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Preliminary Checklist of the Mecoptera of Florida:
Earwigflies, Hangingflies, and Scorpionflies

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Preliminary Checklist of the Mecoptera of Florida: Earwigflies, Hangingflies, and Scorpionflies

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Abstract. We provide the first species checklist of Mecoptera indigenous to Florida, based upon preliminary data gathered primarily from specimens housed in the Florida State Collection of Arthropods. There are 11 described and one undescribed species of mecopterans, representing three families, inhabiting the state of Florida. These include the recently discovered meropeid (earwigfly), *Merope tuber* Newman, four species of bittacids (hangingflies), represented by the genus *Bittacus* Latreille, and 7 species (one undescribed) of panorpids (scorpionflies), represented by the genus *Panorpa* Linnaeus. We are not certain if one of these, *Bittacus texanus* Banks, is indigenous, represents a nonindigenous occurrence, or is simply erroneous. Two of the species on our list, *Bittacus stigmaterus* Say and *Panorpa venosa* Westwood, represent first state records and one species, *Panorpa floridana* Byers, is endemic. Six of the species which have been recorded in Florida, *M. tuber*, *Bittacus punctiger* Westwood, *Panorpa rufa* Gray, *Panorpa pachymera* Byers, *Panorpa lugubris* Swederus and *P. venosa*, represent the southernmost records for these species in the continental United States. Perceived diversity and abundance of mecopteran species in Florida are limited by climate, biogeography, and collection bias.

Introduction

Mecoptera is a small, ancestral order of holometabolous insects. At present there are more than 600 known, extant species arranged in 34 genera and 9 families worldwide (Enderlein 1910; Esben-Petersen 1915, 1921; Tillyard 1918, 1935; Lameere 1936; Grassé 1951; Brues et al. 1954; Willmann 1987, 1989; Grimaldi and Engel 2005; Palmer et al. 2007; Penny 2008). Five families are widely distributed throughout much of the world, including North America, while the other four are restricted to South America and the Australian region (Kaltenbach 1978; Byers 2005; Dunford and Somma [in press]). Two families, Panorpidae and Bittacidae, comprise most of the species, and in North America they are represented by more than 54 species (1 genus) of panorpids and 10 species (4 genera) of bittacids (Hine 1898; Byers 2005; Cheung et al. 2006; Dunford and Somma [in press]). Fossil Mecoptera are well represented in sedimentary rocks of the lower Permian geological period, approximately 270 million years ago (Novokschonov 1998, 2002; Grimaldi and Engel 2005). There are nearly 400 known fossil species in approximately 87 genera and as many as 34 families (although researchers disagree on the exact number of extinct families), exhibiting a greater diversity than extant mecopteran taxa (Grimaldi and Engel 2005). Traditional “Mecoptera” lack defining, uniquely derived, unifying characters, and may not represent a monophyletic grouping. A combination of recent DNA and older morphological data suggests Mecoptera are closely

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related to siphonapterans (Richards 1965; Richards and Richards 1969; Rothschild 1975; Whiting 2002; Grimaldi and Engel 2005; Marshall 2006).

Mecopterans have life histories as diverse as their morphologies. Many species inhabit mesic, forested environments and feed on decaying vegetation or dead, dying, or living soft bodied arthropods as larvae and/or adults; some groups are reported to feed on nectar, pollen, carrion, mosses, or are kleptoparasites of spider webs (Setty 1940; Byers 1963; Webb et al. 1975; Byers and Thornhill 1983; Bockwinkel and Sauer 1993; Palmer and Yeates 2005; Marshal 2006; Dunford and Somma [in press]). Larvae are generally eruciform or caterpillar-like, having a well developed head capsule with chewing mouthparts, and pupae are exarate and denticous, and typically located in soil (Setty 1940; Byers 1963, 1987; Boese 1973); however, these stages remain undiscovered in many mecopterans, including the meropeids (Byers 1987; Abbott et al. 2007; Dunford et al. 2007a, b, [in press]). Since many mecopterans inhabit moist forests, any disturbance reducing moisture levels (i.e., deforestation, global warming) could adversely affect or extirpate those species which are present. In general, Mecoptera are weak fliers, and dispersal could be severely limited if suitable habitat is reduced. This order is of little economic significance in North America but represents a systematically and biologically important, ancient insect lineage.

