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TAXONOMIC STATUS OF *MELANOLESTES PICIPES* AND *M. ABDOMINALIS* (HETEROPTERA:REDUVIIDAE)

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Abstract

Melanolestes picipes has been separated from *M. abdominalis* on the basis of color (black in *picipes*, red wholly or in part in *abdominalis*), wing form (macropterous and brachypterous in *picipes*, macropterous in *abdominalis*), and size of ocelli (smaller in *picipes*). Evaluation of these characters showed they were not diagnostic. We also examined the male and female external genitalia and found no consistent differences within sex between the two "species." We therefore conclude that *M. abdominalis* is not a valid species but is a junior synonym of *M. picipes*.

Resumen

Tradicionalmente, se ha separado *Melanolestes picipes* de *M. abdominalis* en base a el color (negro en *picipes*, completamente rojo, o en parte rojo en *abdominalis*), y el tamaño del oceli (mas pequeño en *picipes*). La nueva evaluacion de estos caracteres demostro que no son suficientes para establecer un diagnostico. Se examino tambien la genitalia externa del macho y la hembra, y no se encontraron diferencias entre las dos "especies". Concluimos que *M. abdominalis* no es una especie valida, sino un sinonimo menor de *M. picipes*.

Herrich-Schaeffer (1846) described two species of reduviids, *Pirates* (sic) *picipes* (p. 62) and *P. abdominalis* (p. 63), now placed in the genus *Melanolestes* Stål. The descriptions (here translated), each based on a single male specimen, are as follows: *M. picipes*—a black *Pirates*, antennae and legs black; appears very similar to *Reduvius personatus*, but has the generic characters of the genus *Pirates*, stouter form, shorter antennae, thicker femora, etc.; a male from North America from Mr. Sturm. *M. abdominalis*—a very black insect, abdomen scarlet, anal region black; the sole of the tibia bears golden-yellow hairs; a male from Mr. Sturm from North America.

Stål (1872, p. 107) questioned the validity of *M. abdominalis* as a species for he listed it as a variety of *M. picipes*. He also added to the description of *picipes* by noting that the hemelytra of the variety are very abbreviated.

Uhler (1876, p. 330) treated *M. picipes* and *abdominalis* as separate species. He stated, "The evidence at present in my possession does not warrant the uniting of these two species. Both are quite common in Maryland, sometimes occurring under the same stone; but while I have seen the sexes united, I have never seen a male of the one caress or unite with a female of the other. The width and proportions of the head and pronotum and abdomen vary considerably in the specimens of both of these species, so that, in the absence of a long series of them, they might be made to constitute a number of species." He followed this opinion in subsequent publications (1878, p. 424; 1884, p. 281; 1886, p. 25). In 1884, he further stated that *M. picipes* is black with piceous legs and antennae, while *abdominalis* has the sides and sometimes the whole upper surface of the abdomen red.

Parshley (1917) in his treatment of the New England fauna listed the two forms as *M. picipes* and *M. picipes abdominalis* without explanation. However, in 1918, he stated, "I have in my collection examples showing all gradations from those having only the slightest tinge of red along the connexivum to those having the abdomen entirely red; I have also a pair taken in copulation (Framingham, Mass., C. A. Frost) in which the male is an entirely black long-winged *picipes* and the female a short-winged *abdominalis*, with red connexivum. It would seem therefore that the *abdominalis* form should be ranked as a mere color variety and not as a species distinct from *picipes*, as I have done in my New England list." Therefore, he agreed with Stål (1872). Parshley used the term "variety" to designate subdivisions of the species (not aberrations) which he thought should be named without structural, geographic, or genetic connotations. Subsequently (1922), he listed *abdominalis* in his South Dakota study as *M. picipes* var. *abdominalis*.

