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PHILLIP A. ADAMS

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A NEW GENUS AND SPECIES OF OSMYLIDAE (NEUROPTERA) FROM CHILE AND ARGENTINA, WITH A DISCUSSION OF PLANIPENNIAN GENITALIC HOMOLOGIES

PHILLIP A. ADAMS

Department of Biology and Peabody Museum of Natural History, Yale University*

ABSTRACT

Phymatosmylus, a new genus of Stenosmylinae, is proposed for the new species *Phymatosmylus caprorum.* The genus is morphologically primitive in the position of the medial fork of the forewing, and in the partially free eighth abdominal tergite of the male. Osmylid female genitalia are prepared for examination by the customary clearing in KOH and staining in chlorazol black E, but removal of the internal structures from the abdomen, following cutting around the genital opening, makes details more visible than when examined *in situ,* as previously. The male gonarcus-mediuncus complex of Planipennia is probably derived from fused parameres, as in some Sialodea, and the articulation of the gonocoxites has shifted from the ninth tergite to the ends of the gonarcus.

*Present address: Department of Biology, California State College, Fullerton, California 92631.

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Introduction

The subfamilies Stenosmylinae and Kempyninae of the neuropteran family Osmylidae (see systematic list at end of paper) are restricted to South America, Australia, New Zealand and Tasmania. The only previously known New World example of the Stenosmylinae is *Isostenosmylus* and of the Kempyninae, *Kempynus falcatus* Navás. Aside from the protosmyline *Paryphosmylus ornatus* Krüger, the only other described Recent osmylid from the New World is the highly aberrant *Gumilla* Navás, which is too poorly known for meaningful discussion. *Narodona* Navás, from Mexico, is probably an ithonid, judging from the illustrations. Carpenter (1943) has discussed the relationships of the fossil species from the Florissant shales of Colorado; they belong to the Protosmylinae and the Kempyninae.

In the course of examining the Neuroptera in the collection of the Peabody Museum, I have been able to study a series of a previously undescribed species from Chile belonging to a new genus of the Stenosmylinae. Additional material from Argentina has been made available by Ellis MacLeod.

The osmylid subfamilies Stenosmylinae and Kempyninae have been revised by Kimmins (1940); his figures may be consulted, where reference is made to features of genera related to the new genus described below.

In this group of osmylids, many features of the male genitalia may be discerned in dried material, as they are usually carried in an exposed position. However, due to shriveling of the soft, membranous structures, the appearance of the genitalia may be markedly different from that of material properly cleared and expanded in KOH and observed in glycerine. The gradual transition from sclerite to membrane on mediuncus, gonarcus, and gonocoxites can only be suggested in a drawing. In Figures 2, 3, and 4, an attempt has been made to indicate, by stipple, areas which stain heavily with chlorazol black E.

Previously, taxonomists have illustrated only the most readily observed portions of the female system, the spermathecae and their ducts. A study of several osmylid genera indicates that the remainder of the female reproductive system also has characters useful in systematics. As with male material, the abdomen is prepared for study by heating in 10% KOH solution, washing, and

staining in chlorazol black E. Removal from the abdomen is accomplished by cutting the membrane surrounding the gonopore and gently drawing the ducts out anteriorly, with forceps. It is virtually impossible to see the details of the delicate ducts and sacs *in situ*. The internal system may be dehydrated and permanently mounted on a slide, or reinserted into the abdomen after examination. This method of removal does no damage to the abdominal exoskeleton.