Materials and Methods

The Mecoptera collection at the Florida State Collection of Arthropods (FSCA) contains 20 drawers of mostly pinned adults, representing more than 4100 specimens (Dunford et al. 2007b). Herein, we present a brief summary of the 302 adult and 7 larval specimens, representing three families of Mecoptera, collected from Florida and housed within FSCA. We have augmented this information with literature records, and additional specimen data from mecopterans gifted to the National Museum of Natural History, Smithsonian Institution (NMNH), from FSCA in 2007. We only present detailed collection data for species representing state and county records of particular significance. We produced all of our illustrations from specimens housed in FSCA. Our overall goal is to provide initial information in order to stimulate further detailed studies on mecopterans inhabiting Florida.

Meropeidae - Earwigflies

The North American earwigfly, *Merope tuber* Newman, was recently (1996) collected in the Florida panhandle, representing first records for the state and southernmost records for North America (Dunford et al. 2007a). All 40 of these specimens, from Leon and Liberty counties, are currently housed in FSCA (Table 1; Dunford et al. 2007a, [in preparation]). This secretive meropeid is indigenous to eastern deciduous forests of North America. Its only other extant confamiliar is *Austromerope poultoni* Killington, an earwigfly restricted to extreme southwestern Western Australia (Byers 1973a; Abbott et al. 2007; Dunford et al. 2007a, [in press]; Somma and Dunford 2007).

Bittacidae - Hangingflies

Four species of bittacids, all in the genus *Bittacus* Latreille, have been collected in Florida. Two of these, *Bittacus pilicornis* Westwood and *Bittacus punctiger* Westwood, are somewhat common and previously recorded from the state (Carpenter 1935; Byers 1954, 1973b; Webb et al. 1975). *Bittacus pilicornis*, the hairy-horned hangingfly, is found in northern Florida, as far west as Jackson County in the eastern panhandle and as far south as Alachua County; while *B. punctiger* (Fig. 1), the spotted hangingfly, is found statewide (Table 1). The two specimens of *B. punctiger* from Miami-Dade County (Fuch's Hammock, near Homestead, 11-12 May 1980, one male collected by T. S. Dickel and H. V. Weems, Jr.; and Everglades National Park, 5 May 1961, one female collected by F. W. Mead), and perhaps the single specimen from an undescribed locality in Monroe County (25 June 1964, one male collected by K. J. Stone), represent the southernmost records for this species in the continental United States. Say's hangingfly, *Bittacus stigmaterus* Say, is only represented by a single specimen from the Florida panhandle, Liberty County (Torreya State Park, 20 August 1987, one male collected by C. Porter and L. A. Stange), and two other specimens from the northern peninsula, Alachua County (Gainesville, 1 October 1940, one individual missing an abdomen collected by T. Hubbell; and unspecified locality, 16 October

