HABITAT AND DISTRIBUTION OF MECOPTERA IN EAST TENNESSEE

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The order Mecoptera is a small and diverse group of primarily forest-dwelling insects. The distribution and abundance of mecopterans in Tennessee is imperfectly known. Cole and Gillespie (1950) recorded the results of several years of collections by members of the University of Tennessee Department of Zoology and Entomology. Although several new state records were reported, in addition to an inclusion of state records of Carpenter (1931, 1939), most species were recorded from a single location. Byers (1954) added three state and one new county record.

This account is the result of a biological and ecological study conducted by the author over the past two years. Several new records were found and the county and seasonal distribution of most species already known from the state were expanded. For each species habitat and brief biological notes are included. Species are listed under the recently revised families (Byers, 1965). The county distribution of the two largest genera in the east Tennessee fauna, Bittacus and Panorpa, are shown (Plates I and II). Open circles on the maps indicate previous county records, while closed circles are new records recorded by the author. Records for the remaining genera, and additional county records for Bittacus and Panorpa, are included in the text, under the appropriate species.

FAMILY MEROPIDAE

Merope tuber Newman. One female specimen of the single North American species of this family was collected in Knoxville, Knox County (October 9, 1965, B. Collier) for a new state record. The specimen was dead when collected from a screen door and was probably attracted to an artificial light adjacent to the door. The habitat of this species is unknown, being almost exclusively collected after attraction to lights at night. This is the first record of Merope for October.

FAMILY BOREIDAE

Boreus brumalis Fitch. No new specimens of this winter mecopteran were collected in Tennessee. Cole (1938) collected a single female specimen in Sevier County (January 30, 1938) and Goslin (1950) recorded five adult specimens from Campbell County (December 25, 1938), as well as Boreus larvae (not identified as to species, but concluded to be brumalis) at the same location, for the only Tennessee records.

Boreus nitrioriusus Fitch. Known from a single male collected with the female B. brumalis specimen above (Cole, 1938).

FAMILY BITTACIDAE

Bittacus apicalis Hagen (Fig. 2). This species is the first hanging-fly to emerge in the spring, generally the first week in May, and occupies shaded, moist, forested locations. During early morning and late afternoon hours, members may also be collected in open fields adjacent to wooded sites. B. apicalis is extremely abundant in May and occasional individuals can be collected through June and into August. This species is well represented in east Tennessee (Fig. 2).

Bittacus punctiger Westwood (Fig. 3). An active hanging-fly, this species can occasionally be found in the canopy layer of the forests it occupies. Members occur at mid-elevations in the mountains and along cool water courses elsewhere from early June until September. It was never abundant in one location, and when found, another bittacid was always more common at the location.

Bittacus pilicornis Westwood (Fig. 4). This species is very common in east Tennessee and occurs in any shaded area where ground vegetation is present. It was common in June in all counties and occasional individuals were collected into September. B. pilicornis replaces B. apicalis on forested sites beginning in late May to become the predominant June bittacid species.

Bittacus occidentis Walker (Fig. 5). A positively phototactic hanging-fly, B. occidentis is normally active at night. The adults were collected at light traps in wooded areas until September. Two immobile specimens, hanging at rest upon ground vegetation, were collected during daylight hours. No reliable population

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estimates of this species were obtained since only occasional individuals were collected.

_Bittacus strigosus_ Hagen (Fig. 6). A common bit-tacid, _B. strigosus_ attains a high population density in cool, damp, forested areas. Specimens were found from May until late August, but only commonly near the latter period of their emergence. _B. strigosus_ replaces _B. pilicornis_ in early August to become the dominant hanging-fly species.

_Bittacus stigmaterus_ Say (Fig. 7). This hanging-fly is found throughout the summer from May to September and is widespread in the east Tennessee area. It inhabits cool, moist, forested sites and is more frequently encountered in the mountains. Byers (1954) also recorded it from Montgomery County.

**FAMILY PANORPIDAE**

_Boychypanora carolinensis_ Banks. Many males were found on June 17, 1965, one male on July 29, 1965, and several males and two macropterous females on June 21, 1966, at a single location about 5000 feet, Roan Mountain, Carter County, for a new state record. They were found upon vegetation and among the abundant ground moss of the forest floor along a water course. This record, as well as additional new information of this remarkable mecopteran, will be published.

**FAMILY PANORPIDAE**

_Panorpa ruja_ Gray. Cole and Gillespie (1950) recorded a single female, collected in June, 1939, from the Smokies. No new specimens were found. In light of other collection data for _P. ruja_ (eastern North Carolina, southern Georgia and Alabama, and Florida, in May and again from October to December), and the difficulties in separating the female _P. ruja_ from _P. banksi_, as described by Byers (1954), the author believes this record is erroneous due to misidentification. Unfortunately the specimen was not available for redetermination.

_Panorpa maculosa_ Hagen (Fig. 8). This species, the earliest scorpion-fly to be found in the east Tennessee area, frequents ground vegetation along streams and lakes and is found only at low elevations (below 2500 feet) in the mountains. The first specimens were collected in mid-April and occasional individuals were found until mid-June. It is common only in April and early May, prior to the occurrence of _P. nebulosa_ on the same sites.

_Panorpa submaculosa_ Carpenter (Fig. 9). Found inhabiting east Tennessee for the first time, this species frequents dry areas of sparse ground vegetation. It is apparently absent in the valleys, being found only in the more mountainous sections. It is never abundant in any one area, although present from early May to mid-August. This species is unusual in that it was only occasionally found in moist areas with abundant ground vegetation, while other species of _Panorpa_ preferred such areas. It was not found above 3500 feet.

