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Authors: Wesley Bicha, and Nathan Schiff

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A NEW SPECIES OF SCORPIONFLY FROM THE BLUEGRASS REGION OF KENTUCKY (MECOPTERA: PANORPIDAE)¹

Wesley Bicha² and Nathan Schiff³

ABSTRACT: A new species of scorpionfly, similar to *Panorpa helena* and *Panorpa insolens*, but lacking 2–4 long, stout, black setae on the male basistyles apices and possessing long barbs on the apices of the male ventral parameres, is described from the Bluegrass Region of Kentucky.

KEY WORDS: *helena*, *insolens*, *Panorpa*, *venosa*

Five families of Mecoptera are known to occur in North America, with Panorpidae being the largest family in both North America (55 US species), and the world (457 species) (Bicha, 2018). The insects are commonly called scorpionflies, because the males have a characteristic up-curved, terminally-bulbous abdomen resembling a scorpion stinger. The adults can be quite abundant at certain times of the year and are typically observed on the tops of lush vegetation at the broken-shaded edges of mesic forest feeding on insect or small animal carrion or rotting fruits. The eruciform larvae bear long, stout setae and are soil dwelling and likely feed on insect carrion and other debris. All North American Panorpidae are currently assigned to the genus *Panorpa* Linnaeus, 1758, which needs revision, because many authors consider the genus paraphyletic (Willmann, 1989; Misof et al., 2000; Whiting, 2002; Cai et al., 2008; Ma et al., 2011, 2012; Zong et al., 2013; Hu et al., 2015; Gao et al., 2016; Miao et al., 2017).

Obadiah Westwood was initially credited as describing *Panorpa venosa* Westwood, in 1846, which was illustrated and reported as having a wide distribution across the eastern United States by subsequent authors Hine (1901), Esben-Petersen (1921), Carpenter (1931), and Byers (1954). Byers (1962) later examined the type of *Panorpa venosa* and concluded that it was synonymous with *Panorpa rufescens* Rambur, 1842, of narrow coastal distribution. Byers (1962) then described *Panorpa helena*, to represent the widespread species previously misidentified and known as *P. venosa*.

In 1993, Byers reestablished *Panorpa venosa* as the valid name for a species limited to the coastal area of Georgia, with *P. rufescens* limited to the New England coastal area. In 2012 Somma established 1841 as the correct date for Westwood's publication. Thus, *Panorpa rufescens* was superseded by *Panorpa confusa* Westwood, 1841.

Carpenter (1935) described *Panorpa insolens* from a lone female with possibly aberrant wing markings from Cincinnati, Ohio. Byers (1973) illustrated the

¹ Received on February 21, 2018. Accepted on June 4, 2018.

² 121 Old Batley Road, Oliver Springs, TN 37840. E-mail: mecoptera@live.com

³ USDA Forest Service, Southern Research Station, Center for Bottomland Hardwoods Research, Stoneville, MS 38776

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male genital bulb of a species from central Kentucky, which he associated with *Panorpa insolens*. Flint (2013) further defined *Panorpa helena* as a species with a northeastern distribution based on the shape of the male ventral parameres, clarified that Byers had misidentified the scorpionfly from central Kentucky when he illustrated the male genital bulb of the species, and redefined *Panorpa insolens* as the species occupying much of the eastern United States except for the northeast United States and central Kentucky. This leaves the scorpionfly from central Kentucky, which was illustrated by Byers (1973) and Webb et al. (1975), and ranges provided by Byers and Covell (1981) without a formal description and a name.

MATERIALS AND METHODS

Specimens were collected from the tops of lush vegetation adjacent to mesic forest by net and dropped alive into 80 percent ethanol. Dissected female genitalia were cleared by soaking in lactophenol for 24 hours. Male genitalia were not cleared prior to photography. Specimens were examined, and dissected genitalia were mounted in clear jellied alcohol (Puracell® hand sanitizer) and photographed with a Leica Z16 apochromatic zoom lens attached to a Leica MC170 digital camera. Images were produced at different focal lengths for each view and the resulting z-stack combined to form a single sharp image using Leica Application Suite version 4.9. The images were combined into a plate using GIMP® 2.8.16. Following examination specimens were pinned and spread. Descriptive nomenclature venation and markings follows Esben-Petersen (1921); terminology for genitalia is that of Carpenter (1931). Specimen localities were plotted using SimpleMappr. Specimens with only county localities were plotted using the county centroid.

