

THE ADULT OF *MORIBAETIS MACAFERTI* (EPHEMEROPTERA: BAETIDAE)¹

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ABSTRACT: Alate stages of the common and distinctive Central American and southern Mexican species *Moribaetis macaferti* are described for the first time based on males of both the adult and subimago stages. The species is distinct as an adult in having forewings with extensive staining, an abdomen with distinctive patterning, and genital forceps with a smooth medial margin. The species' abdominal color pattern is also apparent in the subimago. A key to the male adults of *Moribaetis* species is provided. *Moribaetis macaferti* is reported from Panama for the first time.

The distinctive mayfly genus *Moribaetis* was described by Waltz and McCafferty (1985). It was later restricted by Lugo-Ortiz and McCafferty (1996a) and shown to be a monophyletic, relatively ancestral lineage within the New World *Baetodes* complex of genera, which also includes the genera *Baetodes* Needham and Murphy, *Mayobaetis* Waltz and McCafferty, and *Prebaetodes* Lugo-Ortiz and McCafferty. *Moribaetis* is Neotropical in origin (McCafferty et al. 1992), and the entire *Baetodes* complex is evidently South American in origin (McCafferty 1998), although several species of *Baetodes* are found in the southwestern Nearctic region.

Moribaetis essentially is a Central American genus. It currently consists of *M. macaferti* Waltz, *M. maculipennis* (Flowers), and *M. salvini* (Eaton). Mention of the genus as occurring in South America (Lugo-Ortiz and McCafferty 1996a) was inadvertent, although an unspecified report of the genus by Rojas de Hernández et al. (1995) could actually be applicable to either *Moribaetis* or *Mayobaetis* because they were considered subgenera of *Moribaetis* at the time. The latter may be more likely because *Mayobaetis* is known from Ecuador and Peru as well as Central America.

Moribaetis macaferti has recently been reported from southern Mexico in addition to Costa Rica, Honduras, and Guatemala (Lugo-Ortiz and McCafferty 1994, 1996b). This is a relatively large, striking species of Baetidae that has been collected by WPM from streams and waterfalls, including splash zones, in Costa Rica. A key to the larvae of all three species of *Moribaetis* was provided by Waltz and McCafferty (1985). Although *M. maculipennis* and *M. salvini* are known as adults (Eaton 1885, Flowers 1979), the adult of *M. macaferti* has remained unknown up to this time.

Boris Kondratieff (Fort Collins, Colorado) has kindly given us larvae and an adult of *M. macaferti* that he recently collected from Puebla, Mexico in

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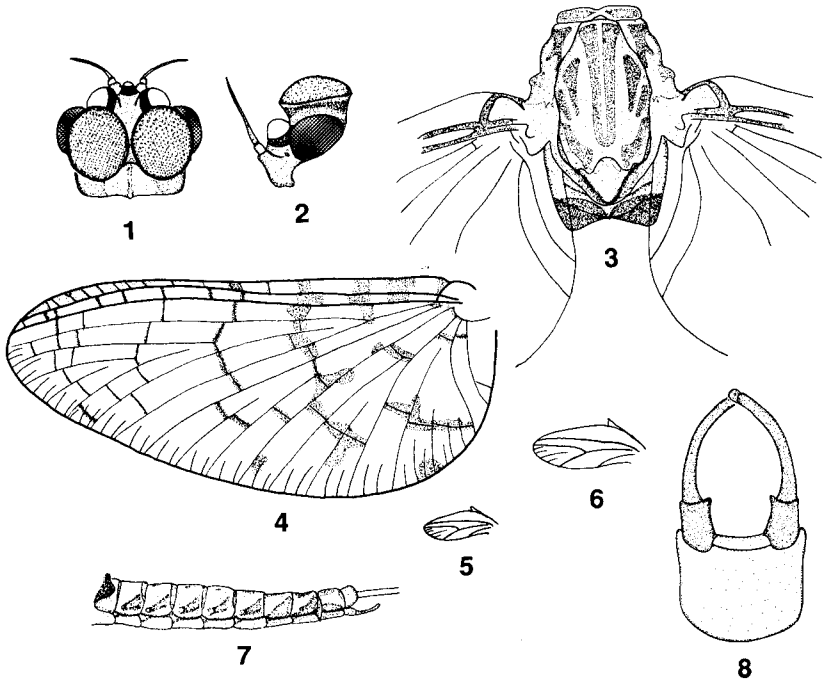
1994. In addition, Wills Flowers (Tallahassee, Florida) has kindly loaned us larvae and a reared subimago of *M. macaferti* that represent a new country record (see material examined, below). We are thereby able to provide a first description of the adult *M. macaferti* and the first species key to male adults of *Moribaetis*.

