A review of Nearctic *Clytocerus* (Diptera: Psychodidae: Psychodinae)

Gregory R. Curler,[1] John K. Moulton

Abstract—Larvae, pupae, and adult males and females of *Clytocerus* (*Boreoclytocerus*) *americanus* (Kincaid), as well as adult males and females of *Clytocerus* (*Boreoclytocerus*) *microlimnetes* **sp. nov.** were collected during various biodiversity surveys in the southeastern United States. *Clytocerus* (*B.*) *americanus* is redescribed, *C.* (*B.*) *microlimnetes* is described, and the natural history and relationships of Nearctic species of *Clytocerus* are discussed.

Résumé—Des larves, nymphes et mâles et femelles adultes de *Clytocerus* (*Boreoclytocerus*) *americanus* (Kincaid), ainsi que des mâles et femelles adultes de *Clytocerus* (*Boreoclytocerus*) *microlimnetes* **sp. nov.** ont été recueillies lors d'échantillonnage de la biodiversité dans différents états du sud-est des États-Unis. *Clytocerus* (*B.*) *americanus* est redécrit, *C.* (*B.*) *microlimnetes* est décrite, et l'histoire naturelle et les relations de *Clytocerus* néarctiques sont discutées.

Introduction

Clytocerus Eaton is among the most commonly collected genera of Psychodidae (Diptera) in the Nearctic region (Quate 1955). Only one Nearctic species of this genus, *Clytocerus* (*Boreoclytocerus*) *americanus* (Kincaid), has been described to date, and only the adult stage is known. Collections from recent biodiversity surveys in the southeastern United States of America have produced few immature and numerous adult specimens of *C.* (*B.*) *americanus*, as well as numerous adult specimens of *Clytocerus* (*Boreoclytocerus*) *microlimnetes* **sp. nov.** In the current paper, we describe the new species and redescribe *C.* (*B.*) *americanus* including all life stages. Our limited knowledge of the natural history of species of *Clytocerus*, and relationships within the genus are discussed.

Materials and methods

Study sites

This study focused on specimens collected from multiple locations in eastern Tennessee, southern Alabama, western North Carolina, and western Kentucky in the United States of America.

Material

Adult males and females of *C.* (*B.*) *americanus* and *C.* (*B.*) *microlimnetes*, as well as a third instar larva and a single pupa of *C.* (*B.*) *americanus* were examined. Adult specimens were collected by Malaise traps and black light pan traps while immature specimens were sorted from mosses and decaying leaves collected near the Malaise trap sites. Association of adult males and females was based on morphological similarity. Larval association was based on the fact that no other species of *Clytocerus* occur at the site where the larva was collected. Pupa–adult association was made using the ontogenetic method (Hogue and Bedoya-Ortiz 1989).

Specimens were borrowed from, and (or) are deposited with the following institutions (acronyms used throughout the text): CAS, California Academy of Sciences, San Francisco, California; CNC, Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, Ontario; CUAC, Clemson University Arthropod Collection,

Received 15 March 2011. Accepted 15 July 2011.

G.R. Curler,[1] J.K. Moulton, Department of Entomology and Plant Pathology, The University of Tennessee, 2431 Joe Johnson Drive, 205 Ellington Plant Sciences Building, Knoxville, Tennessee 37996-4560, United States of America

[1]Corresponding author (e-mail: gcurler@gmail.com).
doi:10.4039/tce.2012.16

Clemson University, Clemson, South Carolina; MCZ, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts; LACM, Natural History Museum of Los Angeles County, Los Angeles, California; USNM, National Museum of Natural History, Smithsonian Institution, Washington, District of Columbia; GSMNP, Great Smoky Mountains National Park Insect Collection, Gatlinburg, Tennessee.

Specimen preparation

Specimens were fixed in 70% or 95% ethanol. Morphological studies were based on slide-mounted specimens for all life stages. Slides were prepared using cold 10% sodium hydroxide to clear specimens and Canada balsam as a mounting medium. Specimens were observed with a Meiji Techno RZ dissecting microscope (Meiji Techno; Tokyo, Japan) and an Olympus BH-2 compound microscope (Olympus; Tokyo, Japan), the former fitted with an optical micrometer. Drawings were rendered with the aid of a drawing tube on the Olympus system.

Terminology

Descriptions of general adult morphology follow Merz and Haenni (2000). We use "hirsute sensilla" in place of "hirsute gland" (Newstead 1912) to describe the sensilla present on some antennal flagellomeres. Terminology of the male terminalia is that of Sinclair (2000), except the use of "surstylus" in place of "cercus," which follows Jezek and Hájek (2007). Female postabdomen terminology follows Kotrba (2000) and Curler and Moulton (2010). General and psychodid-specific (*e.g.*, segmentation and morphology of tergal plates) larval terminology follow Courtney *et al.* (2000) and Vaillant (1971), respectively.

Descriptive format

Diagnoses are provided for all new taxa. Complete descriptions of all life stages are provided where specimens were available. When applicable, sample sizes are provided before each description with measurements in millimeters presented as a mean followed by a range in parentheses. Adult head width was measured at the point of greatest width of the eyes. Adult head length was measured from the vertex to the anterior margin of the clypeus. Palpal ratios were computed as proportions, considering the basal palpomere as 1. Approximate wing length and width were measured at the points of greatest length and width, respectively.

Taxonomy

Clytocerus Eaton

Clytocerus Eaton 1904: 59. Type species: *Clytocerus africanus* Tonnoir, by subsequent monotypy, Tonnoir 1920: 137.

