



Systematics, Morphology and Biogeography

Taxonomic revision of *Plyomydas* Wilcox & Papavero, 1971 with the description of two new species and its transfer to Mydinae (Insecta: Diptera: Mydidae)

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ARTICLE INFO

Article history:

Received 22 December 2016

Accepted 9 March 2017

Available online 24 March 2017

Associate Editor: Marcia Souto Couri

Keywords:

Mydas flies

Neotropical Region

Cybertaxonomy

Open access

ABSTRACT

The monotypic Neotropical Mydidae genus *Plyomydas* Wilcox & Papavero, 1971, to date confined to coastal Peru, is reviewed. Two new species, *Plyomydas adelphe* sp. nov. and *Plyomydas phalaros* sp. nov., are described from mid-elevational western Argentina, which extends the distribution of the genus considerably. Distribution, occurrence in biodiversity hotspots *sensu* Conservation International, and seasonal incidence are discussed. Descriptions/re-descriptions, photographs, illustrations, and identification keys are provided and made openly accessible in data depositories to support future studies of the included taxa. *Plyomydas* is transferred from the Leptomydinae to the Mydinae: Messiasiini based on the absence of acanthophorite spines on abdominal tergite 10 in females and the presence of vein $M_3 + M_4$ terminating in the costal vein C. Leptomydinae is therefore restricted to the Northern Hemisphere with the exception of *Hessemydas* Kondratieff, Carr & Irwin, 2005 known from Madagascar. *Messiasia notospila* (Wiedemann, 1828) is compared to *Plyomydas* species.

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Introduction

Mydidae flies are a conspicuous part of the Diptera fauna of South America. The largest known Mydidae, and possibly Diptera in general, is *Gauromydas heros* (Perty, 1833) from southern Brazil (see Wilcox and Papavero, 1971; Calhau et al., 2015). Several other species of this genus and species of *Protomydas* Wilcox, Papavero & Pimentel, 1989 are also very large, but rarely observed in nature. The discovery of relatively large specimens of Mydidae from Argentina that do not fit the description of *Gauromydas* Wilcox, Papavero & Pimentel, 1989 or *Protomydas* in several natural history collections initiated the present study.

There are some 476 Mydidae species known world-wide and the largest species and generic diversity is found in southern Africa (Dikow, in press). The Neotropical Region has currently some 85 species in 22 genera in six subfamily taxa (Papavero, 2009, see also Neotropical taxon catalog at asiloid flies web-site). Note that the Neotropical catalog by Papavero (2009) includes Nearctic taxa of Ectyphinae, Leptomydinae, and Rhaphiomidinae.

The Neotropical Leptomydinae include *Plyomydas* Wilcox & Papavero, 1971, a genus with a single species known from Peru, *Nemomydas* Curran, 1934 with eight central American species reaching as far south as Colombia, and possibly *Pseudonomoneura* Bequaert, 1961 in southern Mexico. In general, Leptomydinae is a Northern Hemisphere taxon with only *Hessemydas* Kondratieff, Carr & Irwin, 2005 from Madagascar and *Plyomydas* from Peru penetrating the Southern Hemisphere.

The genus *Plyomydas* was described from a single species, *P. peruviana* Wilcox & Papavero, 1971, occurring in coastal Peru (Wilcox and Papavero, 1971) and has not been studied further since. New material of this genus has been discovered in several natural history collections that extend the distribution of this taxon to the eastern Andes in western Argentina as well as low-elevation Paraguay. These flies are relatively large with a wing length between 15 and 21 mm, but are very rare in entomological collections as only 16 specimens (of a total of 29 *Plyomydas*) were located. In this review, we present a taxonomic revision of *Plyomydas* with the description of two new species from Argentina and the transfer of the genus to the Mydinae.

Almeida and Lamas (2014) record *Plyomydas* from Argentina for the first time by making reference to an undescribed species and provide a key to genera of Mydidae occurring in Argentina. The

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specimen shown in Almeida and Lamas (2014, p. 425) is *Plyomydas phalaros* sp. nov. (MZSP-MZ003846).

Materials and methods

Morphological features were examined using an Olympus SZ60 and a Zeiss SteREO Discovery.V12 stereo microscope. Wing length is measured from the tegula to the distal tip of the wing. The female and male terminalia were first excised and macerated in 10% potassium hydroxide (KOH) at 55 °C followed by neutralization in acetic acid (glacial, CH₃COOH) and rinsing in distilled water (H₂O). They were temporarily stored in 75% ethanol (C₂H₅OH) for examination and illustration and eventually sealed in polyethylene vials containing 100% glycerine (C₃H₈O) and attached to the specimen's pin.

Terminology

Terminology follows Dikow (2009) and Cumming and Wood (2009) (general morphology and abbreviations for setae), Stuckenberg (1999) (antennae), and Wootton and Ennos (1989) (wing venation). Abdominal tergites are abbreviated in the descriptions with 'T', and sternites are abbreviated with 'S'. The terms prothoracic, mesothoracic, and metathoracic are abbreviated 'pro', 'mes', and 'met', respectively. The term pubescence (adjective pubescent) refers to the short, fine microtrichia densely covering certain body parts. Other generalized terms follow the Torre-Bueno Glossary of Entomology (Nichols, 1989).

Species descriptions and re-descriptions

Species descriptions are based on composites of all specimens and not exclusively on the holotype and are compiled from a character matrix of 144 features and 179 character states assembled with Lucid Builder (version 3.5) and eventually exported as natural-language descriptions. These species descriptions have been deposited in the Zenodo data depository and can be accessed in XML-format following the SDD (Structure of Descriptive Data) standard. The structure of terminalia is only described once for the genus and additional species-specific features should be interpreted from the provided illustrations. All taxon names have been registered in ZooBank (Pyle and Michel, 2008). Previous taxon descriptions have been marked-up in TaxonX XML language (Catapano, 2010) and uploaded to the Plazi TreatmentBank from where they are accessible for human and machine reading.

Specimen occurrence data

The following data on species occurrences are given (where available): country, state/province, county, locality, geographic co-ordinates (formatted in both degrees minutes seconds and decimal latitude/longitude), elevation (in meters), date of collection (format: yyyy-mm-dd), habitat information, sampling protocol (if other than hand netting), collector, catalog number (a unique specimen number and any other identifying number), depository (institution and collection code), number of specimens, sex, life stage, name of person who identified the specimen, and any other previous identifications. Each specimen is listed with a unique specimen number (either an institutional catalog number or an AAM-XXXXXX number used by the junior author) that will allow the re-investigation as well as provide a unique Life Science Identifier (LSID). The occurrence of all species is illustrated in distribution maps plotted with <http://www.simplemapp.net> with all of those localities for which co-ordinates are available. Type localities are plotted with a square

symbol while all other specimens are plotted with a circular symbol.

The distribution map includes Biodiversity Hotspots *sensu* Conservation International (Mittermeier, 1998; Myers et al., 2000; Mittermeier et al., 2005). The specimen occurrence data are deposited as a Darwin Core Archive (DwC-A) in the Global Biodiversity Information Facility (GBIF) using the Integrated Publishing Toolkit (IPT) at the NMNH.

Photographs and illustrations

Whole habitus photographs of pinned specimens were taken using a Visionary Digital Passport II system (base and StackShot only), an Olympus OM-D EM-5 Micro 4/3 camera, a 60mm f2.8 macro lens (equivalent to 120 mm focal length in 35 mm photography). The specimens were illuminated by a Falcon FLDM-i200 LED dome-light for even and soft light. Individual RAW-format images were stacked using HeliconFocus Pro (version 6.7) and exported in Adobe DNG-format. For further information on the imaging and post-production workflow see [Photographing asiloid flies](#) blog post. All photographs have been deposited in Morphbank::Biological Imaging and images of additional specimens are available on that platform, too. These images will be automatically harvested by the Encyclopedia of Life (EOL) and are available under the respective species page.

