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## NOTES ON SOME NEARCTIC PSYCHOMYIIDAE WITH SPECIAL REFERENCE TO THEIR LARVAE (TRICHOPTERA)

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### Introduction

The caddis-fly family Psychomyiidae is represented in America north of Mexico by 10 genera containing 61 species. The larvae of this family construct fixed retreats that vary from simple silken covers to long tubes and complex trap nets. Until 1944, when Ross published a key to the genera for the larvae and pupae, it was virtually impossible to identify the immature stages of our species, even to genus in most cases. The subsequent modifications of that key (Ross, 1959, and here) permit generic determination of most larvae, but specific determination in our larger genera cannot yet be made with any degree of certainty.

Since the publication of Ross' key (1959), several papers have appeared and a few critical associations have been established that make expansion and modification of his key necessary. Edwards (1961) described the larvae of *Xiphocentron mexicanum*, and the collection of a metamorphotype (sensu Milne, 1938) of Ross' Genus B (1944, p. 74) establishes its synonymy with *Nyctiophylax vestitus*. A critical examination of more material also has necessitated the synonymy of Genus A (Ross 1944, p. 73) with *Nyctiophylax*. The collection



of some larvae from Texas, almost certainly *Cernotina*, requires an addition to the key, and examination of other specimens necessitates additional modifications. The discovery of a new species of *Nyctiophylax* and the recognition of a synonym in *Cyrnellus* are also reported here.

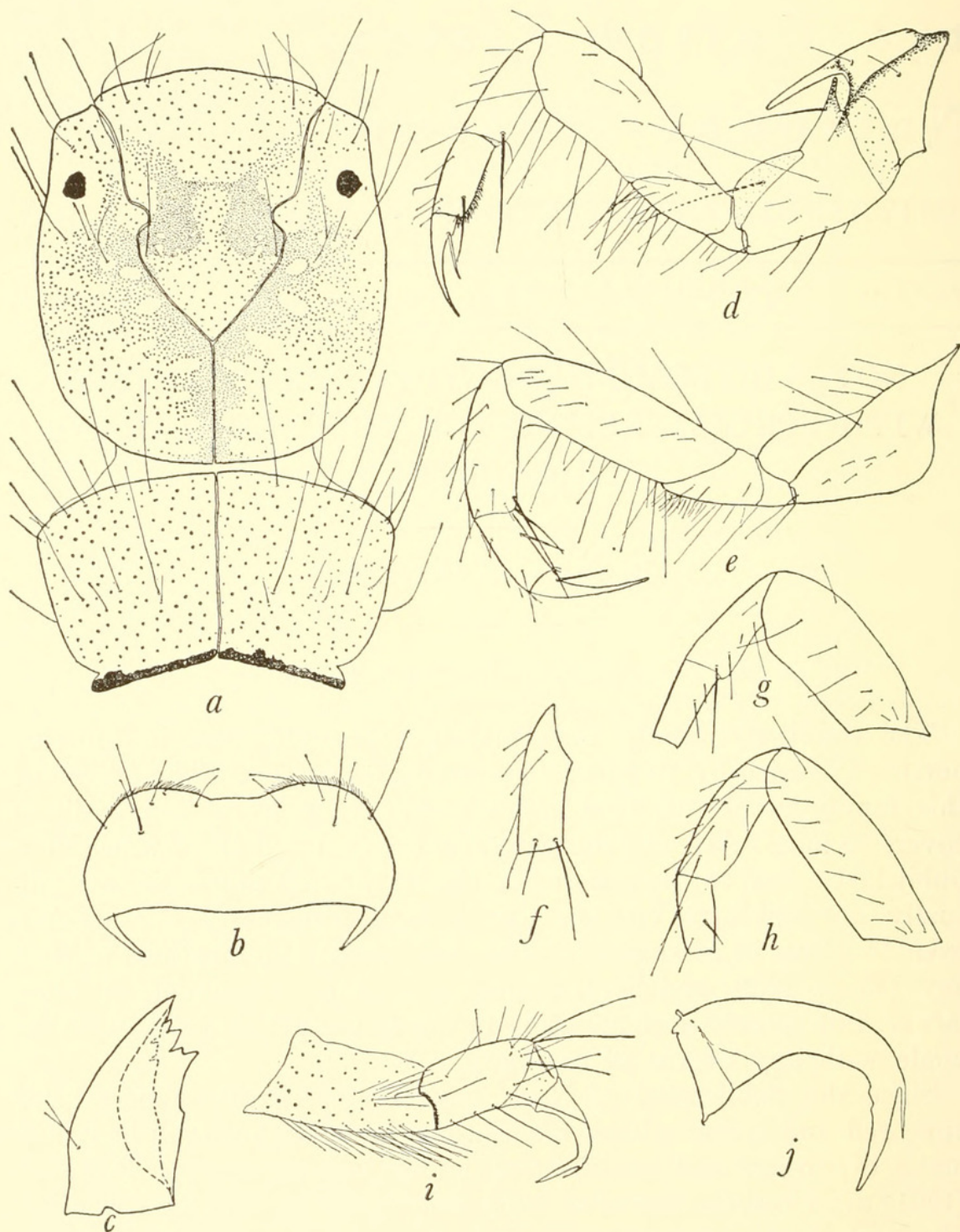


FIGURE 1.—*Cyrnellus fraternus*: *a*, head and pronotum, dorsal aspect; *b*, labrum, dorsal; *c*, left mandible, dorsal; *d*, *e*, foreleg and midleg, posterior; *f*, tibia of hind leg, posterior; *g*, *h*, femur, tibia, and tarsus of foreleg and midleg, anterior; *i*, anal proleg, lateral; *j*, anal claw, lateral.



