♂, Pastaza Prov., Abitagua, 1100m, 1 x 1939 , W.C. – Macintyre (UMMZ); 7♂ 1♀, same data but 13 ix 1939, 10 x 1939, 5 xi 1939, ii 1941; 15 v 1941, 2 vi 1941, 24 vi 1941; 30 vii 1941 (UMMZ); 1♂, Pastaza Prov., Abitagua, 1200 m, 8 xi 1939, W.C. – Macintyre (UMMZ); 2♂, Pastaza Prov., Abitagua, 2 iv 1936 W.C. – Macintyre (UMMZ); 11♂ 2♀, same data but vii 1936, 2 x 1936, x 1936, 28 v 1941(UMMZ), 1♂, Pastaza Prov., Abitagua on trail at Río Guillermina, 1100 m, 3 iii 1941, W.C. – Macintyre (UMMZ); 1♂, Pastaza Prov., Abitagua, Río Pastaza, 1 xi 1939, W.C. Macintyre (UMMZ); 1♂, same data but 1000 m, 6 x 1939 (UMMZ); 1♂, same data but 1200 m, 6 xi 1939 (UMMZ); 1♂, Pastaza Prov., Abitagua, Río Pastaza watershed, 2 iv 1936, W.C. – Macintyre (UMMZ); 1♂, same data but 1000 m, vii 1936 (UMMZ); 2♂, Pastaza Prov., Abitagua, Río Pastaza watershed, 2 x 1936, W.C. – Macintyre (UMMZ); 2♂, Pastaza Prov., Mera, 1000 m, 2 x 1936, W.C. – Macintyre (UMMZ); 2♂, Pichincha Prov., Quito, L.G. Alonzo (UMMZ); 1♂, Tungurahua Prov., La Palmera, 1300 m, xii 1938, W.C. Macintyre (UMMZ); 1♂, Tungurahua Prov., near Banos, Rio Topo, 13 iii 1936, W.C. Macintyre (UMMZ); 1♂, Tungurahua Prov., Río Mapoto, 25 i 1939, W.C. – Macintyre (UMMZ); 1♀, Tungurahua Prov., Río Mapoto, 1300 m, 28 ix 1938, (UMMZ); 1♂, Tungurahua Prov., Río Topo, xii 1948, W.C. – Macintyre (UMMZ); 2♂, Tun gurahua Prov., Río Zuniac, 1300 m, W.C. Macintyre (UMMZ); 1♂, same data but ii 1949 (UMMZ); 1♂, Tungurahua Prov., San Francisco, 1200 m, 14 x 1937, W.C. – Macintyre (UMMZ).

***P. spaeteri* Burmeister & Börzsöny, 2003**
(Figs. 9, 24 a-c, 94)

Polythore spaeteri Burmeister & Börzsöny, 2003: 44 (♂ Holotype ♀ Allotype, Peru, Panguana, Río Llullapichis, ZSM)

Type data

♂ (Holotype), Peru, Panguana, Río Llullapichis (Yuyapichis), rechter Nebenfluss des Río Pachitea, 9°37'S - 74°56'W, 28 ix – 6 x 2000 (ZSM)♀ (Allot ype), same data as holotype♂8 3♀ (Paratypes), same data as holotype (ZSM)

Redescription of male

HW length 37.7 mm; N= 1. HW width 10.9 mm; N= 1. Ax FW 54; Ax HW 36; Px FW 74; Px HW 67. Complete cells under pt 16; N= 1. Length pt 4.24 mm; N= 1. Width pt 1.12 mm; N= 1. Length base to nodus 12.3 mm; N= 1. **Wings**. Color pattern of FW and HW similar, amber. Apex of wings diffusely darkened to brownish (Fig. 9). Color of RP in HW undifferentiated, brown light. No defined markings or spots in any wing. Lunula on axis of Costa in HW absent. **Thorax.** Pattern coloration of prothorax and pterothorax as for genus. Additional mesepisternal pale stripe absent (Fig. 24c). **Genital ligula**. Length distal lobes 0.184 mm; N= 1. Width distal lobes 0.064 mm; N= 1. Length of terminal segment of genital ligula without distal lobes 0.592 mm; N= 1. Distal lobes divergent (Fig. 24a). Apex of distal lobes rounded. Antero-lateral lobes absent. Posterior margin of lateral lobe visible in ectal view. Hairs in projections of lateral lobes absent. Apex of projection of lateral lobes elongated (Fig. 24a, b). Protuberance in lateral lobes present. Lateral edge of distal lobes concave. Width of terminal fold of genital ligula equal to width at level of lateral lobes.

Variation with regards to original description

Male. HW length 37.7 mm. HW width 10.9 mm. Length base to nodus 12.3 mm. Length pt 4.24 mm. Ax HW 36. Px FW 74; Px HW 67. In original description of the species, a black oval spot in the male abdomen is illustrated in figure 4, however in this figure the position of this spot is confuse because in the dorsal view the spot is in S10 while in the lateral view is in S9. This oval spot was not observed in the holotype.

Distribution

Peru (Huanuco Dept.) near foothills of the Andes at 250 m.

Diagnosis

Polythore spaeteri is close to *P. concinna*, sharing an amber coloration in both male wings, but apex is diffusely darkened to brownish in *P. spaeteri* (Fig. 9) while coloration is uniform in *P. concinna* (Fig. 26). Also, apex of projection of lateral lobes of male genital ligula is elongated in *P. spaeteri* (Fig. 24a) and globose in *P. concinna* (Fig. 25c).

Habitat

Primary rainforest with low light. Small dry brooks (flowing only during wet season) or furrows without water (Burmeister and Börzsöny, 2003).

Biology

Burmeister and Börzsöny (2003) observed copulation and oviposition taking place after a longer raining period when the brooks have been filled with water , but we also saw individuals of *P. spaeteri* in tandem and copula at the beginning of a short rainy period. Larvae of *P. spaeteri* were found clinging to lower surfaces of larger stones in a small forest stream with a relative strong current (Etscher *et al*., 2006).

General wing coloration of female

Female pattern wing color different from the male. Infuscate wings with a biconcave brown band (Fig. 94).

Specimens examined

♂ Holotype: **Peru.** Panguana, Río Llullapichis, Rechter Nebenfl des Rio Pachitea, 9°37'S - 74°56', 28 ix – 6 x 2000, E.G. Burmeister, E. Diller T. Kothe & W. Schlang (ZSM); ♀ Allotype: same data as holotype (ZSM)

***P. terminata* Fraser, 1946**
(Figs. 5, 38, 46 a, b)

Polythore derivata race *terminata* Fraser, 1946: 20, fig. 1d (types ♂, ♀ San Antonio, NE Peru, Brit. Mus.); - Soukup, 1954: 14; - Montgomery, 1967: 151.
Polythore picta terminata: Racenis, 1959: 488
Polythore derivata terminata: Montgomery, 1967: 127
Polythore terminata: Bick & Bick, 1985: 10, 13, 17, 25 (new status)

Type data

♂ (Holotype), Peru, San Antonio (BMNH).

Redescription of male

HW length 32.3 –41,5 mm; $\bar{x}$= 35.9 mm; N= 20. HW width 8.5 –11.9 mm; $\bar{x}$= 10.2 mm; N= 20. Ax FW 36 – 49; Ax HW 26 –56; Px FW 43 – 62; Px HW 44 – 62. Complete cells under pt 9 –16; $\bar{x}$= 12.6; N= 20. Length pt 2.92 –4.00 mm; $\bar{x}$= 3.38 mm; N= 20. Width pt 0.96 –1.20 mm; $\bar{x}$= 1.09 mm; N= 20. Length base to nodus 11.0 –14.2 mm; $\bar{x}$= 12.4 mm; N= 20. **Wings**. Color pattern of FW and HW similar. Color of RP vein in HW not differentiated, black. Iridescent black or brown spot in both wings that extends continuously to apex present and beginning distal to nodus (Fig. 38). Percentage of extension of iridescent black or brown spot in HW 16.0 –30.9 mm; $\bar{x}$= 23.3 mm; N= 20. Apical white band preceding iridescent black or brown spot absent. White band disrupting iridescent black or brown spot in both wings absent. **Thorax.** Pattern coloration of prothorax and pterothorax as genus. Additional mesepisternal pale stripe absent. **Genital ligula.** Length distal lobes 0.208 –0.352 mm; $\bar{x}$= 0.257 mm; N= 20. Width distal lobes 0.048 –0.084 mm; $\bar{x}$= 0.057 mm; N= 20. Length of terminal segment without distal lobes 0.544 –0.672 mm; $\bar{x}$= 0.634 mm; N= 20. Distal lobes divergent (Fig. 46a). Apex of distal lobes rounded, or elongated. Antero-lateral lobes absent. Posterior margin of lateral lobe visible in ectal view. Hairs in projections of lateral lobes absent. Apex of projection of lateral lobes elongated (Fig. 46). Protuberance in lateral lobes present. Lateral edge of distal lobes concave. Terminal fold as wide as segment width at level of lateral lobes.

Distribution

E Ecuador (Morona-Santiago Prov. and Zamora Chinchipe Prov.), NE Peru (Loreto Dept.), and

Venezuela (Tachira).

Diganosis

P. terminata is similar to *P. derivata* sharing HW extension of iridescent black or brown spot less than 30%, divergent distal lobes in male genital ligula. However, these two species can be separated by presence of a white apical band preceding iridescent black or brown spot in *P. derivata* (Fig. 39), while this band is absent in *P. terminata* (Fig. 38).

General wing coloration of female

Gynochrome female had a dark brown biconcave band in both wings; the apex is slightly darker (Fig. 95).

Specimens examined

Holotype: ♂, **Peru**, San Antonio (BMNH). Other specimens (20♂, 2♀): **Ecuador**. 3♂, Morona-Santiago, Macas, Río Upano, 1050 m, L.G. Alonzo (UMMZ); 1♂ 1♀, Morona-Santiago, Mangosisa, Río Upano, 850 m, L.G. Alonzo (FSCA); 4♂, same data (UMMZ); 2♂, same data but 30 xi 1945 (UMMZ); 1♂, Zamora Chinchipe Prov., Zamora, 1000 m, 1 xi 1941, D.B. Laddey (UMMZ); 1♂ 1♀, Zamora Chinchipe Prov., Zamora, 1000-1200 m, 15 x 1941, D.B. Laddey (UMMZ); 3♂, same data but 16 x 1941, 25 x 1941, 1 xi 1941 (UMMZ). **Peru**. 3♂, Loreto Dept., Balsapuerto, Río Huallaga, vi 1933, Paul Nagel (UMMZ); 1♂, Loreto Dept., Yurima guas, v 1939, G.G Klug (UMMZ). **Venezuela**. 1♂, Táchira, Táchira, 11 iv 1920, J.H., E.B. Williamson, W.H. Ditzler (UMMZ).

***P. victoria* (McLachlan, 1869)**
(Figs. 27, 32)

Thore victoria McLachlan, 1869: 28 (1♂, Bolivia); - Selys, 1869: 25 (descr. ♂); - Kirby, 1890: 116; - Ris, 1918: 31 (descr. ♂ ♀, Pozuzo, Peru) figs. 12, 13 (wings).

Thore victoria: Selys, (not McLachlan) 1873: 33 (♀, cf. *boliviana*).

Polythore victoria: Kennedy, 1919: 1, figs. 17, 18 (genital ligula drawings); - Fraser, 1946: 16; - Soukup, 1954: 14; - Racenis, 1959: 489; - Montgomery, 1967: 153 (type); - Bick & Bick, 1986: 253-257, 259 (male and female wings, male genital ligula, key).

Type data

♂ (Holotype), Bolivia (BMNH).

Redescription of male

HW length 45.5 mm; N= 1. HW width 12.0 mm; N= 1. Ax FW 50; Ax HW 41; Px FW 71; Px HW 69. Complete cells under pt 13; N= 1. Length pt 4.00 mm; N= 1. Width pt 0.619 mm; N= 1. Length base to nodus 15.6 mm; N= 1. **Wings**. Color pattern of FW and HW different. **FW**. Iridescent black or brown apical spot present, its proximal edge oblique with respect to Costa. White irregular spot present. **HW**. Color of RP differentiated, yellow to proximal margin of pterostigma. Iridescent black or brown spot that extends continuously to apex absent. White band disrupting iridescent black or brown spot present, its edges oblique respect to Costa. Crescent-shaped spot absent. Lunula on axis of Costa absent (Fig. 27). **Thorax.** Pattern coloration of prothorax and pterothorax as for genus. Additional mesepisternal pale stripe absent. **Genital ligula**. Length distal lobes 0.160 mm; N= 1. Width distal lobes 0.141 mm; N= 1. Length of terminal segment of genital ligula without distal lobes 0.621 mm; N= 1. Distal lobes straight. Apex of distal lobes rounded. Antero-lateral lobes absent. Posterior margin of lateral lobe visible in ectal view. Hairs in projections of lateral lobes absent. Apex of projection of lateral lobes elongated (Fig. 32). Protuberance in lateral lobes ligula present. Lateral edge of distal lobes convex. Width of terminal fold of genital ligula equal to width at level of lateral lobes.

Distribution

Bolivia, Colombia (Cauca Dept.), Ecuador, and Peru (Pozuzo).

Diagnosis

Male *Polythore victoria* resembles male *P. vittata* sharing the iridescent brown spot in bot wings and the clear band on the iridescent brown spot in HW. These species differ in the proximal edge of the white band whit respect to Costa, oblique in *P. victoria* (Fig. 27) and perpendicular in *P. vittata* (Fig. 11).