Synseodais Enderlein 1937: 92. Type species: *Synseodais flavitarsis* Enderlein, by original designation.

Notoclytocerus Duckhouse 1975: 428, as subgenus. Type species: *Clytocerus tauricornis* Duckhouse, by original designation.

Notoclytocerus Duckhouse, new synonymy by Duckhouse 1978: 307.

Boreoclytocerus Duckhouse 1978: 307, as subgenus. Type species: *Clytocerus ocellaris* Meigen, by original designation.

Boreoclytocerus Duckhouse, as genus, Withers 1989.

Diagnosis

Larva. Head capsule with one pair of prominent, horn-like protuberances anterolaterally; protuberances with antennae inserted apically. Anal division truncate, about as long as wide, with dorsal sclerite hard, ventral sclerites undeveloped; flabellar processes minute, respiratory fans inconspicuous. **Pupa.** Respiratory horn with pinna restricted to apex. Anal division with single pair of hooked spines apically. **Adult.** *Head*: corniculi present (or secondarily absent in few species) in males; male eye bridge with 3–6 facet rows, divided by width of 1–3 facet diameters; interocular suture inverted V- or U-shaped, often faint; frontal alveoli clearly divided medially, forming two groups; frons with longitudinal furrow or unsclerotized band at median. *Antenna*: scape elongate, 3–6× longer than wide; male with flagellomeres I and II fused to form compound flagellomere; compound flagellomere with cluster of sinuous, clavate setae inserted subapically; ascoids paired, digitiform; various antennal flagellomeres with hirsute sensilla inserted subapically. *Wing*: radial fork and medial fork restricted to basal half of wing. *Male terminalia*: symmetrical; aedeagus with four processes or spatulate apex; parameral sheath present or absent; retinacula numbering six

https://doi.org/10.4039/tce.2012.16 Published online by Cambridge University Press

or more. *Female terminalia*: hypovalvae bilobed; genital duct with lateral, wing-like extensions.

Variation

Differences among species of *Clytocerus* are in the number of facet rows in the eye bridge and the shape of the aedeagus of males. Female terminalia, wing venation, antennal structure, and other characters given in the generic diagnosis are remarkably uniform throughout the genus.

Discussion

Adult males and females of *Clytocerus* are among the most easily recognized species of Psychodinae due to the extremely elongate scape and the distinct frontal setae alveoli arranged in two subcircular groups.

Bionomics

Little is known about the natural history of most *Clytocerus* species. However, one Palaearctic species has been collected from water-filled tree holes, and immatures of others have been collected from decaying vegetation in marginal freshwater habitats (Duckhouse 1975; Vaillant 1983). Adult *Clytocerus* are usually found resting on vegetation near permanently moist, marginal habitats (*e.g.*, near small woodland springs or streams), or collected in Malaise traps set near this type of habitat. At least one species of *Clytocerus* is attracted to black lights.

Distribution

Clytocerus includes 36 described species: 19 from the Palaearctic Region, 15 from the Afrotropical Region, and two from the Nearctic Region.

Clytocerus (*Boreoclytocerus*) *americanus* (Kincaid)

(Figs. 1–9, 16)

Pericoma variegata Kincaid 1899: 33, *nec Pericoma variegata* (Macquart).
Pericoma ocellaris var. *americana* Kincaid 1901: 194.
Pericoma americana Dyar 1927: 163.
Psychoda interrupta Banks 1906: 150.
Psychoda interrupta Banks 1932: 228.
Pericoma satellitia Dyar 1927: 163.
Pericoma (Clytocerus) americana Kincaid; Quate 1955: 151.

See Quate (1955) for complete synonymy with additional references.

Type material

Lectotype (♂)**: USA**. Maine: no date, G. deN. Hough (in Kincaid Collection), deposited in CAS. Partial specimen dissected, mounted on microslide. **Paralectotypes: USA**. Washington: Seattle, Kincaid Collection (CAS), 8.v.1898 (1 ♀ [slide]); Maryland: Plummer's Island, N. Banks (MCZ type No. 13532), 28.viii.(no year) (1 ♂ [slide]); Cabin John Bridge, H.G. Dyar (USNM type No. 40500), 4.vii.1927 (1 ♂ [slide]).