I wish to express my appreciation to Dr. H. H. Ross, of the Illinois Natural History Survey, and Dr. S. S. Roback, of the Philadelphia Academy of Natural Sciences, for their loan of specimens. Dr. P. J. Darlington, Jr., of the Museum of Comparative Zoology at Harvard University, made it possible for me to study the Banks types of *Cyrenellus*. The material used in this study is from four sources: Illinois Natural History Survey (INHS), Academy of Natural Sciences of Philadelphia (ANSP), United States National Museum (USNM), and the author's collection (OSF).

### Key to the Genera of Psychomyiidae Based on the Larvae

1. Foretrochantin broad, hatchet-shaped, set off by a basal suture (PSYCHOMYIINAE) . . . . . 7  
Foretrochantin pointed, fused to pleuron (POLYCENTROPODINAE) . . . . . 2
2. Both mandibles with a linear brush mesally, and equilateral in outline; tarsi broad and densely pilose . . . . . **Phylocentropus**  
Right mandible never with a brush, and distinctly longer than broad; tarsi not pilose . . . . . 3
3. Muscle scars of head and pronotum as pale or paler than surroundings . . . 4  
Muscle scars darker than surroundings . . . . . 6
4. Anal claw with well-developed ventral teeth . . . . . 5  
Anal claw without ventral teeth . . . . . **Cyrenellus**
5. Anal claw with ventral teeth much shorter than apical hook and with an external tooth; foretibiae and midtibiae with 3 short dark setae on posterior face . . . . . **Nyctiophylax**  
Anal claw with ventral teeth nearly as long as apical hook, no external tooth; foretibiae and midtibiae with 1 short dark seta on posterior face.  
(*Cernotina*?) Genus C
6. Basal segment of anal proleg without setae . . . . . **Neureclipsis**  
Basal segment of anal proleg with setae . . . . . **Polycentropus**
7. A broad flat process anteriorly from mesopleuron; tibiae and tarsi fused.  
**Xiphocentron**  
No process on mesopleuron; tibiae and tarsi distinct . . . . . 8
8. Anal claw with several long teeth ventrally . . . . . **Psychomyia**  
Anal claw lacking ventral teeth . . . . . 9
9. Left mandible with linear brush; mandibles distinctly longer than broad.  
**Tinodes**  
Left mandible with 2 discrete brushes; mandibles equilateral in outline . . **Lype**

### *Cyrenellus fraternus* (Banks), new combination

#### FIGURE 1

*Cyrenus fraterna* Banks, 1905, p. 17.

*Nyctiophylax fraternus*.—Ross, 1938b, p. 12 (designates lectotype).

*Nyctiophylax marginalis* Banks, 1930, p. 231.—Ross, 1938b, p. 12 (designates lectotype). New synonymy.

*Cyrenellus marginalis*.—Ross, 1944, p. 71 (male and female).—Sublette, 1957, p. 378 (mentions larvae).—Ross, 1959, p. 1033 (keys larvae).

I recently had the opportunity to study the lectotypic female of *raternus* and found that its forelegs had a preapical spur and its



maxillary palpi a long second segment. These characteristics indicate that the species belongs to the genus *Cyrtellus*, not *Ceratomyza* as indicated by Ross (1944, p. 293). The specific synonymy is based on the fact that only one species is known in this genus in the Nearctic region. In addition, several large collections containing both sexes have been made in recent years at Plummers Island, Maryland, the type locality of *fraternus*.

The female metamorphotype which permitted the establishment of the association of larva and adult was borrowed from Dr. H. H. Ross. The larva was included in Ross' key in 1959; however, no description or figures have been published.

**LARVA.**—Length, 9 mm. Head yellowish, marked with brown which varies greatly in intensity, muscle scars pale (fig. 1,a). Labrum slightly more than twice as wide as long (fig. 1,b). Mandibles with dorsal edge overhanging ventral; left mandible lacking mesal brush (fig. 1,c); right mandible like figure 2,c. Maxillolabium like figure 2,b, except labial lobe barely reaches base of galea. Pronotum sclerotized, generally pale (fig. 1,a), sometimes darker, then with pale muscle scars. Legs without any setae greatly shortened, only apical setae of tibiae conspicuously darkened (fig. 1,h). Basal segment of anal proleg bearing setae ventrally and laterally (fig. 1,i). Anal claw curved at nearly a right angle, without ventral teeth, but with accessory tooth externally at angle (fig. 1,j).

**MATERIAL.**—Iowa: Keokuk, walls of valve chamber New Lock 19, Aug. 27, 1958, C. R. Fremling, 4 larvae, 1♀ pupa (INHS). Oklahoma: Texhoma, Dec. 8, 1950, J. E. Silvey, 1 larva (INHS). Tennessee: Cumberland R., near Hermitage Hills, Oct. 11, 1962, S. S. Roback, 11 larvae (ANSP); Cumberland R., above Old Hickory Dam, Oct. 3, 1959, S. S. Roback, 16 larvae (ANSP); Tennessee R., New Johnsonville, Oct. 14, 1958, S. S. Roback, 14 larvae (ANSP); Tennessee R., below Pickwick Dam, Oct. 20, 1959, R. M. Sinclair, 10 larvae (INHS); South Holston R., above Kingsport, Nov. 29, 1945, J. S. Dendy, 3 larvae (INHS). Virginia: James R., Richmond, July 26, 1951, J. D. Lattin, 6 larvae (ANSP).