Morphological features were illustrated using a 10 × 10 ocular grid on the Olympus SZ60 stereo microscope and later digitally converted to vector graphics using Adobe Illustrator software. The illustrations of male and female terminalia have been deposited in digital format (svg-format) in [figshare](#).

Key

The dichotomous, interactive key has been built with Lucid Phoenix and the multi-access, matrix-based key with Lucid Builder and both can be accessed on Lucidcentral and the junior author's [research](#) web-site.

Institutions providing specimens

Institutions providing specimens are listed below, together with the abbreviations used in the text when citing depositories (institutionCode), a link to the record in the Global Registry of Biodiversity Repositories (GRBio), and the people who kindly assisted: AMNH – American Museum of Natural History, New York City, New York, USA (D. Grimaldi); BMNH – Natural History Museum, London, UK (E. McAlister); CAS – California Academy of Sciences, San Francisco, California, USA (M. Trautwein); CNC – Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, Ontario, Canada (J. Skevington); CSCA – California State Collection of Arthropods, Sacramento, California, USA (M. Hauser, E. Fisher); IMLA – Fundacion e Instituto Miguel Lillo, Universidad Nacional de Tucumán, Tucumán, Argentina (E. Constanza Perez); IADIZA – Instituto Argentino de Investigaciones de las Zonas Áridas, Mendoza, Argentina (C. Dominguez, S. Roig); MNHN – Museum national d'Histoire naturelle, Paris, France (C. Daugeron, E. Delfosse); MUSM – Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru (G. Lamas, P. Sanchez Flores); MZSP – Museu de Zoologia, Universidade de São Paulo, São Paulo, Brazil (C. Lamas); SMNS – Staatliches Museum für Naturkunde, Stuttgart, Baden-Württemberg, Germany (H.-P. Tschorsnig); ZSMC – Zoologische Staatssammlung, München, Bayern, Germany (M. Kotrba).

Data resources

GBIF: specimen occurrence data-set – [7f2de377-9f9f-4276-b0b8-5c792b499223](https://doi.org/10.15468/tiymja) – DOI [10.15468/tiymja](https://doi.org/10.15468/tiymja).

figshare: illustration collection ID – DOI [10.6084/m9.figshare.c.3650510](https://doi.org/10.6084/m9.figshare.c.3650510).

Lucid Builder: illustrated, multi-entry, matrix-based identification key – keys.lucidcentral.org/keys/v3/plyomydas/.

Lucid Phoenix: illustrated, dichotomous identification key – keys.lucidcentral.org/keys/phoenix/plyomydas/.

Morphbank: image collection ID – 860614.

Plazi TreatmentBank taxon treatments:

Wilcox and Papavero, 1971 – [AD29FFB3FF8E2724FFC56619FFF DFFF6](https://doi.org/10.11646/zookey.116.1.1)

SimpleMappr: distribution map – 6102 (as in Fig. 27) – Google Earth KML file [6102](https://www.google.com/maps/@-12.1234,-52.1234,15z/data=!3m1!1e3!3m2!1s6102!1s6102!1s6102).

Zenodo: natural-language species descriptions from Lucid Builder in SDD format – DOI [10.5281/zenodo.154750](https://doi.org/10.5281/zenodo.154750).

ZooBank nomenclatorial acts:

Wilcox and Papavero, 1971 [B57257ED-AF72-4AEB-AF09-9047 AEDF7D3F](https://doi.org/10.11646/zookey.116.1.1)

Castillo and Dikow 2017 [FF635991-5F13-4B7D-A3E4-D314ABB E9E98](https://doi.org/10.11646/zookey.154750).

Taxonomy

***Plyomydas* Wilcox and Papavero, 1971**

ZooBank [43AF4DE6-F7DE-4F35-801F-BF4248D531BB](https://doi.org/10.11646/zookey.116.1.1)

Plazi TreatmentBank [43AF4DE6-F7DE-4F35-801F-BF4248D531BB](https://doi.org/10.11646/zookey.116.1.1)

Plyomydas Wilcox and Papavero, 1971: 106. Type-species: *Plyomydas peruviensis* Wilcox and Papavero, 1971, by original designation.

Diagnosis: The genus is distinguished from other Mydinae by the absence of a ventral metathoracic tibial keel (Figs. 2 and 20), only slightly enlarged metathoracic femora (Figs. 2 and 20), and a partly pubescent scutum (either stripes Fig. 12 or spots Fig. 19). *Messiasia notospila* (Wiedemann, 1828) (see Figs. 28–33) is somewhat similar to *Plyomydas* because it exhibits a weakly developed tibial keel and a grey pubescence pattern on the scutum, but can be separated from *Plyomydas* based on the more expanded metathoracic femur and male terminalia. The distinct ventro-posterior gonocoxal process is much more developed in *Plyomydas* than it is in *Messiasia* and the two other posterior gonocoxal processes (see Fig. 7) are unique to *Plyomydas* within Mydinae (J. Calhau, pers. comm.). See also Discussion for transfer of *Plyomydas* to Mydinae: Messiasini.

Description: F* abdomen and genitalia (Figs. 10 and 11): densely arranged anteriorly directed setae absent on posterior T and S; T8 with broad anterior rectangular apodeme; T9 simple, rectangular; T9+10 entirely fused, T10 formed by single sclerite, acanthophorite spines absent; 3 spermathecae, all equally large, formed by \pm expanded weakly sclerotized ducts; individual spermathecal duct short; S9 (furca) formed by 1 sclerite, inverted U-shaped (joined anteriorly, separated posteriorly), anterior furcal apodeme absent, lateral furcal apodeme present, median furcal bridge absent.

M* abdomen and terminalia (Figs. 7–9, 21–26): T1–7 well-developed, entirely sclerotized, T8 postero-medially weakly sclerotized, with anterior transverse sclerotized bridge connecting lateral sclerites; T7–8 anteriorly with 2 lateral apodemes; S6 regular, without any special setation postero-medially; S8 simple plate, entire (undivided) ventro-medially, with horn-like antero-lateral processes, not fused to T8 dorso-laterally; epandrium formed by two sclerites, separated medially and only joining anteriorly, distally in dorsal view pointed postero-laterally; subepandrial sclerite without lateral or median protuberances; hypandrium

concave, cup-shaped, entirely sclerotized ventrally, entirely fused with gonocoxite, forming a gonocoxite-hypandrial complex, supra-hypandrial sclerite absent; gonocoxite simple, short, hook-like, without median or lateral protuberance, gonocoxal apodeme present, short (at most slightly extending hypopygium anteriorly); 1 functional phallic prong, short and wide, phallic epimere present, distally simple, evenly rounded; lateral ejaculatory process absent; ejaculatory apodeme formed by single dorso-ventrally oriented plate; ventro-medial margin of parameral sheath heavily sclerotized (appearing entirely closed); parameral sheath long, sperm sac entirely covered; sperm sac appearing \pm heavily sclerotized.

***Plyomydas adelphe* sp. nov.**

ZooBank [27B0A7A0-0548-4F53-97AF-BCFD98B057FC](https://doi.org/10.11646/zookey.154750)

Figs. 1–11, 27

Diagnosis: The species is distinguished from congeners by the scutal pubescence pattern with only three pairs of grey pubescent spots (Figs. 1 and 5) and the absence of a grey pubescent stripe on the posterior anepisternum (Fig. 2).

