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(Diptera: Cecidomyiidae: Winnertziinae)
from eastern North America

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A new species of *Neostenoptera* (Diptera: Cecidomyiidae: Winnertziinae) from eastern North America

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Abstract. A new species of paedogenetic gall midge, *Neostenoptera appalachiensis* **sp. nov.**, (Diptera: Cecidomyiidae: Winnertziinae: Heteropezini) from the eastern United States is described and illustrated, and pertinent collection and biological data are also provided. It is compared to its congeners, *N. kiefferi* (Meunier), a subfossil described from African copal, and *N. congoensis* Gagné, from the Congo. This rare, exciting discovery is the first record of the genus *Neostenoptera* in the New World.

Key words. *Neostenoptera appalachiensis*, paedogenetic, gall midge, saproxylic, GSMNP

Introduction

While conducting research in Great Smoky Mountains National Park (GSMNP) (North Carolina and Tennessee, USA) (Ferro et al. 2012), MLF collected numerous unidentifiable flies as bycatch from an emergence chamber used to collect beetles (Coleoptera) from dead wood. A specimen was photographed and placed on Bugguide.net under the title “Mystery Fly” (Fig. 1) (bugguide.net/node/view/786101/). Several years later, JDP noticed the image and thought it bore a resemblance to the paedogenetic *Neostenoptera* Meunier (1902) in the subfamily Winnertziinae (Gagné and Jaschhof 2014).

Neostenoptera (Diptera: Cecidomyiidae: Winnertziinae: Heteropezini) is otherwise known from two African species, *N. kiefferi* (Meunier, 1901) described from African copal, a subfossil resin (Grimaldi 1996), and *N. congoensis* Gagné (1979) described from specimens collected in a Malaise trap in the People’s Republic of the Congo. This new species represents the first record of this unusual genus in North America. Upon contacting Raymond J. Gagné, Systematic Entomology Laboratory, USDA, Washington, DC about our discovery, he notified us that the USNM collection had some additional specimens of *Neostenoptera* from the southeastern United States that we might like to study. We found these to be the same species as the specimens from GSMNP. The specimens loaned to us from the USNM were invaluable as they enabled us to see certain characters obscured in our original slide preparations.

Materials and Methods

Specimens were examined from, or deposited in, the following institutions.

- CUAC** – Clemson University Arthropod Collection, Clemson University, South Carolina (SC) (Clemson, USA).
- JPPC** – John Plakidas Personal Collection, Pittsburgh, PA, USA.
- LSAM** – Louisiana State Arthropod Museum, Louisiana State University (Baton Rouge, LA, USA).
- USNM** – National Museum of Natural History (Washington, D.C., USA), which includes the holotype male and a paratype female from GSMNP and specimens on loan from Alabama and Charlotte, NC.

Adult terminologies are mostly from McAlpine et al. (1981), and Jaschhof and Jaschhof (2013). Specimens examined were dehydrated in ethyl alcohol and slide mounted in Euparal, whereas those from the USNM were mounted in Hoyer's solution.

Systematic Entomology

Diptera: Cecidomyiidae Subfamily Winnertziinae Tribe Heteropezini

Neostenoptera appalachiensis Plakidas and Ferro, new species (Fig. 1–13)

Diagnosis. Adult (Fig. 1), body length (measured from head to end of genitalia) male 1.3 mm (n=4); female 1.8–2.0 (n=3) mm. Color: antennae light brown; head, thorax, and legs brown; eyes reddish brown, with a dark brown spot below each eye; abdomen light brown; wings teneral, with only veins R_1 and CuA_1 present, and a fringe of long, brown setae along wing margin except on proximal 1/4. Males of *N. kiefferi* differ from males of this new species by their flagellomere 11 which is more broadly rounded on its base, and the tarsomere ratio is 1: 0.5: 0.4: 0.7. In addition, *N. congoensis* differs from this new species in that vein R_5 is present at midlength, the scutellum possesses two setae, and females have digitate sensoria on flagellomeres 1–8 and foreleg tarsomere ratio of: 1: 0.6: 0.5: 0.7 (female foreleg tarsomere ratio in *N. appalachiensis* is 1: 0.4: 0.3: 0.5).

Head. Eyes situated laterally, separate, without an eye bridge. Occiput with two stout setae. Palpus and labellum absent; oral opening small (Fig. 2). Frons with 2–3 setae, no scales. Antennal scape with one seta; pedicel with horizontal rows of microtrichia, no setae (Fig. 3, 4); flagellum of female with 10 flagellomeres with 2 digitate sensoria on flagellomeres 1–9 (Fig. 4, 5, 6, only ventral sensoria shown), each with a single lateral seta and short necks, flagellomere 10 shorter, narrower than preceding flagellomeres (Fig. 6); flagellum of male with 11 flagellomeres with either digitate sensoria or simple sensoria on flagellomeres 1–2 or 1–3, flagellomeres 4–11 lack sensoria (Fig. 3, 7).