Other material examined

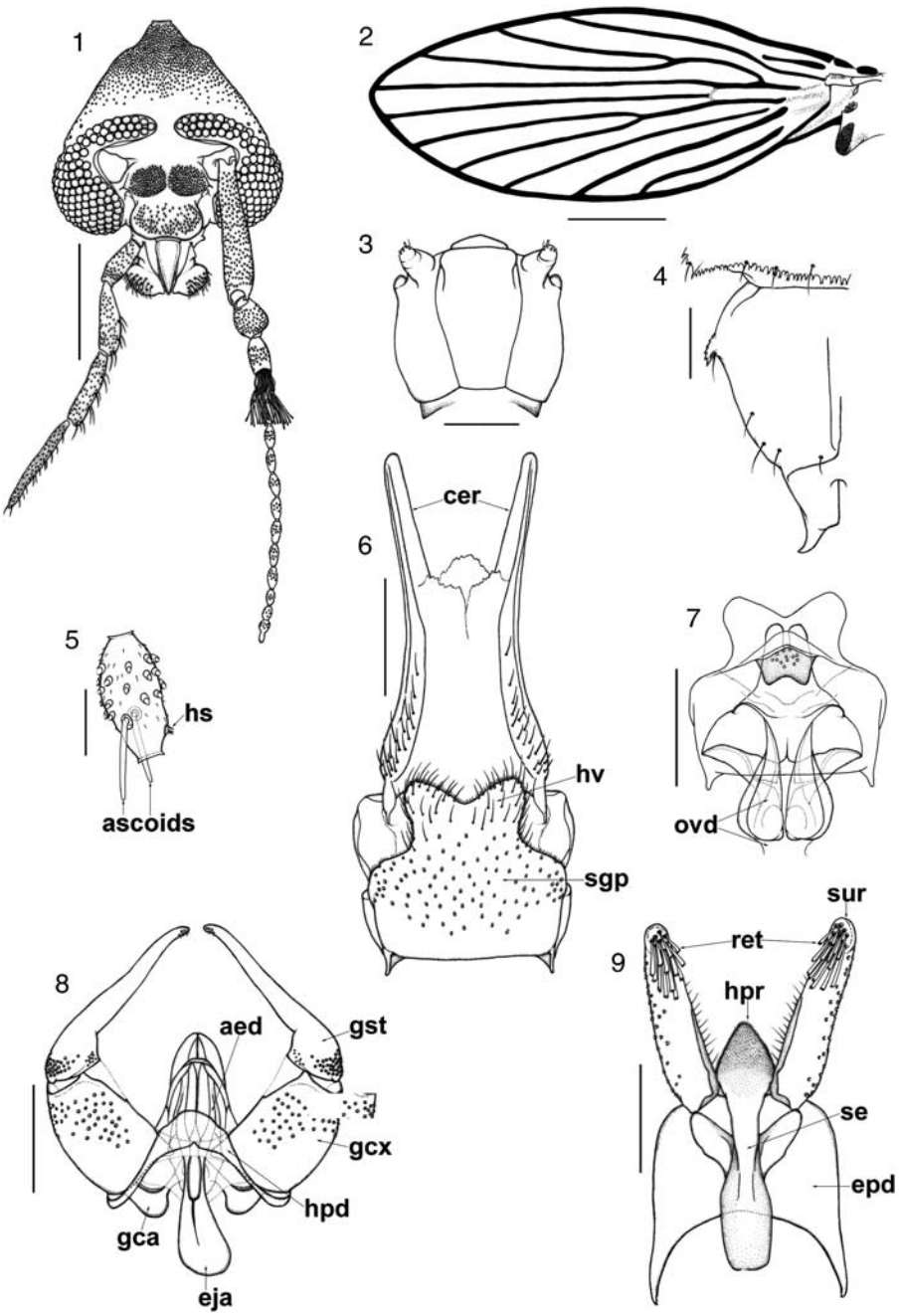
USA. Alabama: *Baldwin Co.*: Byrnes Lake, 30°47′N, 87°54′W, 25.vii.2007, J. McCreadie, Malaise trap (1 ♂, 1 ♀); Silverhill, 30°33′N, 87°46′W, 12.vi.2007, E. Benton, Malaise trap (♂). Kentucky: *Graves Co.*: Terrapin Creek State Nature Preserve, 36°31′N, 88°29′W, 3.ii.–12.iv.2009, J.K. Moulton, Malaise trap (♂♂ and ♀♀); 24.iii.–6.iv.2010, J.K. Moulton, Malaise trap (♂♂ and ♀♀); 6.iv.–12.v.2010, J.K. Moulton, Malaise trap (♂♂ and ♀♀); *Taylor Co.*: Little Angel Spring, 37°26′N, 85°21′W, 27.ix.2005, J.K. Moulton, black light trap (1 ♂, 1 ♀); 8.viii.2006, J.K. Moulton, black light trap (4 ♂♂, 4 ♀♀). North Carolina: *Haywood Co.*: GSMNP, Purchase Knob, 35°35′N, 83°04′W, 15–29.vi.2007, G.R. Curler, Malaise trap (1 ♂, 2 ♀♀); 29.vi.2007, G.R. Curler, moss and leaf sample (1 instar III larva, 1 ♂ pupa); 29.vi.–30.vii.2007, G.R. Curler, Malaise trap (1 ♂, 3 ♀♀); 27.v.–12.vi.2008, G.R. Curler, Malaise trap (4 ♂♂). Tennessee: *Cocke Co.*: GSMNP, Snake Den Ridge, 35°44′N, 83°11′W, 6.v.–5.vi.2002, I.C. Stocks and B. Merritt, ATBI Malaise trap (2 ♂♂); *Knox Co.*: Cherokee Woodlot, 35°56′N, 83°56′W, 15.viii.–7.ix.2003, J.K. Moulton, Malaise trap (1 ♂, 1 ♀). Specimens are housed in the personal collection of the senior author at the Illinois Natural History Survey, Champaign–Urbana, Illinois.