Several authors followed Uhler's opinion, many of whom published prior to Parshley's 1918 paper (e.g., Provancher 1887; Champion 1899; Smith 1909; Banks 1910; Fracker 1912; Van Duzee 1916, 1917; Torre-Bueno 1923; Blatchley 1926; Brimley 1938; Wygodzinsky 1949; Elkins 1951; Coscaron 1983; Froeschner 1988); only Maldonado Capriles (1990), as far as we are aware, has followed Stål and Parshley. Blatchley (1926) discussed the opinions of Stål, Parshley, and Uhler but decided to treat the two forms as separate species because he had not collected "a specimen with intermediate hues." In addition to color, he separated the "species" by wing form (elytra often abbreviated in *pecipes*, entire in *abdominalis*) and by the size of ocelli (smaller in *picipes*). He noted that his *abdominalis* specimens (6 males, 8 females), on which he based his key, were all fully winged; he included in his key individuals that had the abdomen in part (connexivum?) or entirely red but included only the latter in his species description.

Drew and Schaefer (1963), Froeschner (1944), and Slater and Baranowski (1978) treated the two forms as distinct species but indicated some problem with the status of *abdominalis*.

Readio (1927) included *M. picipes* and *abdominalis* in his monographic study of the Reduviidae of America north of Mexico. He mentioned he had in his collection five different kinds of individuals based on sex, color and wing form: (1) male, long-winged, entirely black; (2) male, long-winged, reddish abdomen; (3) female, long-winged, entirely black; (4) female, short-winged, entirely black; and (5) female, short-winged, reddish abdomen. He stated he had no short-winged males and doubted they existed. He felt the short-winged and long-winged females might represent the female sex of two distinct species but that the males would have to be separated by some other character. He also felt that color was not a reliable diagnostic character. Both suppositions were based on the following experimental results.

To determine if the red color of the abdomen was inherited, Readio planned to mate black and red individuals in various combinations. He found, however, that in most cases the females collected in the field to begin the experiment had previously mated because they produced fertile eggs without being mated in the laboratory. Therefore, he could only observe the offspring from these fertile females. From short-winged females (remember, all males are macropterous) of both color forms, he obtained four long-winged males and three short-winged females; all were black. From long-winged females of the black variety (he collected no long-winged *abdominalis* females), he obtained only black long-winged individuals, two males and one female. Therefore, he felt color was not inherited but probably resulted from laboratory rearing conditions. Also, because he obtained only ten adult offspring, he felt that his supposition that the long- and short-winged females might represent two different species was weak.

This paper presents the results of our study of the taxonomic status of the two "species" of *Melanolestes*. We examine the validity of size of ocelli (Blatchley 1926) and color as diagnostic characters and the significance of wing length (macroptery and brachyptery) in the two forms. Furthermore, we examine the male and female external genitalia of both forms.

METHODS AND MATERIALS

We examined specimens from several collections (see Acknowledgments). We recorded the number of individuals exhibiting each color form and, of those, the number that were macropterous or brachypterous. Ocelli were measured as the transverse width of an ocellus versus interocellar distance to compensate for individual size variation.

Both male and female external genitalia were examined. Dried male specimens were softened in warm water to facilitate extraction of the pygophore (genital capsule). Pygophores were then soaked for 24 h in room temperature KOH (10%). The phallus was separated from the pygophore by severing the apodemes connecting the basal plates (BP, Fig. 2) of the phallus to the internal walls of the pygophore. Dissected pygophores and phalluses were cleared in glycerin or clove oil and drawings prepared using a camera lucida. The terminology used in the figures of genitalia follows Davis (1966) for males and Scudder (1959) for females.

Pairs of means were compared ($P = 0.01$) using Student's t test with unequal variances, and multiple comparisons were made using one way ANOVA with means separated using Duncan's multiple range test (SAS Institute 1988).