Moribaetis macaferti Waltz

Male adult. Dimensions in mm: body length, 9.7; forewing length, 7.6; forewing width, 3.5; hindwing length, 1.2; caudal filaments length, 20.0. Head (Figs. 1 and 2): Coloration generally light yellowish brown. Turbinate portion of compound eyes smoke yellow, nearly round with anterior-posterior length only slightly longer than width, nearly contiguous, and mounted on short stalks with encircling band of suffused black. Scape and pedicel of antennae distally marked with brown. Thorax (Figs. 1 and 3): Pronotum (Fig. 1) cream medially and light brown laterally. Antecosta of mesotergum (Fig. 3) suffused dark brown. Meso- and metanota cream with medium and light brown elongated markings as illustrated in Figure 3, including conspicuous narrow-elongate U-shaped submedian medium brown mark on scutum. Forefemora light to medium brown; foretibiae medium brown, with length 1.32x that of femora; foretarsal segment 1 medium brown; foretarsal segments 2-5 cream basally and light brown distally. Mid- and hindlegs cream with femora and tarsi light brown distally; tibiae subequal in length to femora. Claws dissimilar, each consisting of one hooked-acute and one straight-ovoid member. Forewings with distinct markings as illustrated in Figure 4; yellowish brown stains generally associated with crossvenation but more extensive in basal area of membrane with large free spots in basal costal and subcostal area and extensions from crossveins near MA_2 and MP_2 . Hindwings as in Figures 5 and 6; membrane devoid of staining; costal process acute and asymmetrical (straight edged posteriorly); first elongate vein unforked; second elongate vein forked in distal half, with forks encompassing free marginal intercalaries; third elongate vein short, terminating in anal margin. Abdomen (Fig. 7): Terga light basally, becoming more suffused with yellowish light brown shading posteriorly (terga 6-10 markedly becoming progressively more shaded); tergum 1 with narrow lateral medium brown markings; terga 2-8 with additional triangular medium brown markings extending length of terga and filling posterolateral corners of terga; tergum 9 with lateral markings more extensive anteriorly and not well developed posteriorly, with additional pair of small oblique dashes sublaterally at posterior margin; tergum 10 pale and unmarked. Sterna 1-6 whitish, almost translucent; sterna 7-9 pale yellow, almost translucent; sternum 9 pale yellow. Genitalia (Fig. 8) with short, medially smooth basal segment, elongate second segment, and small, rounded terminal segment weakly demarcated from second segment. Caudal filaments, for most of length, distinctly banded in alternating pattern of one white and three darkened segments.

Male subimago. Generally similar to adult. Turbinate portion of compound eyes appearing slightly more oval-elongate. Color pattern not well developed on body and not yet evident in forewings as described above. Submedian elongate marking on thoracic scutum not formed into U-shape, but unconnected posteriorly. Subcostal process of hindwings similar to adults but appearing minutely hooked, probably as an artifact of the subimaginal pellicle; only one major intercalary evident between forks of second elongate vein. Triangular posterolateral abdominal tergal markings evident but not highly contrasting as in adult. Genitalia and caudal filaments missing.

Material examined. MEXICO, Puebla Sta, Pahuatlán, Hwy 106, VIII-17-1994, B. C. Kondratieff, male adult and associated larvae (left fore- and hindwings slide mounted). PANAMA, Bocas del Toro Prov., trib. of Rio Guabo at pipeline rd., V-28-1985, R. W. Flowers (male subimago and associated larvae).



Figs. 1-8. *Moribaetis macaferti*, male adult. 1. Head and pronotum. 2. Head (lateral view). 3. Meso- and metanota. 4. Left forewing. 5. Left hindwing (to scale with forewing). 6. Left hindwing (enlarged). 7. Abdomen (lateral view). 8. Male genitalia (ventral view).

DISCUSSION

The adult male described above was not reared; however, we have no doubt that it is *M. macaferti*. It was taken where only *M. macaferti* larvae were taken (B. C. Kondratieff, pers. comm.), is specifically distinct from other adults in the genus, and essentially agrees with the subimago from Panama that was indeed reared from larvae of *M. macaferti* (R. W. Flowers, pers. comm.).