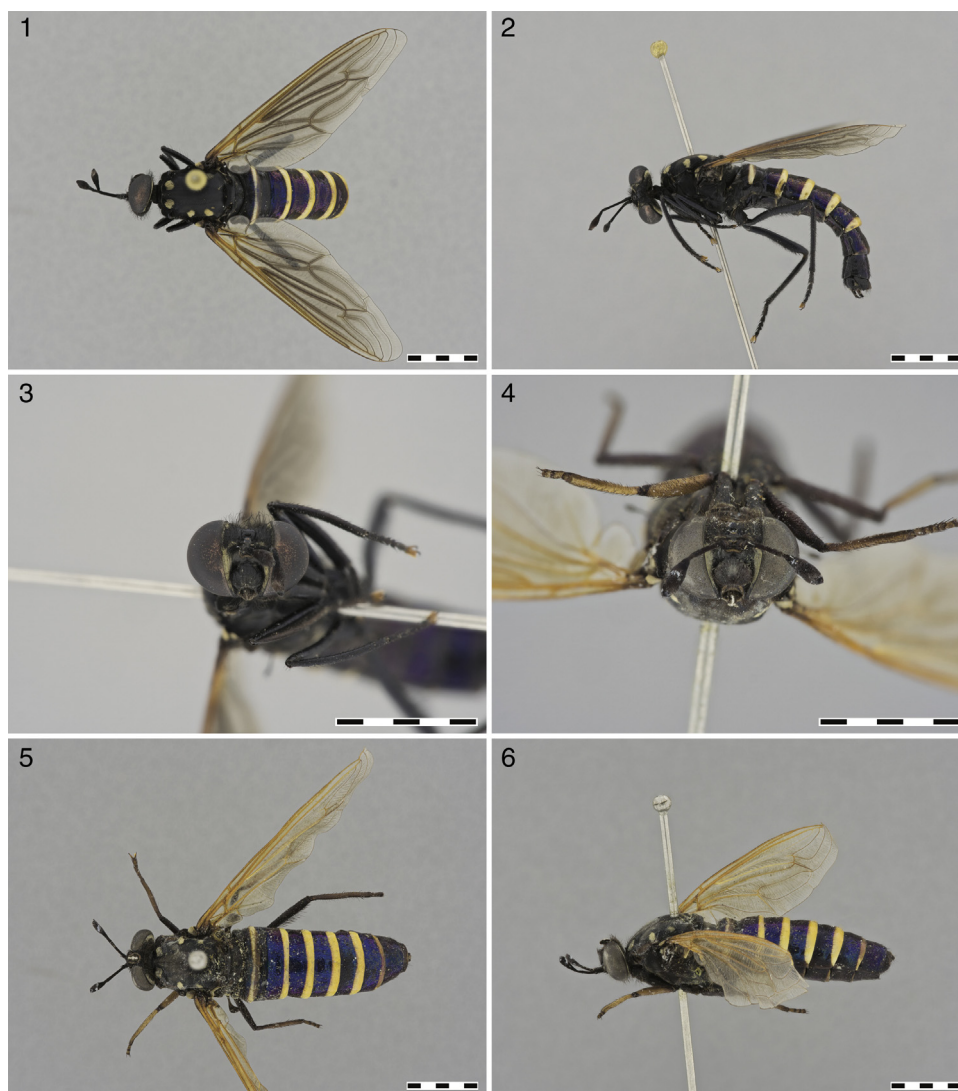
Etymology: From Greek *adelphē* = sister, referring to overall morphological similarity to *Plyomydas phalaros* sp. nov.

Description: Head: black, in general grey pubescent; width distinctly greater than thorax, interocular distance on vertex larger than at ventral eye margin, vertex between compound eyes slightly depressed, parafacial area very narrow, facial gibbosity nearly touching median eye margin; facial gibbosity distinct, well-developed and discernible in lateral view; mystax brown, covering facial gibbosity except dorso-medially; frons not elevated, laterally grey pubescent, medially apubescent; vertex apubescent; postgena lightly grey pubescent; setation: vertex black, frons brown, ocp setae yellow, pocl macrosetae black; ocellar triangle apubescent; proboscis brown, long, reaching fronto-clypeal suture; labellum large, much wider than prementum, longer than prementum and as long as oral cavity, unsclerotized laterally; maxillary palpus cylindrical, light brown, about 1/3 length of proboscis.

Antenna: brown, bulbous part of postpedicel light brown, scape and pedicel black setose dorsally and ventrally, rarely brown setose dorsally and ventrally; postpedicel cylindrical in proximal 1/2, symmetrically bulbous in distal 1/2, ≥ 5.0 times as long as combined length of scape and pedicel, bulbous part brown setose dorsally and ventrally; apical seta-like sensory element situated apically in cavity on postpedicel.

Thorax: black or brown, predominantly apubescent with distinct grey pubescent scutal and pleural spots; scutum uniformly black, surface predominantly smooth, postero-paramedially rivable, lightly grey pubescent with distinct grey pubescent spots: 1 pair antero-paramedially, 2 pairs laterally (1 at transverse suture, 1 postero-laterally), scutal setation comprised of pubescent spots long black or brown setose; dc setae pre- and postsuturally black, acr setae absent, lateral scutal setae black or brown, npl setae 0, spal setae 0, pal setae 0; antepronotum dorso-medially smooth (without any indentation); postpronotal lobe brown to black, lightly grey pubescent; proepisternum, lateral postpronotum, and postpronotal lobe long black setose; scutellum lightly grey pubescent, brown setose, apical scutellar setae absent; mesopostnotum, anatergite, and katatergite lightly grey pubescent, asetose, katatergite elevated and smoothly convex; anterior anepisternum lightly grey pubescent, asetose, supero-posterior anepisternum apubescent, asetose; posterior anepimeron long brown setose, katepimeron asetose; metanepisternum lightly grey pubescent, asetose, metepimeron evenly elevated, same color as T1, grey pubescent, asetose; infra-halter sclerite absent.

Leg: light brown to brown, setation predominantly black; pro, mes, and met coxa lightly grey pubescent, black setose; met trochanter setose medially; femur black or brown, met



Figs. 1–6. Photographs of male and female *Plyomydas adelphe* sp. nov.: (1) M* holotype (USNMENT01242234), dorsal (Morphbank #860756); (2) same, lateral (#860758); (3) same, head anterior (#860760); (4) F* paratype (AAM-004053), head anterior (#860784); (5) same, dorsal (#860780); (6) same, lateral (#860782). Scale line = 5 mm.

femur ± cylindrical only slightly wider than pro and mes femur, in distal ½ macrosetose, 1 antero-ventral and 1 postero-ventral row of macrosetae, postero-ventrally long brown setose; pro and mes tibia laterally arched, met tibia straight, met tibia cylindrical, ventral keel absent, postero-laterally regular setose; pro and mes tarsomere 1 longer than tarsomere 2, but less than combined length of tarsomeres 2–3, met tarsomere 1 as long as combined length of tarsomeres 2–3; pulvillus well-developed, as long as well-developed claw, and as wide as base of claw; setiform empodium absent.