_Panorpa nebulosa_ Westwood (Fig. 10). This species is the most common and widespread scorpion-fly in east Tennessee. It was recorded from a great variety of habitats including the usual shaded, moist locations to drier open sites and from open fields adjacent to wooded areas. The greatest population densities were recorded on moist sites of abundant ground vegetation, with a decreasing density found radiating from such sites. _P. nebulosa_ is abundant from early May until late August. The wide ecological tolerance and high population densities displayed by _P. nebulosa_ were not exhibited by any other panorpid species in the east Tennessee fauna.

_Panorpa flexa_ Carpenter (Fig. 11). This species occupies moist, shaded locations in the east Tennessee area and is present from May until September. It is apparently restricted only to the eastern-most mountain range of the state and was not found below 2000 feet. It is a secretive scorpion-fly and when disturbed frequently flies to the ground and remains motionless. Other panorpids, especially its greatest competitor _P. nebulosa_, normally fly to adjacent vegetation when disturbed. Other differences were also observed between _P. flexa_ and _P. nebulosa_ that probably contribute to keeping the species separated. _P. flexa_ females deposit eggs (in existing cavities in the soil) during daylight hours, while _P. nebulosa_ females do so during darkness. _P. flexa_ rests vertically on ground vegetation, more frequently woody vegetation, while _P. nebulosa_ selects ground vegetation almost exclusively and is horizontal in position. _P. flexa_ is restricted to moist, mountainous areas while _P. nebulosa_ is of wider ecological tolerance. Also, _P. flexa_ is never as abundant as _P. nebulosa_ on common locations (no site was found to contain _P. flexa_ exclusively but some areas were sampled in the mountains where _P. nebulosa_ was present, while _P. flexa_ was not.)

_Panorpa acuta_ Carpenter (Fig. 12). Males were found from mid to high elevations in the Unaka Mountains on both deciduous and coniferous forests from May to September. The type locality for this species is Sevier County (Newfound Gap, near 3500 feet, September 1, 1930). _P. acuta_, like _P. flexa_ described above, was found to share all locations with the more abundant _P. nebulosa_. The author was not able to separate _P. acuta_ females from those of _P. nebulosa_. Male _P. flexa_, although easily differentiated from male _P. nebulosa_ under low magnification, did not display ecological or behavioral differences in field studies.

_Panorpa banksi_ (=chelata) Hine (Fig. 13). _P. banksi_ was widespread in the forested areas of east Tennessee, a new state record (see discussion under _P. ruja_), specimens were collected from May at lower elevations until July at higher sites. This species resembles _P. nebulosa_ in exhibiting a fairly wide ecological tolerance, but it is not as common or widespread. It is most common on moist sites and was found up to 5000 feet.

_Panorpa latipennis_ Hine (Fig. 14). This is the largest scorpion-fly in east Tennessee and is a strong flyer. Specimens were found in May and early June only in the Smokies (Sevier County) from cove hardwood locations at moderate (2000-3500 feet) elevations.
Panorpa longicornis Carpenter (Fig. 15). Another uncommon species, *P. longicornis* occurs only in the Unaka Mountains in May and again in late August and September. It is never abundant. The species was originally described from specimens collected in Sevier and Carter Counties and North Carolina. No specimens were found in the spruce-fir communities at the highest elevations.

*Panorpa virginica* Banks (Fig. 16). No new specimens of this species were collected. It was reported by Carpenter (1931) from Cocke County (August 30, 1930) and by Cole and Gillespie (1950) from Sevier County (May, 1940).

*Panorpa isolata* Carpenter (Fig. 17). Four specimens of this species were collected, all above 2000 feet in forest in Sevier County. Byers (1954) recorded *P. isolata* from April to September. Carpenter secured one specimen in Cocke County (August 30, 1930), a paratype.

*Panorpa carolinensis* Banks (Fig. 18). This species is present only in the mountains at high elevations (above 3500 feet) in both deciduous and coniferous forests from May until September. It is not an active species and can usually be captured without the use of a net among ferns in the spruce-fir forests where it is more frequently found.

*Panorpa helenae* (=venosa) Byers (Fig. 19). A common late fall species of forests throughout east Tennessee, *P. helenae* is seldom above 2500 feet in the mountains. Several specimens were taken in early May upon vegetation along streams and occasional individuals were found throughout the summer months at isolated, cool locations. In August *P. helenae* replaces *P. nebula* on most sites. It is then very abundant and is found in all but excessively dry and open sites.

*Panorpa debilis* (=canadensis) Banks (Fig. 20). Carpenter (1931) recorded this species from east Tennessee but gave no county record. The author found all specimens on poorly shaded sites where ground vegetation and moisture were abundant. All locations were poorly-drained low areas with very dense, tall, herbaceous growth. Adults are present from July until September.

**Literature Cited**


Plate I

Fig. 1
County Map

Fig. 2
Bittacus apicalis

Fig. 3
B. punctiger

Fig. 4
B. pilicornis

Fig. 5
B. occidentis

Fig. 6
B. strigorus

Fig. 7
B. stigmaterus

Fig. 8
Panorpa maculosa

Fig. 9
P. submaculosa

Fig. 10
P. nebulosa
Plate II

Fig. 11
Panorpa flexa

Fig. 12
P. acuta

Fig. 13
P. bansi

Fig. 14
P. latipennis

Fig. 15
P. longicornis

Fig. 16
P. virginica

Fig. 17
P. isolata

Fig. 18
P. carolinensis

Fig. 19
P. helena

Fig. 20
P. debilis