Diagnosis

Larva. Head capsule with two prominent, horn-like protuberances anterolaterally. Anal division with dorsal sclerite hard, ventral sclerites undeveloped; flabellar processes minute, respiratory fans inconspicuous. **Pupa.** Respiratory horn with pinna

https://doi.org/10.4039/tce.2012.16 Published online by Cambridge University Press

Figs. 1–9. *Clytocerus* (*Boreoclytocerus*) *americanus* (Kincaid) 1. Male head, frontal view. 2. Male wing. 3. Larva head capsule, dorsal view. 4. Pupa anal division, left side, dorsal view. 5. Male antennal flagellomere 6, dorsal view. 6. Female terminalia, external structure, ventral view. 7. Female terminalia, internal structure, ventral view. 8. Male hypandrium, gonopods and aedeagus, dorsal view. 9. Male epandrium, subepandrial sclerite and surstyli, dorsal view. Scale bars = 0.025 mm (5), 0.125 mm (3–4, 6–9), 0.25 mm (1), 0.5 mm (2). aed = aedeagus; cer = cercus; eja = ejaculatory apodeme; epd = epandrium; gca = gonocoxal apodeme; gcx = gonocoxite; gst = gonostylus; hpd = hypandrium; hpr = hypoproct; hs = hirsute sensilla; hv = hypovalvae; ovd = oviduct; ret = retinacula; se = subepandrial sclerite; sgp = subgenital plate; sur = surstylus.



https://doi.org/10.4039/tce.2012.16 Published online by Cambridge University Press

restricted to apex; anal division with paired spines posteriorly and laterally; lateral spines serrated over the anterolateral margin. **Adult.** *Head*: eye bridge in male with 3 facet rows divided by width of 2 facet diameters; interocular suture inverted U-shaped, faint; corniculi absent. *Male terminalia*: hypandrium usually rounded posteriorly, not pointed; each surstylus with 12–15 retinacula. *Female terminalia*: subgenital plate with hypovalvae bilobed, with posterior margin broadly V-shaped; genital duct as figured.

Description

Larva (Fig. 3). Head capsule subquadrate in dorsal view, with genae convex in outline posteriorly, with a pair of conspicuous, horn-like protuberances anterolaterally; antennae composed of multiple setiform and digitiform sensilla, arising from apices of anterolateral protuberances. *Trunk*: trapezoidal in transverse cross-section; segmentation and arrangement of tergal plates typical of Psychodinae; segments I–V parallel-sided, thorax and posterior segments slightly more narrow than middle abdominal segments; alveoli numerous, crowded dorsally and ventrally; anterior spiracles digitiform, inserted laterally on posterior annulus of prothorax, about twice as long as wide; tergal plates quadrangular, bearing numerous prominent setae. Anal division: quadrangular, slightly longer than wide; dorsal sclerite hard, not encircling anal division; ventral sclerites not developed; flabellar processes minute, extending only slightly beyond dorsal sclerite; respiratory fans inconspicuous.

Pupa (Fig. 4). Respiratory horn digitiform, constricted basally, with two rows of pores forming pinna apically; exterior surface with pitted, reticulate texture. Anal division with prominent, paired spines posteroventrally, with one prominent spine inserted anterolaterally on each side; posteroventral spines hooked apically; lateral spines having strong serrate anterolateral margin.

Adult male (Figs. 1–2, 5, 8–9, 16). Measurements ($N = 5$) head width 0.46 mm (0.45–0.47), head length 0.43 mm (0.42–0.46), wing length 2.35 mm (2.09–2.61), wing width 0.85 mm (0.78–0.96), palpomere proportion: 1–1.6–1.74–2.65. *Head*: pyriform; vertex completely covered and eyes mostly obscured by white, spatulate setae in live specimen; corniculi absent; eye bridge with 3 facet rows, divided by width of 2 facet diameters; median furrow extending from frons to interocular suture; interocular suture inverted U-shaped, often faint or transparent; frons and clypeus approximately equal in width; frontal setae alveoli divided into paired circular groups; mouthparts extending slightly beyond basal palpomere; labellum slightly wider than anterior margin of clypeus. *Antennae*: scape about 5.5× longer than wide; flagellomeres fusiform; ascoids present on flagellomeres III–XI; hirsute sensilla inserted apicolaterally on flagellomeres VI–X; flagellomere XIII with node fusiform, apical process digitiform, approximately as long as node; ascoids paired, digitiform, extending slightly beyond apex of flagellomere. *Wing*: typical of the genus, Sc not ending in R_1, radial fork arising basal to medial fork and apex of CuA_2, medial fork arising basal to but nearly at the same level as apex of CuA_2, R_5 ending beyond apex; wing membrane lightly infuscated at apices of longitudinal veins. *Terminalia*: hypandrium heavily sclerotized, usually with posterior margin bluntly rounded, not extending to mid-length of gonocoxites; gonocoxite about 1.5× longer than wide, not extending beyond apex of aedeagus; gonocoxal apodemes clavate, with narrow extensions medially; medial extensions connecting to base of aedeagus; gonostylus about 1.5× length of gonocoxites, smoothly tapered from base to apex, curved slightly from mid-length to apex; ejaculatory apodeme dorsoventrally compressed, rounded basally; aedeagus symmetrical, bifurcate, with branches fused apically, enclosed by parameral sheath; parameral sheath with transverse lip encircling aedeagus dorsally; epandrium slightly more wide than long; subepandrial sclerite widened basally, articulated with gonocoxal apodemes and aedeagus, with spatulate bacilliform sclerites laterally articulated with surstyli; hypoproct triangular, microsetose; surstylus gradually tapered from base to apex, with 12–14 retinacula inserted dorsoapically; retinacula with apices pectinate.

Adult female (Figs. 6–7). *Head*: eye bridge with 3 facet rows, divided by 3 facet diameters; interocular suture as in male, but clearly visible; frontal setae alveoli as in male; mouthparts and palpi as in male. *Antenna*: similar to male, except without fusion of basal flagellomeres, without tuft of sinuous setae; ascoids present on flagellomeres III–XI; hirsute sensilla present on flagellomeres I–III. *Wing*: venation as in male. *Terminalia*: subgenital plate with hypovalvae

https://doi.org/10.4039/tce.2012.16 Published online by Cambridge University Press

bilobed, constricted basally, with posterior margin concave, broadly V-shaped; genital duct as figured, about as wide as hypovalvae.

