

SPECIES STATUS AND THE HITHERTO UNRECOGNIZED MALE  
OF *PAPILIO DIAPHORA* STAUDINGER (1891),  
(LEPIDOPTERA: PAPILIONIDAE)

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*Abstract.*—*Papilio xanthopleura* var. *diaphora* is given species status based on examination of the holotype male and other specimens. Former usage applying *diaphora* only to a dimorphic aberration of the female is shown to be in error.

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For many years, *Papilio xanthopleura* var. *diaphora* Staudinger (1891) has been regarded as a dimorphic yellow aberration of the normally blackish female of *xanthopleura* Godman and Salvin (Rothschild and Jordan, 1906; Jordan 1907; Munroe, 1961; D'Almeida, 1965; D'Abrera, 1981). This traditional usage by lepidopterists appears to derive from Staudinger's (1891) concluding sentence in the description of *diaphora*: "so wird *Diaphora* nur eine dimorphe weibliche Form des *Xanthopleura*-♀ sein."

Recently, however, we discovered that a single "yellow female" identified as *xanthopleura* at the American Museum of Natural History (AMNH) was, in fact, a male. This led us to examine the morphology of this specimen in relation to the other taxa in the "scamander Group" of *Papilio* (*sensu* Jordan, 1906; Munroe, 1961; Hancock, 1983). Hancock (1983), in his phylogenetic classification of *Papilio sens. lat.*, which we will hereinafter follow, places this group in *Pterourus* (*Pyrrhosticta*). The "scamander Group," according to the above authors includes the taxa *scamander* Boisduval, *hellanichus* Hewitson, *birchalli* Hewitson, and *xanthopleura*. We obtained for comparison the type of *diaphora* from the Zoologisches Museum der Humboldt (ZMH) in Berlin, which also proved to be a male (see Fig. 1). We examined the text of Staudinger's "Neue exotische Lepidopteren" to ascertain the status of the name *diaphora*. We also sought to determine the known distribution of *xanthopleura* in South America from material in several of the world's major museums. This was necessary since *xanthopleura* and *birchalli* are noted by students and field collectors of *Papilio* as particularly rare, new specimens being available only in small numbers on the commercial butterfly market. Indeed, between the AMNH, Allyn Museum of Entomology (AME), British Museum (Natural History) (BMNH), Field Museum of Natural History (FMNH), and National Museum of Natural History (NMNH), only seventeen specimens of *xanthopleura* are known and none of these is a female. Prof. H. J. Hannemann (ZMH, pers. comm.) has acknowledged that the ZMH contains normal females of *xanthopleura* (as noted in Staudinger, 1891) and also another male specimen exhibiting the yellow morph characteristic of *diaphora*.

Examination of the AMNH male *diaphora* (Figs. 2, 3) and the type (Figs. 1, 3)