Panorpa rosemaria Bicha & Schiff, new species

(Figs. 1-5, 8-9)

Misidentification as *Panorpa insolens*: Byers, 1973: 272, Fig. 18. Webb, et al., 1975: 302, Figs. 81, 126–127, 157. Byers & Covell, 1981: 196–198.

Diagnosis. *Panorpa rosemaria* is very similar to *P. helena* and *P. insolens*, but males lack 2–4 long, black setae on the apices of the basistyles at the bases of the dististyles of the later two species. The male ventral parameres of *P. rosemaria* possess long barbs on the mesal edge from the midpoints to the apices, while the apices of those of *P. helena* are bare and spatulate and those of *P. insolens* are barbed and attenuate. These three species are closely related members in the *insolens* species group (males with anal horn, no aedeagal hamulus, and wings with one or no submarginal spot).

Description. 155 males, 86 females initially preserved in ethanol, subsequently pinned and wings spread.

Head: Head pale orange. Ocelli black; eyes plum to grey. Rostrum pale orange; labrum and mouthparts light brown except apex of maxillary palps dark brown. Antennae long, extending to pterostigma of forewing, with 36–40 flagellomeres; scape pale orange, pedicel and flagellomeres black.

Thorax: Pronotum, mesonotum, and metanotum pale orange. Pronotum anterior margin with 12–20 long, black setae; mesonotum with fine, black caudally-directed setae; posterior margin of mesonotum posterior margin with 6–10 long, black setae. Pleural areas pale yellow (in ethanol) to light brown (dry). Coxae 1 and 2 anterior with 6–12 long, black setae. Coxae, femora, tibiae, and tarsi yellow to orange brown with numerous fine black apically-directed setae; tibiae with few sparse, longer, black setae and two dark brown apical spurs; each tarsus with two serrate claws with dark brown teeth.

Wing (Fig. 1) membranes colorless to slightly amber-tinged, not iridescent; markings slightly diffuse, brown. Apical bands entire. Pterostigmal bands broad; basal branches complete; distal branches broken or absent. Marginal spots (of Esben-Petersen) present. Basal bands broad and typically entire, although sometimes interrupted at midpoint. Humeral (submarginal) spots typically absent, but occasionally one diffuse spot present on each wing. One diffuse basal spot present on each wing. Thyridium present. Nygma in cells R_{4+5} and $1R_5$. Two to four rows of macrotrichia in center of cells distal to basal band. Posterior base of forewings and anterior base of hindwings with 2–3 stout setae.

Abdomen of male: Terga 2–8 pale orange to orange-brown; pleural areas sordid white (in ethanol) to golden to light brown (dry); tergum 3 posterior margin (notal organ) with broad, setaceous process extending to tergum 4 anterior margin pairing with small, upraised, pointed peg near tergum 4 anterior margin (functioning as female wing clamp during mating); segment 6 dorsocaudally subconical (Fig. 2), length 1.6 times anterior width, pale orange; segment 7 anteriorly constricted, length 2.2 times posterior width, pale orange; segment 8 anteriorly constricted, length 2.4 times posterior width, pale orange. Tergum 9 apical margin emarginate; cerci brown. Sternum 9 pale orange to orange-brown, base width two-fifths length, apex width one-fourth length, bearing two, long, thin, parallel hypoalves (Fig. 3) covered with fine black setae and mesal margins bearing longer, black setae; extending just short of bases of dististyles. Basistyles fused basal four-fifths of length, elliptical with width equal to length, orange to orange-brown, apical margins truncate; lacking long, black setae at bases of dististyles. Basistyles, dististyles, and sternum 9 covered with black, caudally-directed setae. Aedeagus ventral and dorsal valves vestigial; ventral parameres long, extending well beyond bases of dististyles, bearing long barbs on the mesal edge from midpoint to apices; dorsal parameres white, extending to base of dististyles and folding over; aedeagal hamula (of Byers) absent. Dististyles comparatively short, falcate, with slight mesobasal cup.