RESULTS

Examination of 442 specimens from several states (Fig. 1) and Baja California revealed that the specimens could not be divided into two or three groups based on color (i.e., abdomen black versus abdomen in part or completely red) but, in agreement with Parshley (1918), were more variable in color (Table 1). Even when the 'black' category was expanded to include dark reddish black, and the 'red' category to include reddish orange and orange, several specimens still could not be placed in one category or the

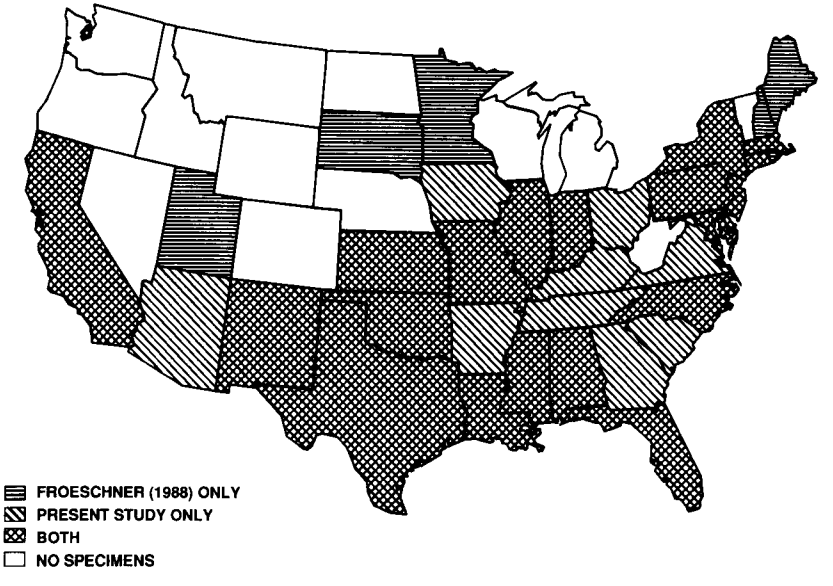

Fig. 1. Geographic distribution of *Melanolestes picipes* as given by Froeschner (1988) and of specimens examined in present study.

TABLE 1. COLOR, SEX, AND WING FORM IN DIFFERENT FORMS OF *MELANOLESTES*.

Color of Abdomen	Sex	N	Wing Form	
			Brachyterous	Macropterous
Black	M	95	0	95
	F	79	59	20
Red	M	152	0	152
	F	31	27	4
Red Connexivum	F	41	41	0
Intermediate	M	20	0	20
	F	24	22	2
TOTAL		442	149	293

other but were, instead, intermediate in color. 'Intermediate' included those specimens in which the general abdominal color was neither red nor black but somewhere in between, and those in which the abdominal color was a mosaic (e.g., red sterna with black spots, larger black patches, irregular black stripes, or black, transverse, intersegmental lines). Therefore, color cannot be used to separate the animals into two forms. Recall that Readio (1927), from his laboratory studies, concluded that color was not inherited but probably resulted from laboratory conditions. Blatchley (1926) stated that the two forms could be separated by the frequent presence of brachypterous females in *picipes*. However, his diagnosis of *abdominalis* was based only on macropterous individuals of both sexes. As can be seen from Table 1, all males were macropterous, thus agreeing with Readio (1927), and females were brachypterous or macropterous for all colors. Thus, the wing form character is invalid for distinguishing the two "species."

Finally, Blatchley (1926) used ocellar size to distinguish between the two forms (i.e., ocelli smaller in *picipes*). It is obvious from a cursory examination that ocellar size does vary (Table 2), but not in the way stated by Blatchley. Again, forcing the specimens into the artificial categories of black and red shows that ocelli did not differ significantly between the two forms but, if anything, tended toward larger size in *picipes*. Those with a red connexivum (all females) had significantly smaller ocelli than black and red individuals, so much so that when combined with red individuals, this combined group also differed from black individuals (Table 2). Again, this is just the opposite of what Blatchley said (i.e., red individuals have larger ocelli). Those intermediate in color did not differ from red individuals or from the red plus red connexivum group but did from black individuals and those with a red connexivum.