Specimens examined

Holotype: ♂, **Bolivia** (BMNH). Other specimens (1♂, 4♀): **Colombia**. 2♀, Cauca (RBINS). **Ecuador**. 1♀, Quito (RBINS); 1♀, Rio Bobonaza (RBINS).

***P. vittata* (Selys, 1869)**
(Figs. 11, 15 a-d, 53, 56)

Thore picta race? *vittata* Selys, 1869: 29 (♂ "Ega sur le haut Amazone", currently Tefé, Brazil)
Thore albovittata Selys, 1873: 65, 66 (no descr., new name for *picta* Selys, race? *vittata* Selys, and race? *aequatorialis* Selys); - Kirby, 1890: 117; - Schmidt, 1942: 247 (key); - Fraser, 1946: 21 (synonym); - Montgomery, 1967: 128, 149 (synonym, types).
Thore vittata: Kirby, 1890: 117; - Ris, 1918: 31, 37 (key, descr., Pozuzo, Peru); - Schmidt, 1942: 250.
Thore acostai Navas, 1924: 320 (1♂, Yepisca, Peru); - Schmidt, 1942: 250 (synomyn); - Racenis, 1959: 489 (synonym); - Montgomery, 1967: 140, 149 (type).
Thore tincta Navas, 1924: 319 (1♂, Yepisca, Peru); - Schmidt, 1942: 250 (synonym); - Racenis, 1959: 489 (synonym); - Montgomery, 1967: 140, 153 (type).
Polythore vittata: Fraser, 1946: 21, I, figs. 2, 3, (wings, as *albovittata*); -Racenis, 1959: 489; - Montgomery, 1967: 153 (type); - Bick & Bick, 1986: 253-257 (male and female wings, male genital ligula, key).

Type data

♂ (Holotype), "Ega sur le haut Amazone", currently Tefé, Brazil (Collect. Selys)

Type comments. Selys (1969) described *Thore vittata* as a race of *T. picta* with dubts based on one adult male, and mentioned that the female was unknown. In 1973 he stated that *T. vittata* race? was a different species than *T. picta* and proposed the new name *Thore albovittata*. As mentioned by Montgomery (1967), a new name was not needed since Selys had used the infraspecific name race *vittata* in 1869, and according to the ICZN these names are valid before 1960 (Article 74). Montgomery (1967) designated two specimens, male and female, of the Selys' collection in RBINS as lectotypes, in error, since the only specimen of *P. vittata* included in the original description, the male on RBINS from the type locality and in the Selys' collection, is the holotype by monotypy.

Redescription of male

HW length 27.1 –40.4 mm; $\bar{x}$= 34.1 mm; N= 23. HW width 8.69 –12.1 mm; $\bar{x}$= 9.99; N= 23. Ax FW 44 – 53; Ax HW 33 – 44; Px FW 56 – 74; Px HW 49 – 63. Complete cells under pt 8 –14; $\bar{x}$= 10.2; N= 23. Length pt 2.45 –3.6 mm; $\bar{x}$= 2.80 mm; N= 23. Width pt 0.762 –1.20 mm; $\bar{x}$= 0.957

mm; N= 23. Length base to nodus 10.8 –15.5 mm; x̄= 12.4 mm; N= 23. **Wings**. Color pattern of FW and HW similar, infuscate. Color of RP in HW undifferentiated. Iridescent black or brown spot in FW absent. No HW iridescent black or brown spot continuing to apex. White band disrupting iridescent black or brown spot in FW present (Fig. 11). Edges of iridescent black or brown spot in HW, interrupted by a white band, perpendicular to Costa. Iridescent black or brown medial spot in HW absent. Crescent-shaped HW spot absent. White nodal bands and pale yellow nodal bands absent. Lunula on axis of Costa vein in HW absent. **Thorax.** Pattern coloration of prothorax and pterothorax as for genus. Additional mesepisternal pale stripe present, occupying half of its length (Fig. 53, 56), sometimes reduced in tenerals (Bick and Bick, 1986). **Genital ligula**. Length distal lobes 0.016 –0.113 mm; x̄= 0.045 mm; N= 19. Width distal lobes 0.064 –0.096 mm; x̄= 0.079 mm; N= 19. Length of terminal segment without distal lobes 0.415 –0.560 mm; x̄= 0.513 mm; N= 19.Distal lobes short (Fig. 15a). Apex of distal lobes rounded. Antero-lateral lobes present (Fig. 15b, c). Posterior margin of lateral lobe not visible in ectal view. Hairs in projections of lateral lobes present (Fig. 15 c, d). Apex of projection of lateral lobes globose. Protuberance in lateral lobes absent. Lateral edge of distal lobes convex. Terminal fold as wide as segment width at level of lateral lobes (Fig. 15a).

Variation with regards to original description

Male. HW length 27.1 –40.4 mm. Complete cells under pt 8 –14. Ax FW 44 – 53, Px FW 56 – 74. Additional mesepisternal pale stripe present.

Diagnosis

Male *P. vittata* is close to *P. victoria* male, sharing the iridescent brown spot in bot wings and the clear band on the iridescent brown spot in HW. These species differ in the proximal edge of the white band whit respect to Costa, oblique in *P. victoria* (Fig. 27) and perpendicular in *P. vittata* (Fig. 11).

Distribution

NW Brazil (Amazonas State), Ecuador (Morona-Santiago Prov.) and Peru (Loreto Dept.).

Specimens examined

Holotype: ♂, **Brazil**. “Ega sur le haut Amazone”, currently Tefé, Bates (RBINS). Other specimens (26♂, 7♀): **Brazil**. 3♂, Amazonas State, São Paulo de Olivença (UMMZ); 1♂, Amazonas State,

São Paulo de Olivença, i 1923, S. Klages (FSCA); 1♂, same data but xi 1931, F.Wucherpfennig (UMMZ); 1♂ 1♀, same data but xii 1931 (FSCA); 12♂ 2♀, same data but i 1932, ii 1932, iv 1932, vi 1932, xii 1932 (FSCA, UMMZ); 2♂, Amazonas State, Tefé, B. Phol (UMMZ); 1♀, same data but xii 1924, H. Bassler (FSCA); 4♂ 1♀, Amazonas State, Tefé, 1878 m, xi 1924 (FSCA). Ecuador. 1♀, Morona-Santiago, Macas via Riobamba, 20 ix 1924, M. Madera, from L. J. Higgins (UMMZ). **Peru**. 2♂ 1♀, Pebas, no more data (RBINS).

***P. williamsoni* (Förster, 1903)**
(Figs. 20, 22, 61)

"*Thore Williamsoni* n. sp. (*Th. boliviana* Rasse *Williamsoni*)" Förster, 1903: 2 (numerous ♂ ♀, copulating pair, Vilcanota, Peru).

Thore boliviana williamsoni: Schmidt, 1942: 247, III, figs. 7, 8 (wings).

Polythore boliviana williamsoni: Racenis, 1959: 487.

Polythore williamsoni: Kennedy, 1919: I, figs. 11, 12 (male ligula drawings, Bolivia); - Montgomery, 1967: 153 (type); - Bick and Bick, 1986: 253-257, 259, 264 (male and female wings, male genital ligula, key).

Type data

♂ (Lectotype), Peru, Vilcanota, O. Garlepp coll. 9 i 1899 (UMMZ). 1♂, 2 ♀ (Paralectotypes) same data as lectotype (UMMZ).

Comments. Förster (1903) described the species based on numerous males and females from Vilcanota, Peru, and this type series included a pair of specimens in copula. Bick and Bick (1986) designated these pair of specimens in copula of the UMMZ as Lectotypes. According to Article 74 of the International Code of Zoological Nomenclature (ICZN, 1999) designation of two specimens as lectotypes is invalid, and in consequence, the male is retained as lectotype, and the female plus the other two specimens of the type series in UMMZ, are considered paralectotypes. In UMMZ there is also a male of *P. williamsoni* from Bolivia with a 'paratype' label, which did not belong to the type series. We corrected this with the following label on the specimen "invalid paratype because it does not belong to the type series"

Redescription of male

HW length 30.9 –42.6 mm; x̄= 36.0 mm; N= 3. HW width 8.51 –12.8 mm; x̄= 10.5 mm; N= 3. Ax FW 37 - 54; Ax HW 32 - 40; Px FW 51 - 65; Px HW 49 - 63. Complete cells under pt 12 –16; x̄= 14; N= 3. Length pt 3.00 –4.64 mm; x̄= 3.72 mm; N= 3. Width pt 1.04 –1.44 mm; x̄= 1.28; N= 3. Length base to nodus 10.8 –13.6 mm; x̄= 11.9 mm; N= 3. **Wings**. Color pattern of FW and HW similar. Amber coloration absent. Smoky gold coloration in both wings present (Fig. 20). Color of RP in HW differentiated from rest of venation, pale yellow to proximal margin of pterostigma (Fig. 22). Beige crescent-shaped spot in both wings present. Lunula on axis of Costa absent. **Thorax.** Pattern coloration of prothorax and pterothorax as for genus. Additional mesepisternal pale stripe absent. **Genital ligula**. Length distal lobes 0.160 –0.123 mm; x̄= 0.147 mm; N= 3. Width distal lobes 0.064 –0.112 mm; x̄= 0.087 mm; N= 3. Length of terminal segment of genital ligula without distal lobes 0.744 –0.920 mm; x̄= 0.832 mm; N= 2. Distal lobes straight. Apex of distal lobes rounded. Antero lateral lobes absent. Posterior margin of lateral lobe not visible in ectal view. Hairs in projections of lateral lobes absent. Apex of projection of lateral lobes elongated. Protuberance in lateral lobes present. Lateral edge of distal lobes convex. Terminal fold as wide as segment width at level of lateral lobes.

Variation with regards to original description

Male. HW length 30.9 –42.6 mm.

Distribution

Bolivia and SE Peru (Puno Dept.). This species is registered for the first time from Colombia (Huila Dept.) expanding its geographical range.

Diagnosis

Males of *P. williamsoni* resemble male of *P. manua*, sharing the lunule in HW and cresent-shaped spot in HW but these differ in HW RP color, being yellow in the first and light brown in the last (Figs. 22, 23).

Specimens examined

Lectotype: ♂, **Peru**. Puno Dept., Vilcanota, O. Garlepp coll., 9 i 1899 (UMMZ). Paralectotypes: 1♂, 1♀, same data as lectotype (UMMZ). Other specimens (4♂) : **Bolivia**. 1♂, no more data (UMMZ). **Colombia**. 2♂, Huila Dept., Municipio de San Agustín, Estrecho del Magdalena,

1500 m, 1°55’31”N - 76°18’00”W, ix 2011, E. Realpe (ANDES-E). **Peru**. 1♂, Cuzco, Río Urubamba, 4 iii 1929, H. Bassler (FSCA).

MORPHOMETRIC ANALYSIS

The populations proposed by Bick and Bick (1985) were not differentiated when using the characters they suggested they. For example, extension of iridescent black spot in HW and length of distal lobes of male genital ligula were proposed for differentiation of populations of species of the picta group; here these characters differed between species but not between populations proposed for each species. Statistical difference was found only in the characters for populations of *P. procera*, suggesting that populations of Colombia and Puyo are significantly different. Also, for *P. gigantea* significant difference was found between populations of Antioquia, Balsapampa, and San Martin but greater morphological differentiation was expected due to geographical separation of the populations. In most cases in the picta group, size correction analysis did not improve differentiation between populations.

Population level study

P. derivata

There was no clustering of individuals in populations of *P. derivata* in PCA with raw measurements (Fig. 62a). Of the three characters proposed by Bick and Bick (1985), only extension of iridescent black spot in HW (Dse) was statistically significant between populations of Puyo and Aguaytia in the analyses with raw and size-corrected measures (Tables 1 - 2). There was no difference in the characters proposed in this study between populations, only length of HW was significantly different between populations of Puyo and Limoncocha, and between those of Puyo and Aguaytia in the size-corrected analysis (Table 2).

In the Discriminant analysis with raw measurements all individuals of population Puyo were correctly assigned to this population (100% percent correct) suggesting that the population is clearly differentiated; while Aguaytia had 85% percent correct assigments, and Limoncocha 77%. In the DA with size-corrected measures, the correct percent of assignment was the same for Puyo and

Aguaytia while for Limoncocha was down to 44%. This statistical difference is evidenced in the PCA plot with size-corrected measures, in which Limoncocha individuals are mixed with individuals of other populations, while Puyo and Aguaytia individuals are grouped within each population (Fig. 62b).

Differentiation between Puyo and Aguaytia is not related to geographical distribution because both populations belong to the Yungas Province of the Amazonic biogeographic domain according to the provinces proposed by Cabrera and Willink (1980). The differentiation is not related to their altitudinal distribution either because Aguaytia's altitudinal range (800 m to 1700 m) overlaps with Puyo's range (1000 m to 1300 m).

P. gigantea

Statistical difference was found between populations of *P. gigantea* in both analyses: raw and size-corrected measures (Tables 1 and 2) supporting the proposal of Bick and Bick (1985). Also, both characters proposed in the literature as interpreted in this study support the difference between populations of Antioquia, Balsapamba, and San Martín. Most individuals of each population tend to separate into defined clusters in the PCA with raw measures; the differentiation was improved when using size-corrected data (Fig. 63). Despite the significant difference between populations in the analyses of variance of the studied characters, 86% of individuals were correctly assigned to Balsapamba in DA, followed by 83% for Antioquia, and 75% for San Martin in both analyses with raw measures and with size-corrected measures.