Variation

The hypandrium of some species of *Clytocerus* is variable in shape (Jezek and Hájek 2007). This is also true for *C.* (*B.*) *americanus*, as the posterior margin of the hypandrium is bluntly rounded or more narrow and triangular. The number of retinacula also varies among specimens.

Bionomics

Clytocerus (*B.*) *americanus* is multivoltine, and is active year-round in some locations. Adults are most abundant from June to August. Despite collection of numerous adults, only a single larva and a single pupa have been collected and the natural history of this species remains relatively poorly understood. The larva, dead at the time of collection and invaded by fungal hyphae, was incidentally discovered in a sample of plant material including mosses and decaying leaves. It retained a coating of detritus entangled in the dorsal setae, which is characteristic of larvae of *Clytocerus* (Duckhouse 1994). It is assumed that the larvae are detritivores and have a habit similar to Palaearctic species (Vaillant 1983). The immature specimens examined in this study were collected from the marginal zone near a hillside seep in Great Smoky Mountains National Park, North Carolina.

Distribution

Clytocerus (*B.*) *americanus* is common throughout the eastern United States, from western Kentucky to eastern Maryland, and from Maine to southern Alabama. It has also been collected in Illinois, Wisconsin, Minnesota, California, Washington, and Ontario (Quate 1955). A lack of records from the southwestern United States could be due to fewer collections, but probably indicates a lack of suitable habitat.

Discussion

A single paralectotype female labeled as *Pericoma* (*Clytocerus*) *americana* from Seattle, Washington was examined for this study. This specimen has 4 facet rows in the eye bridge, and terminalia that differ slightly from those of other female *C.* (*B.*) *americanus* examined. It is very likely that this single female specimen represents a new species, but without additional male and female specimens from the western United States, the issue will remain unresolved. No specimens of *Clytocerus* from the Midwest, United States of America were available for study, but should be examined and compared to eastern *C.* (*B.*) *americanus* if material becomes available.

Clytocerus (*Boreoclytocerus*) *microlimnetes* Curler and Moulton sp. nov.

(Figs. 10–15)

Type material

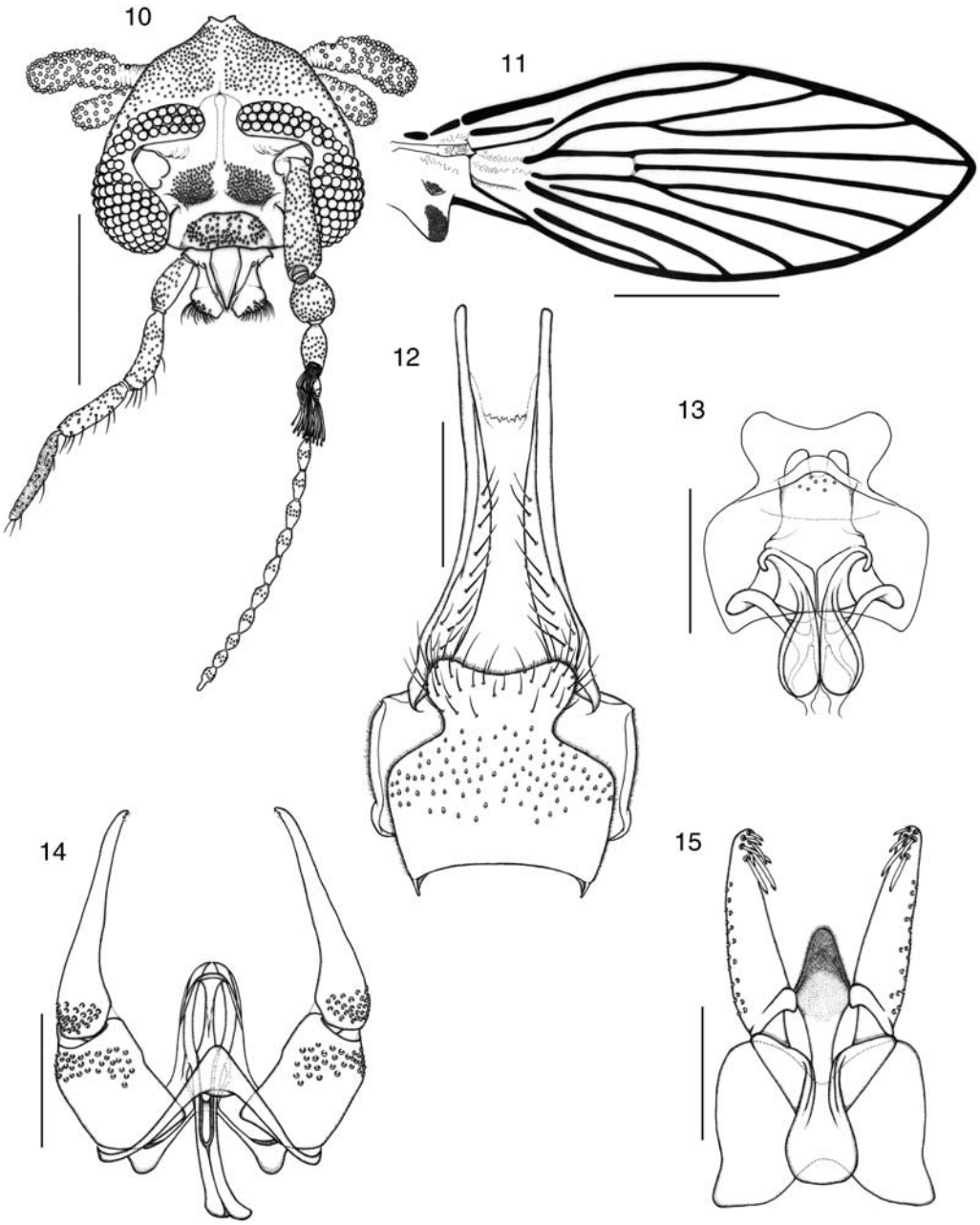
Holotype (♂)**: USA**. KENTUCKY: *Graves Co.*: Terrapin Creek State Nature Preserve, 36°31′N, 88°29′W, 27.iii.–6.iv.2010, J.K. Moulton, Malaise trap, deposited in USNM. Specimen dissected, mounted on slide. Allotype (♀): same data as holotype; deposited in USNM. Specimen dissected, mounted on slide. **Paratypes: USA**. ALABAMA: *Baldwin Co.*: Silverhill, 30°33′N, 87°46′W, 19.xii.2006, E. Benton, Malaise trap (1 ♂ [slide]); 12.vi.2007, E. Benton, Malaise trap (2 ♂♂ [slides]); 22.vi.2007, E. Benton, Malaise trap (3 ♂♂, 1 ♀ [slides]); same location as holotype, 24.v.–6.vii.2009, J.K. Moulton, Malaise trap (6 ♂♂, 2 ♀♀ [slides]); same location as holotype, 6–31.vii.2009, J.K. Moulton, Malaise trap (5 ♂♂, 4 ♀♀ [slides]); same data as holotype (5 ♂♂, 5 ♀♀ [slides]). Paratypes deposited in LACM, USNM, CUAC, and CNC.