Abdomen of female: Terga 2–8 brown; sterna 2–5 light brown; terga 7–10 light brown; sterna 6 brown; sterna 7–10 light brown; cerci black. Subgenital plate of sternum 8 (Fig. 4) light brown, subtriangular, caudal portion bearing long light

brown setae, remainder with shorter setae. Genital plate (Fig. 5) width one-fourth length; spermathecal apodeme divergent, extending one-third beyond basal plate; caudal margin of distal plate deeply subcircularly incised.

Measurements: Body length of holotype male approximately 15 mm; allotype female approximately 14 mm. Forewing length approximately 14 mm.

Type material. **HOLOTYPE** male, KENTUCKY, Trimble Co., 38°32'57.0" N, 85°18'19.0" W, 8 July 2017 on stinging nettle along a slow, limestone-bottomed stream in a bottomland forest of large sycamore. **ALLOTYPE** female and 5 males, 2 females paratypes, same locality and date as holotype. Additional **PARATYPES**: KENTUCKY, Anderson Co., 8 July 2017, 1 male; Bracken Co., Brooksville, 25 May 1971, 1 male; Boone Co., 29 July 1977, 1 female; Boone Co., 24 June 1978, 4 males, 5 females; Boone Co., 19 July 1979, 1 male; Boone Co., 29 June 1980, 3 males, 3 females; Boone Co., 23 May 1982, 6 males, 4 females; Boone Co., 38°52.515'N, 84°39.336'W, 1 June 2014, 6 males, 3 females; Boone Co., Big Bone Lick State Park, 29 June 1971, 1 male, *leg.* P. H. Freytag & G. Leppert; Boyle Co., 37°39'11.1"N, 84°54'49.5"W 283 m, 3 September 2016, 3 males, 3 females; Breckenridge Co., 37°46'16.7"N, 86°16'42.9"W 171 m elevation, 3 September 2016, 1 male; Bullitt Co., 14 September 1985, 19 males, 2 females; Casey Co., 37.32026°N, 85.1347°W 241 m elevation, 4 June 2011, 4 males, 2 females; Clarke Co., 17 September 1983, 2 males, 3 females; Edmonson Co., 37.27881°N 86.12097°W, 24 September 2016, 1 male; Fayette Co., Lexington, 10 May 1991, 1 male, *leg.* M. F. Potts; 17 May 1957, 1 male, *leg.* L. H. Townsend; 20 June 1975, 1 male, malaise trap; Franklin Co., 17 September 1983, 2 males, 1 female; Franklin Co., 38.23680°N, 84.916430°W, 28 May 2010, 6 males, 7 females; Gallatin Co., 14 September 1985, 1 female; Garrard Co., 11 June 1983, 2 males, 5 females; Garrard Co., 37°33'25.1"N, 84°21'21.8"W, 23 September 2017, 1 male, 1 female; Grant Co., 38°39'27.7"N, 84°40'16.4"W, 16 September 2017, 2 males; Green Co., 37.26858°N, 85.53849°W 241 m elevation, 28 August 2010, 6 males, 1 female; Green Co., 37°10'34.2"N, 85°25'17.3"W, 9 September 2017, 1 male, 2 females; Hardin Co., 37°40'37.9"N, 85°53'23.3"W 205 m elevation, 3 September 2016, 2 males, 1 female; Harrison Co., Buena Vista, 20 May 1963 1 male; Hart Co., 38.37744°N, 85.89469°W, 24 September 2016, 2 males, 2 females; Harrison Co., 38.4494°N, 84.3773°W, 16 June 2018, 1 male; Jefferson Co., Louisville, 11 September 1977, 1 male, *leg.* M. Day; 16 September 1976, 1 male, *leg.* D. A. Casey; 18 September 1976, 1 male, *leg.* R. C. Ransbottom; 7 October 1976, 1 male; *leg.* J. A. Long; Jefferson Co., 14 May 1960, 1 male, *leg.* B. A. Reid; Jefferson Co., Clifton, 8 May 1957, 1 male; Jefferson Co., Prospect, 5 June 1970, 1 male, *leg.* E. E. Leppert; Jessamine Co., 7–14 September 1974, 1 male, malaise trap, *leg.* P. H. Freytag; Jessamine Co., Indian Falls, 3 May 1974; 1 male, *leg.* G. Florence; Kenton Co., 10 May 1986, 2 males, 1 female; Larue Co., 37.51283°N, 85.69822°W, 24 September 2016, 5 males, 9 females; Lincoln Co., 2 mi SE of Paint Lick on highway 21, 16 August 2008, 1 male, 2 females; Lincoln Co., 17 September 1983, 5 males, 2 females; Madison Co., 37°44'29.8"N, 84°9'23.6"W, 23 September 2017, 1 male; Marion Co., 37.45860°N,