Multiple comparisons tests show significant difference between Antioquia and other populations for most characters studied; this significant difference between San Martin and Balsapamba. However, more differentiation was expected because of the wide geographical separation of these populations, being Antioquia the northernmost population while San Martin is the most southerly; and even though Balsapamba is the intermediate population it is considerably distanced from the other two. The population of Antioquia belongs to the Pacific Province of Cabrera and Wilink (1980), while those of Balsapamba and San Martin belong to Yungas Province. Considering this biogeographical separation a more clear morphological difference of the Antioquia population was expected.

P. neopicta

The characters proposed by Bick and Bick (1985) for differentiation of populations of *P. neopicta*,

extension of iridescent black spot in HW (Dse) and length of distal lobes of male genital ligula (Ldl), were statistically significant (Table 1). Width of terminal segment of male genital ligula on terminal fold (Wts2) and length of terminal segment of male genital ligula (Lts) were also significant, differentiating populations of Balsapuerto from those of Satipo in the raw analysis, and those of Balsapuerto from Tingo Maria in the size-corrected analysis (Table 2). PCA plot shows that individuals of Balsapuerto population grouped between them differ slightly from the other two populations (Fig 63). Size-correction of the characters did not improve clustering of individuals in each population (Fig. 63).

Statistical differences found show that Satipo differs from Balsapuerto; this is consistent with the DA, by which 100% of the individuals were correctly assigned to this first population and 96% of the individuals to the last population while Tingo Maria had the lowest percent of correct assignment with 64%. Correct percent was the same for Satipo in the DA with size-corrected measures while for Balsapuerto and Tingo Maria it was lower, 92% and 62% respectively. Considering the above results and that *P. neopicta* populations are the less extensive in geographical distribution of the species studied, since Balsapuerto population is north of Peru, Satipo is south of Peru, and Tingo Maria is located between these two in central Peru, the poor clustering of individuals of each population may be a problem of lack of sampling. In addition, it is noteworthy that the population with the lowest correct percent of assignment is Tingo Maria, located in central Peru and therefore intermediate to the other populations, which supports the explanation of lack of sampling.

P. procera

Colombia and Puyo populations of *P. procera* were statistically different in two of the three characters proposed by Bick and Bick (1985) and in Wts1 (Table 1). The same difference was found in the size-corrected analysis, in addition to the statistical difference in Lpt (Table 2). Individuals of each population were grouped and separated from other populations in PCA with raw measures, but not so clearly in the PCA with size-corrected measures (Fig 64). 100% of individuals were correctly assigned to Puyo population in DA analysis, while 93% were correctly assigned to the population of Colombia, suggesting that population Puyo is better defined than population Colombia. This differentiation is related to the wide separation of populations, since individuals of Colombia are NE in the E cordillera of the Andes while Puyo is located in central Ecuador.

Table 1. Statistical analyses for raw measures of populations of species of the picta group. Significance limit 0,05. Asterisk represents the significant difference.

Species	Variable	Anova / Kruskal - Wallis	Post-hoc test
P. derivata	LHW	Anova: F(2, 23)= 2.3 p= 0.12	
	Dse	Anova: F(2, 23)= 7.3 p= 0.0035*	Limoncocha - Puyo p= 0,071 Limoncocha - Aguaytia p= 0,29 Puyo - Aguaytia p= 0,0030*
	Wse	Anova: F(2, 23)= 0.2 p= 0.79	
	Ldl	Anova: F(2, 23)= 3.6 p= 0.044*	Limoncocha - Puyo p= 0,13 Limoncocha - Aguaytia p= 0,84 Puyo - Aguaytia p= 0,054
	Wts2	Anova: F(2, 23)= 0.78 p= 0.47	
	Lpt	Anova: F(2, 23)= 0.24 p= 0.79	
	Lts	Kruskal-Wallis: H(2, 26)= 2.9 p= 0.23	
P. gigantea	LHW	Anova: F(2, 41)= 15 p= 0.00001*	Antioquia - Balsapamba p= 0,0003* Antioquia - San Martin p= 0,00026* San Martin - Balsapamba p= 0,13
	Dse	Anova: F(2, 41)= 16 p= 0.00001*	Antioquia-Balsapamba p= 0,00019* Antioquia - San Martin p= 0,00025* San Martin - Balsapamba p= 0,16
	Ldl	Anova: F(2, 41)= 5.1p= 0.013*	Antioquia - Balsapamba p= 0,95 Antioquia - San Martin p= 0,0092* San Martin - Balsapamba p= 0,013*
	Wts2	Anova: F(2, 41)= 6.8 p= 0.0028*	Antioquia - Balsapamba p= 0,053 Antioquia - San Martin p= 0,0042* San Martin - Balsapamba p= 0,11
	Lpt	Kruskal-Wallis: H(2, 44)= 17 p= 0.0002*	Antioquia - Balsapamba p= 0,00049* Antioquia - San Martin p= 0,017* San Martin - Balsapamba p= 1,0
	Lts	Anova: F(2, 41)= 10 p= 0.00025*	Antioquia - Balsapamba p= 0,00030* Antioquia - San Martin p= 0,073 San Martin - Balsapamba p= 0,96
P. neopicta	LHW	Anova: F(2, 61)= 2.9 p= 0.063	
	Dse	Kruskal-Wallis: H(2, 64)= 48 p= 0.000*	Balsapuerto - Satipo p=0,0000* Balsapuerto - Tingo María p= 0,0000* Satipo - Tingo María p=0,0804
	Wse	Kruskal-Wallis: H(2, 64)= 0.13 p= 0.94	
	Ldl	Kruskal-Wallis: H(2, 64)= 31 p = 0.000*	Balsapuerto - Satipo p=0,000001* Balsapuerto - Tingo María p= 0,00084* Satipo - Tingo María p=1,0
	Wts2	Anova: F(2, 61)= 7.8 p= 0.00093*	Balsapuerto - Satipo p= 0,00076* Balsapuerto - Tingo Maria p = 0,11 Satipo - Tingo Maria p = 0,61
	Lpt	Anova: F(2, 61)= 2.2 p= 0.12	
	Lts	Anova: F(2, 61)= 6.1 p= 0.0039*	Balsapuerto - Satipo p= 0,0030* Balsapuerto - Tingo Maria p = 0,64 Satipo - Tingo Maria p = 0,20

P. procera	LHW	Anova: F(1, 49)= 2.4 p= 0.13	
	Dse	Kruskal-Wallis: H(1, 51)= 29 p= 0.000*	
	Wse	Kruskal-Wallis:H(1,51)= 0.044 p= 0.83	
	Ldl	Kruskal-Wallis: H(1, 51) = 28 p = 0.000*	
	Wts1	Anova: F(1, 49)= 24 p= 0.00001*	
	Lpt	Kruskal-Wallis: H(1, 51) = 8.1 p = 0.0043*	
	Lts	Anova: F(1, 49)= 0.78 p= 0.38	
P. terminata	LHW	Anova: F(2, 16)= 0.68 p= 0.52	
	Dse	Kruskal-Wallis: H(2, 19)= 12 p= 0.0025*	Mangosiza - Zamora p=0,00315* Mangosiza - Loreto p=0,119 Zamora - Loreto p=1,0
	Ldl	Kruskal-Wallis: H(2, 19)= 1.5 p= 0.47	
	Wts2	Anova: F(2, 16)= 1.0 p= 0.37	
	Lpt	Anova: F(2, 16)= 0.44 p= 0.65	
	Lts	Kruskal-Wallis: H(2, 19)= 1.9 p= 0.38	

P. terminata

There was no clear clustering of populations of *P. terminata* in PCA with raw measures or with size-corrected measures, suggesting that populations proposed by Bick and Bick (1985) do not exist (Fig. 64). Also, only the iridescent black spot in HW (Dse) proposed by these authors differed between populations in both analyses (Tables 1 and 2).

Table 2. Statistical analyses for size correction measures of populations of species of the picta group. Significance limit 0,05. Asterisk represents the significant difference

Species	Variable	Anova / Kruskal - Wallis	Post-hoc test
P. derivata	LHW	Anova: F(2, 23)= 7.3 p= 0.0034*	Limoncocha - Puyo p= 0.036* Limoncocha - Aguaytia p= 0.49 Puyo - Aguaytia p= 0.0038*
	Dse	Kruskal-Wallis: H(2, 26)= 15 p= 0.0004*	Limoncocha - Puyo p= 0.088 Limoncocha - Aguaytia p= 0.206 Puyo - Aguaytia p= 0.00030*
	Wse	Anova: F(2, 23)= 0.5 p= 0.61	
	Ldl	Anova: F(2, 23)= 2.5 p= 0.11	
	Wts2	Anova: F(2, 23)= 0.36 p= 0.70	
	Lpt	Anova: F(2, 23)= 2.3 p= 0.12	
	Lts	Anova: F(2, 23)= 0.13 p= 0.88	
P. gigantea	LHW	Anova: F(2, 41)= 17 p= 0.0000*	Antioquia - Balsapamba p= 0.00054* Antioquia - San Martin p= 0.00013* San Martin - Balsapamba p= 0.020*
	Dse	Anova: F(2, 41)= 19 p= 0.0000*	Antioquia-Balsapamba p= 0.00017* Antioquia - San Martin p= 0.00014* San Martin - Balsapamba p= 0.055
	Ldl	Kruskal-Wallis: H(2, 44)= 14 p= 0.007*	Antioquia-Balsapamba p= 0.11 Antioquia - San Martin p= 0.00069* San Martin - Balsapamba p= 0.035*
	Wts2	Anova: F(2, 41)= 8.1 p= 0.0011*	Antioquia - Balsapamba p= 0.012* Antioquia - San Martin p= 0.0036* San Martin - Balsapamba p= 0.19
	Lpt	Kruskal-Wallis: H(2, 44)= 9.1 p= 0.0103*	Antioquia - Balsapamba p= 1.0 Antioquia - San Martin p= 0.0083* San Martin - Balsapamba p= 0.019*
	Lts	Kruskal-Wallis: H(2, 44)= 9.8 p= 0.0073*	Antioquia - Balsapamba p= 0.25 Antioquia - San Martin p= 0.0074* San Martin - Balsapamba p= 0.12
P. neopicta	Dse	Kruskal-Wallis: H(2, 64)= 48 p= 0.000*	Balsapuerto - Satipo p= 0.0000* Balsapuerto - Tingo Maria p = 0.0000* Satipo - Tingo Maria p = 0.080
	Wse	Kruskal-Wallis: H(2, 64)= 0.13 p= 0.93	
	Ldl	Anova: F(2, 61)= 29 p= 0.0000*	Balsapuerto - Satipo p= 0.00012* Balsapuerto - Tingo Maria p = 0.00012* Satipo - Tingo Maria p = 0.97
	Wts2	Anova: F(2, 61)= 2.0 p= 0.14	
	Lpt	Anova: F(2, 61)= 2.0 p= 0.15	
	Lts	Kruskal-Wallis: H(2, 64)= 4.3 p= 0.12	

P. procera	Dse	Kruskal-Wallis: H(1, 51)= 29 p= 0.000*	
	Wse	Kruskal-Wallis: H(1, 51)= 0.044 p= 0.83	
	Ldl	Anova: F(1, 49)= 88 p= 0.0000*	
	Wts1	Anova: F(1, 49)= 31 p= 0.0000*	
	Lpt	Anova: F(1, 49)= 19 p= 0.00007*	
	Lts	Anova: F(1, 49)= 3.4 p= 0.0704	
P. terminata	Dse	Kruskal-Wallis: H(2, 19)= 12 p= 0.0025*	Mangosiza - Zamora p=0.0032* Mangosiza - Loreto p=0.12 Zamora - Loreto p=1.0
	Ldl	Anova: F(2, 16)= 2.3 p= 0.72	
	Wts2	Anova: F(2, 16)= 1.7 p= 0.20	
	Lpt	Anova: F(2, 16)= 5.1 p= 0.020*	Mangosiza - Zamora p=0.81 Mangosiza - Loreto p=0.015* Zamora - Loreto p=0.085
	Lts	Anova: F(2, 16)= .94 p= 0.41	

Species level study for genus *Polythore*

The PCA analysis indicates that the character related more closely with size was length of the HW (Fig. 65). The projection variables of the PCA show the following groups of measures that are more related to each other, and thus provide the same morphometric information: 1) width of HW (WHW), length of pterostigma (Lpt), length of DCP to nodus (Lbn), width of pterostigma (Wpt), and length from nodus to RP_1 ending point (LnRP1), and 2) width of distal lobes of genital ligula (Wdl), extension of iridescent black spot in HW (Dse), and width of terminal segment of male genital ligula in lateral lobes (Wts1).

There was no clear differentiation among 18 species of the genus, and only in the analysis with raw measurements some individuals of *P. aurora* separated into a distinctive group (Fig. 66). The PCA with size-corrected measures did not improve clustering of species, except for *P. aurora, P. batesi*, *P. beata*, and *P. mutata*; according to Bick and Bick (1986) species that belong to the batesi group tend to cluster better (Fig. 67).

Although species of the genus did not differ in morphometric characters there are discrete characters which distinguish them, most of them related to color pattern of wings and some to male genital ligula.

CONCLUSIONS

Presence of supplementary sectors between RP_2 and IR_2 beginning proximal to pterostigma in HW is a diagnostic character for males of *Polythore*. Other useful characters for identification of males of *Polythore* are: one thickened Ax at vicinity of arculus (shared with *Cora* and *Miocora* but distinct from *Euthore*, which has two thickened Ax); four or more supplementary sectors between CuA and MP in HW (shared with *Euthore*, but distinct from *Cora*, *Chalcopteryx*, *Chalcothore*, *Miocora*, and *Stenocora* which have less than four sectors); and two supplementary sectors between MP and MA in HW (shared with *Chalcopteryx* and *Chalcothore*, but distinct from other genera which have no supplementary sectors).