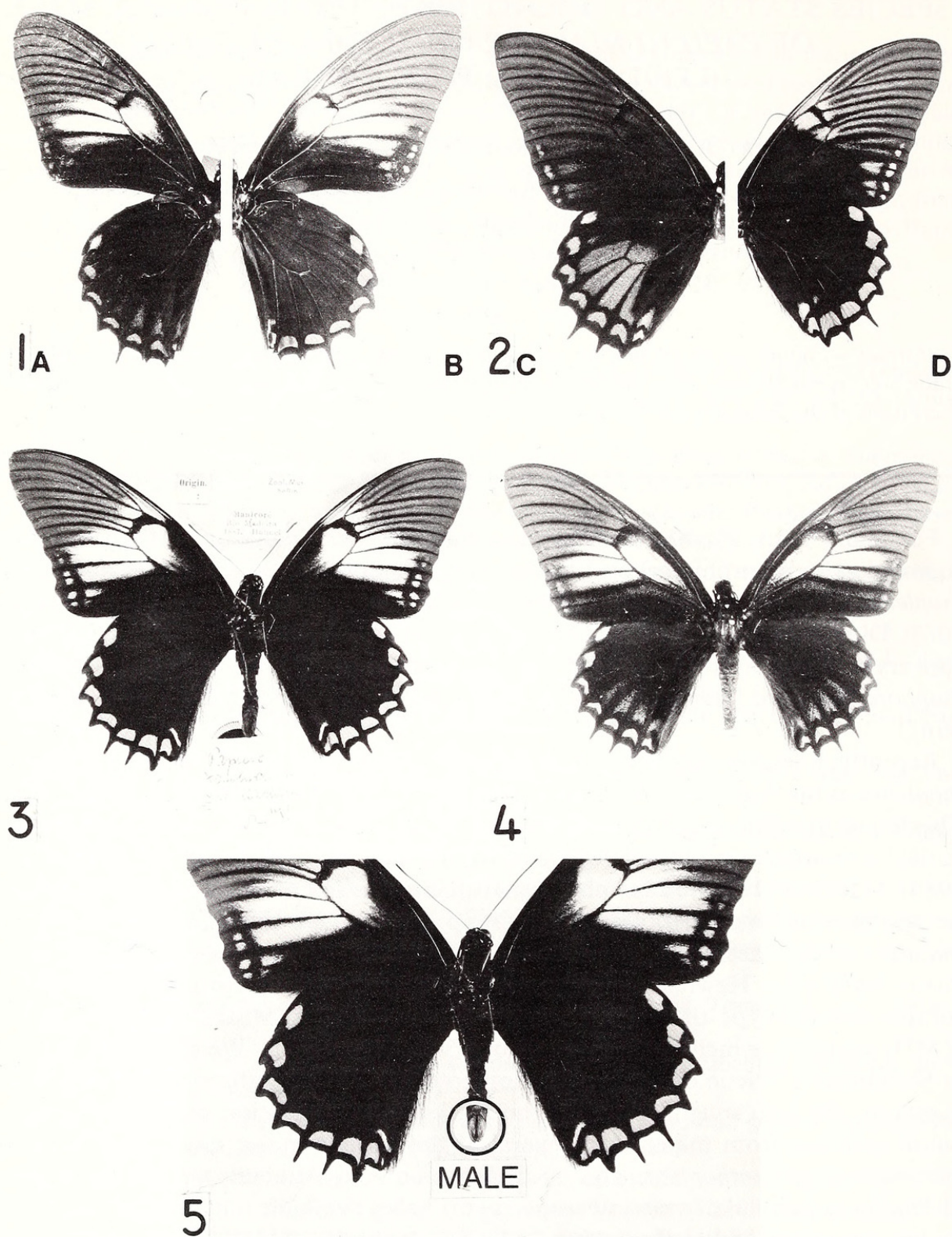


Fig. 1. *P. diaphora* (1, 3, 4, 5) and *P. xanthopleura* (2). 1, AMNH male *diaphora*: A, upper surface; B, under surface. 2, *xanthopleura*: C, upper surface; D, under surface. 3, Type of *diaphora* (ZMH): under surface. 4, Type of *diaphora*: upper surface. 5, Type of *diaphora* enlarged showing brushed abdominal terminus exposing male claspers.