85.25972°W 219 m elevation, 4 June 2011, 2 males, 1 female; Nelson Co. 37.80626°N, 85.58553°W 148 m elevation, 4 June 2011, 3 males, 3 females; Nelson Co., Bardstown, 24 May 1967, *leg.*, 2 males, G. Florence; Oldham Co., Covered Bridge Boy Scout Reservation 8 May 1968, 1 male, *leg.* C. Covell; 21 June 1968, 1 male, *leg.* Covell; 15 September 1974, 1 male, *leg.* C. Covell; 15 September 1976, 2 males, *leg.* C. Covell; Oldham Co., 15 May 1968, 1 male, *leg.* T. H. Livers; 17 May 1968, 1 male, *leg.* M. Fitzgerald; 30 July 1974, 1 male, *leg.* G. Remley; Oldham Co., Horner Bird Sanctuary, 1 July 1975, 1 male, *leg.* C. Covell; 4 September 1974, 2 males, *leg.* N. Thieret; Oldham Co., University of Louisville farm, 1 July 1975, 1 male, *leg.* G. T. Beha; Oldham Co., 17 May 1968, 1 male, *leg.* M. Fitzgerald; Owen Co., 38°28'24.5" N, 84°57'18.3" W, 16 September 2017, 2 males, 1 female; Pulaski Co., 37.12103°N, 84.83211°W 333 m elevation, 4 June 2011, 2 males, 2 females; Pulaski Co., 37°10'47.8"N, 84°35'49.4"W, 30 September 2017, 1 male; Scott Co., 27 May 1983, 1 male; Shelby Co., 38°16'37.8"N, 85°12'49.4"W, 16 September 2017, 2 males, 3 females; Scott Co., 38.3837°N, 84.5651°W, 15 June 2018, 1 male, 2 females; Shelby Co., Waddy, 10 May 1963, 1 male; Spencer Co., 38°2'21.5"N, 85°5'40.4"E, 16 September 2017, 1 female; Taylor Co., 37.22395°N, 85.34561°W 259 m elevation, 28 August 2010, 5 males, 1 female; Trimble Co., 28 July 1985, 1 male, 2 females; Trimble Co., 38°32'57.9"N, 85°18'19.0"W 181 m elevation, 4 September 2016, 7 males, 2 females; Washington Co., 37.7824°N, 85.25481°W 214 m elevation, 4 June 2011, 4 males, 4 females; Washington Co., Springfield, 13 May 1963, 1 male; Woodford Co., westbound rest area on I-65, 25 May 2008, 1 male. Specimens with no collector listed were collected by the first author (WJB).

Holotype and allotype Paratypes deposited in the United States Natural History Museum (USNM), Washington, DC. Paratypes deposited in the Florida Collection of Arthropods (FSCA), Gainesville, Florida, Illinois Natural History Survey (INHS), Champaign, Illinois, Purdue Entomology Research Collection (PERC), West Lafayette, Indiana, Triplehorn Insect Collection (TIC), Columbus, Ohio, Snow Entomological Museum (SEM), Lawrence, Kansas, University of Kentucky Collection (UKC), Lexington, Kentucky and the collection of the first author (WJB).