**REMARKS.**—The larvae of this species are markedly similar to the larvae of *Nyctiophylax* in having an enlarged dorsal edge of the mandibles and pale muscle scars; however, the setation of the legs and structure of the anal prolegs and claws indicate an affinity to *Polycentropus*. This combination of characters is distinctive.

I have never collected the immature stages of this species, but Dr. Roback states (in litt.) "I have found *Cyrtellus* both in rivers and lake situations on wood and on rock. In the Cumberland River, for example, I found it on rocks up in the lake along the banks and also



below Old Hickory Dam in about 15 feet of water, also on rocks. It apparently can take the range of flow from practically standing water to quite rapidly flowing water. On these rocks it lives under an amorphous silk mat usually silt covered."

### Genus *Nyctiophylax* Brauer

The genus is found throughout the world with the exception of Australia-New Zealand and Europe, although it is well represented in the Baltic Amber. In North America there are at least 5 closely related species. Larvae of this genus were first described by Noyes (1914) as *Cyrnus pallidus* (?), and later by Ross (1944) as Genus A and Genus B. Ulmer (1957) described the larvae and pupae of the Sumatran *N. flavus*. Generic characters of the larvae are given below:

Head about as wide as long; muscle scars pale. Labrum over twice as wide as long (fig. 2,d). Mandibles with dorsal edge overhanging ventral edge, left mandible with mesal brush (fig. 2,c). Pronotum sclerotized, with pale muscle scars; mesonotum and metanotum membranous. Forefemora with stout dark setae ventrally and anteriorly; foretibiae with 3 stout dark setae posteriorly and 4 anteriorly; midtibiae with 3 stout dark setae both posteriorly and anteriorly (fig. 2,e-i). Ninth segment ventrally with a T-shaped area of small spicules. Basal segment of anal prolegs with spicules basoventrally; and long hairs apically and apicomesally (fig. 2,k). Anal claw with strong teeth ventrally, and an accessory tooth externally (fig. 2,j).

The pale muscle scars of the head and pronotum and enlarged dorsal margin of the mandibles relate the genera *Nyctiophylax*, *Cyrnellus*, and the one described here as Genus C. The short, broad, and black setae on the legs also indicate a close relationship between *Nyctiophylax* and Genus C, as do the ventral teeth on the anal claw. The larvae of *Nyctiophylax* differ from those of Genus C in having 3 dark setae posteriorly on the midtibiae and hind tibiae, setae ventrally on the basal segment of the anal proleg, and a dorsal brush on the apical segment; also in having the ventral teeth shorter and farther from the base on the anal claw as well as an external tooth on the claw.

### Key to Larvae of Genus *Nyctiophylax*

1. Dark color on genae completely enclosing frontoclypeus posteriorly. species A  
Dark color of the genae not meeting broadly posterior to frontoclypeus . . . 2
2. Dark color extending anteriorly along frontal sutures to anterior margin of the head . . . . . *N. nephophilus*  
Dark color of head not reaching anterior margin . . . . . *N. vestitus*



*Nyctiophylax vestitus* (Hagen)

## FIGURE 2

*Polycentropus vestitus* Hagen, 1861, p. 293.

*Nyctiophylax vestitus*.—Ross, 1938b, p. 13 (designates lectotype); 1944, p. 70 (male and female).

GENUS B Ross, 1944, p. 74; 1959, p. 1032.

Although the adults of this species are commonly collected at lights throughout much of eastern North America, the larvae have remained unknown until recently. Ross (1944) gave the first description of the larvae under the name *Psychomyiidae* Genus B. In the summer of 1961 I collected a male metamorphotype of the species, finally establishing the correlation of stages.

LARVA.—Length 8 mm. Head yellowish, with brown area neither reaching anterior margin nor extending posteriad of frontoclypeus (fig. 2,a).

MATERIAL.—Illinois: Kankakee R., Momence, May 26, 1936, H. H. Ross, 1 larva (INHS). Virginia: Broad Run, Thoroughfare Gap, Fauquier County, July 22, 1961, O. S. Flint, 1 larva, 1 ♂ pupa (USNM); May 27, 1961, 27 larvae, 4 pupae (OSF); June 14, 1961, 1 larva, 1 pupa (USNM); Thornton R., above Sperryville, Mar. 4, 1961, O. S. Flint, 9 larvae (USNM); Apr. 15, 1961, 7 larvae (USNM). North Carolina: Deep Creek, 2,000 ft., near Bryson City, May 19, 1959, O. S. Flint, 1 larva (OSF); June 7, 1961, 1 larva (USNM).

REMARKS.—There is considerable variation in the shape of the clasper of the male. It may well be that further study will show that our present concept of the species includes several closely related species. For this reason, I give figure 2*l*, showing the clasper from the metamorphotype. In all likelihood the name *vestitus*, based on a female, is correctly associated with this male as the type locality is Washington, D.C., and this is the only clasper shape I have seen from the area.

The larva of this species is most like that of *nephophilus*, differing from it in the coloration of the head. In *vestitus* the dark area does not reach the anterior margin of the head.

The larvae are found on rocks in streams generally about a meter or two wide, near one or the other end of the pools, generally shunning the fastest water of the rapids and cascades. They construct, in some angle on a rock, a silken shelter of considerable rigidity beneath which they hide. The shelter is open at both ends, but as far as can be seen no trap net is constructed. At pupation time the shelter is strengthened and closed except for a cylindrical aperture at one end. The end of the cylinder inside the shelter is partially closed by a silken sieve.