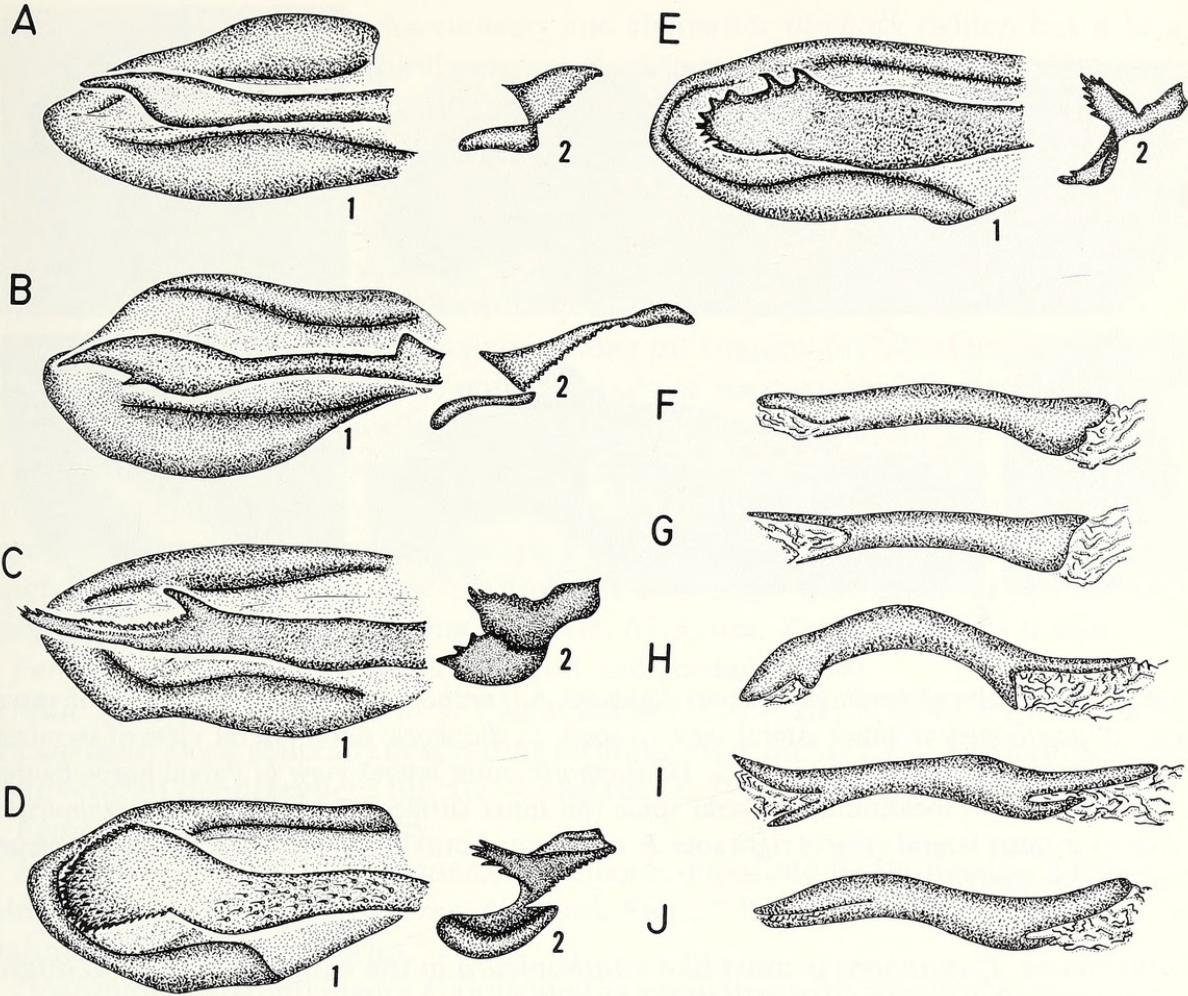


Fig. 2. Genitalia, the *scamander* Group. A, *scamander*: 1, inner lateral view of valve; 2, inner lateral view of socii. B, *hellanichus*: 1, 2, as above. C, *birchalli*: 1, 2, as above. D, *xanthopleura*: 1, 2, as above. E, *diaphora*: 1, 2, as above. Aedeagus F, *scamander*. G, *hellanichus*. H, *birchalli*. I, *xanthopleura*. J, *diaphora*.