Phymatosmylus, new genus

DESCRIPTION. In forewing (Fig. 1A), MP forks halfway from base to apex; CuA bends sharply posteriad, anteriorly pectinate; 2A fuses with 1A opposite fused portion of RS+MA. In hindwing, basal piece of MA sinuate, joining R before origin of RS+MA, or absent. Proximal nygma of forewing opposite or slightly beyond divergence of RS and MA. Distal nygmata highly irregular; in male forewing, usually one or two, sometimes three, between proximal branch of RS and MA, sometimes one between last two branches of RS, and a few, usually small, between MA and MP. In hindwing, one distal nygma between last branch of RS and MA; one or two between last two branches of RS. All veins of male forewing thickened and filled with granular substance; in female, bases of Cu and 1A slightly thickened. In forewing, most crossveins with single dorsal seta, borne on swelling at midpoint. Fore coxa of female with two irregular rows of pedestalled setae (Fig. 8); arolium bilobed.

TYPE. The type is the only known species, *Phymatosmylus caprorum*. The name is derived from the Greek *phyma, phymatos,* a swelling, referring to the enlarged veins of the male forewing, plus - *osmylus*.

DISCUSSION. *Phymatosmylus* is placed in the Stenosmylinae because of the thickened veins and the partial fusion of the eighth and ninth abdominal tergites of the male. Both the structure of the media in the forewing and the structure of the male abdomen appear transitional between the Stencsmylinae and the Kempyninae. In Osmylidae, the primitive position of the medial fork

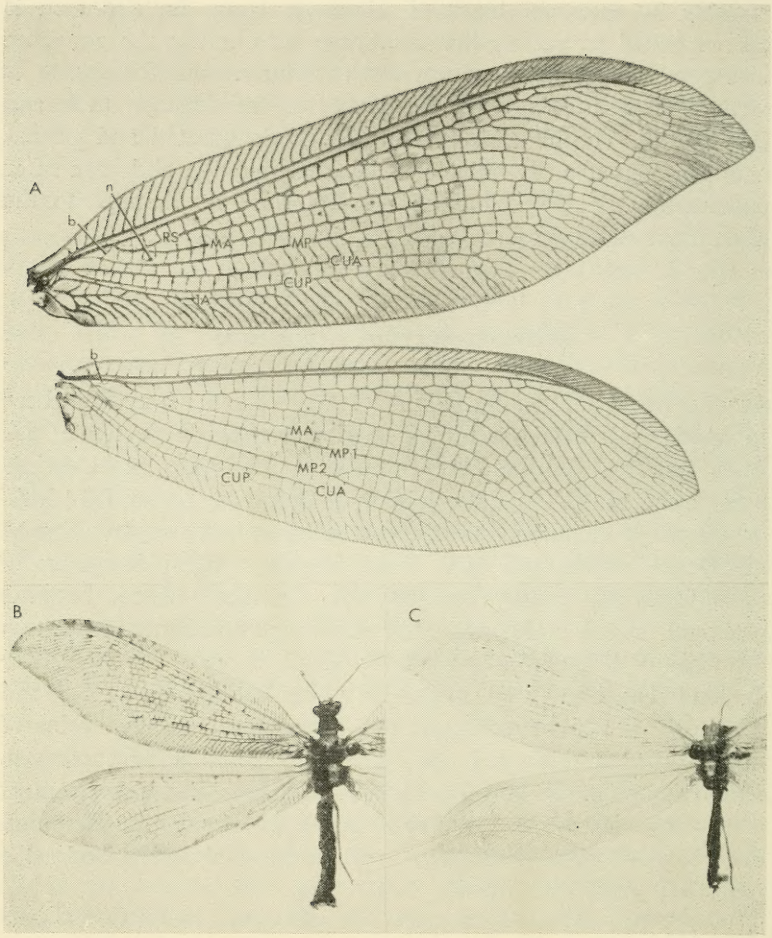

FIG. 1. *Phymatosmylus caprorum.* A) Wings of a lightly pigmented male, showing venation and thickening of veins in forewing. B) Heavily pigmented female. C) Moderately pigmented female.