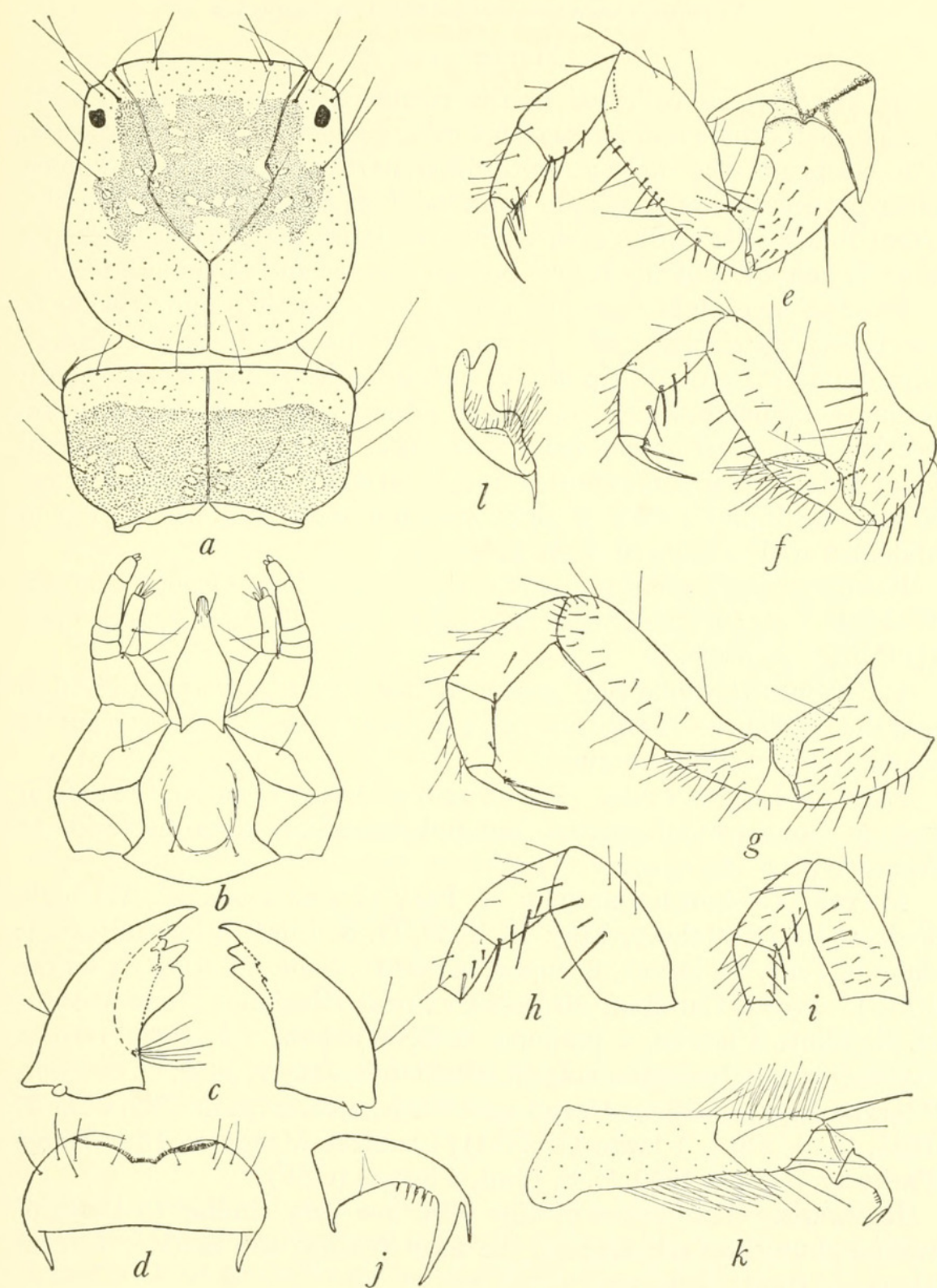


FIGURE 2.—*Nyctiophylax vestitus*: *a*, head and pronotum, dorsal aspect; *b*, maxillolabium, ventral; *c*, mandibles, dorsal; *d*, labrum, dorsal; *e*–*g*, foreleg, midleg, and hind leg, posterior; *h*, *i*, femur, tibia, and tarsus of foreleg and midleg, anterior; *j*, anal claw, lateral; *k*, anal proleg, lateral; *l*, clasper of male, caudal.



*Nyctiophylax nephophilus* Flint, new speciesFIGURE 3, *a-c*

In the material collected in the Southern Appalachians in 1961 were found a male and female that belong to an undescribed species. The clasper of the male is quite different from that of any known Nearctic species, but may be contrasted with *vestitus* most readily. From this species it differs in having the inner margin of the clasper slightly convex, and the lateral process shorter and directed laterad.

ADULT.—Length of forewing, male 6 mm., female 8 mm. Color of specimens in alcohol pale brown, wing membrane white around thyridium, at r-m, and tip of Cu. Male genitalia (fig. 3, *b,c*): Tenth tergum semimembranous, elongate in lateral view. Cercus quadrate, bearing a decurved process from mesal face. Clasper with apicomesal point long, lateral point short, directed laterad, inner margin convex. Female genitalia: Lobes of eighth sternum short and wide. Tip of abdomen with 3 pairs of short processes.

Holotype male, allotype female: South Carolina, Oconee County, Walhalla Federal Fish Hatchery, June 6, 1961, R. A. and O. S. Flint (USNM type 66796).