indicates that along with the notable wing characters differentiating *diaphora* from *xanthopleura* and other taxa of the species group (Fig. 1), in the genitalia the valvular harpe of *diaphora* differs distinctly from all other taxa (Fig. 2). This is significant since students of the morphology of *Papilio sens. lat.* (Munroe, 1961; Hancock, 1983) utilize this character to differentiate amongst taxa of *Pterourus*. Notably, the harpe of *diaphora* (Fig. 2: E1) is like *birchalli* (Fig. 2: C1) in that both have terminal teeth pointing dorsad along an overall descending arch, whereas in *scamander*, *hellanichus*, and *xanthopleura* (Fig. 2: A, B, D, respectively) the arch is ascending with teeth variously apical and/or ventral. Differences are also apparent in the socii. Contrasted to *scamander* and *hellanichus* (Fig. 2: A2, B2, respectively), *xanthopleura*, *birchalli* and *diaphora* have generally hemispherical socii (Fig. 2: C2, D2, E2, respectively) but of these only *diaphora* and *birchalli* have furcations on the ventrad quadrasphere. The aedeagi (Fig. 2: F-J) of all the species are similar except *birchalli* in which it is notably curved. These characters clearly suggest that *diaphora* should be regarded as a species, part of a triad with *xanthopleura* and *birchalli*, and the sister species of



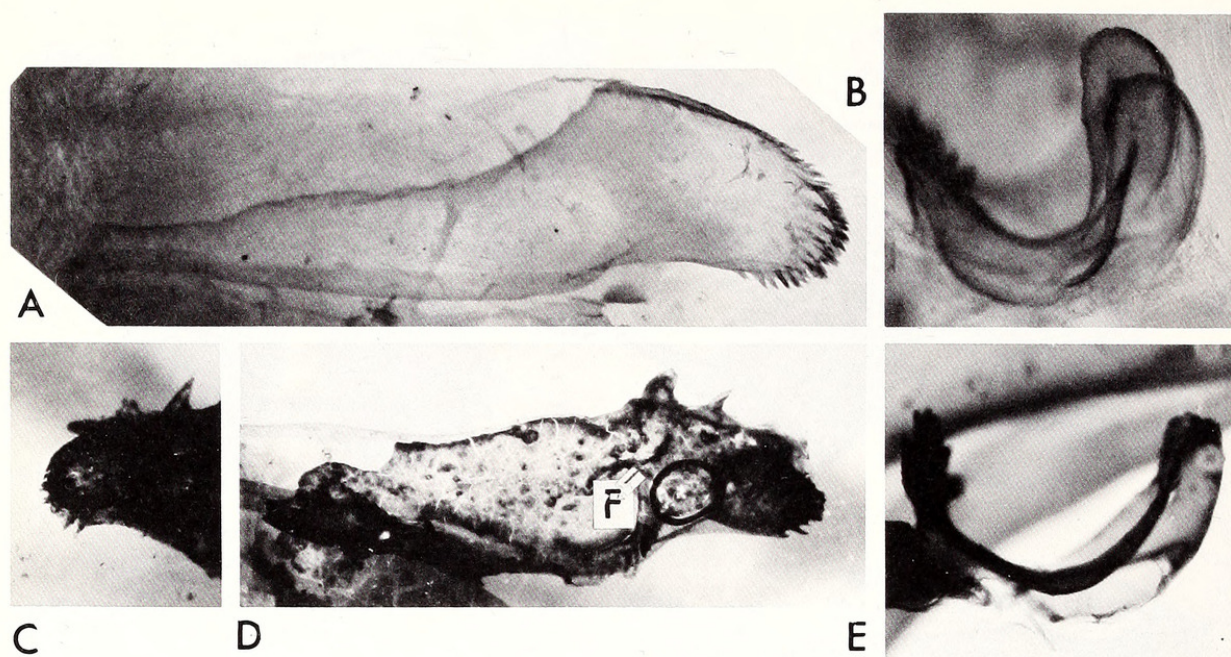


Fig. 3. Genitalia of *xanthopleura* and *diaphora*. A, *xanthopleura*: outer lateral view of valval harpe. B, *xanthopleura*: outer lateral view of socii. C, *diaphora*: outer lateral view of terminus of valval harpe not figured in Figure 2. D, *diaphora*: outer lateral view of valval harpe figured in Figure 2 with F, location of a lateral spine (on inner surface) not present in *xanthopleura*. E, *diaphora*: outer lateral view of right socii. *P. diaphora* photos from AMNH male; *xanthopleura* from Uaupes, Brazil, AMNH.