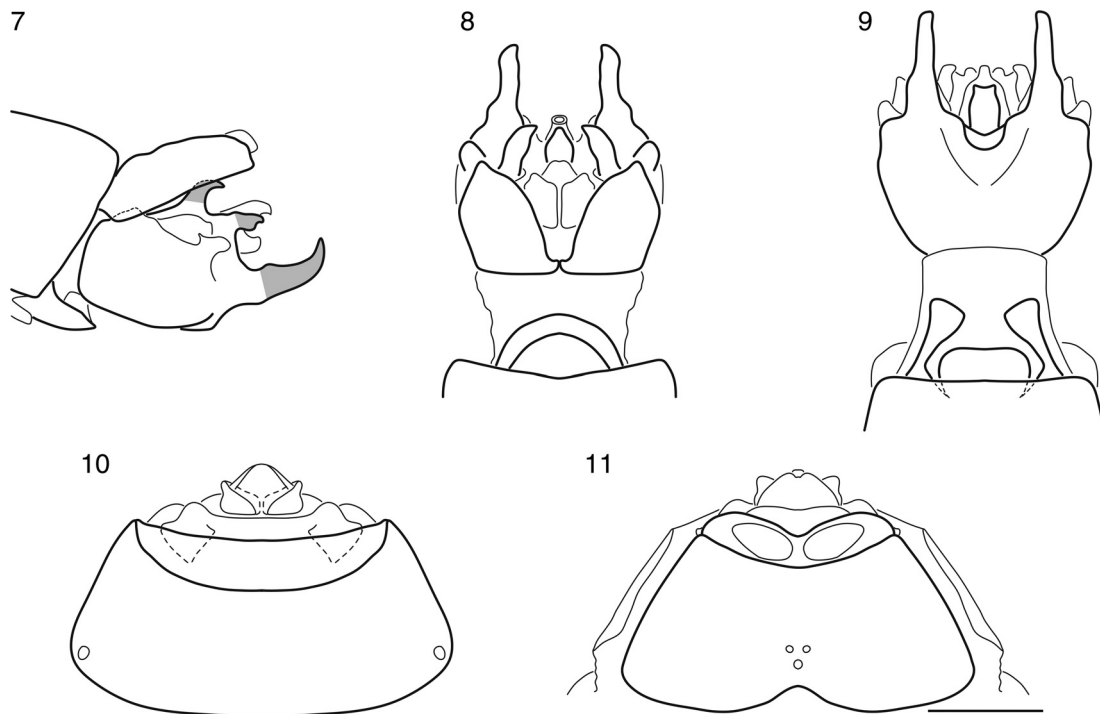
Wing: length = 15.2–18.5 mm; light brown stained, especially along veins, distal ¼ and posterior margin unstained, veins brown, microtrichia absent; cells r_1 , r_4 , r_5 , m_3 , + cup closed except r_5 open; C well-developed, around entire wing; R_4 terminates in R_1 ; R_5 terminates in R_1 ; stump vein (R_3) at base of R_4 present, long but not reaching R_2 ; R_4 and R_5 ± parallel medially; r-m distinct, $R_4 + 5$ and M_1 apart, connected by crossvein; M_1 curves slightly anteriorly at r-m, M_1 (or $M_1 + M_2$) terminates in C; M_4 and CuA split proximally to m-cu (cell m_3 narrow proximally); $M_3 + M_4$ terminate together in C (reaching wing margin); CuP straight, cell cup wide, CuP and wing margin further apart proximally than distally; alula well-developed, very large and partly overlapping with scutellum medially; halter brown.

Abdomen: brown to metallic bluish-black; setation comprised of scattered black setae, surface entirely smooth; T1–7 brown with narrow yellow posterior margin; T1 long brown to black setose, T2–7 short black setose; T1 lightly grey pubescent, T2–7 apubescent; S1 brown with light brown posterior margin, S2–6 brown with narrow yellow posterior margin; S1 asetose, S2–7 sparsely black setose; S apubescent; T2–4 parallel-sided and not constricted waist-like; bullae on T2 black, transversely elongate, surface entirely smooth, T2 surface anterior to bullae smooth.

Type locality: Argentina: Mendoza: Rt. 142 at Mendoza River, 32°35'29"S 068°17'28"W (–32.59139 –68.29111).

Material examined: Argentina: Mendoza: 1M* Rt. 142 at Mendoza River, 21 km NE Costa de Araujo, 32°35'29"S 068°17'28"W, –32.59139 –68.29111, 585 m, 2015-12-04, Steiner, W., Swearingen, J. (USNMENT01242234, Holotype, IADIZA); 1F* Mendoza, 35°52'00"S 068°49'00"W, –32.88944 –68.84583, 1907-00-00 (AAM-004053, Paratype, ZSMC); La Rioja: 1M* Cuesta de Miranda, 29°19'00"S 067°39'00"W, –29.31667 –67.65, 1700 m, 1977-11-29, Willink, A., Fidalgo (AAM-002719, Paratype, MZSP).

Distribution and biodiversity hotspot: Western Argentina in the provinces of La Rioja and Mendoza (Fig. 27). Not known to occur in any biodiversity hotspot.



Figs. 7–11. Male and female terminalia of *Plyomydas adelphe* sp. nov.: (1) M* paratype (MZSP-MZ003844), lateral (posterior gonocoxal processes highlighted in grey); (2) same, dorsal; (3) same, ventral; (4) F* paratype (AAM-004053), dorsal; (5) same, ventral. Scale line = 1 mm, setation omitted. Figshare DOI [10.6084/m9.figshare.4490462](https://doi.org/10.6084/m9.figshare.4490462).

Remarks: Sexual dimorphism is minimal. Based on the three known specimens, females are larger (wing length 18.5 mm in the sole female paratype, 15.2–16.6 mm in two males) and dimorphism only occurs in color of legs and sclerites. The holotype was collected in low flat mesquite desert and dry riverbed.

***Plyomydas peruviansis* Wilcox and Papavero, 1971: 108**

ZooBank [F954F6B0-BC56-4C16-BB82-0D2734030993](https://zoobank.org/F954F6B0-BC56-4C16-BB82-0D2734030993)

Plazi TreatmentBank [511087CB-FFCB-276D-FC9D-67B4FB8EF](https://treatmentbank.org/511087CB-FFCB-276D-FC9D-67B4FB8EF)

D41

Figs. 12–14, 21–23, 27

Diagnosis: The species is distinguished from congeners by the scutal pubescence pattern with three distinct grey pubescent stripes (no spots, Fig. 12), the presence of a grey pubescent stripe on the posterior anepisternum (Fig. 13), and its distribution in coastal Peru (Fig. 27).

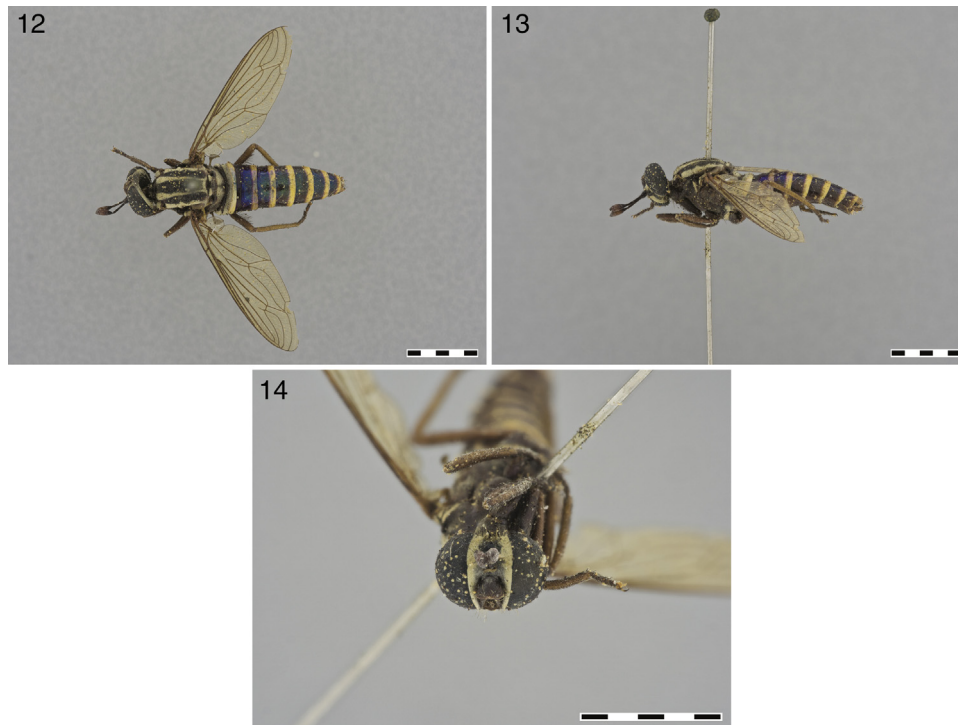
Description: Head: brown, facial gibbosity light brown, in general grey pubescent; width distinctly greater than thorax, interocular distance on vertex larger than at ventral eye margin, vertex between compound eyes slightly depressed, parafacial area very narrow, facial gibbosity nearly touching median eye margin; facial gibbosity distinct, well-developed and discernible in lateral view; mystax yellow, sparse; frons not elevated, entirely grey pubescent; vertex entirely grey pubescent; postgena lightly grey pubescent; setation: vertex yellow, frons brown or light brown, ocp setae yellow, pocl macrosetae light brown; ocellar triangle apubescent; proboscis brown, long, reaching fronto-clypeal suture; labellum large, much wider than prementum, longer than prementum and as long as oral cavity, unsclerotized laterally; maxillary palpus cylindrical, light brown, about ¼ length of proboscis.