A statistically significant difference between populations proposed in the literature was found only for populations of *P. procera* from Puyo and Colombia, and for populations of *P. gigantea* from Antioquia, Balsapamba, and San Martin. Extension of HW iridescent black spot and length of distal lobes of male genital ligula, proposed by Bick and Bick (1985) to differentiate between populations of the picta group, were different in populations of each species of the picta group, except in *P. terminata* in which the second character was not significantly different among its populations. The difference found between populations was not correlated to their biogeographical or altitudinal distribution.The new characters studied to differentiate populations were not statistically different in most of species. Correcting the effect of body size did not improve differentiation between populations.

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CHAPTER 2

PHYLOGENETIC ANALYSIS OF THE GENUS *Polythore* Calvert, 1917 (ODONATA: POLYTHORIDAE)

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ABSTRACT

Polythore comprises 20 species of damselflies distributed in western South America, in the foothills of the eastern slope of the Andes, and in the Amazon region. A cladistic analysis of all the species of *Polythore* plus 29 outgroup species was performed based on wing venation, wing pattern coloration of male and female, and male genital ligula. Character coding and processing was conducted through DELTA package and phylogenetic analyses using NONA of the WinClada package. Partitioned analysis using male and female characters were designed and were compared with a total evidence analysis. The statistical support for individual clades was assessed with bootstrap values calculated from 3,000 Bootstrap replicates and Bremer support values. A strict homology as support of the monophyly of *Polythore* was found. Of the six species groups proposed in the literature, only three were found to be natural groups. The sister group of *Polythore* is *Euthore*. Total evidence analysis had the lowest percentage of strict homologies (22%) while partitioned analysis of male characters had the highest percentage of strict homologies with 37.5%.

Key words. Damselfly, male, female, total evidence, monophyly.

RESUMEN

Polythore comprende 20 especies de caballitos del diablo distribuidos en el oeste de Suramérica, en las estribaciones de la Cordillera de los Andes y en la región Amazónica. Se llevó a cabo un análisis cladístico incluyendo todas las especies de *Polythore* y 29 especies del grupo externo basado en coloración alar de macho y hembra y caracteres morfológicos de la lígula genital del macho. Los caracteres se codificaron y procesaron en el software DELTA y los análisis filogenéticos fueron llevados a cabo usando NONA bajo el paquete WinClada. Se realizaron análisis particionados usando caracteres del macho y de la hembra, y sus resultados se compararon con un análisis de evidencia total. Soporte estadístico para los clados individuales fue evaluado a través de Bootstrap con 3.000 réplicas y con soporte de Bremer. Una homología soporta la monofilia de *Polythore*. De los seis grupos de especies propuestos en la literatura, solo tres son naturales. El grupo hermano de *Polythore* es *Euthore*. El análisis de evidencia total presentó el menor porcentaje de homologías estrictas (22%) mientras que el análisis particionado con los caracteres del macho presentó el mayor número de homologías estrictas con 37.5%.

Palabras clave. Caballitos del diablo, señal filogenética, variabilidad morfológica, morfometría geométrica.

INTRODUCTION

Polythoridae is a neotropical damselfly family belonging to the suborder Zygoptera that includes 57 species distributed in seven genera: *Chalcopteryx*, *Chalcothore*, *Cora*, *Euthore*, *Miocora*, *Polythore*, and *Stenocora* (Garrison *et al*., 2010). The species of Polythoridae are insects of medium to large size, with squarish pterothorax and short abdomen, wings with dense venation, a long pterostigma, and usually show colored patches which are sometimes iridescent at sunlight.

Polythoridae is considered a monophyletic family with the following synapomorphies: RP3 and IR2 begin closer to arculus than to nodus and postnodal crossveins of C-RA and RA-RP spaces are not aligned (Rehn, 2003; Bybee *et al*., 2008; Garrison *et al*., 2010). Nevertheless, the current phylogenetic hypotheses of the family differ about the intergeneric relationships. Rehn (2003) proposed *Euthore* as the sister group of *Polythore*, and these two genera being the sister group of *Miocora*; instead, Bybee *et al*. (2008) proposed *Cora* as the sister group of *Polythore* and *Euthore* clade. These hypotheses could need revision since Garrison *et al*. (2010) proposed that genera like

Miocora and *Cora* are most likely synonymous.

The genus *Polythore* was described by Hagen in Selys, 1853 as *Thore* from one male of *P. gigantea* but the name was preoccupied by *Thore* Koch, 1850 in Arachnida, therefore Calvert in 1917 proposed *Polythore* as replacement name for *Thore. Polythore* is the second largest genus of the family with 20 species; its distribution is strictly Neotropical, mainly in west South America, the Andes foothills, and the Amazon region. Traditional characters for *Polythore* identification are: one thickened Ax at vicinity of arculus (shared with *Cora* and *Miocora*) differing from *Euthore*, which has two thickened Ax; four or more supplementary sectors between CuA and MP in HW (shared with *Euthore*); and two supplementary sectors between MP and MA in HW (shared with *Chalcopteryx* and *Chalcothore*) differing from *Cora* (Fig. 3). From our taxonomic revision of the genus (see chapter 1) we found that in males the presence of supplementary sectors between RP_2 and IR_2 veins beginning proximal to pterostigma in hind wing is the diagnostic character of *Polythore*.

The first revision of the genus was developed by Bick and Bick (1985) including six species of the picta group. Later, in 1986 these authors revised the remaining species of the genus. According to Bick and Bick (1985, 1986) *Polythore* is divided into six species groups: batesi, boliviana, concinna, picta, victoria, and vittata, these groups are defined by differences in hind wing length, wings color patterns, number of cells under pterostigma, length of the distal lobes of the male genital ligula, and segmentation of the lateral lobe of the male genital ligula. Also, Bick and Bick (1986) proposed relationships among some species based on color pattern of the wings.

Polythore has been included in some phylogenetic studies of the order Odonata (Rehn, 2003; Bybee *et al*., 2008); however, no specific study of its species relationships has been conducted and the current phylogenies include no more than three species of the genus.

Considering this context a phylogenetic study of the *Polythore* was conducted with the following objectives: 1) to test whether *Polythore* is a monophyletic taxon, 2) to propose a phylogenetic hypothesis of relationships of the species of *Polythore*, and 3) to test whether species groups of the genus are natural groups.

MATERIALS AND METHODS

Taxa

The analysis included 49 species as follows: the 20 species of the *Polythore* and 29 species as outgroup. For the ingroup includes representatives of all described species. As many specimens as possible were analyzed in order to record variation, a total of 736 specimens were included. Outgroup includes representative species of all genera of Polythoridae: *Chalcopteryx* (five species), *Chalcothore montgomeryi*, *Cora* (11 species), *Euthore* (six species), *Miocora* (two species), and *Stenocora percornuta*. Two species of *Hetaerina* (Calopterygidae) and one of *Heteragrion* (Megapodagrionidae) were also included based on Rehn (2003) and Bybee *et al*. (2008) proposals.

Specimens from the following collections (acronyms are provided within brackets) were studied: D. R. Paulson Collection, Seattle, Washington, USA (DRPC); Florida State Collection of Arthropods, Gainesville, Florida, USA (FSCA); Instituto de Ciencias Naturales, Bogotá, Colombia (ICN); K.W. Knopf Collection (KWKC); Museo de Historia Natural Universidad de los Andes (ANDES); Museo Entomológico Francisco Luis Gallego, Medellín, Colombia (MEFLG); Museo Entomológico Universidad del Valle, Cali, Colombia (MUSENUV); N. v Ellenrieder Personal Collection; R.W. Garrison Collection, Sacramento, California, USA (RWGC); Royal Belgian Institute of Natural Sciences, Brussels, Belgium (RBINS); The Natural History Museum, London, UK (BMNH); United States National Museum, Washington D.C, USA (USNM); University of Michigan, Museum of Zoology, Ann Arbor, Michigan, USA (UMMZ); Zoologische Staatssammlung München, Germany (ZSM).

Character coding and cladistic analyses

Seventy-one morphological characters were analyzed. Characters were coded directly from the specimens in most species. In *Chalcopteryx machadoi* Costa, 2005, *Chalcopteryx sebrai* Santos & Machado, 1961, *Chalcothore montgomeryi* (Racenis, 1968), and *Micora pellucida* Kennedy, 1940 character information was obtained from original descriptions since no specimens were available. Characters were defined as proposed by Sereno (2007). According to this proposal the logical structure of a character includes the character *per se* and the statement, the character *per se* is

composed by the structure location (locator), the aspect that varies (variable), and the variable modifier (variable qualifier), and the statement is the mutually exclusive condition of a character (character state). Wing veins nomenclature follow Riek and Kukalová-Peck´s (1984) proposal, body morphology follows Westfall and May´s (2006). The characters were encoded in a matrix using the DELTA package (Descriptive Language for Taxonomy, Dallwitz [2000]). All multistate characters were treated as non-additive; polymorphic states were coded for characters 20, 45, 54, 62, 63, 64, 68, 69, 71; missing data are indicated by a "?" sign and inapplicable data by a "-" sign.

The matrix compiled 71 characters in total, 12 from wing venation, 40 from adult male (characters 13 to 52) and 19 from adult female (characters 53 to 71). The informative value of male and female characters sets was assessed by running these separately and looking at tree resolution, consistency and retention indexes. A total evidence analysis was performed including all characters. In all analysis the wing venation characters were included.

Cladistic analyses were carried out under parsimony criteria and using program NONA of the WinClada package v.1.00.08 (Nixon 1999-2002). The heuristics search based on Ratchet search algorithm (Nixon, 1999) was conducted using tree-bisection-reconnection (TBR) branch swapping. A progressive increase of search replicates up to 100.000 was conducted until reaching a stabilization of the number of fundamental trees and thus a confident assessment of tree search thoroughness. Ratchet search was conducted with 10% of characters resampled and 10 trees retained for replicate. The support for individual nodes was assessed with Bootstrap values calculated from 3,000 replicates and also with absolute Bremer support values using a sample of 100,000 suboptimal trees that were 1 to 10 steps longer than the most parsimonious trees (MPTs).

Regardless of the controversy about the use of consensus tree (Barrett *et al*., 1991), we agree with Nixon and Carpenter (1996) that the consensus tree can be understood as a summary of the congruent information found in the fundamental cladograms. Therefore the strict consensus trees of total evidence and partitioned data were used to analyze and to compare the phylogenetic relationships and to track the characters.

Characters

Wing venation

1. *Quadrangle in both wings, proximal side, length*: less than twice its side distal (1); twice as long as its distal side (2)

2. *Wings, petiolation*: absent (1); present (2)

3. *Wings petiolation, length*: less than half the length between base and arculus (1); half length between base and arculus (2); equal to length between base and arculus (3)

4. *Antenodals veins, number*: 2 (1); more than 10 (2)

5. *Postnodal veins of C-RA and RA-RP spaces*: aligned (1); non aligned (2)

6. *Forewing, shape*: longer and narrower than hind wing (1); similar to hind wing (2)

7. *Cells between CuA vein and margin posterior of the hind wing*: crosslinked (1); arranged in a row (2)

8. *Thickened antenodal veins in hind wing, number*: 0 (1); 1 (2); 2 (3)

9. *CuA vein apically*: unbranched (1); branched (2)

10. *Male hind wing, supplementary sectors between IR_2 and RP_2 proximal to pterostigma*: absent (1); present (2)

11. *Male hind wing, supplementary sectors between CuA and MP*: zero to three (1); four or more

12. *Male hind wing, supplementary sectors between MP and MA, number*: 0 (1); 2 (2)

Male

13. *Forewing and hind wing of male, red basal spot*: absent (1); present (2)

14. *Male forewing, color pattern*: similar to hind wing (1); different to hind wing (2)

15. *Forewing and hind wing of male, amber coloration*: absent (1); present (2)

16. *Forewing and hind wing of male, smoky gold coloration*: absent (1); present (2)

17. *Male hind wing, complete black iridescent coloration*: absent (1); present (2)

18. *Forewing and hind wing of male, infumate*: absent (1); present (2)

19. *Forewing and hind wing of male, infuscate*: absent (1); present (2)

20. *RP vein of male hind wing, color*: as the rest of venation (1); different from the rest of venation, yellow to proximal side of pterostigma (2); different from the rest of venation, yellow beyond to distal side of pterostigma (3)

21. *Forewing and hind wing of male, black iridescent basal spot*: absent (1); present (2)

22. *Male hind wing, iridescent black spot that continues to the apex*: absent (1); present (2)

23. *Male hind wing, iridescent black spot that continues to the apex, percentage*: zero to 30 (1); between 30 and 60 (2); over 60 (3)

24. *Male hind wing, white band disrupting iridescent black spot*: absent (1); present (2)

25. *Male hind wing, spot crescent-shaped*: absent (1); present (2)

26. *Male hind wing, spot crescent-shaped, color*: white (1); grayish (2); ochre (3); beige (4)

27. *Male forewing, white nodal band*: absent (1); present (2)

28. *Male hind wing, white nodal band*: absent (1); present (2)

29. *Male hind wing, white nodal band, extending*: to near at pterostigma (1); slightly distal to nodus (2)

30. *Male forewing, orange-yellow band*: absent (1); present (2)

31. *Male hind wing, orange-yellow band*: absent (1); present (2)

32. *Male hind wing, orange-yellow band beginning*: proximal to nodus (1); slightly distal to nodus (2)

33. *Male wings, pale yellow trapezoidal spot*: absent (1); present (2)

34. *Male forewing, beige to creamy yellow irregular spot*: absent (1); present (2)

35. *Male forewing, ochre round spot*: absent (1); present (2)

36. *Male hind wing, whitish spot*: absent (1); present (2)

37. *Male hind wing, triangular white spot*: absent (1); present (2)

38. *Male wings, white band preceding the iridescent black or brown spot that continuous to the apex*: absent (1); present (2)

39. *Male hind wing, lunula on the axis of the Costa vein*: absent (1); present (2)

40. *Male hind wing, black iridescent band*: absent (1); present (2)

41. *Male genital ligula, distal lobes*: absent (1); present (2)

42. *Male genital ligula, antero-lateral lobes*: absent (1); present (2)

43. *Male genital ligula, lateral lobes*: longer than wide (1); wider than long (2)

44. *Male genital ligula, projection of the lateral lobes*: absent (1); present (2)

45. *Male genital ligula, projection of the lateral lobes, shape*: tubular (1); laminar (2)

46. *Male genital ligula, hairs in the projections of lateral lobes*: absent (1); present (2)

47. *Male genital ligula, protuberance in lateral lobes*: absent (1); present (2)

48. *Male genital ligula, terminal fold, width*: equal to the width at level of the lateral lobes (1);

bigger than width at the level of lateral lobes (2)

49. *Male cerci, ventro-medial process*: with an inner-ventral ridge at mid-length (1); with a large inner-ventral tooth at mid-length (2)

50. *Male paraproct*: vestigial, plate like (1); no vestigial, developed (2)

51. *Male paraproct*: with a digitiform process (1); rounded lacking processes (2)

52. *Male S10, dorsum*: lacking a strong upright horn higher than cercus length (1); with a strong upright horn higher than cercus length (2)

Female

Number inside square brackets indicates the number for the partitioned analysis and trees.