What do the above results concerning ocellar size indicate? First, Blatchley's statements were in error (i.e., ocelli are smaller in *picipes*, larger in *abdominalis*). This undoubtedly resulted from his small sample size of *abdominalis* (6 males, 8 females), and because the sample included only macropterous individuals. Also, the two red forms (red and red connexivum) demonstrate the unreliability of color because they differ in ocellar size but are supposed to be two forms of the same species. Finally, keeping in mind that the color categories in our study were somewhat arbitrary, we also found that ocellar size was not a valid character for separating the two "species." But there is obviously a difference in ocellar size. Is there a pattern? Excluding color as a factor in the analyses, but including sex and wing form (macropterous and brachypterous), it can be seen that males, which are always macropterous, have the largest ocelli; macropterous females, an intermediate size; and brachypterous females, the smallest ocelli of all (Table 2). That is, ocellar size is linked to sex and wing form.

TABLE 2. COMPARISON OF RATIO OF OCELLAR WIDTH TO INTEROCELLAR DISTANCE BETWEEN FORMS OF *MELANOLESTES*.

Color	Sex	Wing Form	N	Ratio $\bar{x} \pm SE$[a]	df	Prob.
Black	–	–	174	1.16 ± 0.04 A		
Red	–	–	183	1.07 ± 0.02 A	258.1	0.02[b]
Black	–	–	174	1.16 ± 0.04 A		
Red	–	–	183	1.07 ± 0.02 A		
Red Connexivum	–	–	41	0.52 ± 0.01 B	2,395	0.00[c]
Black	–	–	174	1.16 ± 0.04 A		
Red + Red Connexivum	–	–	224	0.97 ± 0.02 B	287.4	0.00[b]
Black	–	–	174	1.16 ± 0.04 A		
Red	–	–	183	1.07 ± 0.02 AB		
Intermediate	–	–	44	0.92 ± 0.06 B		
Red Connexivum	–	–	41	0.52 ± 0.01 C	3,438	0.00[c]
Black	–	–	174	1.16 ± 0.04 A		
Red + Red Connexivum	–	–	224	0.97 ± 0.02 B		
Intermediate	–	–	44	0.92 ± 0.06 B	2,439	0.00[c]
—	M	Macropterous	267	1.27 ± 0.02 A		
—	F	Macropterous	26	1.07 ± 0.04 B		
—	F	Brachypterous	149	0.62 ± 0.01 C	2,439	0.00[c]

[a]Means followed with same letter within column within each cell are not significantly different at the 0.01 probability level using Duncan's Multiple Range Test.
[b]Student's *t* test.
[c]One way ANOVA.

As noted above, in addition to Blatchley's characters, we also examined the male and female genitalia of the black and red (including red connexivum) forms to determine if there were any obvious differences. Female genitalia (Fig. 2a) were highly uniform across color forms and followed the pattern outlined by Davis (1966) for peiratine reduviids. Male pygophores (Fig. 2b, c) and phalluses (Fig. 2d) were asymmetrical as is typical for Peiratinae. Pygophores were notable for the large medial process (MP) that arose from the ventral rim, leaned to the right (Fig. 2b), and curled cephalad (Fig. 2c). The left paramere (LPM) was always larger than the right paramere (RPM). The pedicel (PD) of the phallus (Fig. 2d) curled to the left as it descended to articulate with the strut (STR). The caudally directed strut angled from left to right. The dorsal phallothecal sclerite (DPS) was largely absent from the left half of the phallus. None of these structures varied significantly between individuals of the two color forms.

From our results, therefore, we conclude that *abdominalis* is not a valid species and must be treated as a synonym of *picipes*.

REDESCRIPTION

Melanolestes picipes (Herrich-Schaeffer)
Pirates picipes Herrich-Schaeffer 1846, p. 62.
Pirates abdominalis Herrich-Schaeffer 1846, p. 63.