Remarks. *Panorpa rosemaria* is very similar to *P. helena* and *P. insolens* (*insolens* species group) in males possessing an anal horn on tergum 6 (Fig. 2) and lacking an aedeagal hamulus, and wings lacking submarginal (humeral) spots and with slightly diffuse wing bands (Fig. 1), but differs in males lacking 2–4 long, black setae on the apices of the basistyles (Figs. 6 & 7) at the bases of the dististyles of the latter two species (Figs. 6 & 7 vs Fig. 8). The male ventral parameres of *P. rosemaria* (Fig. 8) possess long barbs on the mesal edge, from the midpoints to the apices, while the apices of those of *P. helena* are bare and spatulate (Fig. 6) and those of *P. insolens* are barbed and attenuate (Fig. 7). The females of these three species appear to be morphologically impossible to separate.

This species is generally quite abundant in May and September sitting on the tops of broadleaf herbaceous vegetation growing in the broken-shaded edges of

mesic forest (Fig. 9) growing in rich soil, especially near slow streams, and tends to congregate near overripe pokeweed fruit (*Phytolacca americana*) in late August and throughout September. In contrast to its two wide-ranging sister species, *Panorpa rosemaria* seems to avoid areas with clayey soil and appears to be endemic to the Bluegrass Region of Kentucky, with its limey soils (Fig. 10). In May and June *P. rosemaria* often is found with *P. speciosa* Carpenter, 1931, in August and September with *P. debilis* Westwood, 1841 or *P. speciosa*, and in late September to early October with *P. neglecta* Carpenter, 1931. *Panorpa capillata* Byers, 1993 flies in May in similar localities as *P. rosemaria*, but only in the deep shade of the moist forest.

Etymology. The specific epithet, *rosemaria*, was selected to honor the author's (WJB) wife, Rosemary, who has been steadfastly supportive of field work, enduring four decades of sharing driving, guarding the vehicle, eating, and sleeping in less than desirable places.