Thorax and chaetotaxy. Two dorsolateral, 1–2 dorsocentral setae; 4 shorter setae on pronotum; lateral sclerites bare except for a fine covering of microtrichia. Wing (Fig. 1) elongate, narrow, with a row of long brown setae along the entire wing margin except on proximal ¼; vein R_1 closely joined to C, reaching the wing margin before midlength, vein R_5 absent; vein CuA_1 visible near wing base. Halter with a single long seta near its base. Legs with fore femur inflated distally, mid, hind femora slender, or only slightly inflated distally; tarsi 4-segmented, tarsomere 1 about twice as long as 2, $T1 > T2 > T3 < T4$, tarsal claws falcate, empodia shorter than claws (Fig. 8); male foreleg tarsal ratio (excluding tarsal claw): 1: 0.4: 0.3: 0.5; female foreleg tarsal ratio (excluding tarsal claw): 1: 0.4: 0.3: 0.5.

Male abdomen and chaetotaxy. Tergites, and sternites membranous. Tergite 1 with 2 lateral setae; tergites 2–7 with 2 setae situated anteriorly and posteriorly, and 2 closely approximated trichoid sensillae; tergite 8 (Fig. 9) with 2 setae and 2 trichoid sensillae. Sternite 1 membranous, without setae; sternites 2–7 with 4 setae and 2 closely approximated trichoid sensillae; sternite 8 with 2 setae and 2 trichoid sensillae. Tergite 9 (epandrium) with 5–6 setae along posterior margin, no lateral setae or trichoid sensillum (Fig. 9). Cerci elliptical (Fig. 9), hypoproct (sternite 10) not discernible.

Gonocoxites fused along anterior margin (Fig. 10), covered with microtrichia and lateral, ventral setae. Gonostyli about 3 x longer than wide (Fig. 9, 10), covered with fine setulae and a few setae, inner margin with longer, stouter hair-like setae forming a dense comb. Ejaculatory apodeme brown, heavily sclerotized, extending above the tegmen and longer than gonocoxal apodemes (Fig. 10). Tegmen positioned dorsal to ejaculatory apodeme (Fig. 10), heavily sclerotized, interrupted basally by a series of horizontal ridges (Fig. 10, 11), and fused basally with the gonocoxal apodemes. Aedeagus membranous the apex extends beyond the tip of ejaculatory apodeme (Fig. 10, 11).

Female abdomen and chaetotaxy. Tergites, sternites 1–7 similar to male, except for distortion due to slide mounting, and therefore the trichoid sensillae are not visible. Tergite 8 with 2 anterior, 2 posterior setae; sternite 8 with 4 setae and one seta positioned laterally (Fig. 12); other tergites, sternites

with more numerous setae and a group of lateral setae (Fig. 12). Hypoproct bilobed; cerci two segmented (Fig. 12), disticercus slightly longer than basicercus, with horizontal rows of microtrichia and 2 short dorsal setae located at the distal corners (Fig. 12). Two ovoid, lightly sclerotized spermathecae at level of tergite 8.

Type material. Holotype male, labeled: USA: TN: Sevier Co. GSMNP Sugarlands QW, 24 VI-15 VII 2006, N35°39.826', W83°31.509', reared 1-M. Ferro. Deposited in USNM. Six paratypes: 3 males, 3 females, with same pertinent data as the holotype. One female deposited in USNM; 1 female deposited in LSAM; 1 male, 1 female deposited in CUAC; and 1 male, 1 female deposited in JPPC.

Additional non-paratype material from USNM: 3 females, 1 male, Alabama, Baldwin Co. Shell mounds, Malaise trap, 5/19/2006, John McCreadle, mounted in Hoyer's solution; 1 female, 3 males, North Carolina, Mecklenburg Co. Charlotte, VII-21-23-1991, J.F. Cornell, lot 91 09754, in Hoyer's solution. The above material from the USNM is labeled *N. appalachiensis* Plakidas and Ferro.

Etymology. The specific name *appalachiensis*, Latin, "from the Appalachians", in reference to the collection site of the type series from Tennessee, located along the western flank of the Appalachian Mountains.

Bionomics

Neostenoptera appalachiensis is presently known only from southern Alabama, North Carolina, and Tennessee (Fig. 13), however; it will likely be found in other southeastern states and perhaps throughout most of eastern North America. Specimens were collected with an emergence chamber and a Malaise trap during May, June, and July, indicating that specimens do fly, but they are likely weak fliers.