I attribute the following larvae to this species purely on circumstantial evidence—the adults were collected beside the stream in which this larval form occurs.

LARVA.—Length 9 mm. Brown spot on head extending to anterior margin along frontal sutures, but not extending much posterior to frontoclypeus (fig. 3, *a*).

MATERIAL.—South Carolina: E. Fork of Chattooga R., Walhalla Federal Fish Hatchery, May 18, 1959, O. S. Flint, 6 larvae (OSF); June 6, 1961, 14 larvae, 2 pupae (USNM); Sept. 11, 1958, 3 larvae (OSF). North Carolina: Green's Cr., near Highlands, June 6, 1961, O. S. Flint, 3 larvae, 1 prepupa, (USNM); Sept. 11, 1958, 1 larva (OSF); stream, biological station, Highlands, July 1, 1958, O. S. Flint, 2 larvae, 1 pupa (OSF); Deep Cr., 2,000 ft., near Bryson City, June 7, 1961, O. S. Flint, 1 larva (USNM); Crabtree Meadows, Blue Ridge Parkway, Sept. 2, 1959, O. S. Flint, 4 larvae (OSF).

REMARKS.—The larvae of this form are very similar to those of *vestitus*, but the dark area on the head reaches the anterior margin along the frontal sutures.

The habits of the immature stages of this species seem to be the same as recorded for *vestitus*, with the possible exception of their inhabiting slightly smaller streams.



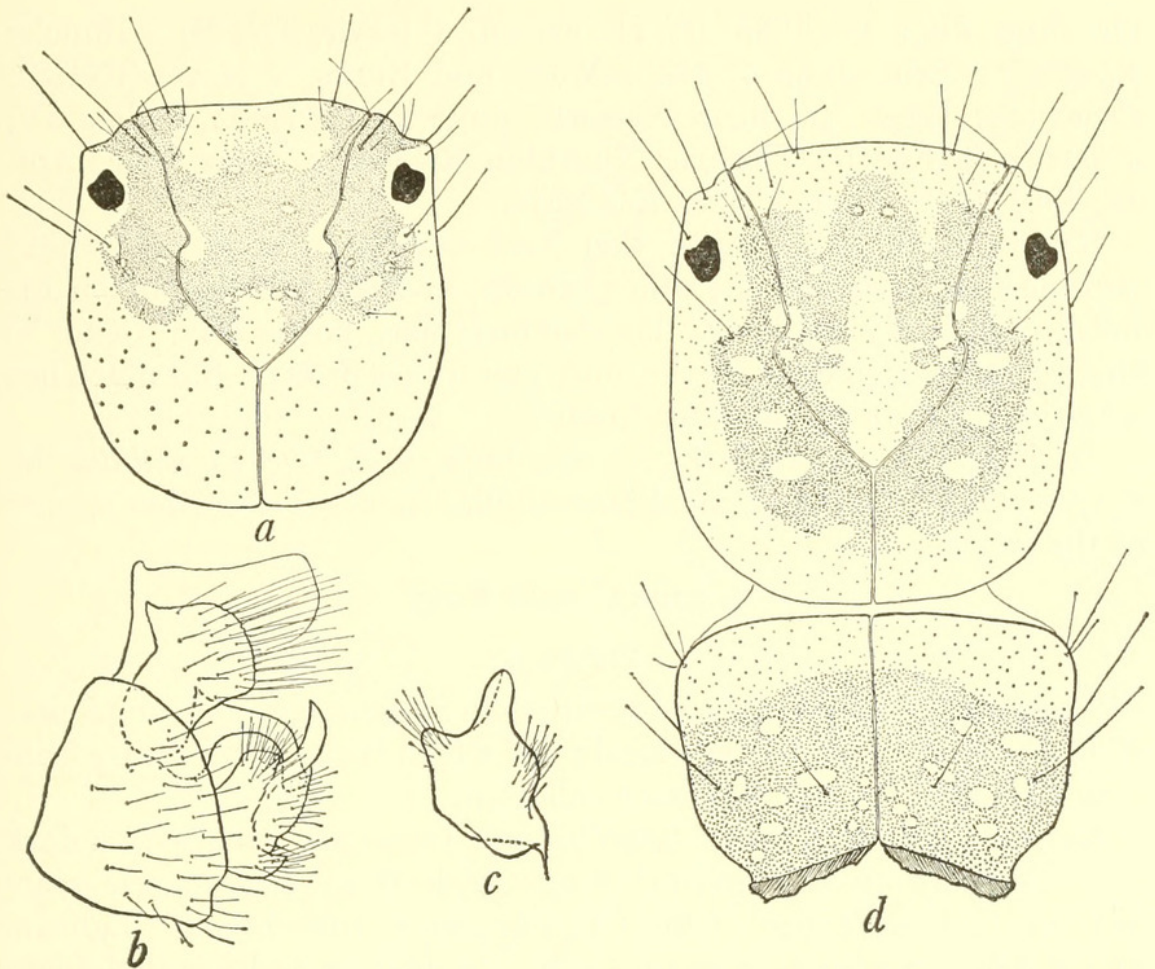


FIGURE 3.—*a-c*, *Nyctiophylax nephophilus*: *a*, head, dorsal aspect; *b*, male genitalia, lateral; *c*, male clasper, caudal. *N. species A*: *d*, head and pronotum, dorsal.

*Nyctiophylax species A*

FIGURE 3,*d*

*Cyrnus pallidus* (?), Noyes, 1914, p. 263 (misidentification).