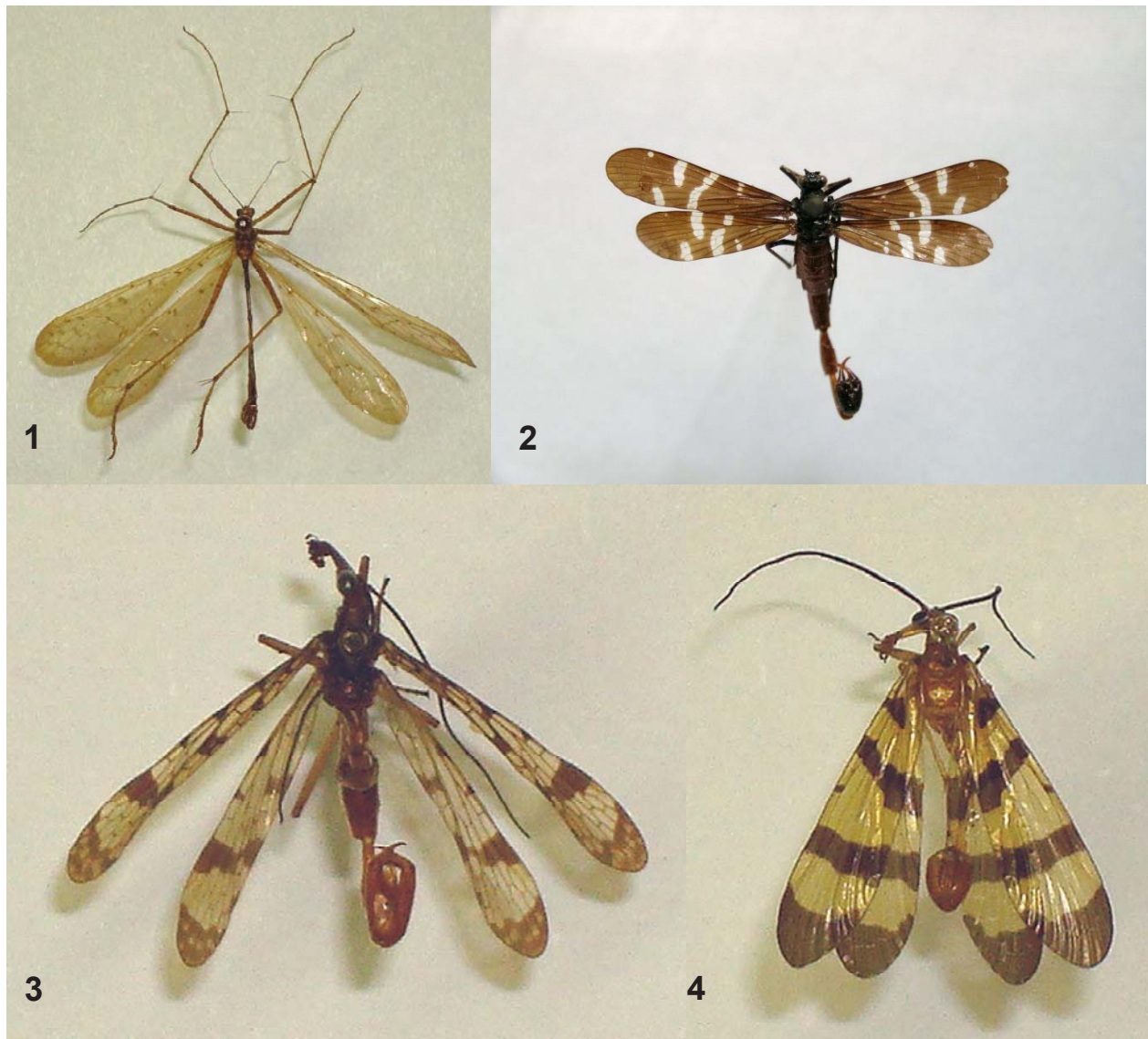


Figure 1-4. 1) Habitus of male *Bittacus punctiger*, spotted hangingfly, from Alachua County, Florida. Image by James C. Dunford. 2) Habitus of male *Panorpa lugubris*, black scorpionfly, from unknown locality, Florida. Image by Gary J. Steck. 3) Habitus of male *Panorpa floridana* holotype, Florida scorpionfly, from Alachua County, Florida. Image by James C. Dunford. 4) Habitus of male *Panorpa americana*, American scorpionfly, from Liberty County, Florida. Image by James C. Dunford.

1951, one female collected by "G. E. N.") (Table 1). These are first state records for *B. stigmaterus* in Florida. A single specimen of *Bittacus texanus* Banks, the Texas scorpionfly, was collected in Citrus Center west of Lake Okeechobee, Glades County, Florida (Carpenter 1931; Byers 1993), but no specimens exist in FSCA. As this record is greatly disjunct from the more westerly range of this species (Carpenter 1931; Webb et al. 1975), and no other records for Florida exist of which we are aware, we are not clear whether *B. texanus* is indigenous to the state or if this represents a single nonindigenous record. Byers (1993) suspects that the label locality data for this specimen are erroneous.

Panorpidae - Scorpionflies

Six described and one undescribed species of panorpid, represented by the genus *Panorpa* Linnaeus, occur in Florida. Five of these, *Panorpa lugubris* Swederus, *Panorpa rufa* Gray, *Panorpa floridana*

Byers, *Panorpa pachymera* Byers and *Panorpa americana* Swederus, were previously recorded from the state. *Panorpa lugubris*, the black scorpionfly (Fig. 2), is clearly the most widespread and abundant scorpionfly indigenous to Florida (Glover in Hagen 1861; Hine 1901a, b; Carpenter 1931, 1935; Byers 1954, 1993). Specimens of this species in FSCA represent 15 counties that include the panhandle, northern peninsular and portions of central peninsular Florida, as far south as Orange and Pinellas counties (Table 1). A larval *Panorpa* collected from Glen St. Mary, Baker County, Florida, on 27 January 1961 by E. W. Holder was putatively assigned to *P. lugubris* by G. W. Byers (Table 1). Additionally, a map provided by Byers (1993) includes Escambia, Jackson, and Manatee counties; the lattermost being the southernmost record for *P. lugubris* in Florida and the continental United States. Lastly, on 29 March 2007, FSCA gifted 24 pinned adult *P. lugubris* to NMNH that were collected from Leon (N = 10), Baker (N = 7), and Alachua (N = 7) counties, Florida.