Antenna: brown, bulbous part of postpedicel light brown, scape and pedicel brown setose dorsally and ventrally; postpedicel cylindrical in proximal 2/5, symmetrically bulbous in distal 3/5, ≥ 5.0 times as long as combined length of scape and pedicel, bulbous

part brown setose dorsally and ventrally; apical seta-like sensory element situated apically in cavity on postpedicel.

Thorax: light brown, predominantly apubescent with distinct grey pubescent scutal stripes and pleural spots; scutum uniformly brown, surface predominantly smooth, postero-paramedially rivose, predominantly grey pubescent, apubescent paramedian and median stripes (not reaching posterior margin), scutal setation comprised of pubescent stripes short black setose; dc setae pre- and postsuturally brown, acr setae absent, lateral scutal setae brown, npl setae 0, spal setae 0, pal setae 0; anteprepronotum dorso-medially smooth (without any indentation); postpronotal lobe light brown, grey pubescent; proepisternum, lateral postpronotum, and postpronotal lobe short brown setose; scutellum lightly grey pubescent, laterally densely grey pubescent, brown setose, apical scutellar setae absent; mesopostnotum, anatergite, and katatergite lightly grey pubescent, asetose, katatergite elevated and smoothly convex; anterior anepisternum lightly grey pubescent, asetose, supero-posterior anepisternum grey pubescent, asetose; posterior anepimeron short brown setose, katepimeron asetose; metanepisternum grey pubescent, asetose, metepimeron evenly elevated, same color as T1, grey pubescent, asetose; infra-halter sclerite absent.

Leg: light brown to brown, setation predominantly brown; pro, mes, and met coxa lightly grey pubescent, brown setose; met trochanter setose medially; femur light brown, met femur \pm cylindrical only slightly wider than pro and mes femur, in distal ½ macrosetose, 1 antero-ventral and 1 postero-ventral row of macrosetae, postero-ventrally long brown setose; pro and mes tibia laterally arched, met tibia straight, met tibia cylindrical, ventral keel absent, postero-laterally regular setose; pro and mes tarsomere 1 longer than tarsomere 2, but less than combined length of tarsomeres 2–3, met tarsomere 1 as long as combined length of tarsomeres 2–3; pulvillus well-developed, as long as well-developed claw, and as wide as base of claw; setiform empodium absent.



Figs. 12–14. Photographs of male *Plyomydas peruvienis* (AAM-003731): (12) dorsal (Morphbank #860772); (13) same, lateral (#860774); (14) same, head anterior (#860776). Scale line = 5 mm.

Wing: length = 10.7–13.0 mm; slightly brown stained throughout, veins brown, microtrichia absent; cells r_1 , r_4 , r_5 , m_3 , +cup closed except r_5 open; C well-developed, around entire wing; R_4 terminates in R_1 ; R_5 terminates in R_1 ; stump vein (R_3) at base of R_4 present, long but not reaching R_2 ; R_4 and R_5 \pm parallel medially; r-m distinct, $R_4 + 5$ and M_1 apart, connected by crossvein; M_1 curves slightly anteriorly at r-m, M_1 (or $M_1 + M_2$) terminates in C; M_4 and CuA split proximally to m-cu (cell m_3 narrow proximally); $M_3 + M_4$ terminate together in C (reaching wing margin); CuP straight, cell cup wide, CuP and wing margin further apart proximally than distally; alula well-developed, very large and partly overlapping with scutellum medially; halter light brown.

Abdomen: brown to metallic bluish-black; setation comprised of sparsely scattered short brown setae, surface entirely smooth; T1–7 brown with narrow yellow posterior margin; T1 long light brown setose, T2–7 sparsely brown setose; T1 lightly grey pubescent, T2–7 apubescent; S1 brown with light brown posterior margin, S2–6 brown with narrow yellow posterior margin; S1 asetose, S2–7 sparsely black setose; S apubescent; T2–4 parallel-sided and not constricted waist-like; bullae on T2 black, transversely elongate, surface entirely smooth, T2 surface anterior to bullae smooth.

F* abdomen: No female was available for detailed study.

Type locality: Peru: Lima: Lima, 12°03'00"S 077°02'00"W (–12.05 –77.03333).

Material examined: Peru: Ica: 1F* Eglise de Pisco, 13°42'36"S 076°12'12"W, –13.71 –76.20333, 1954-12-29, Dorst (AAM-001235, MNHN); La Libertad: 1M* Cartavio, 07°53'30"S 079°13'22"W, –7.89167 –79.22278, 0000-00-00, Smyth, E. (AAM-003729, Paratype, AMNH); 1M* Cartavio, 0000-00-00, Smyth, E. (AAM-003730, Paratype, AMNH); Lima: 1M* Lima, 12°03'00"S 077°02'00"W, –12.05 –77.03333, 1939-02-08, Weyrauch, W. (MZSP-MZ001668, Holotype, MZSP); 1M* Lima, 1968-01-15, Picho, H. (MZSP-MZ003836, Paratype, MZSP); 1F* Lima, 1969-02-11, Razuri, V. (MZSP-MZ003837, Paratype, MZSP); 1M* Lima, 1939-02-08, Weyrauch, W. (CNC Diptera 198085, CNC); 1M* Lima,

1948-04-00 (AAM-003005, MUSM); 1M* Hacienda Chuquitanta, 12°04'32"S 076°57'00"W, –12.07556 –76.95, 1974-03-10, Lamas, G., Medina, N. (AAM-003742, MUSM); 1M* Antioquia, 12°04'49"S 076°30'36"W, –12.08028 –76.51, 1975-01-11, Garcia, R. (AAM-003737, MUSM); 1M* La Molina, 12°04'54"S 076°55'45"W, –12.08167 –76.92917, 280 m, 1966-03-11, Garcia, R. (AAM-003769, MUSM); 1M* La Molina, 280 m, 1966-03-11, Garcia, R. (AAM-003731, MUSM); 1F* no locality data (BMNH(E)1202927, BMNH).

Distribution and biodiversity hotspot: Coastal Peru (Fig. 27). Not known to occur in any biodiversity hotspot.

Remarks: The description above is based on male specimens only because no females were available for detailed study to provide an updated F* description and inclusion in this manuscript although three specimens (see above) had been studied several years ago and can be unambiguously assigned to this species. Sexual dimorphism is most likely minimal as in the other species and the female terminalia will most likely be identical to *P. adelphe* sp. nov. and *P. phalaros* sp. nov. The female specimen in the BMNH (BMNH(E)1202927) was apparently studied by Macquart and labeled *Mydas peruvianus*, but never described as a new species by him.