*xanthopleura*. *P. diaphora* is most like *xanthopleura* in the wings, but in the genitalia displays notable resemblances to *birchalli*.

Study of the original description in "Neue exotische Lepidopteren" indicates that the limitation of *diaphora* to a morph of the female can be judged in error. Throughout his text, Staudinger used the categories "variety" ("var. xus") and "aberration" ("ab. xus") consistently, and when in doubt "var. (ab.?) xus." In the description of *diaphora* Staudinger entertained that it may be a "consistent local form," "dimorphic female form" or, perhaps a valid species. Further, the initial citation of *diaphora* (Staudinger, 1891, p. 63) was as a trinomen, whereas elsewhere in his text Staudinger also used quadrinomials. Hence, according to our reading of ICZN Article 45, sections (d) (i), (iii), and (e) (i), the name *diaphora* can be judged as available.

*Pterourus (Pyrrhosticta) diaphora* (Staudinger),  
New Combination, Revised Status

*Papilio xanthopleura* Godman and Salvin var. *diaphora* Staudinger, 1891, p. 63.

*Papilio xanthopleura* Godman and Salvin ♀ var. *diaphora*: Rothschild and Jordan, 1906, p. 633.

*Papilio xanthopleura* ♀ f. *diaphora*: Rothschild and Jordan, 1906, p. 633. Jordan, 1907, p. 32. D'Almeida, 1965, p. 278.

*Papilio xanthopleura* ♀ form [*diaphora*]: D'Abrera, 1981, p. 50.

*Male*. Compared to all taxa of *scamander* Group, wings most like *xanthopleura* (in that both lack the broad yellow bands across both wing upper surfaces charac-



teristic of *hellanichus* and *scamander*) and thereafter *birchalli* (which has a broad yellow band limited to the hindwing upper surface only). Wings differing from *xanthopleura* as follows: (1) forewing at least one-sixth longer than *xanthopleura*; (2) upper surface of forewing not completely dark as in *xanthopleura* but with bright yellow patch from central area of discal cell distad to postmedian areas from vein  $M_2$  to  $CU_2$  and with powdered yellow over most of subapical area; (3) upper surface of hindwing not generally shiny "powder green" from median area distad as in *xanthopleura* but deeply iridescent navy blue throughout with only small "powder green" chevrons in the vein interspaces along the margin; (4) tail at terminus of vein  $M_3$  notably longer than others, not with tails of approximately equal length as in *xanthopleura*; (5) under surface similar to *xanthopleura* except (a) *diaphora* with bright yellow patch expansive on forewing across entire median and postmedian area from center of discal cell to the outer margin and (b) *diaphora* with hindwing marginal orange chevrons only becoming yellow at the anal angle in a slightly hemispherical patch, not in two large yellow chevrons at anal angle and basad in cell 2V as in *xanthopleura*. Length of forewing: AMNH, 67.5 mm; ZMH (type), 71.0 mm.

*Female*. Unknown (but see Rothschild and Jordan, 1906).

*Male genitalia*. Figures 1, 2, 3. Valval harpe (1: 5; 2: E1; 3: C, D, F) with marked dorsad teeth along generally descending terminal arch. Socii (2: E2; 3: E) hemispherical with ventrad quadrasphere furcate. Aedeagus (2: J) not radically curvate.

*Female genitalia*. Unknown.

*Holotype*. ♂ BRAZIL: Amazonas: Manicoré, deposited ZMH bearing labels "Origin," "Papilio xanthopleura var. diaphora Stgr.," "Manicoré, Rio Madeira, 1887, Hahnel," "Zool. Mus. Berlin."