The type series was collected in GSMNP in Tennessee from pieces of mixed dead hardwood in decay class II (still structurally sound, but loss of bark, some staining from fungi) that was 5–25 cm in diameter. The collection site was on Roaring Fork Sandstone, has a successional hardwood overstory, and an herbaceous/deciduous understory. Vegetation disturbance was "settlement class" and during a 1938 survey this location was designated as grassland (see Ferro et al. 2012). Samples of wood were sealed in an emergence chamber (design, Ferro and Carlton 2011) during April 2006. Adult flies were collected in the 24 June–15 July 2006 sample, but not from the month-long collecting periods before or after that date. Presumably a non-adult form (egg, larva, or pupa) was in the wood before it was collected in April.

Discussion

The discovery of a genus in the Nearctic region that was formerly known only from the Afrotropics was unexpected. *Neostenoptera* and many other small, fragile, non-economically important species suffer from Overlooked Syndrome (Ferro and Carlton 2010) and future work may show an even wider distribution.

The discovery and description of *N. appalachiensis* represents the confluence of several important scientific and social endeavors: 1) the concept, creation, and public funding of National Parks, including GSMNP; 2) recognition of the importance of biotic surveys by both the All Taxa Biotic Inventory (ATBI) at GSMNP and financial support through the National Science Foundation; 3) retention and curation of residues/bycatch by museums; and 4) crowdsourcing using platforms such as Bugguide.net with an oversight of professional naturalists and entomological specialists. Without the above opportunities similar discoveries would be severely hindered.