GENUS A ROSS, 1944, p. 73; 1959, p. 1032.

This larva may be that of *N. uncus* Ross, which has the same general distribution, or of some presently unrecognized member of the genus.

**LARVA.**—Length 9 mm. Brown area on genae broadly joined posterior to frontoclypeus, and with conspicuous pale muscle scars and a large pale spot centrally on frontoclypeus (fig. 3,*d*).

**MATERIAL.**—Ontario: La Vase R., 1 mile NW. of La Vase L., near North Bay, Sept. 24, 1957, S. S. Roback, 12 larvae (ANSP). Wisconsin: Namekagon R., Spooner, June 5–6, 1936, Frison and Ross, 1 larva (INHS). Michigan: Platte R., Honor, Sept. 16, 1936, Ross and Burks, 3 larvae (INHS); Big Sable R., N. of Scotville, Sept. 16, 1936, Ross and Burks, 2 larvae (INHS); power dam on Au Sable R.,



Grayling, June 17, 1935, T. H. Frison, 1 larva (INHS). Illinois: Rock Cr., Erie, June 5, 1940, Mohr and Burks, 1 larva (INHS). Delaware: West Cr., near Newark, June 7, 1951, T. Dolan IV, 2 larvae (ANSP). Virginia: Thornton R., above Sperryville, Apr. 15, 1961, O. S. Flint, 1 larva (USNM).

REMARKS.—The larvae of this form have a more elongate head capsule than either of the other species, and the brown spot on the head completely encloses the frontoclypeus posteriorly. The T-shaped patch of spicules on the ninth sternum is present, but much less conspicuous than in the other species.

To judge by the remarks on the biology of *Cyrnus pallidus* by Noyes (1914), the larvae must have similar habits to the other species of the genus.

### Genus C, new form

#### FIGURE 4

These larvae are almost unquestionably *Cernotina*, and quite possibly *C. astera* Ross the type locality of which is the same spring from which some of these larvae were collected.

LARVA.—Length 8 mm. Sclerites pale yellowish; head with a dark area centrally on the frontoclypeus which bears pale muscle scars (fig. 4,a). Head capsule conspicuously longer than broad. Labrum about twice as wide as long (fig. 4,b). Mandibles and maxillolabium as in *Nyctiophylax*. Pronotum sclerotized, mesonotum and metanotum membranous. Foretibiae and midtibiae with 1 short, dark seta in posterior series and 4 in anterior series; midtibia with an additional apicoventral black seta (fig. 4,c-g). Basal segment of anal proleg with a small number of setae apicomesally (fig. 4,h). Anal claw with 4 very long teeth ventrally (fig. 4,i).

MATERIAL.—Texas: San Felipe Spring, Del Rio, Sept. 21, 1960, Flint and Collette, 8 larvae (OSF); stream, near Bandera, Oct. 9, 1960, Flint and Collette, 9 larvae (OSF).

REMARKS.—The larvae are most closely related to those of *Nyctiophylax*, from which they differ in the much longer head capsule, the setation of the legs (especially the fewer dark setae on the posterior row of the tibiae), and in the unique structure of the anal claw.

They seem to construct the same type of larval shelter as *Nyctiophylax*, and frequent similar areas in the same type of streams.