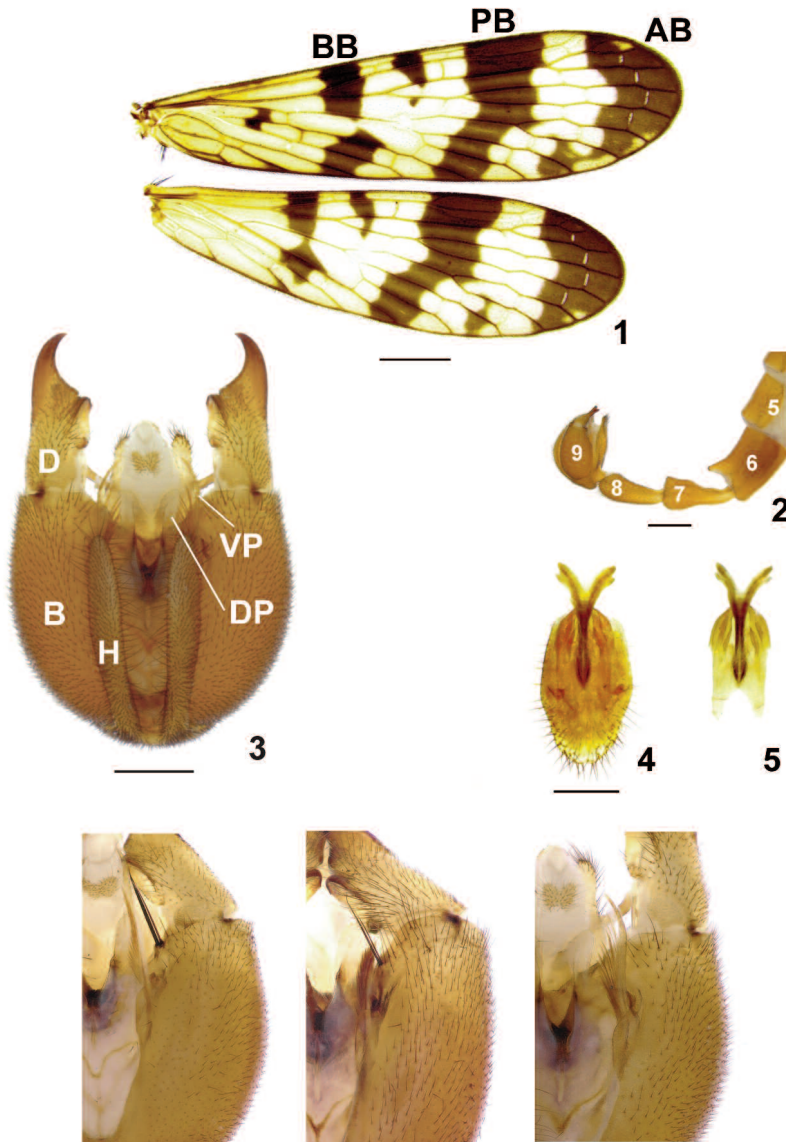
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Figs. 1–5, 8 *Panorpa rosemaria*. 1) right fore and hind wings, AB = apical band, BB = basal band, PB = pterostigmal band. scale bar = 1 mm. 2) right lateral view of abdominal segments 5–9, scale bar = 0.5 mm. 3) ventral view of male genital bulb, B = basistyle, D = dististyle, DP = dorsal paramere, H = hypovalve, VP = ventral paramere, scale bar = 0.2 mm. 4) dorsal view of female subgenital plate with attached genital plate. 5) ventral view of genital plate, scale bar for Figs. 4–5 = 0.2 mm. 8) ventral view of male genital bulb with hypovalve removed to show ventral paramere. Figure 6) *Panorpa helena*. Ventral view of male genital bulb with hypovalve removed to show ventral paramere. Figure 7) *Panorpa insolens*. Ventral view of male genital bulb with hypovalve removed to show ventral paramere, scale bars for Figs. 6–8 = 0.2 mm.



Fig. 9. *Panorpa rosemaria* male.

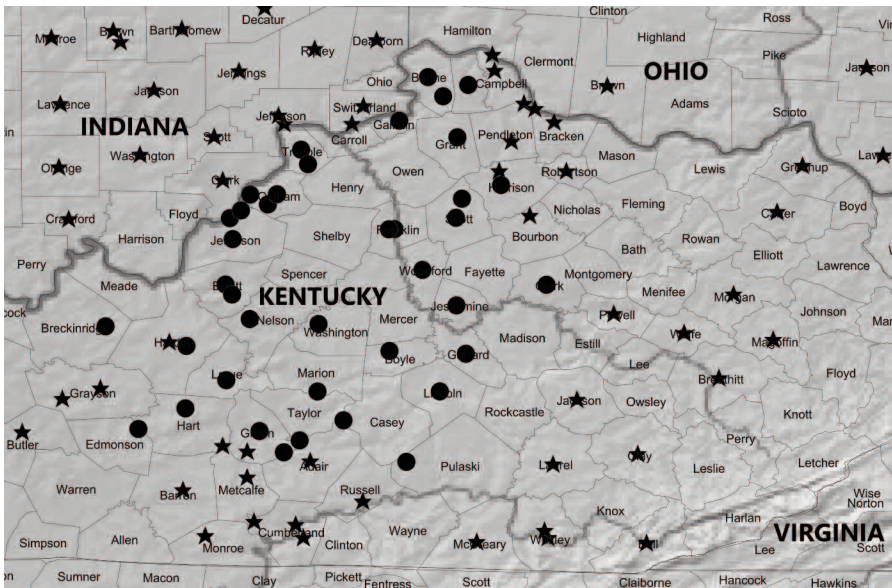


Fig. 10. Geographical distribution of *Panorpa rosemaria* dots and *Panorpa insolens* stars.