Panorpa rufa, the red scorpionfly, is indigenous to northern Florida. Byers (1954, 1993) and FSCA specimens (Table 1) limit this species to the panhandle in addition to disjunct records from Alachua County in the northern peninsula. The Alachua County records are the southernmost in the United States. FSCA gifted 2 pinned adult specimens from Gulf and Okaloosa counties, Florida, respectively, to NMNH on 29 March 2007. In addition to the 5 counties listed in Table 1, Byers (1954, 1993) includes Bay and Holmes counties in the Florida panhandle.

Panorpa floridana, the Florida scorpionfly, is endemic to Florida and is only known from Alachua and Clay counties (Byers 1993; Table 1). The two specimens in FSCA are the holotype from Alachua County, Florida (near the San Felasco Hammock, Gainesville, 10 November 1970, one male collected by L. A. Hetrick; Fig. 3), and a paratype from Clay County, Florida (Orange Park, 25 December 1936, one male collected by K. Wheeler) (Byers 1993). Additionally, Byers (1993) lists an allotype from Clay County, Florida (Gold Head Branch State Park, 20 November 1982, one female collected by S. W. Gross); and two more paratypes from Florida (Alachua County, 8 November 1974, one female collected by D. Richman; and Gold Head Branch State Park, Clay County, 20 November 1982, one male collected by S. W. Gross).

Byers (1993) tentatively assigned a *Panorpa* specimen from Santa Rosa County, in the Florida panhandle, to *P. pachymera*, the stout-genitaled scorpionfly. Additionally, Carpenter's (1931) record for *Panorpa rufescens* Rambur, the rufous scorpionfly, from Madison County, northern Florida, before this species group was split by Byers (1993), potentially could be referable to *P. pachymera*. Other than these two presumptive records, there exist two *P. pachymera* from Gainesville, Alachua County, Florida (4 December 1918, one male and one female collected by G. B. Merrill) and four from Leon County, Florida (Tall Timbers Research Station, 6-7 May 1968, one male and two females collected by H. V. Weems Jr.; and 6 May 1968, one male collected by G. H. Heinrich). These FSCA specimens verify the existence of *P. pachymera* in Florida (Table 1). The Alachua County specimens are the southernmost records from the United States.

Panorpa americana (Fig. 4), the American scorpionfly, is limited to the Florida panhandle (Carpenter 1931; Byers 1954, 1993; Table 1). Additionally, 12 pinned adult *P. americana* from Okaloosa County, Florida, were gifted from FSCA to NMNH on 29 March 2007.

We report the first state records for *Panorpa venosa* Westwood, the veined scorpionfly, in Florida; they include Baker (Glen St. Mary, 17-28 November 1960, two males and two females collected by H. V. Weems Jr.) and Leon counties (Tall Timbers Research Station, 4-17 May 1996, one female collected by P. W. Kovarik) (Table 1). These specimens are the southernmost records for this species.

Several specimens of *Panorpa* from Florida in FSCA are not assigned to species (Table 1). These include six larval *Panorpa* from Glen St. Mary, Baker County, Florida, collected on 14 January 1961 by E. W. Holder. Additionally, a single adult female from the J. & E. Turf Farm, north of LaCrosse, in the Santa Fe River floodplain, Alachua County, Florida, collected 19-26 July 1986 by G. J. Steck and B. D. Sutton, only can be assigned to the *Panorpa virginica* Banks, Virginia scorpionfly, species group (Table 1). Lastly, an undescribed species of *Panorpa* is represented by a poorly preserved male in alcohol, collected on 3 August 1948 from an unspecified locality in Putnam County, Florida (Table 1). There are not enough discernable characters preserved on this headless specimen to allow it to be described, but it is a member of the *P. virginica* species group (G. W. Byers pers. comm. 2007).