Abbreviations: b — basal piece of MA, CuA — cubitus anterior, CuP — cubitus posterior, MA — media anterior, MP — media posterior, n — nygma, RS — radial sector, 1A, 2A — first and second anal veins.

in the forewing is near the base, as seen in fossil material (e.g., *Sogjuta* O. Martynova, Triassic) and in the Recent Protosmylinae. *Phymatosmylus* has this fork in an intermediate position; in other Stenosmylinae, it lies near the wing apex. In *Oedosmylus* and *Isostenosmylus,* CuA2 curves abruptly posteriad at the level of the

medial fork, and usually is anteriorly pectinate. *Stenosmylus* and *Stenolysmus* are more specialized in that MP2 has fused with CuA; the location of the medial fork in these genera is marked only by an oblique crossvein, as in the forewing of the Myrmeleontidae. Thickened forewing veins also occur in *Oedosmylus,* but in the female rather than in the male (Kimmins, 1940).

The partially free eighth abdominal tergite in the male is more generalized than in the remainder of the Stenosmylinae, where the eighth and ninth tergites are completely fused.

The female reproductive system of *Phymatosmylus* (Fig. 6) differs from that of *Plethosmylus* (Osmylinae) only in minor details. In the closely related genus *Isostenosmylus* (Stenosmylinae), which is more specialized in male genitalic characters and wing venation, the female reproductive system differs significantly from that of *Phymatosmylus:* the genital opening is located at the bottom of a large genital atrium; the copulatory bursa is expanded into a sac posteriorly to the attachment of the spermathecal canals; the slender dorso-median duct is absent; the oviduct is expanded laterally to form large folds enveloping the sides of the copulatory bursa, so that the spermathecal ducts arise from the bottom of a depression; the proximal connection of the fertilization canal is not apparent, and the canal extends much farther anteriad along the oviduct; a prominent duct joins the oviduct opposite the distal end of the fertilization canal. Most of these features of *Isostenosmylus* appear to be specializations, but too few genera of osmylids have been examined to state this with assurance. These differences, however, are sufficiently fundamental to demonstrate the potential utility of the female system as a source of taxonomic characters.

Phymatosmylus caprorum, new species

DESCRIPTION. Head and antennae yellow, a brown spot at anterior mandibular articulation; ocelli black-bordered medially; vertex scars pale, variable in shape, usually large medial square and thick lateral band. Pronotum subrectangular, viewed from above, width slightly greater than length, yellow, bordered with lateral fuscous stripe; a thin median fuscous line on anterior half; setae long, pale except on lateral stripes. Meso- and metanota fuscous-mottled laterally, with broad median yellow stripe. Pleurae and legs pale,

spurs short, hind basitarsus as long as next three tarsomeres. Abdomen pale, tergites 1-7 fuscous; thin ventral fuscous line. Male with fused ninth tergite and ectoproct shiny, yellow. Gonarcus, gonocoxites and tenth sternite pale; tenth sternite setose (Figs. 2-4). Gonarcus and gonocoxites suspended from apical margin of ninth tergite. Mediuncus lobes membranous laterally, sclerotized medially, shaped as in Figures 2 and 3; extended prominently in dried specimens. An irregular, weakly sclerotized gonapsis anterior to gonopore, shaped similarly to hypandrium internum (Fig. 4, gps). A lightly sclerotized, setaless ring surrounds anus. Female eighth sternite concave, with anterior median hook, projecting angle at anterior margin of eighth tergite, lateral setose spatulate process opposite eighth spiracle (Fig. 7). Eighth gonocoxite narrowed medially, with rounded disclike apical lobes (Figs. 5, 7). Ninth tergite and gonocoxites pale, a black stripe on gonocoxite; setae on abdominal apex pale. Female genital opening single (Fig. 5, go); slender colleterial gland reservoir opens into copulatory bursa posteriorly, lined with microtrichia (Fig. 6). Thin duct, probably from bursal gland, joins copulatory bursa dorsally. Spermathecae spheroidal, ducts enter sclerotized anterior lobe of bursa; below this a short fertilization canal of typical externally microvillose appearance joins bursa at base of oviduct.