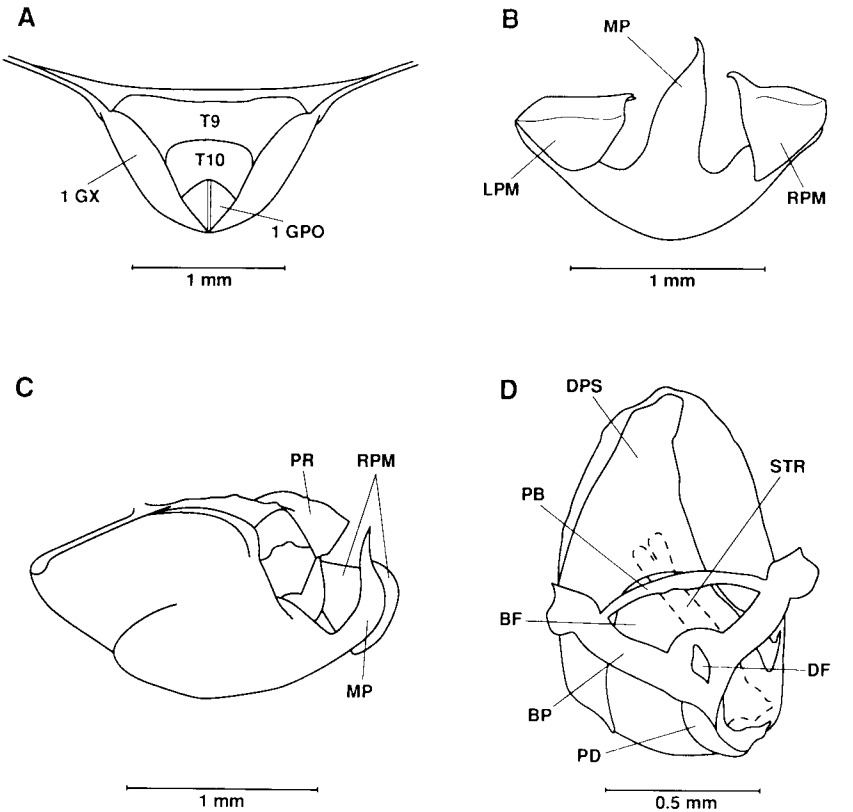

Fig. 2. Male and female genitalia of *Melanolestes picipes*: A. female, ventroposterior view. B. male, pygophore, ventroposterior view. C. male, pygophore, lateral view (left paramere removed). D. male, phallus, dorsal view. Abbreviations: BF, basal foramen; BP, basal plate; DF, ductifer; DPS, dorsal phallothecal sclerite; 1GPO, first gonapophysis; 1 GX, first gonocoxa; LPM, left paramere; MP, medial process; PB, basal plate bridge; PD, pedicel; PR, proctiger; RPM, right paramere; STR, strut; T9, tergum 9; T10, tergum 10.

(For more complete taxonomic history, see Froeschner [1988] and Maldonado Capriles [1990]).

Body elongate-oval. Color varying from entirely black or reddish black to head and thorax dark brown to black and abdomen with varying amounts of red (i.e., only connexivum red to terga and sterna red); tarsi brownish to black; hemelytral membrane dark brown to black.

Compound eye with width subequal to or, most often, less than interocular space, the latter most evident in females. Antennal segment 2 with most hairs more than one-half width of segment in males, often shorter than one-half in females, those of males almost perpendicular to long axis of segment giving it a bristly appearance, those of female forming about 30° angle to subparallel to segment. Ocelli varying from large to small, those of male subequal in width or wider than interocellar space, those of female either wide as those of males (generally macropterous individuals) or narrower than interocellar width (generally brachypterous individuals).

Pronotum with posterior lobe finely rugose-granulate, humeral angles rounded. Males macropterous, females macropterous or brachypterous; wings in macropterous form reaching to slightly exceeding tip of abdomen, those in brachypterous form not surpassing tergum 3.

Length, 12.0-20.0 mm.

Distribution (taken in part from Froeschner [1988]): AL, AR, AZ, CA, CO, CT, DC, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, NH, NJ, NM, NY, OH, OK, PA, RI, SC, SD, TN, TX, UT, VA (Quebec, Mexico to Brazil, Hawaii-introduced).

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