*Distribution*. Spatial: Figure 4. Indicated as sympatric with *xanthopleura* as follows.

**P. diaphora**: BRAZIL: Manicoré (ZMH, type); São Paulo de Olivença (Michael, pers. comm., Rothschild and Jordan); BRAZIL/BOLIVIA: Between Porto Velho, Brazil, and Villa Bella, Bolivia (AMNH).

**P. xanthopleura**: BOLIVIA: Bolivia (BMNH). BRAZIL: Campana (AMNH); Cuiabá River (BMNH); Madeira River (NMNH); Manicoré (Staudinger); São Paulo de Olivença (Staudinger, Rothschild and Jordan); São Thomás (Staudinger, Rothschild and Jordan); Rio Negro (Rothschild and Jordan); Uaupes (AMNH); Upper Amazon (BMNH). ECUADOR: Napo River (BMNH). PERU: Eastern Peru (Staudinger); Iquitos (AME, BMNH, NMNG, Staudinger, Rothschild and Jordan); Peru (Rothschild and Jordan); Pichis (Matusik); Rio Huallaga (Rothschild and Jordan).

#### DISCUSSION

Four specimens of *diaphora* are evidenced: the type, the AMNH male, a male subsequently reported in the ZMH (Hannemann, pers. comm.), and a reputed female reported pers. comm. by Michael (Rothschild and Jordan, 1906). Additional data on the AMNH male is found on accession card No. 3955, Registrar's Acc. No. 15861, date received January 10, 1912, from D. P. Davis, Marlborough Hotel, New York City, New York, from locality "Between Porto Velho, Brazil, and Villa Bella, Bolivia." Card has been placed with AMNH specimen.

Our diagnosis (Fig. 1) of the type of *diaphora* as a male suggests the female of *diaphora* may be unknown, depending on the veracity of Michael's identification