Wing venation as in Figure 1A. Color varies from uniform light brown to pale with veins and membrane fuscous-mottled. In heavily marked individuals (Fig. 1B), on the forewing pale spots appear on basal subcostal area, scattered over disc; a pale line directed toward wing apex, and a row of small spots on posterior margin. Hind wing patterned similarly, but paler. Nygmata dark brown or black.

MEASUREMENTS. Chilean specimens: forewing length, ♂ 20-(21.3)-23 mm (N=7), ♀ 22-(22.5)-24 mm (N=6), antenna 7.4-8.4 mm (N=4). Argentine specimens: forewing length 25-26 mm (N=3), antenna length 6.5-6.8 mm (N=2).

HOLOTYPE. Male, Las Cabras, "S. of Chillan vulcain", 36°49′S-71°26′W, Nuble Province, Chile, elev. 1480 m, 10-23 Dec. 1954, Luis E. Peña, leg. Peabody Museum of Natural History.

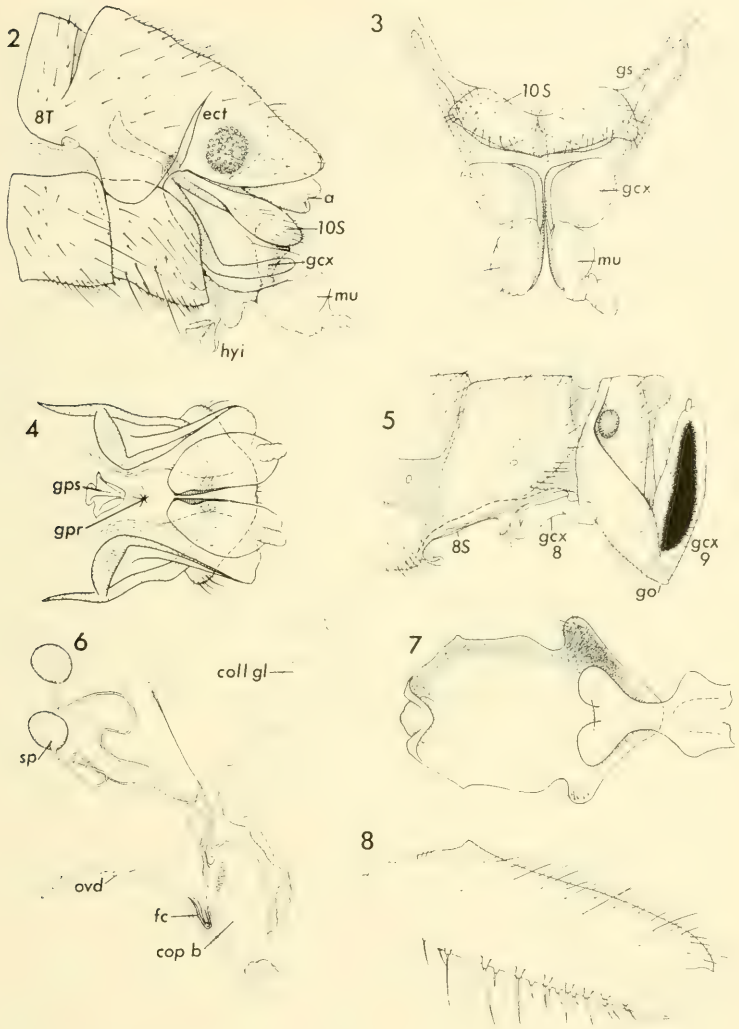

FIG. 2. male abdominal apex, lateral view. FIG. 3, gonarcus and gonocoxites, posterior view. FIG. 4, same, ventral. FIG. 5, female abdomen, lateral view; fine dotted lines show location of spermathecae. FIG. 6, female genital system, cleared specimen. FIG. 7, female 8th sternite and gonocoxite, ventral. FIG. 8, female left fore coxa, lateral, showing pedestaled setae.