The forewings of *M. macaferti* have more extensive staining than those of *M. maculipennis* [see Flowers (1979): Fig. 1] and *M. salvini* [see Eaton (1885): Fig. 29a]. The hindwings are most similar to those of *M. maculipennis* in venation but differ in not having any staining [see Flowers (1979): Figs. 2 and 3]. It is possible that the number of marginal intercalaries between the forks of the second elongate vein in the hindwings is variable within *M. macaferti*, based on a comparison of the hindwings of the subimago from Panama and the adult from Mexico, and thus we do not recommend attempting to identify adults of species of *Moribaetis* on that basis. The abdominal terga of *M. macaferti* (Fig.

7) possess distinct posterolateral markings on segments 2-8, and additionally lack the distinctive large brown submedian markings of *M. maculipennis* [see Flowers (1979): Fig. 5] and the pitch-black posterior marginal markings of the terga described by Eaton (1885). There are, however, very slight and difficult to detect indications of a pair of pale spots on most abdominal terga in *M. macaferti*. The terminal segment of the genital forceps of *M. macaferti* (Fig. 8) is most similar to that of *M. maculipennis* [see Flowers (1979): Fig. 4] in that it is weakly demarcated from segment 2. However, *M. macaferti* lacks the roughened medial margin of the basal segment of the forceps that is present in both *M. maculipennis* and *M. salvini* [see also Kimmins (1934): Fig. 13], in addition to the well-defined rounded and setose medioapical protrusion of the basal forceps segment seen in *M. maculipennis* [Flowers (1979): Fig. 4].

Key To Male Adults of *Moribaetis* Species

[key to larvae in Waltz and McCafferty (1985)]

1. Forewings with extensive staining throughout membrane (Fig. 4); abdominal terga 2-8 with triangular posterolateral markings (Fig. 7); forceps with medial margin of basal segment smooth medially (Fig. 8) *M. macaferti*
 1'. Forewings [Flowers (1979): Fig. 1; Waltz and McCafferty (1985): Fig. 43] and abdominal terga not as above; forceps [Kimmins (1934): Fig. 13; Flowers (1979): Fig. 4] with medial margin of basal segment roughened. 2
2. Cerci banded with two to three dark segments alternating with two light segments [Waltz and McCafferty (1985): Fig. 33]. *M. maculipennis*
 2'. Cerci banded with one slightly darkened segment alternating with three light segments [Waltz and McCafferty (1985): Fig. 42]. *M. salvini*

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BOOKS RECEIVED AND BRIEFLY NOTED

METHODS IN ECOLOGICAL & AGRICULTURAL ENTOMOLOGY. D.R. Dent & M.P. Walton, eds. 1997. CAB International. 387 pp.

Citing the need for an up-to-date and comprehensive textbook on experimental and analytical methods in both ecological and agricultural entomology, this book seeks to integrate new technologies and approaches to research with traditional methods, to provide a balanced view of the subject for final year undergraduates and postgraduates, and to be a useful source of reference for research workers. Twenty three authors contributed chapters on thirteen subjects ranging from sampling, handling and rearing insects to studying insect behavior, quantifying insect populations and insect migration, host plant selection, insect pollination, insecticide efficacy and efficacy of natural enemies, and modelling.

THE EVOLUTION OF MATING SYSTEMS IN INSECTS AND ARACHNIDS. J.C. Choe & B.J. Crespi, eds. 1997. Cambridge University Press. 387 pp. \$44.95 pbk, \$100 hdbk.

The complex mixtures of conflict and cooperation that typify sex and sociality make these among the most endlessly fascinating and difficult topics in ecology and evolution. The twenty one chapters in this volume, contributed by thirty six authors, explore the intricacies of sexual and social competition and the variety of ways in which males and females pursue, persuade, manipulate and control, and help one another. This volume is intended to update the synthesis of insect mating systems by Thornhill and Alcock (1983) and complement the recent synthesis of the study of sexual selection by Andersson (1994).

PROGRESS AND PROSPECTS IN EVOLUTIONARY BIOLOGY: THE *DROSOPHILA* MODEL. J.R. Powell. 1997. Oxford University Press. 562 pp. Cloth \$70.00.

The author states the primary impetus for this book is the conviction that if a major advance in understanding evolution is to be achieved, it is most likely to come from integration of levels of knowledge centered on a single closely related set of organisms. *Drosophila* has the greatest chance of being this organism. Thus, this book is about empirical studies of *Drosophila*, and is directed primarily toward graduate students but also to evolutionary biologists and colleagues studying development, molecular biology, and neurobiology of *Drosophila*.