Material examined

USA. ALABAMA: *Baldwin Co.*: Silverhill, 30°33′N, 87°46′W, 19.xii.2006, E. Benton, Malaise trap (♂); 22.vi.2007, E. Benton, Malaise trap (♂♂ and ♀♀). KENTUCKY: *Graves Co.*: Terrapin Creek State Nature Preserve, 36°31′N, 88°29′W, 12.xii.2008–2.ii.2009, J.K. Moulton, Malaise trap (♂♂ and ♀♀); 3.ii–12.iv.2009, J.K. Moulton, Malaise trap (♂♂ and ♀♀); 24.v.–6.vii.2009, J.K. Moulton, Malaise trap (♂♂ and ♀♀); 6–31.vii.2009, J.K. Moulton, Malaise trap (♂♂ and ♀♀); 16.ix.–21.x.2009, J.K. Moulton, Malaise trap (♂♂ and ♀♀); 24.iii.–6.iv.2010, J.K. Moulton, Malaise trap (♂♂ and ♀♀); 6.iv.–12.v.2010, J.K. Moulton, Malaise trap (♂♂ and ♀♀). Specimens

https://doi.org/10.4039/tce.2012.16 Published online by Cambridge University Press

Figs. 10–15. *Clytocerus* (*Boreoclytocerus*) *microlimnetes* Curler and Moulton **sp. nov.** 10. Male head, frontal view. 11. Male wing. 12. Female terminalia, external structure, ventral view. 13. Female terminalia, internal structure, ventral view. 14. Male hypandrium, gonopods and aedeagus, dorsal view. 15. Male epandrium, subepandrial sclerite and surstyli, dorsal view. Scale bars = 0.1 mm (14–15), 0.125 mm (12–13), 0.25 mm (10), 0.5 mm (11).



are housed in the personal collection of the senior author at the Illinois Natural History Survey, Champaign–Urbana, Illinois.

Etymology

Derived from the Greek "micro" meaning small, and "limnetes" meaning "inhabiting or

https://doi.org/10.4039/tce.2012.16 Published online by Cambridge University Press

Fig. 16. *Clytocerus* (*Boreoclytocerus*) *americanus* (Kincaid), male habitus. Wing length approximately 2.30 mm.

born in a lake or marsh." This name was chosen due to the habitat of this species, and the fact that it is markedly smaller than *C.* (*B.*) *americanus*, with which *C.* (*B.*) *microlimnetes* is often sympatric.

Diagnosis

Adult. *Head*: eye bridge in male with 3 facet rows divided by width of 3 facet diameters; interocular suture inverted U-shaped, with posterior spur at median, faint; frons with unsclerotized longitudinal band at median, band extending to interocular suture; corniculi present, bifurcate, with dorsal branch about 4× longer than ventral branch when fully extended. *Male terminalia*: hypandrium usually triangular, surstylus with 6–10 retinacula. *Female terminalia*: subgenital plate with hypovalvae bilobed, with posterior margin U-shaped; genital duct as figured.