Abbreviations: a — anus, coll gl — colleterial gland, cop b — copulatory bursa, ect — ectoproct, fc — fertilization canal, gcx — gonocoxite, go — genital opening, gpr — gonopore, gps — gonapsis, gs — gonarcus, hyi — hypandrium internum, mu — mediuncus, ovd — oviduct, sp — spermatheca, 8S — eighth sternite, 8T— eighth tergite, 10S — tenth sternite.

PARATYPES. Same data as holotype, seven males, seven females. One ♂, one ♀ in Museum of Comparative Zoology, Harvard, one ♂, one ♀ in British Museum (Natural History), one ♂, one ♀ in Adams collection, remainder in Peabody Museum. Additional paratypes: Las Trancas, Cord. Chillán, Nuble Prov., Chile, 21-30 Nov. 1964 (2 ♂), 1-10 Dec. 1964 (2 ♀), L. E. Peña, leg., Adams collection; Alto de Vilches, Cordillera, [35°37′ S, 70° 21′ W] Talca Prov., Chile. 21-23 Nov. 1964 (♂), leg. L. E. Peña. Lagi Currhué, 1000 m. [39°52′ S, 71°28′ W], Neuquén, Argentina, 26 Dec. 1954 (♀), Adams collection, purchase ex F. H. Walz; Pucará, Parque Nac. Lanín. Argentina, 30 Nov. 1959 (♀), Adams collection, purchase ex F. H. Walz, Feb. 1951 (♀), leg. S. S. Schajovskoy, MacLeod collection; Lago Hermoso, Parque Nac. Lanín, Neuquén, Argentina, Nov. 1949 (♀), Dec. 1949 (♂), leg. S. S. Schajovskoy. Material from the Adams collection was not available for study when the foregoing description was written.

DISTRIBUTION. This species appears confined to moist montane areas. The specimens from Argentina were collected in the lake region of Neuquén. Probably the Andes do not constitute an important distributional barrier in this area, since several passes exist at 1200 meters elevation. The gap of approximately 300 kilometers between the Nuble localities, on the west slope of the Andes, and the Neuquén localities may be an artifact of collecting.

Homologies of Planipennian Male Genitalia

The terminology used here differs from that of Tjeder, Kimmins, and other recent workers in several respects, but is consistent with my previous usage (e.g., MacLeod and Adams, 1968). The tenth sternite is often present in the Planipennia; it is nearly always setose, and in archaic forms it may be associated with the gonarcus (e.g., Psychopsidae, Acker, 1960, figs. 74-79, "sternite 11"). As Kimmins (1940) has pointed out, the tenth sternum of this subfamily is the most archaic to be found among the Planipennia. Along its ventral border extends the gonarcus, which may be a derivative of part of the tenth sternum, as Kimmins suggested.

Another interpretation, which I consider more probable, is that the entire gonarcus-mediuncus complex has arisen from the fused parameres of Sialodea and Raphidiodea. The bilobed or bipartite structure of the planipennian mediuncus is apparent in most cases; even when the mediuncus is a single structure, it is ordinarily lightly sclerotized medially. Occasionally, the gonarcus similarly shows evidence of a paired origin (*Oliarces,* Acker, 1960, fig. 52, "coxopodite 9"). Among the Sialodea, the parameres may be approximated at the midline (some species of *Sialis*) or show medial fusion and a pair of lobes (*Corydalus*), or occur as a bilobed medial process (*Neohermes, Chauliodes*). Thus, among the Sialodea, a gonarcus-like structure is commonly found, from which it is reasonable to consider that the planipennian gonarcus has been derived.

In the Sialodea and Raphidiodea there is a difference in texture of the parameres and gonocoxites that offers a helpful guide to homologies: the parameres are never setose (in Sialodea, they are smooth, and in Raphidiodea, minutely spinose); in contrast, the gonocoxites, or claspers, are nearly always setose. Primitively, the gonocoxites articulate on the ninth tergite, but they are occasionally attached laterally to the fused parameres (*Neohermes*).