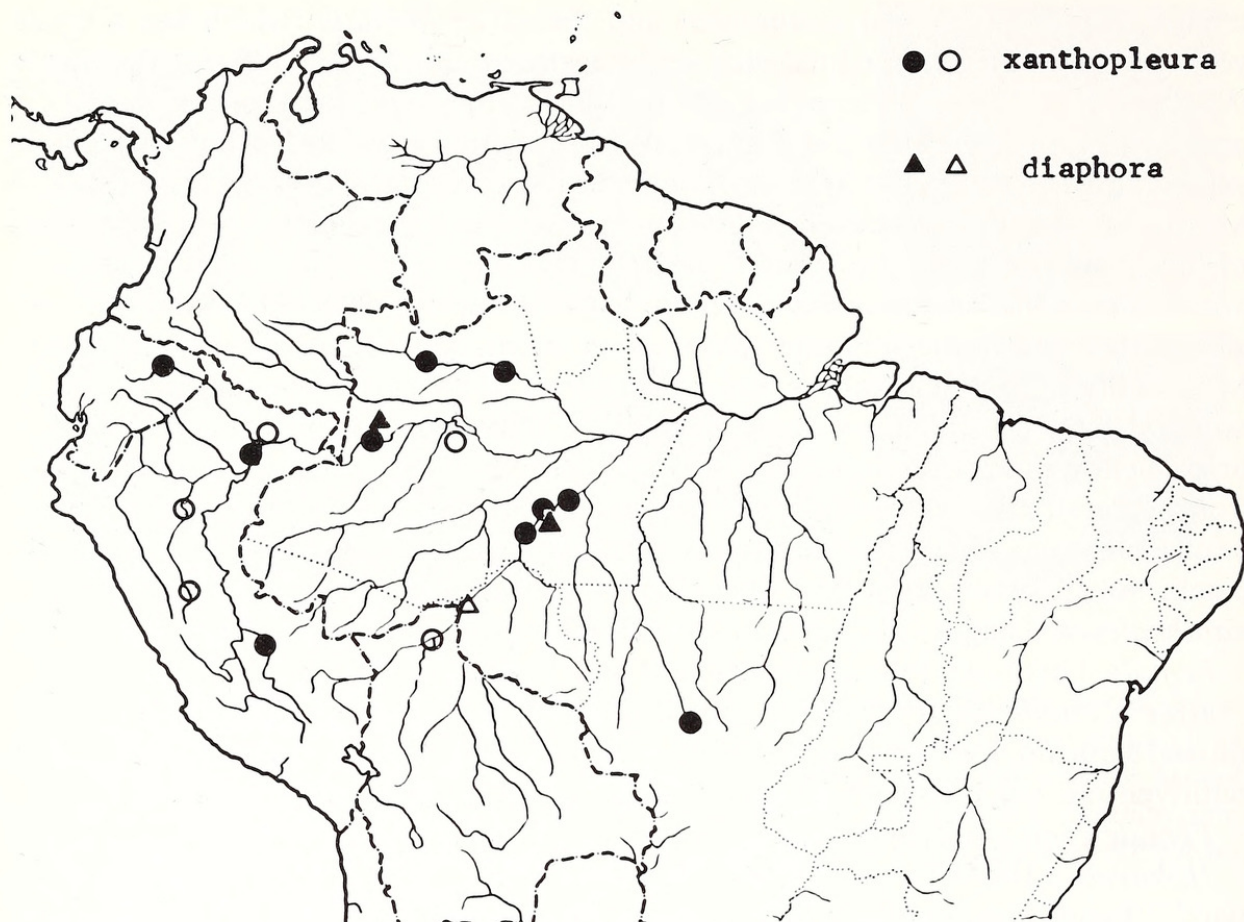


Fig. 4. Geographic distributions of *P. xanthopleura* (●, exact data; ○, generalized locality data) and *P. diaphora* (▲, exact data; △, generalized locality data).

(Rothschild and Jordan, 1906). The misdiagnosis of the type gender of *diaphora* has contributed to the view of *diaphora* as an aberration of the female of *xanthopleura*. The following factors probably contributed to this misdiagnosis: (1) the abdomen of the type was profusely hairy and upon ventral examination exhibited a small opening with protruding spines suggesting papillae anales. The lateral area of the abdomen, however, clearly suggested claspers to us and our subsequent examination of the genitalium confirmed this; (2) the large size of *diaphora* (all *xanthopleura* seen by us in this study have been under 60 mm); (3) female variation in some superficially similar groups of *Papilio* (like widely variant *Papilio androgeus* Cramer) includes a frequency of large yellow-patched females contrasting the more common and smaller dark-winged females. The assumption that large yellow-patched specimens were females may have contributed to the lack of reference to the genitalia of *diaphora* hitherto. We dissected the type of *diaphora* and this dissection corroborates the characters of *diaphora* in the AMNH male. We are returning this dissection in permanent mount to the ZMH and retaining photographs at the AMNH.

#### ACKNOWLEDGMENTS

We are particularly grateful to Prof. H. J. Hannemann (ZMH) for providing the type of *diaphora* for examination. Four anonymous reviewers made helpful comments, particularly



concerning the type depository and the status of *diaphora*. In addition, Drs. Frederick H. Rindge, Randall T. Schuh, Lee H. Herman (AMNH), Klaus Sattler (BMNH), Lee D. Miller (AME), and G. Bernardi (Museum National d'Histoire Naturelle, Paris) gave opinions concerning the latter. Not all agreed, however, with the decision that *diaphora* was available. The above persons, along with Mr. Richard Vane-Wright and Mr. Philip Ackery (BMNH) and Dr. Robert K. Robbins (NMNH) variously aided in the securing of distributional data for *xanthopleura*. Eric Quinter (AMNH) aided in the study of the type of *diaphora*. Bonnie T. Gardner provided the drawings from permanent mounts at the AMNH.

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