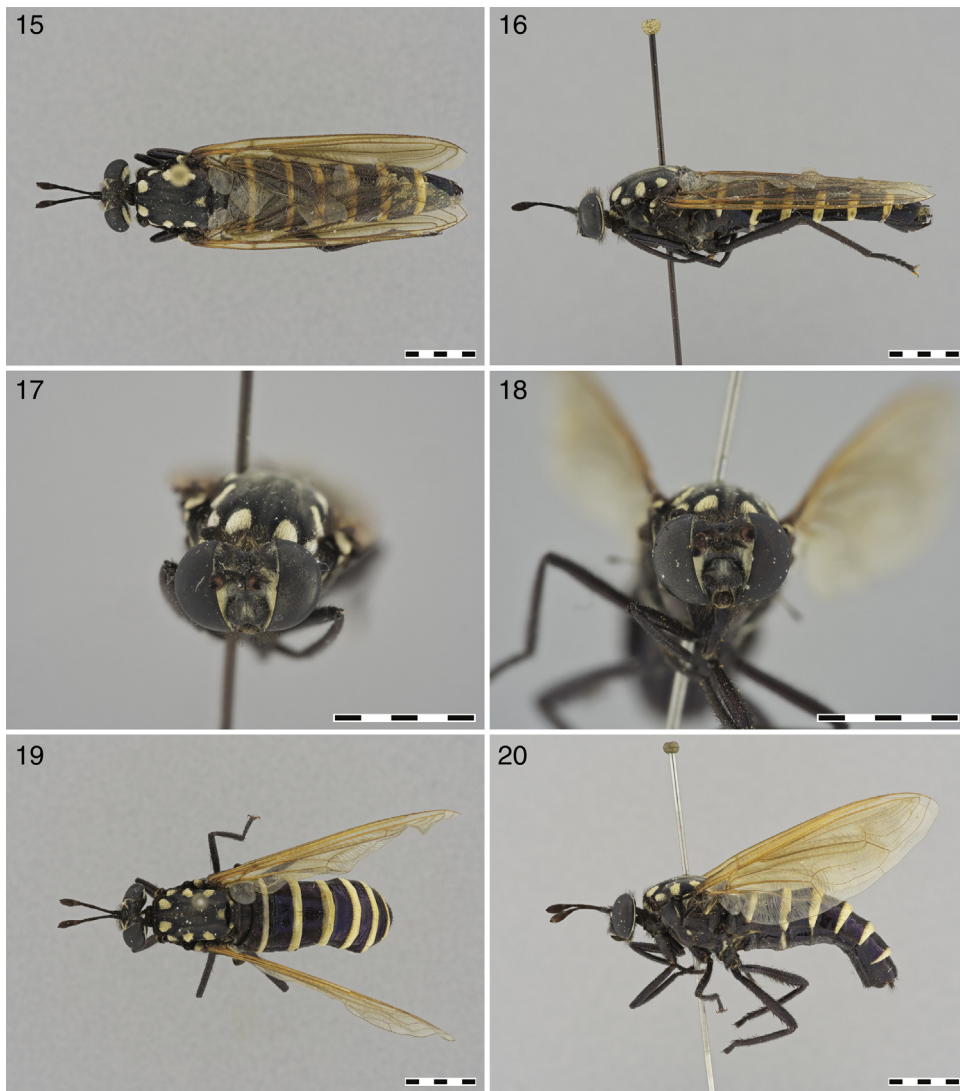
***Plyomydas phalaros* sp. nov.**

ZooBank AA0C21E1-0420-4A8A-93F3-40DC17864BCE
Figs. 15–20, 24–27

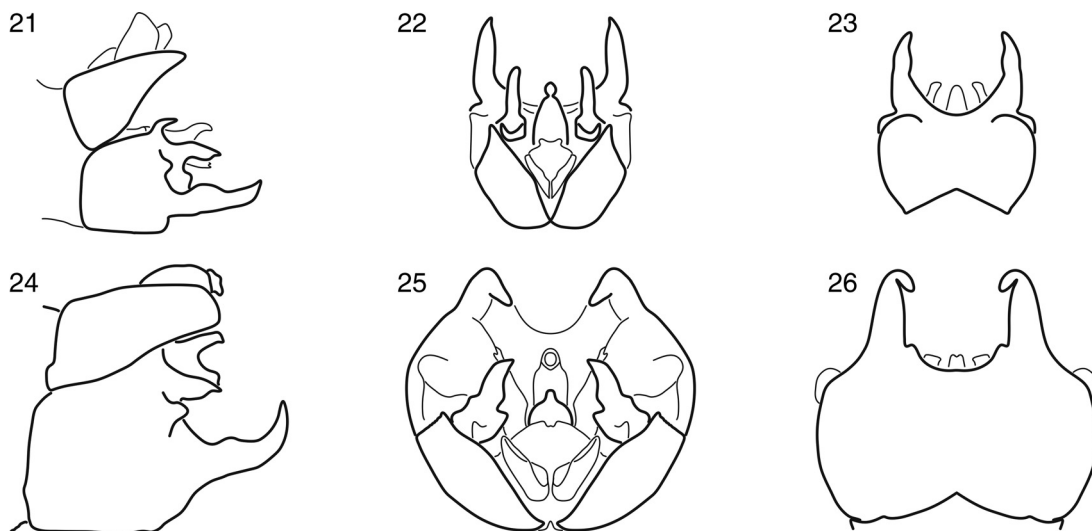
Diagnosis: The species is distinguished from congeners by the scutal pubescence pattern with four pairs and a postero-median grey pubescent spot (Figs. 15–16, 19–20), and the presence of a grey pubescent stripe on the posterior anepisternum (Figs. 16 and 20).

Etymology: From Greek *phalaros* = white-spotted, referring to the distinctive grey pubescent spots on the scutum.

Description: Head: brown, in general grey pubescent; width distinctly greater than thorax, interocular distance on vertex larger than at ventral eye margin, vertex between compound eyes



Figs. 15–20. Photographs of male and female *Plyomydas phalaros* sp. nov.: (15) M* holotype (AAM-005629), dorsal (Morphbank #860834); (16) same, lateral (#860836); (17) same, head anterior (#860838); (18) F* paratype (MZSP MZ003846), head anterior (#860752); (19) same, dorsal (#860524); (20) same, lateral (#860750). Scale line = 5 mm.



Figs. 21–26. Male terminalia of *Plyomydas* species: (21) *Plyomydas peruviensis* (AAM-003729), lateral; (22) same, dorsal; (23) same, ventral; (24) *Plyomydas phalaros* sp. nov. paratype (CASENT8380022), lateral; (25) same, dorsal; (26) same, ventral. Scale line = 1 mm, setation omitted. Figshare DOI [10.6084/m9.figshare.4490474](https://doi.org/10.6084/m9.figshare.4490474).



Fig. 27. Map of South America with elevational relief and biodiversity hotspots (in grey) showing distribution of *Plyomydas adelphe* sp. nov. (orange), *P. peruviansis* (yellow), and *P. phalaros* sp. nov. (blue). Type localities plotted with square symbols. Map data available in Google Earth KML file [6102](#) and also through GBIF (data-set [7f2de377-9f9f-4276-b0b8-5c792b499223](#), DOI [10.15468/tiyjja](#)).

slightly depressed, parafacial area very narrow, facial gibbosity nearly touching median eye margin; facial gibbosity distinct, well-developed and discernible in lateral view; mystax brown, covering facial gibbosity except dorso-medially; frons not elevated, laterally grey pubescent, medially apubescent; vertex apubescent; postgena lightly grey pubescent; setation: vertex brown, frons brown, ocp setae yellow, pocl macrosetae brown; ocellar triangle apubescent; proboscis brown, long, reaching fronto-clypeal suture; labellum large, much wider than prementum, longer than prementum and as long as oral cavity, unsclerotized laterally; maxillary palpus cylindrical, light brown, about 1/3 length of proboscis.

Antenna: brown, bulbous part of postpedicel light brown, scape and pedicel black setose dorsally and ventrally, rarely brown setose dorsally and ventrally; postpedicel cylindrical in proximal 1/2, symmetrically bulbous in distal 1/2, ≥ 5.0 times as long as combined length of scape and pedicel, bulbous part brown setose dorsally and ventrally; apical seta-like sensory element situated apically in cavity on postpedicel.