53. [13] *Female, polychromatic*: absent (1); present (2)

54. [14] *Female, forewing*: hyaline (1); with bands or spots (2)

55. [15] *Female hind wing, brown iridescent spot with orange reflections*: absent (1); present (2)

56. [16] *Female, forewing, infuscate*: absent (1); present (2)

57. [17] *Female hind wing, bright triangular white spot*: absent (1); present (2)

58. [18] *Female forewing, ochre or yellow band*: absent (1); present (2)

59. [19] *Female hind wing, ochre or yellow band*: absent (1); present (2)

60. [20] *Female hind wing, proximal edge of the ochre or yellow band*: oblique (1); concave (2)

61. [21] *Female, row of teeth on outer valve of ovipositor*: single throughout (1); double apically (2)

62. [22] *Female forewing, black or brown iridescent spot that extends continuously to the apex*: absent (1); present (2)

63. [23] *Female hind wing, black or brown iridescent spot that extends continuously to the apex*: absent (1); present (2)

64. [24] *Female, hind wing, narrow band of light brown translucent*: absent (1); present (2)

65. [25] *Female forewing, black iridescent medial spot*: absent (1); present (2)

66. [26] *Female hind wing, black iridescent medial spot*: absent (1); present (2)

67. [27] *Female wings, black iridescent spot interrupted by a white band*: absent (1); present (2)

68. [28] *Female, forewing, white band*: absent (1); present (2)

69. [29] *Female, hind wing, white band*: absent (1); present (2)

70. [30] *Female, hind wing, edges of the white band*: straight (1); curved (2)

71. [31] *Female, wings, white spot*: absent (1); present (2)

RESULTS AND DISCUSSION

Phylogenetic analyses

In the analysis of total evidence and in the partitioned analyses, the number of most parsimonious trees (MPTs) increased as we progressively increase the number of search replicates of Ratchet search to 100,000 (Table 2). However, the topology of the consensus trees was the same with polytomies located in the same places in all cases; this result indicates that the increased number of trees as replications are added is due to specific areas where no informative characters were found.

Table 2. Number of most parsimonious trees with respect to Ratchet replicates. Total evidence analysis L = 119, CI = 0.62, RI = 0.83; Male characters analysis L = 79, CI = 0.72, RI = 0.89; Female characters L = 45, CI = 0.68, RI = 0.91.

	Most parsimonious trees		
Ratchet replicates	***Total evidence***	***Male characters***	***Female characters***
2,000	192	18	24
5,000	290	49	75
10,000	1,027	51	93
15,000	742	53	62
20,000	904	49	136
25,000	1,580	78	78
30,000	1,748	85	116
40,000	1,067	54	129
50,000	782	60	362
60,000	2,294	54	151
70,000	1,771	49	334
80,000	3,300	72	332
100,000	2,652	77	258

Monophyly of Polythore, interspecific relationships, and species groups

In agreement with previous studies (Rehn, 2003; Bybee *et al.*, 2008) *Polythore* was a monophyletic clade in the total evidence and partitioned analyses (male and female characters). One strict homology (i.e. a character transformation that occurs only once in the tree as indicated by a retention index of 1) supports its monophyly; this character is the presence in males of the supplementary sectors between IR_2 and RP_2 proximal to pterostigma ([character 10(2)], Fig. 3a).

In the consensus tree of the total evidence analysis the follow clades were recovered (*P. mutata* (*P. aurora*, *P. batesi*)), (*P. boliviana*, *P. manua*, *P. williamsoni*), and ((*P. neopicta*, *P. procera*), (*P. picta*, *P. derivata*), *P. terminata*, *P. lamerceda*, *P. gigantea*). The first clade was supported by the character width of terminal fold bigger than width at the level of lateral lobes [character 48(20)] (Fig. 13a) (Bootstrap= 56, Bremer= 1); within this clade *P. aurora* was recovered as a sister species of *P. batesi*, this relationship is supported by three strict homologies being the clade with the highest number of homologies within the genus [characters 30(2), 65(2), 66(2)], the support values of this clade were: Bootstrap= 98, Bremer= 2. There were no strict homologies that support the clade (*P. boliviana*, *P. manua*, *P. williamsoni*) and its support values were low (Bootstrap < 50 and Bremer= 1, Fig. 72). The latter clade corresponds to the picta group proposed by Bick and Bick

(1985) and it was supported by the presence of the iridescent black spot continues to the apex in male hind wing ([character 22(2), Fig. 5]); its Bootstrap value was under 50 and Bremer was 1. Two clades were recovered within the picta group (*P. neopicta*, *P. procera*) and (*P. derivata*, *P. picta*), for the first clade supports values were: Bootstrap= 63 and Bremer= 1 and for the last were: Bootstrap < 50 and Bremer= 1. Each clade was supported by one synapomorphy (Fig. 72).

The consensus trees of each partitioned analysis show more resolution than consensus tree of the total evidence analysis. The consensus tree of male characters analysis presented the highest resolution with 11 clades (Fig. 70) in contrast with eight clades of the consensus of the female characters analysis (Fig. 71).

In the male characters analysis the clade corresponding to picta group was supported by the same character than that from the total evidence analysis [character 22]; however, the Bootstrap value was 62 being higher than the Bootstrap value for this clade in the total evidence analysis. Within the picta group recovered in the male characters analysis the only clade (*P. neopicta*, *P. procera*) was retained (Bootstrap= 64, Bremer= 0; Fig. 70). In addition, in this analysis *P. concinna* appears as sister species of *P. spaeteri*, this relationship is supported by the character amber coloration of the male wings (character 15, Figs. 9 and 26), the support values of this clade were Bootstrap= 61, Bremer= 1 (Fig. 73); considering the similarities between the wing coloration and the morphology of the male genital ligula of these two species and their relationship as sister species I believe that *P. spaeteri* may considered as part of the concinna group proposed by Bick and Bick (1986).

The clade corresponding to the boliviana group ((*P. boliviana*, *P. ornata*) *P. williamsoni*, *P. manua*) was recovered in the male characters analysis and two synapomorphies support it (Fig. 70) as follows, presence of the crescent-shaped spot in HW [character 25(2)] and presence of lunula on HW [character 39(2)] (Bootstrap value = 61, Bremer= 1). *P. boliviana* is the sister species of *P. ornata*, as supported by the synapomorphy beige to creamy yellow irregular spot in FW [character 34(2)] its support values are Bootstrap < 50 and Bremer = 1 (Fig. 73). *P. victoria* appears as the sister species of the boliviana group, but this relationship was not supported by any strict homology and its Bootstrap < 50 and Bremer = 0.

The last clade recovered in the analysis of the male characters ((*P. beata*, *P. chiribiquete*), *P. mutata*, *P vittata* (*P. aurora*, *P. batesi*)) was supported by one strict homology, antero-lateral lobes of the male genital ligula present [character 42(2)] (Figs. 7a, 13-15, 30, 31, 51); nevertheless this

clade had Bremer= 1 and Bootstrap < 50 (Fig. 73).

In the consensus tree of the female characters analysis none of the species group proposed by literature was recovered (Fig. 71). Five clades were supported by strict homologies but with Bootstrap values under 50 and Bremer values of 1. None of the clades found in this analysis were recovered in the total evidence or in the male characters analyses. *Polythore aurora* appears as a sister species of *P. batesi* as supported by two synapomorphies, absence of the black iridescent medial spot in FW and HW [characters 65[25](2), 66[26](2)] (Fig. 71); also the Bootstrap and Bremer values of this clade were the highest of the genus (Fig. 74).

The clade *Polythore aurora* - *P. batesi* was a recurring clade in the three analyses (Figs. 69-71). Also its support values were the highest within the genus (Figs. 72-74). Three synapomorphies supporting this clade in the total evidence analysis are evidence that these characters are congruent.

The species groups proposed by Bick and Bick (1986) for *Polythore* were characterized by non-unique characters mainly of wing coloration pattern. Also, since three of the six proposed groups are composed by only one species, we expected them to be paraphyletic taxa.

The sister group of *Polythore* was *Euthore* in the total evidence and the male characters analyses in agreement with the proposal of Rehn (2003) and Bybee *et al*. (2008) while in female characters analysis the phylogenetic relations between *Cora*, *Chalcothore*, *Chalcopteryx*, *Euthore* and *Polythore* are not resolved (Fig. 71). In the total evidence and the male characters analyses the presence of the projection of the lateral lobes in the male genital ligula [character 44(2)] groups the genera *Stenocora*, *Micora*, *Cora*, *Euthore*, and *Polythore* leaving the clade *Chalcothore* - *Chalcopteryx* as a basal clade (Figs. 69, 71). In all analyses the species of the genus *Cora* appear as a polytomy.

As expected, Polythoridae was a monophyletic family and its three synapomorphies are: proximal side of quadrangle twice as long as its distal side [character 1(2)] and postnodal veins of C-RA and RA-RP spaces non aligned [character 5(2)] and male paraproct vestigial like a plate [character 50(1)].

Male characters vs. female characters

The analysis of total evidence, i.e. male and female characters together, yielded 3,300 MPTs of 119 steps each (CI = 0.62, RI = 0.83). In general MPTs proposed the same relationships within *Polythore* but these differed in the relationships of the outgroups. The strict consensus tree had 140 steps (CI = 0.52, RI = 0.75, fig. 69). The highest values of Bootstrap occurred in the outgroups, but some high values are observed within *Polythore*. Bremer values were generally low except *Hetaerina* clade that is supported with Bootstrap= 98 and Bremer= 5 (Fig. 72). The analysis of the male characters yielded 85 MPTs of 79 steps each (CI = 0.72, RI = 0.89). The strict consensus had 82 steps (CI = 0.69, RI = 0.88, fig. 70) and present the highest resolution of the three analyses for *Polythore* species; of the 11 clades inside *Polythore* eight were supported by at least one strict homology. Bootstrap values were higher for the outgroups, although the range of this support for *Polythore* was 61 to 82. In general, Bremer values were low (< 3) except for the clade *Hetaerina* (Figure 73).

362 MPTs were produced in the analysis of the female characters (Length = 45, CI = 0.68, RI = 0.91). The strict consensus of these (Length = 50, CI = 0.62, RI 0.88, fig. 71) showed low resolution compared with male characters analysis but high resolution when compared with the total evidence analysis. The Bootstrap values were the lowest of the three analyses and within *Polythore* only one clade presented bootstrap support higher to 50. Bremer values are lower than in other analysis (Fig. 74).

Considering the amount and variety of sources of characters available in the last decades for estimating phylogenies, sets or types of characters can be analyzed in different ways: 1) combining data prior to phylogenetic analysis (i.e. total evidence) (Kluge, 1989; Barrett *et al.*, 1991), 2) analyzing separately each data set performing partitioned analyses, then comparing the consensus of each these (de Queiroz, 1993), and 3) analyzing separately the data then obtaining the combined consensus (de Queiroz, 1993). For the first method Bull *et al*. (1993) stated that the data sets must be not significantly heterogeneous with respect to the reconstruction model, because different subsets of the characters may have evolved under different ways; whereby according to Chippindale and Wiens (1994) the result of a combined analysis could be misleading. In this study both set of characters, male and female, are morphological therefore these data sets selected could not be heterogeneous with respect to their rates of evolution; case can occur when comparing morphological data with molecular data.