In Planipennia, the articulation of the gonocoxites shifts to the gonarcus, but the setose condition is usually retained. Their structure is often still clasper-like (e.g., *Myiodactylus*, see Acker, 1960, fig. 152, "paramere", and Psychopsidae, figs. 50-60, "paramere"). In *Phymatosmylus,* the primitive attachment of the gonocoxites to the ninth tergite has persisted, in addition to the more advanced articulation with the gonarcus.

Probable stages in the evolution of the mediuncus-gonarcus complex and gonocoxites may be summarized as follows:

1. A pair of plates (volsellae or parameres) lie laterally to the phallus (as in *Agulla,* Raphidiodea); these may be united dorsally to the phallus (*Raphidia ophiopsis* L.). Gonocoxites articulate on the ninth tergite.

2. A pair of plates dorsal to the genital opening, usually approximated on the midline, each of which may bear a submedian process (Sialodea: *Sialis*).

3. Paramere plates fused medially to form a transverse band dorsal to the genital opening; usually with a pair of submedian processes. Gonocoxites may be articulated to the ninth tergite

(Sialodea: *Corydalus*) or appear as setose lateral lobes of the transverse band (Sialodea: *Neohermes*).

4. Paramere plates fused medially to form a transverse band (gonarcus) which bears a pair of movable, closely approximated submedian processes (mediuncus lobes); gonocoxites articulated laterally on the gonarcus (Planipennia: *Dilar, Sisyra,* and Osmylidae).

5. Mediuncus lobes fused, often bifid apically or showing median suture; gonocoxites laterally articulated on gonarcus (most Planipennia).

According to this interpretation, the gonocoxite corresponds to the "paramere" or the "entoprocessus" of Tjeder's (1957) terminology, and the true parameres to his combined "gonarcus" and "mediuncus". But the gonarcus and mediuncus bear very little resemblance to primitive parameres, and two separate terms are needed for them. Furthermore, use of the term paramere in this unusual sense would inevitably result in confusion. Therefore there appears to be strong justification for retention of Tjeder's terms, gonarcus and mediuncus. The gonocoxites may as well be referred to as such, thus making it possible to avoid applying the rather ambiguous term paramere to any planipennian structure.

Acker (1960) has generally identified the gonarcus as the "ninth coxopodite", the mediuncus as the fused "styli", and the ninth gonocoxites as "parameres"; in the osmylid *Porismus,* however, the mediuncus lobes are identified as "parameres" and the gonocoxites as "styli".

The small gonapsis-like structure has not been previously noted in osmylids; however, I have also found it in *Porismus* and *Kempynus.*

Acknowledgments

Ellis G. MacLeod has kindly lent material from his collection, and contributed many useful comments; C. L. Remington has generously assisted during the progress of this study, and has made many helpful suggestions. Their aid is gratefully acknowledged. Thanks are also due to Luis E. Peña, the collector of the Chilean material, who is accomplishing so much toward achieving a better knowledge of the insect fauna of his country.

Systematic List

Order Neuroptera
- Suborder Raphidiodea
  - *Agulla, Raphidia ophiopsis* L.
- Suborder Sialodea
  - *Sialis, Neohermes, Chauliodes, Corydalus*
- Suborder Planipennia
  - Osmylidae
    - Osmylinae: *Plethosmylus*
    - Protosmylinae: *Paryphosmylus ornatus* Krüger
    - Stenosmylinae: *Isostenosmylus, Oedosmylus, Stenosmylus, Stenolysmus, Phymatosmylus caprorum* Adams
    - Kempyninae: *Kempynus falcatus* Navás
    - Porisminae: *Porismus*
    - Incertae sedis: *Gumilla*
  - Ithonidae: *Narodona* (?), *Oliarces*
  - Nymphidae: *Myiodactylus*
  - Psychopsidae
  - Dilaridae: *Dilar*
  - Sisyridae: *Sisyra*

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