Thorax: brown, predominantly apubescent with distinct grey pubescent scutal and pleural spots; scutum uniformly black, surface predominantly smooth, postero-paramedially rivose, lightly

grey pubescent with distinct grey pubescent spots: 1 pair antero-paramedially, 3 pairs laterally (1 antero-laterally, 1 at transverse suture, 1 postero-laterally), 1 spot postero-medially, scutal setation comprised of pubescent spots long black or brown setose; dc setae pre- and postsuturally black, acr setae absent, lateral scutal setae brown, npl setae 0, spal setae 0, pal setae 0; antepronotum dorso-medially smooth (without any indentation); postpronotal lobe brown, predominantly grey pubescent; proepisternum, lateral postpronotum, and postpronotal lobe long black setose; scutellum lightly grey pubescent, laterally densely grey pubescent, brown setose, apical scutellar setae absent; mesopostnotum, anatergite, and katatergite lightly grey pubescent, asetose, katatergite elevated and smoothly convex; anterior anepisternum lightly grey pubescent, asetose, supero-posterior anepisternum grey pubescent, asetose; posterior anepimeron long brown setose, katepimeron asetose; metanepisternum lightly grey pubescent, asetose, metepimeron evenly elevated, same color as T1, grey pubescent, asetose; infra-halter sclerite absent.

Leg: brown, setation predominantly black; pro, mes, and met coxa lightly grey pubescent, black setose; met trochanter setose medially; femur brown, met femur \pm cylindrical only slightly wider

than pro and mes femur, in distal ½ macrosetose, 1 antero-ventral and 1 postero-ventral row of macrosetae, postero-ventrally long brown setose; pro and mes tibia laterally arched, met tibia straight, met tibia cylindrical, ventral keel absent, postero-laterally regular setose; pro and mes tarsomere 1 longer than tarsomere 2, but less than combined length of tarsomeres 2–3, met tarsomere 1 as long as combined length of tarsomeres 2–3; pulvillus well-developed, as long as well-developed claw, and as wide as base of claw; setiform empodium absent.

Wing: length = 16.7–20.8 mm; light brown stained, especially along veins, distal ¼ and posterior margin unstained, veins brown, microtrichia absent; cells r_1 , r_4 , r_5 , m_3 , + cup closed except r_5 open; C well-developed, around entire wing; R_4 terminates in R_1 ; R_5 terminates in R_1 ; stump vein (R_3) at base of R_4 present, long but not reaching R_2 ; R_4 and R_5 ± parallel medially; r-m distinct, $R_4 + 5$ and M_1 apart, connected by crossvein; M_1 curves slightly anteriorly at r-m, M_1 (or $M_1 + M_2$) terminates in C; M_4 and CuA split proximally to m-cu (cell m_3 narrow proximally); $M_3 + M_4$ terminate together in C (reaching wing margin); CuP straight, cell cup wide, CuP and wing margin further apart proximally than distally; alula well-developed, very large and partly overlapping with scutellum medially; halter brown.

Abdomen: brown to metallic bluish-black; setation comprised of scattered black setae, surface entirely smooth; T1–7 brown with narrow yellow posterior margin; T1 long brown to black setose, T2–7 short black setose; T1 lightly grey pubescent, T2–7 apubescent; S1 brown with light brown posterior margin, S2–6 brown with narrow yellow posterior margin; S1 asetose, S2–7 sparsely black setose; S apubescent; T2–4 parallel-sided and not constricted waist-like; bullae on T2 black, transversely elongate, surface entirely smooth, T2 surface anterior to bullae smooth.

Type locality: Argentina: Catamarca: Belén, 27°38'59"S 067°01'58"W (–27.64972 –67.03278).

Material examined: Argentina: Catamarca: 1M* Belén, 27°38'59"S 067°01'58"W, –27.64972 –67.03278, 1975-11-25, Bohart, R. (AAM-005629, Holotype, CSCA); 1F* 1M* Belén, 6 km S, 27°43'47"S 067°01'15"W, –27.72972 –67.02083, 1975-11-25, Stange, L. (M* AAM-002714, F* AAM-002718, Paratypes, IMLA); 1F* 4M* Belén, 6 km S, 1975-11-25, Stange, L. (MZSP-MZ003838–MZSP-MZ003841, MZSP-MZ003846, Paratypes, MZSP); Salta: 1M* Cafayate, 22 km N, 26°02'56"S 065°54'01"W, –26.04889 –65.90028, 1578 m, 2003-11-13, white sand dunes, Irwin, M., Parker, F. (CASENT8380021–CASENT8380022, Paratypes, CAS); 1M* Cafayate, 26°04'06"S 065°58'29"W, –26.06833 –65.97472, 1700 m, 1991-01-05, dune, Osten, T. (AAM-003864, Paratype, SMNS); 1M* Cafayate, 1993-11-14, Rozen, J., Rozen, B. (AAM-004054, Paratype, AMNH); Paraguay: San Pedro: 1M* Carumbé, 24°08'46"S 056°37'30"W, –23.95 –56.6, 1973-01-10–1973-02-10, Golbach, R. (MZSP-MZ003843, Paratype, MZSP).

Distribution and biodiversity hotspot: Western Argentina (Catamarca and Salta) and Paraguay (San Pedro) (Fig. 27). The geographic co-ordinates for Carumbé (Paraguay) are taken from GBIF record 416921317. The easternmost distribution of this species in Paraguay overlaps with the Atlantic Forest biodiversity hotspot.

Remarks: Sexual dimorphism is minimal with only slight differences in color of sclerites or setae. The two females studied have a wing length of 19.3–19.4 mm while males have a wing length of 16.7–20.8 mm. Two specimens (AAM-003864, AAM-002715) lack the postero-median grey pubescent spot directly anterior to the scutellum. We believe that these two specimens belong to *P. phalaros* sp. nov. though. The disjunct distribution of *P. phalaros* sp. nov. in mid-elevation western Argentina and low-elevation Paraguay is interesting. We have no reason to believe that the Paraguayan specimen (AAM-002720) is mislabeled as a search on the internet reveals that other insects have been collected by

R. Golbach in Carumbé in the 1970s (Google search) providing evidence that the specimen is correctly labeled.

Key to species

1. Scutum predominantly densely grey pubescent, only median stripe (not reaching posterior margin) and paramedian stripes apubescent (Fig. 12); coastal Peruvian Andes . . . *peruvienis*
- Scutum predominantly apubescent, with only widely separated anterior and lateral grey pubescent spots (Fig. 1); western Argentina and Paraguay . . . 2
2. Scutum with only three pairs of grey pubescent spots (antero-lateral spot posterior to postpronotal lobe absent, Figs. 1–2) and without postero-median pubescent spot (Fig. 1); scutellum only lightly pubescent; anepisternum without posterior pubescent stripe (Fig. 2); postpronotal lobe lightly grey pubescent . . . *adelphe* sp. nov.
- Scutum with four pairs of grey pubescent spots (antero-lateral spot posterior to postpronotal lobe distinct, Figs. 15 and 16) and with postero-median grey pubescent spot (in addition to other spots although absent in two studied specimens, Figs. 15 and 19); scutellum densely grey pubescent laterally; anepisternum with narrow posterior pubescent stripe (Figs. 16 and 20); postpronotal lobe distinctly grey pubescent . . . *phalaros* sp. nov.