On the other hand, in the literature the partitioned analysis is advocated due its property to keep the information defined by a shared similar history. Simultaneously, other authors recommend combined analysis because it is argued that this method increases the chance that true phylogenetic support from reliable characters may be diluted (Bull *et al*., 1993). Considering that of the three analyses carried out in this study, the total evidence analysis has the lowest resolution and the male characters analysis had the highest, I would think that male characters are weak. Nevertheless, 34.9% of the characters included in the male characters analysis correspond to strict homologies while in the female characters analysis is 31.6% and in the total evidence analysis is 22%. This indicates that the male characters are not weak, instead provide greater percentage of strict homologies compared with the female characters but there is conflict between these two types of characters. This conflict may arise because females have a higher number of polymorphic characters, 37% in contrast with 5% in the male characters.

It is worth mentioning that strict homologies are strong support for the clades found in the phylogenetic analyses compared with statistical supports because these are characters that have a unique origin and thus are evolved only once in the history of the lineage.

CONCLUSIONS

Polythore is a monophyletic taxon supported by one synapomorphy. Only three of the species groups proposed by the literature are natural groups. The male characters in the genus provide higher phylogenetic information than female characters.

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Appendix. Morphological character matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Heteragrion sp.	1	2	3	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Hetaerina capitalis	1	1	-	2	1	2	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Hetaerina occisa	1	1	-	2	1	2	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Chalcopteryx rutilans	2	2	1	2	2	1	2	3	2	1	1	2	1	2	1	1	2	1	1	1	1	1	-	1	1	-	1	1	-
Chalcopteryx scintillans	2	2	1	2	2	1	2	3	2	1	1	2	1	2	1	1	2	1	1	1	1	1	-	1	1	-	1	1	-
Chalcopteryx radians	2	2	1	2	2	1	2	3	2	1	1	2	1	1	1	1	2	1	1	1	1	1	-	1	1	-	1	1	-
Chalcopteryx sebrai	2	2	1	2	2	1	2	3	2	1	1	2	1	2	1	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Chalcopteryx machadoi	2	2	1	2	2	1	2	3	2	1	1	2	1	1	1	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Chalcothore montgomeryi	2	2	1	2	2	2	2	3	2	1	1	2	1	1	1	1	1	1	1	1	2	1	-	1	1	-	1	1	-
Cora xanthostoma	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Cora inca	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Cora marina	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Cora cyane	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Cora modesta	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Cora munda	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Cora notoxantha	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Cora obscura	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Cora semiopaca	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Cora chirripa donnellyi	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Cora lugubris	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Micora peraltica	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Micora pellucida	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Stenocora percornuta	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Euthore fassli	2	2	1	2	2	2	2	3	2	1	2	1	1	1	1	1	1	1	2	1	1	1	-	1	1	-	1	1	-
Euthore fasciata	2	2	1	2	2	2	2	3	2	1	2	1	1	1	1	1	1	1	1	1	1	1	-	1	1	-	2	2	1
Euthore fastigiata	2	2	1	2	2	2	2	3	2	1	2	1	1	1	1	1	1	1	1	1	1	1	-	1	1	-	2	2	1
Euthore inlactea	2	2	1	2	2	2	2	3	2	1	2	1	1	1	1	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Euthore hyalina	2	2	1	2	2	2	2	3	2	1	2	1	1	1	1	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Euthore meridana	2	2	1	2	2	2	2	3	2	1	2	1	1	1	1	1	1	1	1	1	1	1	-	1	1	-	2	2	1
Polythore aurora	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	2	1	1	1	-	1	1	-	1	1	-
Polythore batesi	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	2	2	1	1	-	1	1	-	1	1	-
Polythore beata	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	1	1	1	1	1	1	-	1	1	-	1	2	2

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Polythore chiribiquete	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Polythore boliviana	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	1	1	2	2	1	1	-	1	2	2	1	1	-
Polythore concinna	2	2	2	2	2	2	2	2	2	2	2	2	1	1	2	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Polythore derivata	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	2	1	1	1	-	1	1	-
Polythore gigantea	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	2	3	1	1	-	1	1	-
Polythore lamerceda	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	2	2	1	1	-	1	1	-
Polythore manua	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	2	3	1	1	-	1	2	3	1	1	-
Polythore mutata	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	2	1	1	1	-	1	1	-	2	2	2
Polythore ornata	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	1	1	1	2	1	1	-	1	2	1	1	1	-
Polythore neopicta	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	(1, 2)	1	2	2	1	1	-	1	1	-
Polythore picta	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	2	2	1	1	-	1	1	-
Polythore procera	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	2	2	1	1	-	1	1	-
Polythore spaeteri	2	2	2	2	2	2	2	2	2	2	2	2	1	1	2	1	1	1	1	1	1	1	-	1	1	-	1	1	-
Polythore terminata	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	2	1	1	1	-	1	1	-
Polythore victoria	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	1	1	1	2	1	1	-	2	1	-	1	1	-
Polythore vittata	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	2	1	1	1	-	2	1	-	1	1	-
Polythore williamsoni	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	2	1	1	1	2	1	1	-	1	2	4	1	1	-

Appendix continued

	3										4										5									
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Heteragrion sp.	1	1	-	1	1	1	1	1	1	1	1	2	1	1	1	-	-	1	1	1	2	2	1	1	1	1	1	1	1	1
Hetaerina capitalis	1	1	-	1	1	1	1	1	1	1	1	2	1	2	1	-	-	1	1	1	2	2	1	1	2	1	1	1	1	1
Hetaerina occisa	1	1	-	1	1	1	1	1	1	1	1	2	1	2	1	-	-	1	1	1	2	2	1	1	2	1	1	1	1	1
Chalcopteryx rutilans	1	1	-	1	1	1	1	1	1	1	1	2	1	1	1	-	-	1	1	1	1	2	1	1	1	2	1	1	1	1
Chalcopteryx scintillans	1	1	-	1	1	1	1	1	1	1	1	2	1	1	1	-	-	1	1	1	1	2	1	?	?	?	?	?	?	?
Chalcopteryx radians	1	1	-	1	1	1	1	1	1	1	1	2	1	1	1	-	-	1	1	1	1	2	1	?	?	?	?	?	?	?
Chalcopteryx sebrai	1	1	-	1	1	1	1	1	1	1	1	?	1	1	1	-	-	1	1	1	1	2	1	?	?	?	?	?	?	?
Chalcopteryx machadoi	1	1	-	1	1	1	1	1	1	1	1	2	1	1	1	-	-	1	1	1	1	2	1	?	?	?	?	?	?	?
Chalcothore montgomeryi	1	1	-	1	1	1	1	1	1	1	1	2	1	1	?	?	?	?	1	1	1	1	1	?	?	?	?	?	?	?
Cora xanthostoma	1	1	-	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	2	1	2	1	?	?	?	?	?	?	?
Cora inca	1	1	-	1	1	1	1	1	1	1	1	2	1	2	2	1	1	1	1	2	1	2	1	?	?	?	?	?	?	?
Cora marina	1	1	-	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	2	1	2	1	?	?	?	?	?	?	?
Cora cyane	1	1	-	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	2	1	2	1	?	?	?	?	?	?	?
Cora modesta	1	1	-	1	1	1	1	1	1	1	1	2	1	2	2	1	1	1	1	2	1	2	1	?	?	?	?	?	?	?
Cora munda	1	1	-	1	1	1	1	1	1	1	1	2	1	2	2	1	1	1	1	2	1	2	1	?	?	?	?	?	?	?
Cora notoxantha	1	1	-	1	1	1	1	1	1	1	1	2	1	2	2	1	1	1	1	2	1	2	1	?	?	?	?	?	?	?
Cora obscura	1	1	-	1	1	1	1	1	1	1	1	2	1	2	?	?	?	1	1	2	1	2	1	?	?	?	?	?	?	?
Cora semiopaca	1	1	-	1	1	1	1	1	1	1	2	2	1	2	2	(1, 2)	1	1	1	2	1	2	1	?	?	?	?	?	?	?
Cora chirripa donnellyi	1	1	-	1	1	1	1	1	1	1	1	2	1	2	2	1	1	1	1	2	1	2	1	?	?	?	?	?	?	?
Cora lugubris	1	1	-	1	1	1	1	1	1	1	1	2	1	2	?	?	?	1	1	2	1	2	1	?	?	?	?	?	?	?
Micora peraltica	1	1	-	1	1	1	1	1	1	1	1	2	1	2	2	2	1	1	1	2	1	2	1	?	?	?	?	?	?	?
Micora pellucida	1	1	-	1	1	1	1	1	1	1	1	2	1	2	2	2	1	1	1	2	1	2	1	?	?	?	?	?	?	?
Stenocora percornuta	1	1	-	1	1	1	1	1	1	1	1	2	1	1	2	1	1	1	1	1	1	2	2	?	1	1	1	1	1	1
Euthore fassli	1	1	-	2	1	1	1	1	1	1	2	2	1	2	2	2	1	1	1	2	1	2	1	?	?	?	?	?	?	?
Euthore fasciata	1	1	-	1	1	1	1	1	1	1	2	2	1	2	2	2	1	1	1	2	1	2	1	?	1	1	2	1	1	1
Euthore fastigiata	1	1	-	1	1	1	1	1	1	1	2	2	1	2	2	2	1	1	1	2	1	2	1	?	?	?	?	?	?	?
Euthore inlactea	1	1	-	1	1	1	1	1	1	1	2	2	1	2	2	2	1	1	1	2	1	2	1	?	?	?	?	?	?	?
Euthore hyalina	1	1	-	1	1	1	1	1	1	1	1	2	1	2	2	2	1	1	1	2	1	2	1	?	1	1	1	1	1	1
Euthore meridana	1	1	-	1	1	1	1	1	1	1	2	2	1	2	2	2	1	1	1	2	1	2	1	?	1	1	2	1	1	1
Polythore aurora	2	2	1	1	1	1	1	1	1	1	1	2	2	2	2	1	2	1	2	2	1	2	1	1	2	1	2	1	2	2
Polythore batesi	2	2	2	1	1	1	1	1	1	1	1	2	2	2	2	1	2	1	2	2	1	2	1	1	2	1	2	1	2	2
Polythore beata	1	1	-	1	1	1	1	1	1	1	1	2	2	2	2	1	1	1	1	2	1	2	1	1	1	1	1	1	1	1
Polythore chiribiquete	1	2	1	1	1	2	1	1	1	1	1	2	2	2	2	1	1	1	1	2	1	2	1	1	1	1	2	1	1	2

	3										4										5									
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Polythore boliviana	1	1	-	1	2	1	1	1	1	2	1	2	1	2	2	1	1	2	1	2	1	2	1	1	2	1	2	1	2	2
Polythore concinna	1	1	-	1	1	1	1	1	1	1	1	2	1	2	2	1	1	2	1	2	1	2	1	1	2	1	2	1	2	2
Polythore derivata	1	1	-	1	1	1	1	1	2	1	1	2	1	2	2	1	1	2	1	2	1	2	1	2	2	1	1	1	1	1
Polythore gigantea	1	1	-	1	1	1	1	1	1	1	1	2	1	2	2	1	1	2	1	2	1	2	1	2	2	1	1	1	1	1
Polythore lamerceda	1	1	-	1	1	1	1	1	1	1	1	2	1	2	2	1	1	2	1	2	1	2	1	2	2	1	1	1	1	1
Polythore manua	1	1	-	1	1	1	1	1	1	2	1	2	1	2	2	1	1	2	1	2	1	2	1	1	2	1	1	1	2	2
Polythore mutata	1	1	-	1	1	1	1	1	1	1	1	2	2	2	2	1	1	1	2	2	1	2	1	1	2	1	2	1	2	2
Polythore ornata	1	1	-	1	2	1	1	1	1	2	1	2	1	2	2	1	1	2	1	2	1	2	1	2	(1, 2)	1	1	1	1	1
Polythore neopicta	1	1	-	1	1	1	2	1	1	1	1	2	1	2	2	1	1	2	1	2	1	2	1	2	2	1	1	1	1	1
Polythore picta	1	1	-	1	1	1	1	2	2	1	1	2	1	2	2	1	1	2	1	2	1	2	1	1	2	1	1	2	1	1
Polythore procera	1	1	-	1	1	1	2	1	1	1	1	2	1	2	2	1	1	2	1	2	1	2	1	2	2	1	1	1	1	1
Polythore spaeteri	1	1	-	1	1	1	1	1	1	1	1	2	1	2	2	1	1	2	1	2	1	2	1	1	2	1	2	1	1	1
Polythore terminata	1	1	-	1	1	1	1	1	1	1	1	2	1	2	2	1	1	2	1	2	1	2	1	2	2	1	1	1	1	1
Polythore victoria	1	1	-	1	1	1	1	1	1	1	1	2	1	2	2	1	1	2	1	2	1	2	1	2	1	1	1	1	1	1
Polythore vittata	1	1	-	1	1	1	1	1	1	1	1	2	2	2	2	1	2	1	1	2	1	2	1	1	2	1	2	1	1	1
Polythore williamsoni	1	1	-	1	1	1	1	1	1	2	1	2	1	2	2	1	1	2	1	2	1	2	1	1	2	1	1	1	2	2