Description

Adult male (Figs. 10–11, 14–15): Measurements, ($N = 5$) head width 0.37 mm (0.34–0.42), head length 0.37 mm (0.35–0.42), wing length 1.67 mm (1.55–1.84), wing width 0.64 mm (0.59–0.71), palpomere proportion: 1–1.3–1.4–1.6. *Head*: triangular in frontal view, with vertex narrowing basally; vertex uniformly set with black, spatulate setae in freshly collected specimen; corniculi bifurcate, with branches clavate, retractile; dorsal branch of corniculi about as long as the head, 4× longer than ventral branch when fully extended; eye bridge with 3 facet rows, divided by width of 3 facet diameters; frons with unsclerotized longitudinal band at median, band extending to interocular suture, widened posteriorly; interocular suture inverted U-shaped, often faint or transparent, with posterior spur at median; frons slightly wider than clypeus; frontal setae alveoli divided into paired subcircular groups; mouthparts not extending beyond basal palpomere; labellum about as wide as anterior margin of clypeus. *Antenna*: scape about 3.25× longer than wide; flagellomeres fusiform; ascoids present on flagellomeres IV–X; hirsute sensilla inserted apicolaterally on flagellomeres VI–X; flagellomere XIII with node fusiform, apical process digitiform, approximately as long as node; ascoids paired, digitiform, extending beyond apex of flagellomere. *Wing*: typical of genus, Sc not ending in R_1, radial fork arising slightly basal to medial fork and apex of CuA_2, medial fork arising at level of apex of CuA_2, R_5 ending beyond apex; wing membrane lightly infuscated at apices of longitudinal veins. *Terminalia*: hypandrium heavily sclerotized, generally triangular in shape, barely extending to mid-length of gonocoxites; gonocoxite about 2× longer than wide, not extending beyond aedeagus; gonocoxal apodemes clavate, with narrow extensions medially; medial extensions connecting to base of aedeagus; gonostylus about 1.25× length of gonocoxites, smoothly tapered from base to apex, curved slightly near apex; aedeagus symmetrical, bifurcate, with branches fused apically, enclosed by parameral sheath; parameral sheath with transverse lip encircling aedeagus dorsally; epandrium slightly more wide than long; subepandrial sclerite broad, rounded basally, articulated with gonocoxal apodemes and aedeagus, with spatulate bacilliform sclerites laterally; bacilliform sclerites articulated with surstyli; hypoproct triangular, microsetose apically; surstylus gradually tapered from base to apex, with 7–10 retinacula inserted dorsoapically; retinacula with apices pectinate.

Adult female (Figs. 12–13). *Head*: eye bridge with 3 facet rows, divided by 4.5 facet diameters; interocular suture as in male, not clearly visible; frontal setae alveoli as in male; mouthparts extending slightly beyond basal palpomere; labellum slightly wider than clypeus. *Antenna*: similar to male, except without complete fusion of basal flagellomeres; flagellomere IV with single ascoid,

https://doi.org/10.4039/tce.2012.16 Published online by Cambridge University Press

flagellomeres V–XI with paired ascoids; one or more hirsute sensilla present on flagellomeres II–III, V, and VII–XIII. *Wing*: venation as in male. *Terminalia*: subgenital plate with hypovalvae bilobed, constricted basally, with posterior margin concave, broadly U-shaped; genital duct as figured, about as wide as hypovalvae.

Variation

Males of *C.* (*B.*) *microlimnetes* also have a hypandrium that is variable in shape from triangular to spatulate or tongue shaped. The number of retinacula also varies among specimens. Some preserved male specimens have corniculi that are fully extended, and therefore, markedly longer than those of other specimens.

Bionomics

Clytocerus (*B.*) *microlimnetes* is multivoltine and active year-round at some sites. Adults are most abundant from late May to late July, with the greatest number of specimens captured in July. Terrapin Creek State Nature Preserve is an extensive wetland with numerous springs and spring runs providing ample ideal habitat for species of *Clytocerus*. *Clytocerus* (*B.*) *microlimnetes* is often very abundant at this site and *C.* (*B.*) *americanus* is not uncommon. Several attempts were made to collect the immature stages of either species at Terrapin Creek, but surprisingly, neither larvae nor pupae were found.

Distribution

This species has been collected from one location in each of western Kentucky and southern Alabama.

Discussion

Clytocerus (*B.*) *microlimnetes* is easy to recognize because it is currently the only Nearctic species of *Clytocerus* in which the males have corniculi. *Clytocerus* (*B.*) *microlimnetes* is similar to some Palaearctic species of *Clytocerus*, especially *Clytocerus* (*B.*) *tetracorniculatus* Wagner, but differs by having an eye bridge with only 3 facet rows versus 4 rows in *C.* (*B.*) *tetracorniculatus*.

General discussion

Based on their distribution and the similarity of their male terminalia to those of *C.* (*B.*) *ocellaris* Meigen, *C. americanus*, and *C. microlimnetes* are placed in subgenus *Boreoclytocerus* Duckhouse. Duckhouse (1978) proposed this subgenus for "the northern species" with *C. ocellaris* Meigen as type species, but a formal diagnosis of the subgenus was not given. Despite many characters present in all species of *Clytocerus* (see diagnosis above), one author has placed *Boreoclytocerus* as a separate genus (Withers 1989, 2005) as discussed by Jezek and Hájek (2007). Regardless of how subgenera of *Clytocerus* are ranked, examination of the immature stages of *C.* (*B.*) *americanus* confirms that all life stages of the two known Nearctic *Clytocerus* species are most similar to those of Palaearctic species, and both differ from Afrotropical species. Nonetheless, the world fauna of *Clytocerus* is probably not completely described (especially for the western Nearctic), and a phylogenetic analysis of the genus has not been completed.

Acknowledgments

It is our pleasure to dedicate this work to the coordinators of the Manual of Nearctic Diptera. As a result of their work, students in dipterology have an invaluable reference for identifying and describing flies. We are among the many authors who have been inspired by the excellent taxonomic keys and superior illustrations in the Manual.