Discussion

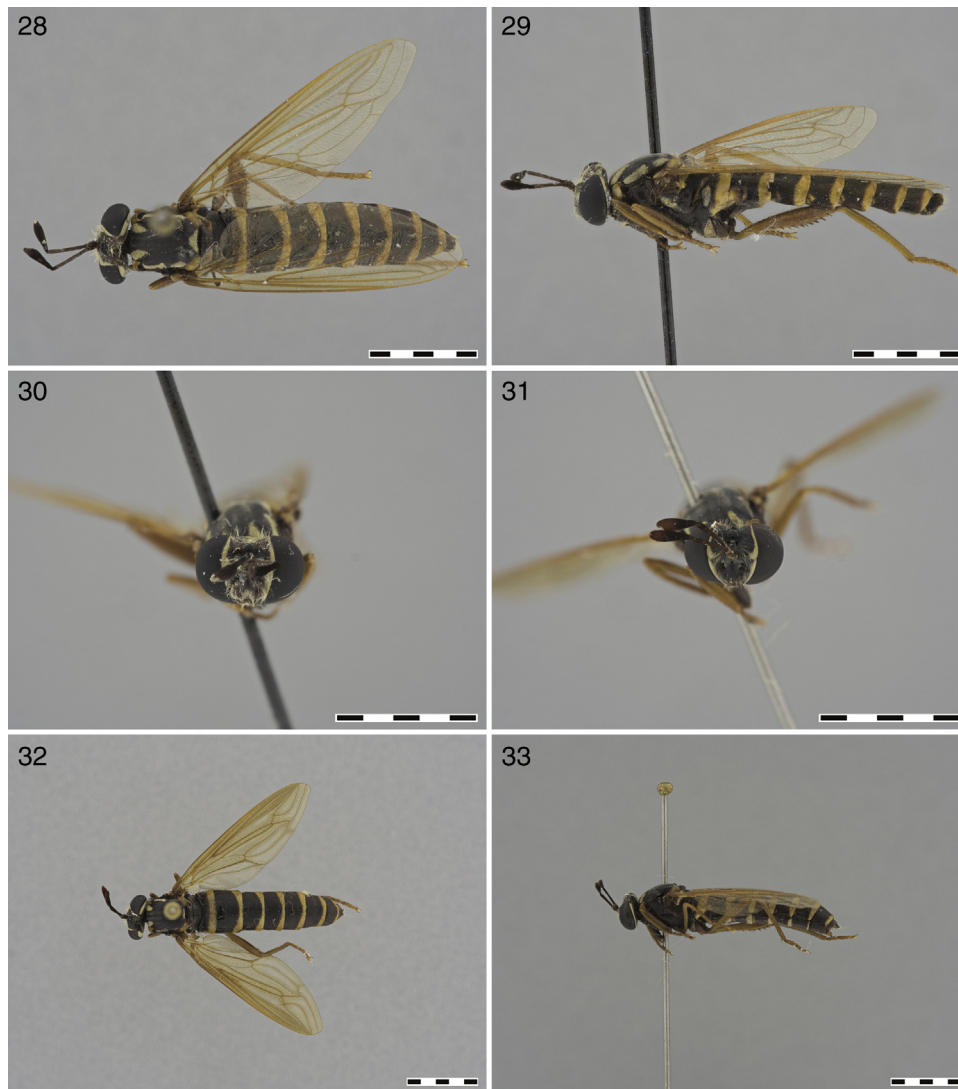
Male terminalia are often reliable in delimiting species boundaries, but they can be conserved among species of a genus or even across generic boundaries such as in Afrotropical Syllegomydinae (Dikow, in press). Within *Plyomydas*, the male terminalia are very similar in all three species and cannot easily be described with words so that we defer the reader to compare the illustrations (Figs. 7–9, 21–26). We postulate that in this taxon the thoracic pubescence pattern is reliable for species delimitation and that comparison of male terminalia is unnecessary at this stage.

Transfer from Leptomydinae to Mydinae: Messiasiini

Wilcox and Papavero (1971), Papavero (2009), and Papavero and Artigas (2009) consider *Plyomydas* to belong to Leptomydinae. This is chiefly based on the absence of a keel on the ventral metathoracic tibia, which is absent in *Plyomydas* and Leptomydinae, but present in virtually all Mydinae (an exception is *Messiasia notospila* (Wiedemann, 1828) known from Argentina, Brazil, Paraguay, and Uruguay with a weakly developed keel (Figs. 28–33)). We regard the absence of the metathoracic tibial keel to be a simple loss of this feature and not an important feature to place the genus *Plyomydas* in Leptomydinae. Instead, as in all Mydinae, and several other Mydidae genera, vein $M_3 + M_4$ reaches the costal vein C in *Plyomydas* (Fig. 12) and which is absent in all Leptomydinae genera. Furthermore, the female terminalia of *Plyomydas* lack acanthophorite spines and tergite 10 is a single sclerite (Fig. 10) as found in all Mydinae, Cacatuopyginae, and three genera of Syllegomydinae in the Afrotropical Region (Dikow, in press). All known Leptomydinae, in contrast, utilize a divided tergite 10 with acanthophorite spines to oviposit in sand or soil. From the shape of the female terminalia we can postulate that *Plyomydas* species oviposit in either decaying wood or ant nests as has been observed in other Mydinae taxa (see Papavero and Artigas, 2009).

Note that the key to Neotropical subfamilies in Papavero and Artigas (2009) is incorrect in couplet 11 where it should read “Hind tibia with ventral keel (carinate). Subfamily Mydinae . . . 12” and “Hind tibia cylindrical. Subfamily Leptomydinae . . . 23”. This key will key out *Plyomydas* correctly, but within Leptomydinae and not within Mydinae as proposed here.

The Mydinae are currently divided into four tribes (Papavero and Wilcox, 1974; Wilcox et al., 1989) and we place *Plyomydas* in the Messiasiini based on the similarity to *Messiasia*, the only



Figs. 28–33. Photographs of male and female *Messiasia notospila* (Argentina: Entre Rios: Pronunciamento, 32°20'45" S 058°26'40" W, 1970-03-00, Bolle, S.): **(28)** M* (CNCIDiptera198880), dorsal (Morphbank #860859); **(29)** same, lateral (#860861); **(30)** same, head anterior (#860863); **(31)** F* (CNCIDiptera198880), head anterior (#860870); **(32)** same, dorsal (#860866); **(33)** same, lateral (#860868). Scale line = 5 mm.

included genus so far, in antennal, proboscis, and female terminalia morphology. With *Plyomydas* now in Mydinae, Leptomydinae is a taxon restricted to the Northern Hemisphere with the exception of *Hessemydas* from Madagascar.

Seasonal incidence

Species of *Plyomydas* have only been collected during the Southern Hemisphere summer to early autumn. *Plyomydas adelphe* sp. nov. has been collected in November–December, *Plyomydas peruviansis* between December–April, and *Plyomydas phalaros* sp. nov. in November in Argentina and January–February in Paraguay.

Biodiversity hotspots

With the exception of the single specimen of *Plyomydas phalaros* sp. nov. from Paraguay, which is distributed in the Atlantic Forest biodiversity hotspot, the genus is not confined to and does not occur in any biodiversity hotspot *sensu* Conservation International.

Conflicts of interest

The authors declare no conflicts of interest.

Acknowledgments

We would like to thank the museum curators who made specimens available through loans and for their hospitality when visiting the collections. Warren Steiner (NMNH, Washington, DC, USA) is thanked for bringing the newly collected specimen, now holotype, of *Plyomydas adelphe* sp. nov. to our attention and Donat Agosti (Plazi, Bern, Switzerland) for help with adding the original taxon descriptions to the Plazi TreatmentBank. We thank Julia Calhau for insight into the male terminalia of Mydinae species. We furthermore thank the two peer reviewers who provided constructive comments that enhanced the manuscript. We gratefully acknowledge support from the U.S. National Science Foundation for funding the Research Experience for Undergraduates site grant called Natural History Research Experience (NHRE) (OCE 1560088; PI E. Cottrell, Co-PI E. Hunt) through which the senior author participated in this research project. Special thanks to Gene Hunt,

Elizabeth Cottrell, and Virginia Power for their support and administration of the NHRE Program. Part of this project was funded by a U.S. National Science Foundation REVSYS award (DEB 0919333; PI T. Dikow, Co-PI David Yeates). Any opinions, findings, and conclusions or recommendations expressed in this manuscript are those of the authors and do not necessarily reflect the views of the National Science Foundation.

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