Appendix continued

	6										7	
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**0**	**1**
Heteragrion sp.	-	1	1	1	1	1	1	1	1	1	-	1
Hetaerina capitalis	-	1	1	1	1	1	1	1	1	1	-	1
Hetaerina occisa	-	1	1	1	1	1	1	1	1	1	-	1
Chalcopteryx rutilans	-	1	1	1	1	1	1	1	1	1	-	1
Chalcopteryx scintillans	?	1	?	?	?	?	?	?	?	?	?	?
Chalcopteryx radians	?	1	?	?	?	?	?	?	?	?	?	?
Chalcopteryx sebrai	?	1	?	?	?	?	?	?	?	?	?	?
Chalcopteryx machadoi	?	1	?	?	?	?	?	?	?	?	?	?
Chalcothore montgomeryi	?	1	?	?	?	?	?	?	?	?	?	?
Cora xanthostoma	?	2	?	?	?	?	?	?	?	?	?	?
Cora inca	?	2	?	?	?	?	?	?	?	?	?	?
Cora marina	?	2	?	?	?	?	?	?	?	?	?	?
Cora cyane	?	2	?	?	?	?	?	?	?	?	?	?
Cora modesta	?	2	?	?	?	?	?	?	?	?	?	?
Cora munda	?	2	?	?	?	?	?	?	?	?	?	?
Cora notoxantha	?	2	?	?	?	?	?	?	?	?	?	?
Cora obscura	?	2	?	?	?	?	?	?	?	?	?	?
Cora semiopaca	?	2	?	?	?	?	?	?	?	?	?	?
Cora chirripa donnellyi	?	2	?	?	?	?	?	?	?	?	?	?
Cora lugubris	?	2	?	?	?	?	?	?	?	?	?	?
Micora peraltica	?	2	?	?	?	?	?	?	?	?	?	?
Micora pellucida	?	2	?	?	?	?	?	?	?	?	?	?
Stenocora percornuta	-	1	1	1	1	1	1	1	1	1	-	-
Euthore fassli	?	2	?	?	?	?	?	?	?	?	?	?
Euthore fasciata	-	2	1	1	2	1	1	1	1	1	-	2
Euthore fastigiata	?	2	?	?	?	?	?	?	?	?	?	?
Euthore inlactea	?	2	?	?	?	?	?	?	?	?	?	?
Euthore hyalina	-	2	1	1	1	1	1	1	1	1	-	1
Euthore meridana	-	2	1	1	2	1	1	1	1	2	1	1
Polythore aurora	1	2	1	1	1	2	2	1	1	1	-	1
Polythore batesi	1	2	1	1	1	2	2	1	1	1	-	1

	60	1	2	3	4	5	6	7	8	9	70	1
Polythore beata	-	2	1	1	1	1	1	1	1	2	1	1
Polythore chiribiquete	1	2	1	1	1	1	1	1	1	1	-	1
Polythore boliviana	2	2	1	1	1	1	1	1	1	1	-	1
Polythore concinna	2	2	1	1	1	1	1	1	1	1	-	1
Polythore derivata	-	2	(1, 2)	(1, 2)	1	1	1	1	2	2	2	1
Polythore gigantea	-	2	(1, 2)	(1, 2)	1	1	1	1	1	1	-	1
Polythore lamerceda	-	2	(1, 2)	(1, 2)	1	1	1	1	1	1	-	1
Polythore manua	2	2	1	1	1	1	1	1	1	1	-	1
Polythore mutata	1	2	1	1	1	1	1	1	1	1	-	1
Polythore ornata	-	2	1	1	(1, 2)	1	1	(1, 2)	1	(1, 2)	2	1
Polythore neopicta	-	2	(1, 2)	(1, 2)	1	1	1	1	(1, 2)	(1, 2)	2	1
Polythore picta	-	2	1	1	1	1	1	1	2	2	2	1
Polythore procera	-	2	(1, 2)	(1, 2)	(1, 2)	1	1	1	(1, 2)	(1, 2)	2	(1, 2)
Polythore spaeteri	-	2	1	1	1	1	1	1	1	1	-	1
Polythore terminata	-	2	(1, 2)	(1, 2)	1	1	1	1	1	1	-	1
Polythore victoria	-	2	1	1	2	1	1	1	1	2	1	1
Polythore vittata	-	2	1	1	1	1	1	2	2	2	1	1
Polythore williamsoni	1	2	1	1	1	1	1	1	1	1	-	1

CHAPTER 3

RELATIONSHIP BETWEEN INTRASPECIFIC VARIABILITY AND PHYLOGENETIC SIGNAL IN THE DAMSELFLY GENUS *Polythore* (ODONATA: POLYTHORIDAE)

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ABSTRACT

Male genitalia have traditionally been considered important morphological features for systematics of insects providing diagnostic characters. There is also broad agreement that genital characters are under sexual selection and therefore may tend to evolve rapidly exhibiting less phylogenetic signal. However, recent studies have challenged this prediction even finding that genital characters provide more phylogenetic information than other characters. On the other hand, the relationship between intraspecific variability and the informative value of the characters is little known. Body regions with great intraspecific variation would be expected to be equally labile at interspecific level; therefore they may have little information value. This study tested this prediction using characters of two body regions. Morphological variability of wings and of genitalia was analyzed using the species of *Polythore* as a model through lineal and geometric morphometrics. Coefficient of variation was used for quantifying intraspecific variability and was compared with the retention index and percentage of strict homologies as indicators of the phylogenetic signal of the region. Cladistics analyses of the two body regions, wings and genitalia, were carried out. Coefficient of variation was higher in wings than in genitalia. Average retention index was higher in genitalia but the percentage of strict homologies was higher in wings, indicating that although wings vary more than genitalia they provide more phylogenetic information.

Key words. Damselfly, coefficient of variation, landmarks, strict homology.

RESUMEN

Los genitales del macho tradicionalmente han sido considerados características morfológicas importantes en la sistemática de insectos ya que proporcionan caracteres diagnósticos. Existe amplio consenso de que los caracteres genitales están bajo selección sexual por lo cual tienden a evolucionar rápidamente y presentan menos señal filogenética. Sin embargo, estudios recientes desafían esta predicción encontrando que los genitales proveen más información filogenética que otros sistemas de caracteres. Por otra parte, es poco conocida la relación entre la variabilidad intraespecífica y el valor informativo de caracteres morfológicos. Se espera que regiones corporales con gran variación intraespecífica sean igualmente lábiles a nivel interespecífico, por lo que tendrían poco valor informativo. Este estudio pone a prueba esta predicción mediante la comparación de caracteres de dos regiones corporales. La variabilidad morfológica de las alas y los genitales fue analizada utilizando las especies de *Polythore* como modelo; para esto se usaron aproximaciones morfométricas lineales y geométricas. El coeficiente de variación se utilizó para cuantificar la variabilidad intraespecífica y se comparó con el índice de retención y el porcentaje de homologías estrictas como indicadores de la señal filogenética de cada región corporal. Se llevaron a cabo análisis cladísticos de evidencia total y análisis particionados de los caracteres de alas y genitales. El coeficiente de variación fue mayor en las alas que en los genitales. El índice de retención promedio fue mayor en los caracteres de genitales que en los de las alas, no obstante el porcentaje de homologías estrictas fue mayor en las alas. Esto indica que a pesar de que las alas varían más que los genitales proveen mayor información filogenética.

Palabras clave. Caballitos del diablo, coeficiente de variación, landmarks, homologías estrictas.

INTRODUCTION

Regardless of morphological intraspecific variability being widely seen in nature this is not as closely studied in traditional taxonomy and systematic as it should be. In most of these studies, the characters that show variability (polymorphic) have been leaved aside as mentioned by Mayr (1969) “characteristics, by which individuals of the same populations differ from each other, are not taxonomic characters”. The basis for this exclusion is that these characters are unreliable for distinguishing species and to infer their phylogenetic relationships. Nevertheless, Wiens and

Servedio (1997) have found that polymorphic characters may content phylogenetic information, and their exclusion reduces the accuracy of phylogenetic analysis. Causes of the relationship between homoplasy and variability are linked to the canalization of characters. Canalization, as mentioned Debat and David (2001) refers to the elimination of phenotypic variation in a character. Therefore, when intraspecific variability is high, canalization is low and therefore characters do not provide information on historical relationships since these are highly labile and subject to homoplasy.

Male genitalia have traditionally been considered relevant morphological characteristics in systematics of insects by providing diagnostic characters. Nevertheless, there is extensive agreement in considering that genital characters could be under sexual selection pressure and thus genitalia diversification (Arnquist, 1997; Eberhard, 1985; McPeek, *et al*., 2008; Takami and Sota, 2007). Therefore genital characters tend to evolve rapidly exhibiting less phylogenetic signal. For example, Arnquist and Rowe (2002) found little correlation between phenotypic similarity and phylogenetic information in their study of male genitalia in species of the water striders genus *Gerris*. The same tendency was found by Eberhard (2004) in several groups of insects and spiders. However, Song and Bucheli (2009) have recently challenged this prediction since they found that in several insect studies genital characters provide more phylogenetic information than other systems of characters. On the other hand, relationship between intraspecific variability and informative phylogenetic value of the characters system has been poorly studied. Body regions with great intraspecific variation would be expected to be equally labile at interspecific level; therefore they may have little information value.

Although Odonata has been widely used as model in studies of ecology, evolution, and sexual selection (Córdoba-Aguilar and Cordero-Rivera, 2008; 2005) no study about phylogenetic informativeness of characters that show intraspecific variability has been conducted. Therefore, this study tests whether characters with high intraspecific variability in males of the genus *Polythore*, that theoretically have a lower canalization, provide less phylogenetic signal.

Polythore inhabits streams, shade muddy creeks, and seepage areas along small forest creeks from lowland Amazon to Andean cloud forests (Garrison *et al*., 2010). Ecology and behavior of the genus is little known (De Marmels, 1982) and only the larva of *Polythore spaeteri* has been described; it lives under rocks in small fast moving forest streams (Etscher *et al*., 2006). However, it is known that males in the family are territorial and spend most of the time perching, remaining still though alert. Male territory is established along small streams and close to oviposition sites. After

mating occurs female lays the eggs on a piece of submerged wood (Esquivel, 2006). Also, *Polythore* is a genus of polygamous species as most of Zygoptera.

MATERIALS AND METHODS

Males of *Polythore boliviana, P. concinna, P. derivata, P. gigantea, P. mutata, P. ornata, P. neopicta, P. procera,* and *P. terminata* were used as model subjects.

Morphological variability

Two body regions were considered: genitalia and wings. Following lineal variables were measured for genital ligula: length of distal lobes (*Ldl*), width of distal lobes (*Wdl*), and length of terminal segment (*Lts*) (Fig. 2c, d), and for wings: length of pterostigma (*Lpt*), width of pterostigma (*Wpt*) (Fig. 2a), length from base to nodus (*Lbn*), length from nodus to RP_1 vein ($LnRP_1$), width of HW (*WHW*) (Fig. 1). Also, geometric variables were used to analyze wing color pattern variability. Following criteria proposed by Zelditch *et al*. (2004) were taken into account for choosing landmarks: they should 1) be homologous anatomical loci; 2) do not alter their topological positions relative to other landmarks; 3) provide adequate coverage of the morphology; 4) be replicable and reliable; and 5) lie within the same plane. Around 10 to 15 landmarks were defined and digitalized in the species studied (Figs. 68, 69). It is worth mentioning that chosen landmarks located in intersections of spots with principal veins, to ensure their status as true landmarks (Table 1). Shape variation of wing color pattern and variation of landmarks location between individuals of each species were analyzed through shape deformation or Thin-plate spline analysis. Software used for geometric morphometric analyses included TpsDig v.2.16 (Rohlf, 2010), TpsUtil v. 1.46 (Rohlf, 2010b), and Thin-plate spline v. 1.20 (Rohlf, 2004).

After obtaining morphometric variables of two body regions, I calculated standard deviation and average of each variable, and from these I calculated their coefficient of variation (*CV*).

Table 1. Landmarks defined for hind wing by species

Species	Landmarks
P. batesi	1. Distal costal plate – DCP (Ninomiya and Yoshizawa, 2009) 2. Proximal intersection of yellow spot with Costa vein 3. Distal intersection of spot with Costa vein 4. Proximal costal side of pterostigma 5. End of RP_1 vein 6. Intersection of brown spot with the RP_2 vein 7. Distal intersection of yellow spot with posterior margin of wing 8. Point of intersection between yellow spot and first supplementary sector between RP_3 and MA 9. Distal intersection of RP_2 vein and yellow spot 10. Proximal intersection between RP_2 and yellow spot 11. Proximal intersection of MA and yellow spot 12. Proximal intersection of yellow spot with posterior margin of wing 13. Starting point of CuA
P. boliviana	1. Distal costal plate – DCP 2. Proximal intersection of crescent-shaped spot (*scs*) with Costa vein 3. Distal intersection of *scs* with Costa vein 4. Proximal costal side of pterostigma 5. End of RP_1 vein 6. Intersection of brown spot with posterior margin of wing 7. Distal intersection of *scs* with posterior margin of wing 8. Intersection between *scs* and first supplementary sector between RP_3 and MA 9. Distal intersection of RP_2 vein and *scs* 10. Proximal intersection of RP_2 vein and *scs* 11. Proximal intersection between MA and *scs* 12. Proximal intersection of *scs* with posterior margin of wing 13. Starting point of CuA
P. derivata	1. Distal costal plate – DCP 2. Proximal intersection of white band with Costa vein 3. Distal intersection of white band with Costa vein 4. Proximal costal side of pterostigma 5. End of RP_1 vein 6. Intersection of iridescent brown spot with posterior margin of wing 7. Distal intersection of white band with posterior margin of wing 8. Intersection between white band and fourth supplementary sector between RP_1 and RP_2 9. Intersection between white band and second supplementary sector between RP_1 and RP_2 10. Intersection between white band and distal supplementary sector between RP_3 and MA 11. Proximal intersection of white band with posterior margin of wing 12. Starting point of CuA
P. gigantea	1. Distal costal plate – DCP 2. Proximal intersection of iridescent black spot with Costa vein 3. Proximal costal side of pterostigma 4. End of RP_1 vein 5. Intersection of iridescent brown spot with RP_2 and posterior margin of wing 6. Intersection of iridescent brown spot with MA and posterior margin of wing 7. Proximal intersection of iridescent brown spot with posterior margin of wing 8. Intersection of iridescent brown spot with CuA 9. Intersection of iridescent brown spot with RP_3 10. Intersection of iridescent brown spot with RP_1 11. Starting point of CuA