We are grateful to the National Park Service and the Kentucky State Nature Preserves Commission for granting permission to collect in Great Smoky Mountains National Park and Terrapin Creek State Nature Preserve, respectively. We thank D. Furth (USNM), C. Griswold (CAS), and P. Perkins (MCZ) for loaning type specimens of *C.* (*B.*) *americanus*. We also thank J.W. McCreadie and P.H. Adler for providing specimens of *Clytocerus* collected during the Total Insect Bio-Inventory Project of the Mobile-Tensaw Delta. S.A. Marshall kindly provided the photograph of *C.* (*B.*) *americanus*. A. Jacobson assisted with lab procedures. Comments from J. Ježek, J. Skevington, and S. Ibáñez-Bernal were helpful in improving the manuscript. Support for various aspects of this research included grants from the United States National Science Foundation (Award No. DEB-0933218 to JKM), the United States Army (Award No. W81XWH-06-1-0471 to JKM), and Discover Life in America.

https://doi.org/10.4039/tce.2012.16 Published online by Cambridge University Press

References

Banks, N. 1906. The Psychodidae of the vicinity of Washington. Proceedings of the Entomological Society of Washington, **8**: 148–151.

Banks, N. 1932. Some Psychodidae from the Carolina mountains. Bulletin of the Brooklyn Entomological Society, **26**: 227–228.

Courtney, G.W., Sinclair, B.J., and Meier, R. 2000. Morphology and terminology of Diptera larvae. *In* Contributions to a manual of Palaearctic Diptera, vol. 1. *Edited by* L. Papp and B. Darvas. Science Herald, Budapest. pp. 85–161.

Curler, G.R., and Moulton, J.K. 2010. Descriptions of three new species of Psychodidae (Diptera) from the southeastern United States. Zootaxa, **2524**: 51–62.

Duckhouse, D.A. 1975. Non-phlebotomine Psychodidae (Diptera, Nematocera) of southern Africa. I. Subfamily Psychodinae: *Pericoma*, *Clytocerus* and *Mystropsychoda* gen. n. Annals of the Natal Museum, **22**: 421–448.

Duckhouse, D.A. 1978. Non-phlebotomine Psychodidae (Diptera, Nematocera) of southern Africa. II. Subfamily Psychodinae: *Neoarisemus* and the brunettoid and telmatoscopoid genera. Annals of the Natal Museum, **23**: 305–359.

Duckhouse, D.A. 1994. The final-stage larvae of *Brunettia* (Diptera: Psychodidae: Psychodinae) and their evolutionary significance. Invertebrate Taxonomy, **9**: 83–105.

Dyar, H.G. 1927. American Psychodidae I. (Diptera). Proceedings of the Entomological Society of Washington, **27**: 162–164.

Eaton, A.E. 1904. New genera of European Psychodidae. Entomologist's Monthly Magazine Ser. 2, **15**: 55–59.

Enderlein, G. 1937. Klassifikation der Psychodiden (Diptera). Deutsche Entomologische Zeitschrift, **1936**: 81–112.

Hogue, C.L., and Bedoya-Ortiz, I. 1989. The net-winged midge fauna (Diptera: Blephariceridae) of Antioqua Department, Colombia. Contributions in Science, Natural History Museum of Los Angeles County, **413**: 1–57.

Jezek, J., and Hájek, J. 2007. Psychodidae (Diptera) of the Orlické hory Protected Landscape Area and neighboring areas with descriptions of two new species from the Czech Republic. Acta Entomologica Musei Nationalis Pragae, **47**: 237–285.

Kincaid, T. 1899. The Psychodidae of the Pacific Coast. Entomological News, **10**: 30–37.

Kincaid, T. 1901. Notes on American Psychodidae. Entomological News, **12**: 193–196.

Kotrba, M. 2000. Morphology and terminology of the female postabdomen. *In* Contributions to a manual of Palaearctic Diptera, vol. 1. *Edited by* L. Papp and B. Darvas. Science Herald, Budapest. pp. 75–84.

Merz, B., and Haenni, J.-P. 2000. Morphology and terminology of adult Diptera (other than terminalia). *In* Contributions to a manual of Palaearctic Diptera, vol. 1. *Edited by* L. Papp and B. Darvas. Science Herald, Budapest. pp. 21–51.

Newstead, R. 1912. Notes on *Phlebotomus* with descriptions of new species. Part 1. Bulletin of Entomological Research, **3**: 361–367.

Quate, L.W. 1955. A revision of the Psychodidae (Diptera) in America north of Mexico. University of California Publications in Entomology, **10**: 103–273.

Sinclair, B.J. 2000. Morphology and terminology of Diptera male genitalia. *In* Contributions to a manual of Palaearctic Diptera, vol. 1. *Edited by* L. Papp and B. Darvas. Science Herald, Budapest. pp. 53–74.

Tonnoir, A.L. 1920. Notes sur quelques Psychodidae Africains. Revue Zoologique Africaine, **8**: 127–147.

Vaillant, F. 1971. Psychodidae-Psychodinae. *In* Die Fliegen der palaearktischen region, vol. 3/1. *Edited by* E. Lindner. Schweitzerbart'sche, Stuttgart. pp. 1–48.

Vaillant, F. 1983. Psychodidae-Psychodinae. *In* Die Fliegen der palaearktischen region, vol. 3/1. *Edited by* E. Lindner. Schweitzerbart'sche, Stuttgart. pp. 311–360.

Withers, P. 1989. Moth flies (Diptera: Psychodidae). Dipterists Digest, **4**: 1–83.

Withers, P. 2005. New records of Psychodidae (Diptera) for Switzerland. Revue Suisse de Zoologie, **112**: 183–188.

https://doi.org/10.4039/tce.2012.16 Published online by Cambridge University Press