Discussion

Current records for Mecoptera in Florida, representing only 11 described and one undescribed species, indicate a low diversity for the state. Two species, *B. stigmaterus* and *P. venosa*, represent first state records. One species, *P. floridana*, is endemic, and six others, *M. tuber*, *B. punctiger*, *P. rufa*, *P. pachymera*, *P. lugubris* and *P. venosa*, are the southernmost records for these species in the continental United States. The single record for *B. texanus* in Glades County, in southern peninsular Florida (Carpenter 1931), could be erroneous (Byers 1993) or represent a nonindigenous occurrence. However, Byers (1954, 1993) makes note of a disjunct population of *B. texanus* in Kansas, more than 800 km north of its previously known range. This suggests that further collecting should be done in Glades County, Florida, and the Lake Okeechobee area in order to verify this record.

Three factors may limit mecopteran distribution and diversity in Florida, as perceived in our preliminary list. One factor may be the lack of suitable habitat, especially in the southernmost portions of the state, where warmer temperatures might be unfavorable to most species of North American mecopterans. This climatological restriction might be further enhanced by the Pleistocene biogeography (i. e., marine flooding and xerification) of Florida, especially the peninsular portions of the state (Neill 1957; Dunford et al. 2007a). Lastly, few naturalists study and collect extant mecopterans (Byers 1990; Palmer et al. 2007). This collection bias might partially explain why there is an apparent dearth of records for mecopterans in central and southern Florida, including widespread species such as *B. punctiger* and *P. lugubris*, while larger numbers and more diverse species representation come from heavily collected areas such as Leon, Okaloosa, and Alachua counties (Table 1). Alachua County, in particular the city of Gainesville, has a high density of entomologists and other naturalists, and it is not surprising that it is the type locality for Florida's only endemic mecopteran, *P. floridana*. This species has been recorded from only two counties to date, and we suspect that further intensive collecting may reveal a somewhat broader distribution for *P. floridana* in low elevation regions of northern peninsular Florida.

Our preliminary data presented herein are fragmentary and preclude generating adequate summaries of distribution, abundance, and phenologies for Floridian mecopterans. Although climatological and biogeographical limitations likely account for the seeming paucity of species and overall lower abundance of mecopterans at these southerly latitudes, further dedicated collecting may reveal a previously unrecognized diversity and allow for the generation of complete ecological, phenological and biogeographical data for this insect order in Florida. We opine that new records and undoubtedly new species of Mecoptera await discovery in the state, and strongly encourage individuals and institutional collections to publish records of mecopterans collected from Florida.

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TABLE 1. Species of Floridian Mecoptera, listed by family, based exclusively upon specimens in the Florida State Collection of Arthropods current 20 May 2008. Florida counties from which each species was collected are listed beneath each, with number of specimens from each county provided in parentheses. Previously unpublished state records are indicated with a “*”.

Meropeidae

Merope tuber Newman 1838
Leon (34), Liberty (6)

Bittacidae

Bittacus pilicornis Westwood 1846
Alachua (11), Clay (2), Jackson (1), Suwannee (3), Wakulla (1)

Bittacus punctiger Westwood 1846
Alachua (40), Collier (4), Highlands (2), Jefferson (1), Manatee (1), Miami-Dade (2), Monroe (1), Pinellas (1), Suwannee (2)

Bittacus stigmaterus Say 1823*
Alachua (2), Liberty (1)

Panorpidae

Panorpa americana Swederus 1787
Gulf (1), Leon (1), Liberty (2), Okaloosa (26)

Panorpa floridana Byers 1993
Alachua (1), Clay (1)

Panorpa lugubris Swederus 1787
Alachua (17), Baker (30), Bradford (1), Columbia (2), Duval (2), Lake (1), Leon (63), Levy (1), Marion (2), Okaloosa (1), Orange (6), Pinellas (1), St Johns (2), Suwannee (3), Wakulla (1), unspecified locality (1)

Panorpa pachymera Byers 1993
Alachua (2), Leon (4)

Panorpa rufa Gray 1832
Alachua (2), Gulf (1), Okaloosa (2), Wakulla (1), Walton (2)

Panorpa venosa Westwood 1832*
Baker (4), Leon (1)

Panorpa sp., undescribed species¹
Putnam (1)

Panorpa sp.²
Alachua (1)

Panorpa larvae
Baker (7)³

¹Determined by G. W. Byers 1977. An undescribed member of the *P. virginica* species group (G. W. Byers pers. comm. 2007).

²Not possible to assign to a species but in the *P. virginica* species group (determined by G. W. Byers 2002).

³Six undetermined specimens and one individual putatively assigned to *P. lugubris* (determined by G. W. Byers 1963).