P. mutata	1. Distal costal plate – DCP 2. Proximal intersection of white band with Costa vein 3. Distal intersection of white band with Costa vein 4. Proximal costal side of pterostigma 5. End of RP_1 vein 6. End of RP_2 vein 7. Distal intersection of white band with posterior margin of wing 8. Intersection between white band and first supplementary sector between RP_3 and MA 9. Intersection of white band and RP_2 10. Proximal intersection between white band and IR_2 11. Intersection of white band and CuA 12. Intersection of white band with posterior margin of wing 13. Starting point of CuA
P. neopicta	1. Distal costal plate – DCP 2. Proximal intersection of iridescent black spot with Costa vein 3. Proximal costal side of pterostigma 4. End of RP_1 vein 5. End of RP_2 vein 6. Proximal intersection of iridescent black spot with posterior margin of wing 7. Intersection between iridescent black spot and distal supplementary sector between RP_3 and MA 8. Point of intersection of iridescent black spot with first supplementary sector between RP_1 and RP_2 9. Starting point of CuA
P. ornata	1. Distal costal plate – DCP 2. Proximal intersection of *scs* with Costa vein 3. Distal intersection of *scs* with Costa vein 4. Proximal costal side of the pterostigma 5. End of RP_1 vein 6. Intersection of brown spot with posterior margin of wing 7. Distal intersection of crescent-shaped spot (*scs*) with posterior margin of wing 8. Intersection between *scs* and first supplementary sector between RP_3 and MA 9. Distal intersection of RP_2 vein and *scs* 10. Proximal intersection of RP_2 vein and *scs* 11. Proximal intersection of *scs* with posterior margin of wing 12. Proximal intersection of brown spot with posterior margin of wing 13. Intersection of the brown spot and CuA 14. Proximal intersection between brown spot and IR_2 15. Starting point of CuA
P. procera	1. Distal costal plate – DCP 2. Proximal intersection of white spot with Costa vein 3. Distal intersection of spot with Costa vein 4. Proximal costal side of pterostigma 5. End of RP_1 vein 6. Intersection of brown spot with IRP_2 vein 7. Intersection of white spot, iridescent black spot, and posterior margin of wing 8. Point of intersection between white spot and MP 9. Intersection of white spot, iridescent black spot, and RP_2 vein 10. Intersection between white spot and RP_2 11. Point of intersection between bifurcation of CuA and white spot 12. Proximal intersection of white spot with posterior margin of wing 13. Starting point of CuA

P. terminata	1.	Distal costal plate – DCP
	2.	Proximal intersection of iridescent black spot with Costa vein
	3.	Proximal costal side of pterostigma
	4.	End of RP_1 vein
	5.	End of RP_2 vein
	6.	Proximal intersection of iridescent black spot with posterior margin of wing
	7.	Intersection between iridescent black spot and first supplementary sector between IR_2 and RP_3
	8.	Point of intersection of iridescent black spot with first supplementary sector between RP_1 and RP_2
	9.	Starting point of CuA

Phylogenetic signal

Morphological male characters were defined as proposed by Sereno (2007) and encoded in a matrix using the DELTA package (Descriptive Language for Taxonomy, Dallwitz [2000]). All multistate characters were treated as non-additive. Wing veins nomenclature follow Riek and Kukalová-Peck´s (1984) proposal. Cladistic analyses were carried out under parsimony criteria and using program NONA of the WinClada package v.1.00.08 (Nixon 1999-2002). The heuristics search based on Ratchet search algorithm (Nixon, 1999) was conducted using tree-bisection-reconnection (TBR) branch swapping with 50.000 replicates. Two body regions were defined: genital ligula (12 characters) and wing color pattern (28 characters). Partitioned analysis was conducted for characters of the two body regions. A total evidence analysis was also carried out. Retention index (RI) of each character and tracing characters through the cladogram identifying strict homologies were used in order to evaluate phylogenetic signal. Retention index and percentage of homologies were compared with coefficient of variation.

Characters

Male wing venation

1. *Quadrangle in both wings, proximal side, length*: less than twice its distal side (1); twice as long as its distal side (2)

2. *Wings, petiolation*: absent (1); present (2)

3. *Wings petiolation, length*: less than half the length between base and arculus (1); half length between base and arculus (2); equal to length between base and arculus (3)

4. *Antenodals veins, number*: 2 (1); more than 10 (2)

5. *Postnodal veins of C-RA and RA-RP spaces*: aligned (1); non aligned (2)

6. *Forewing, shape*: longer and narrower than hind wing (1); similar to hind wing (2)

7. *Cells between CuA vein and posterior margin of hind wing*: crosslinked (1); arranged in a row (2)

8. *Thickened antenodal veins in hind wing, number*: 0 (1); 1 (2); 2 (3)

9. *CuA vein apically*: unbranched (1); branched (2)

10. *Male hind wing, supplementary sectors between IR_2 and RP_2 proximal to pterostigma*: absent (1); present (2)

11. *Male hind wing, supplementary sectors between CuA and MP*: zero to three (1); four or more

12. *Male hind wing, supplementary sectors between MP and MA, number*: 0 (1); 2 (2)

Wings

13. *Male forewing and hind wing, red basal spot*: absent (1); present (2)

14. *Male forewing, color pattern*: similar to hind wing (1); different to hind wing (2)

15. *Male forewing and hind wing, amber coloration*: absent (1); present (2)

16. *Male forewing and hind wing, smoky gold coloration*: absent (1); present (2)

17. *Male hind wing, complete black iridescent coloration*: absent (1); present (2)

18. *Male forewing and hind wing, infumate*: absent (1); present (2)

19. *Male forewing and hind wing, infuscate*: absent (1); present (2)

20. *RP vein of male hind wing, color*: as the rest of venation (1); different from the rest of venation, yellow to proximal side of pterostigma (2); different from the rest of venation, yellow beyond to distal side of pterostigma (3)

21. *Forewing and hind wing of male, black iridescent basal spot*: absent (1); present (2)

22. *Male hind wing, iridescent black spot that continues to apex*: absent (1); present (2)

23. *Male hind wing, iridescent black spot that continues to apex, percentage*: zero to 30 (1); between 30 and 60 (2); over 60 (3)

24. *Male hind wing, white band disrupting iridescent black spot*: absent (1); present (2)

25. *Male hind wing, crescent-shaped spot (scs)*: absent (1); present (2)

26. *Male hind wing, crescent-shaped spot, color*: white (1); grayish (2); ochre (3); beige (4)

27. *Male forewing, white nodal band*: absent (1); present (2)

28. *Male hind wing, white nodal band*: absent (1); present (2)

29. *Male hind wing, white nodal band, extending*: to near pterostigma (1); slightly distal to nodus (2)

30. *Male forewing, orange-yellow band*: absent (1); present (2)

31. *Male hind wing, orange-yellow band*: absent (1); present (2)

32. *Male hind wing, orange-yellow band beginning*: proximal to nodus (1); slightly distal to nodus (2)

33. *Male wings, pale yellow trapezoidal spot*: absent (1); present (2)

34. *Male forewing, beige to creamy yellow irregular spot*: absent (1); present (2)

35. *Male forewing, ochre round spot*: absent (1); present (2)

36. *Male hind wing, whitish spot*: absent (1); present (2)

37. *Male hind wing, triangular white spot*: absent (1); present (2)

38. *Male wings, white band preceding iridescent black or brown spot that is continuous to apex*: absent (1); present (2)

39. *Male hind wing, lunula on axis of Costa vein*: absent (1); present (2)

40. *Male hind wing, black iridescent band*: absent (1); present (2)

Genitals

41. *Male genital ligula, distal lobes*: absent (1); present (2)

42. *Male genital ligula, antero-lateral lobes*: absent (1); present (2)

43. *Male genital ligula, lateral lobes*: longer than wide (1); wider than long (2)

44. *Male genital ligula, projection of lateral lobes*: absent (1); present (2)

45. *Male genital ligula, projection of lateral lobes, shape*: tubular (1); laminar (2)

46. *Male genital ligula, hairs in projections of lateral lobes*: absent (1); present (2)

47. *Male genital ligula, protuberance in lateral lobes*: absent (1); present (2)

48. *Male genital ligula, terminal fold, width*: equal to width at level of lateral lobes (1); higher than width at level of lateral lobes (2)

49. *Male cerci, ventro-medial process*: with an inner-ventral ridge at mid-length (1); with a large inner-ventral tooth at mid-length (2)

50. *Male paraproct*: vestigial, plate like (1); well developed (2)

51. *Male paraproct*: with a digitiform process (1); rounded lacking processes (2)

52. *Male S10, dorsum*: lacking a strong upright horn higher than cercus length (1); with a strong upright horn higher than cercus length (2)

RESULTS AND DISCUSSION

The coefficient of variation (CV) was higher for the morphometric variables of the wings than for the genitalia in all species studied (Fig. 75). *Polythore ornata* was the species with the highest CV for wings and for genitalia, followed by *P. boliviana* for wings and *P. procera* for genitalia; the species with the lowest CV for wings was *P. terminata* and for genitalia was *P. neopicta* (Fig. 76). This change is represented by the vectors of the landmarks of each individual. A set of shorts vectors with homogeneous orientation means less variation among individuals while a long set of long vectors with heterogeneous orientation means more variation between individuals. Vectors for landmarks of *P. ornata*, *P. boliviana*, and *P. procera*, species with the highest CV, were dissimilar for each species, showing a set of long and short vectors with opposite directions in most landmarks (Figs. 76 b, g, h). *P. terminata* showed a shorter and more homogeneous set of vectors (Fig. 76 i), this variation matching its low CV.

With respect to phylogenetic signal, the total evidence analysis yielded 85 trees of 79 steps each, its strict consensus had 82 steps and CI = 0.69 and RI = 0.88 (Fig. 80). The analysis with genital characters produced 11 trees of 33 steps each; the consensus tree had 36 steps (CI 0.72, RI 0.83, Fig. 81). The analysis with wings characters produced 110 trees of 61 steps each; consensus tree had 63 steps (CI 0.71, RI 0.88, Fig. 82). Consensus tree of the total evidence analysis showed the highest resolution compared with partitioned analyses; which recovered 11 clades. In contrast, the analysis with genital characters exhibited the lowest resolution with two large polytomies.

In the total evidence analysis (Fig. 78a) average retention index of characters included for genitalia analysis (ri= 0.87) was higher than for characters included for wings analysis (ri= 0.68).This tendency was found in the partitioned analysis, in which average ri for genitalia characters was 0.77 and average ri for wings characters was 0.62 (Fig. 79a). However, average ri may be affected by uninformative characters and by total number of characters of each body region (12 characters for genitalia and 28 for wings). Whereby I consider that analyzing distribution of characters depending of ri (homologies: ri=1, homoplasies: ri=0, and uninformative) is more appropriate since this shows the number of informative characters relative to the total number of characters. Number of strict homologies in wings is higher than in genitalia in both analyses, total evidence (21 and 17% respectively) and partitioned (21% and 17%, respectively) (Fig. 77). In total evidence analysis, percentage of characters with ri equal to zero corresponds to 11% for wings while there were no characters of this ri in genitalia; percentage of this character was similar in the partitioned analyses

(17% for genitalia and 18% for wings). In both phylogenetic analyses, percentage of uninformative characters was higher in wings than in genitalia.

In the total evidence analysis six wing characters support five clades and two characters of genitalia support two clades (Fig. 80). In the partitioned analysis of wings six characters support five clades (Fig. 82) and in the partitioned analysis of genitalia two characters support two clades (Fig. 81). Distribution of characters provides a better analysis of informativeness of characters compared to retention index even though this has been widely used in systematic studies because it is not affected by number of characters in the analysis (Forey *et al*., 1998). Even so, a character can provide high ri value but this ri may result from undesirable processes such a redundant encoding of the character or through phenomenon such as pleiotropy (Wagner *et al*., 2008). Thus, characters that do not exhibit problems of independence and therefore that do not present redundant encoding should support the proposed relationships in different parts of the cladogram, providing more phylogenetic information than characters located in certain clades. In my study genital characters had a high average retention index compared with wing characters but number of clades supported by strict homologies was higher for the wings than for genital characters. This is evidence that wing characters provide more phylogenetic information.

CONCLUSIONS

In synthesis, wings of *Polythore* are most variable body region, and at the same time this region that provides the highest phylogenetic signal. This result differed from the prediction proposed by Debat and David (2001), according to which when intraspecific variability is high, canalization is low and therefore characters do not provide information on historical relationships. On the other hand, our results agreed with Areekul and Quicke (2006) where wing color pattern can provide important phylogenetic information and they would not be in conflict with other morphological characters.

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GENERAL CONCLUSIONS

Polythore currently includes 20 species. Only three of the species groups proposed by the literature are natural groups. Male characters in the genus provide higher phylogenetic information than female characters.

Populations proposed for *P. procera* (Puyo and Colombia) and *P. gigantea* (Antioquia – Balsapamba and San Martin) are significantly different statistically. This difference was not correlated to their biogeographical or altitudinal distribution. The new characters studied to differentiate populations were not statistically different in most species.

Wings represent the most intraspecificaly variable body region in *Polythore*, and at the same time provide the highest phylogenetic signal. Wing color pattern can provide important phylogenetic information and does not conflict with other morphological characters.