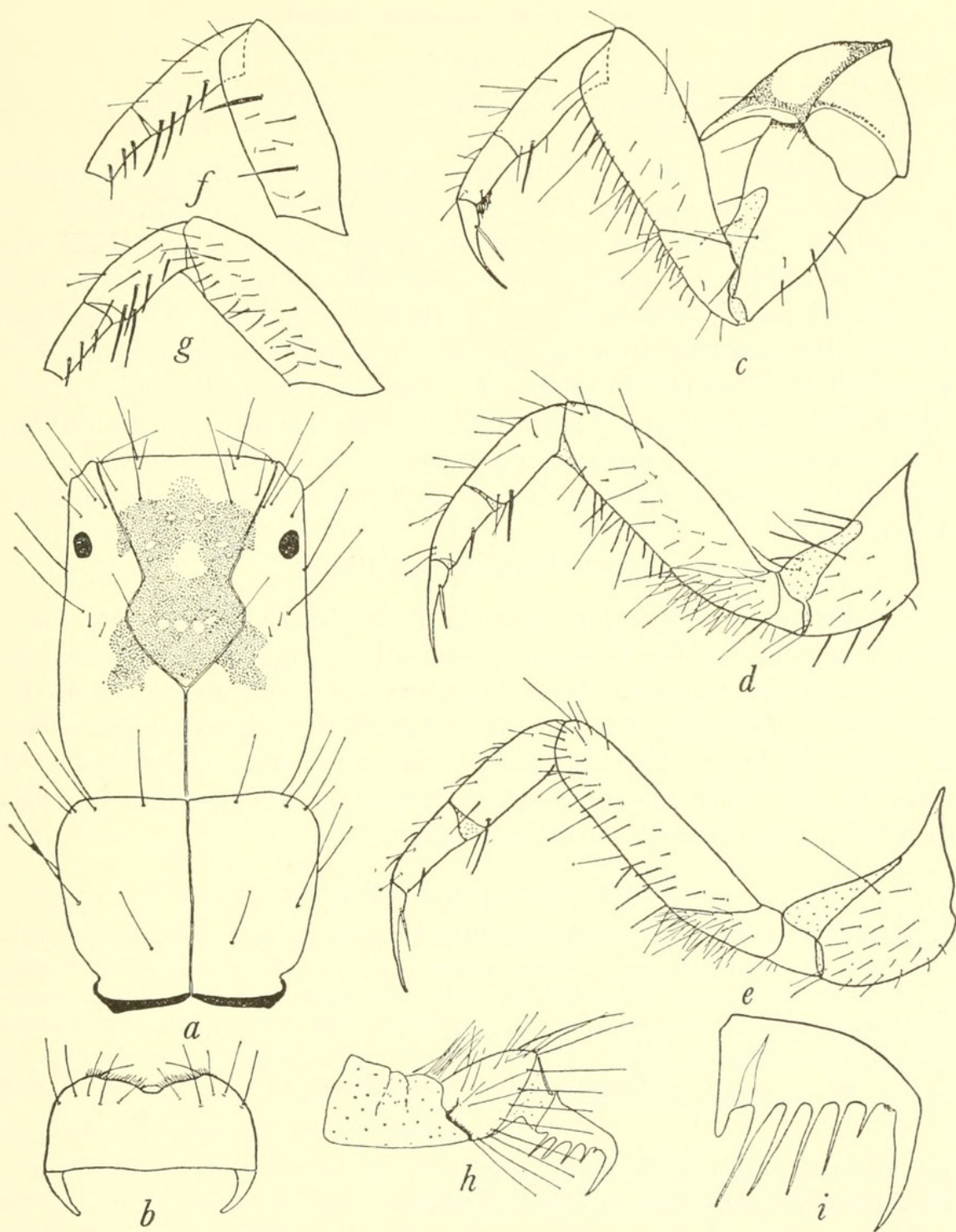


FIGURE 4.—Genus C: *a*, head and pronotum, dorsal aspect; *b*, labrum, dorsal; *c-e*, foreleg, midleg, and hind leg, posterior; *f,g*, femur, tibia, and tarsus of foreleg and midleg, anterior; *h*, anal proleg, lateral; *i*, anal claw, lateral.



*Polycentropus cinereus* Hagen

FIGURE 5,g

*Polycentropus cinereus* Hagen, 1861, p. 293.—Ross, 1944, p. 67 (male and female, larva).

Ross (1944) provided good figures of the head and anal prolegs of the larva of this species, but unfortunately did not illustrate the mandibles. During the preparation of this paper I examined the larval mandibles in a male metamorphotype and discovered they had the dorsal margin overhanging the ventral (fig. 5,g). The presence of this characteristic in a species of *Polycentropus* renders the key proposed by Ross (1944) incorrect. For this reason the color of the muscle scars on the head is used in place of the shape of the mandibles. This characteristic is not only constant in all specimens of the genus examined by me, but also in the exotic species for which descriptions are available.

Genus *Psychomyia* Pictet

The larvae of this genus have been relatively well known for a long time, those of the European species being first described around the turn of the century. Ross described the immature stages of the Nearctic *P. flavida* in 1944, and the larva of the other eastern species is described here. The larvae of this genus are easily separated from all the other known Psychomyiinae by the presence of well-developed ventral teeth on the anal claw.

Key to Larvae of *Psychomyia*

1. Anterior margin of frontoclypeus with a conspicuous pair of submesal processes . . . . . **P. nomada**
- Anterior margin of frontoclypeus with submesal processes almost obsolete . . . . . **P. flavida**

*Psychomyia nomada* (Ross)

FIGURE 5, c-e

*Psychomyiella nomada* Ross, 1938a, p. 138.

*Psychomyia nomada*.—Ross, 1944, p. 75 (male).

This species, which has been reported only from the Great Smoky Mountain region of North Carolina, is now recorded from Virginia. During the summer of 1961 I was able to collect a number of metamorphotypes of this species, thereby correlating the three stages.

**LARVA.**—Length 6–7 mm. Sclerites pale yellowish brown, nearly immaculate; membranous areas greenish. Frontoclypeus with anterior margin bearing a pair of conspicuous projections submesally (fig. 5,c). Mandibles with several broad mesal teeth (fig. 5,d).

**MATERIAL.**—Virginia: Broad Run, Thoroughfare Gap, Fauquier County, May 22, 1961, P. J. Spangler, 9 ♂ 1 ♀ (USNM); May 27,



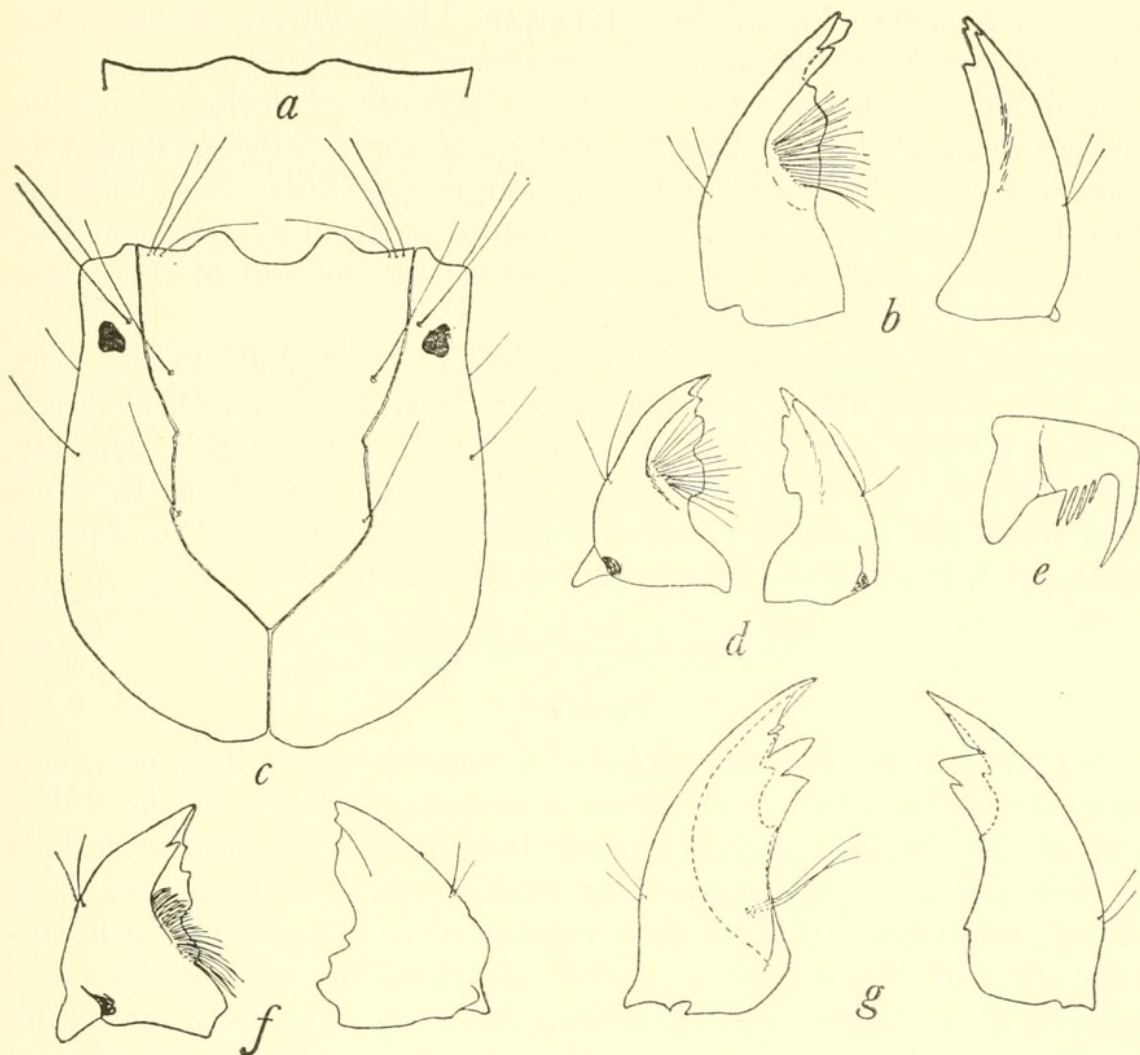


FIGURE 5.—*a, b*, *Psychomyia flava*: *a*, anterior margin of frontoclypeus; *b*, mandibles, dorsal. *c-e*, *P. nomada*: *c*, head, dorsal; *d*, mandibles, dorsal; *e*, anal claw, lateral. *Tinodes*: *f*, mandibles, dorsal. *Polycentropus cinereus*: *g*, mandibles, dorsal.

1961, O. S. Flint, 2 larvae, 4 prepupae, 2 ♂ 4 ♀ pupae (OSF); Thornton R., above Sperryville, Apr. 15, 1961, O. S. Flint, 3 larvae (USNM); Jefferson National Forest, 5 miles east of Buchanan, June 19–20, 1961, A. B. Gurney, many ♂♀ (USNM).

REMARKS.—The larvae of this species are much like those of *P. flava*, but differ in the conspicuous projections from the frontoclypeus, and the differently shaped mandibles.

The habits of this species are apparently similar to those of *Nyctiophylax*, with which they are found. The larval shelter is considerably smaller, however, as one would expect from their comparative sizes.

### *Psychomyia flava* Hagen

FIGURE 5, *a, b*

*Psychomyia flava* Hagen, 1861, p. 294.—Ross, 1938b, p. 14 (designates lectotype); 1944, p. 75 (male, female, larva).

This species is widespread over eastern North America and as



far west as Colorado and Saskatchewan. Ross (1944) provided the only description of the larvae of this species.

The larvae studied differ from the preceding species in having the processes from the anterior margin of the frontoclypeus barely developed (fig. 5,a), and in having longer mandibles that lack the broad mesal teeth (fig. 5,b). Those figured are from a recently molted individual so that the tips are not worn; by the end of the instar they will be considerably shorter.

MATERIAL.—New York: Willseyville Cr., near Willseyville, Aug. 20, 1956, O. S. Flint, 2 larvae (OSF); Sept. 16, 1956, O. S. Flint, 1 larva (OSF). North Carolina: Green's Cr., near Highlands, May 18, 1959, O. S. Flint, 5 larvae (OSF). South Carolina: E. Fork Chattooga R., Walhalla Federal Fish Hatchery, Oconee Co., June 6, 1961, O. S. Flint, many larvae, pupae (USNM).

### Genus *Tinodes* Stephens

#### FIGURE 5,f

No larva of a Nearctic species of *Tinodes* has definitely been correlated with the adult. There are, however, two larvae in the collection of the USNM, probably from Utah, that seem safely referable to this genus. They agree very closely with the larvae of *Lype* (Flint, 1959) but differ by their greater size (12 mm.) and the conformation of the mandibles. The left mandible of *Tinodes* bears a single linear hair brush rather than two as in *Lype*, both mandibles are distinctly longer than broad, whereas in *Lype* they are equilateral in outline, and the dentation on the inner margin is quite different in the two genera. These larvae of *Tinodes* do not possess small teeth on the ventral margin of the anal claw, as do the European species.

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