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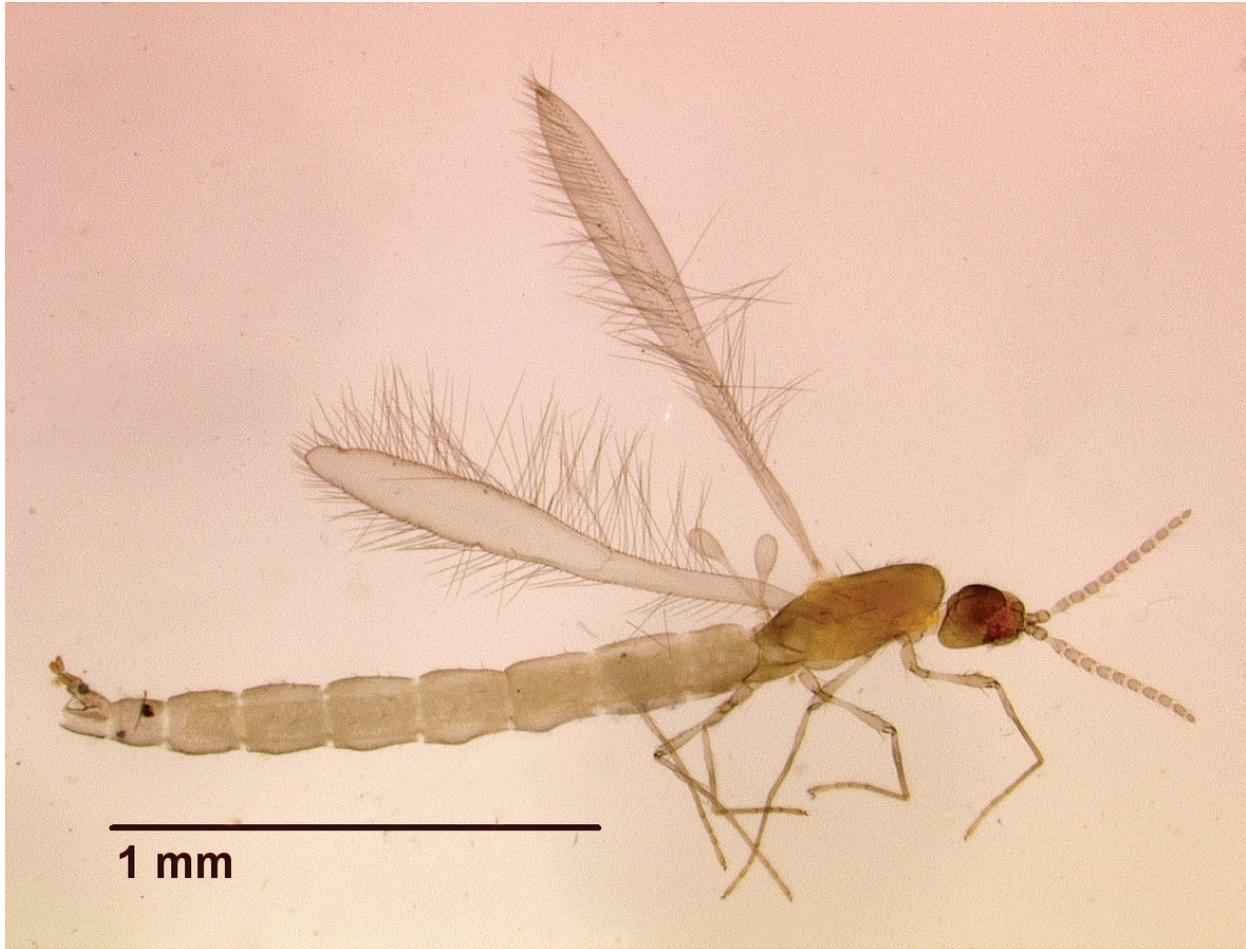
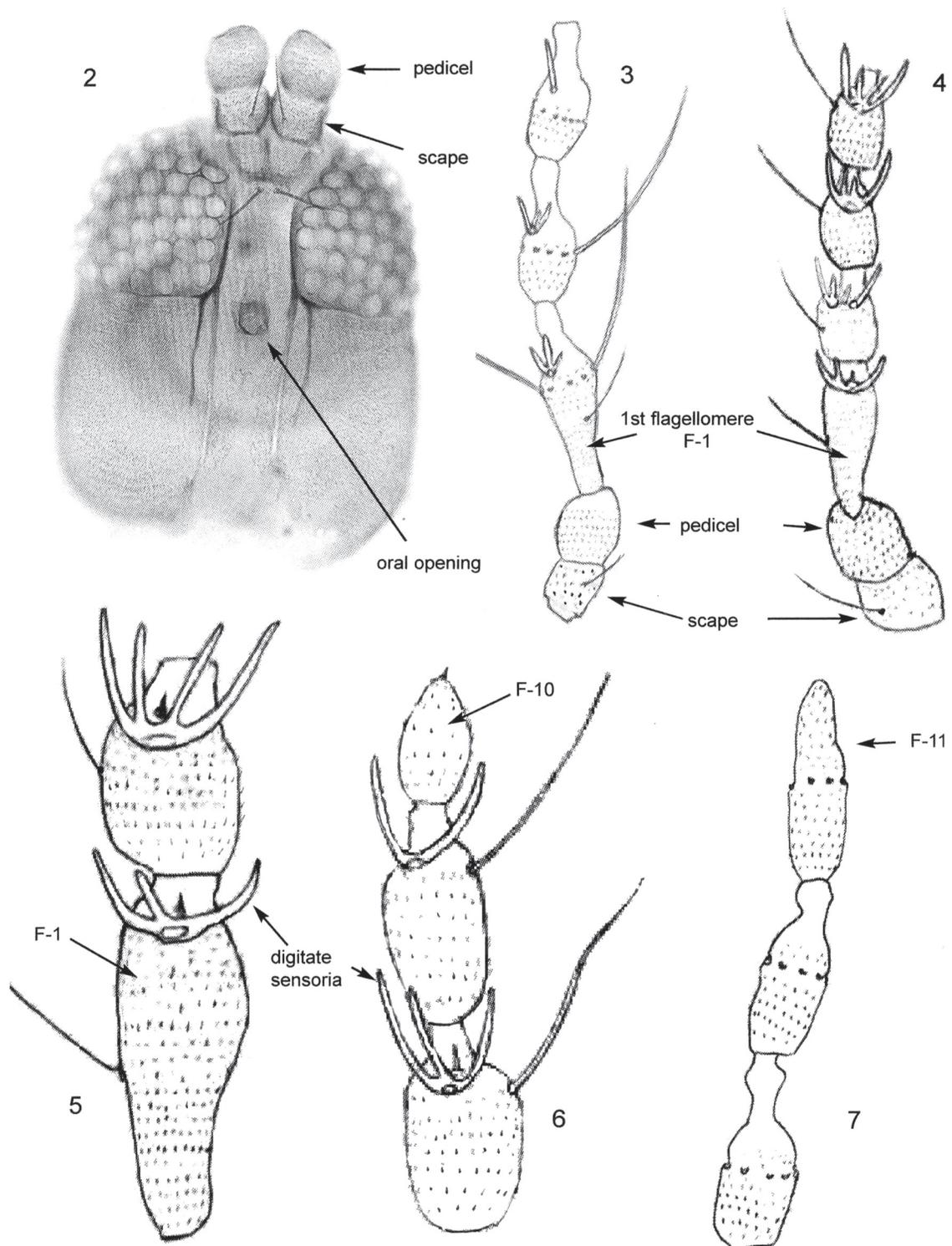
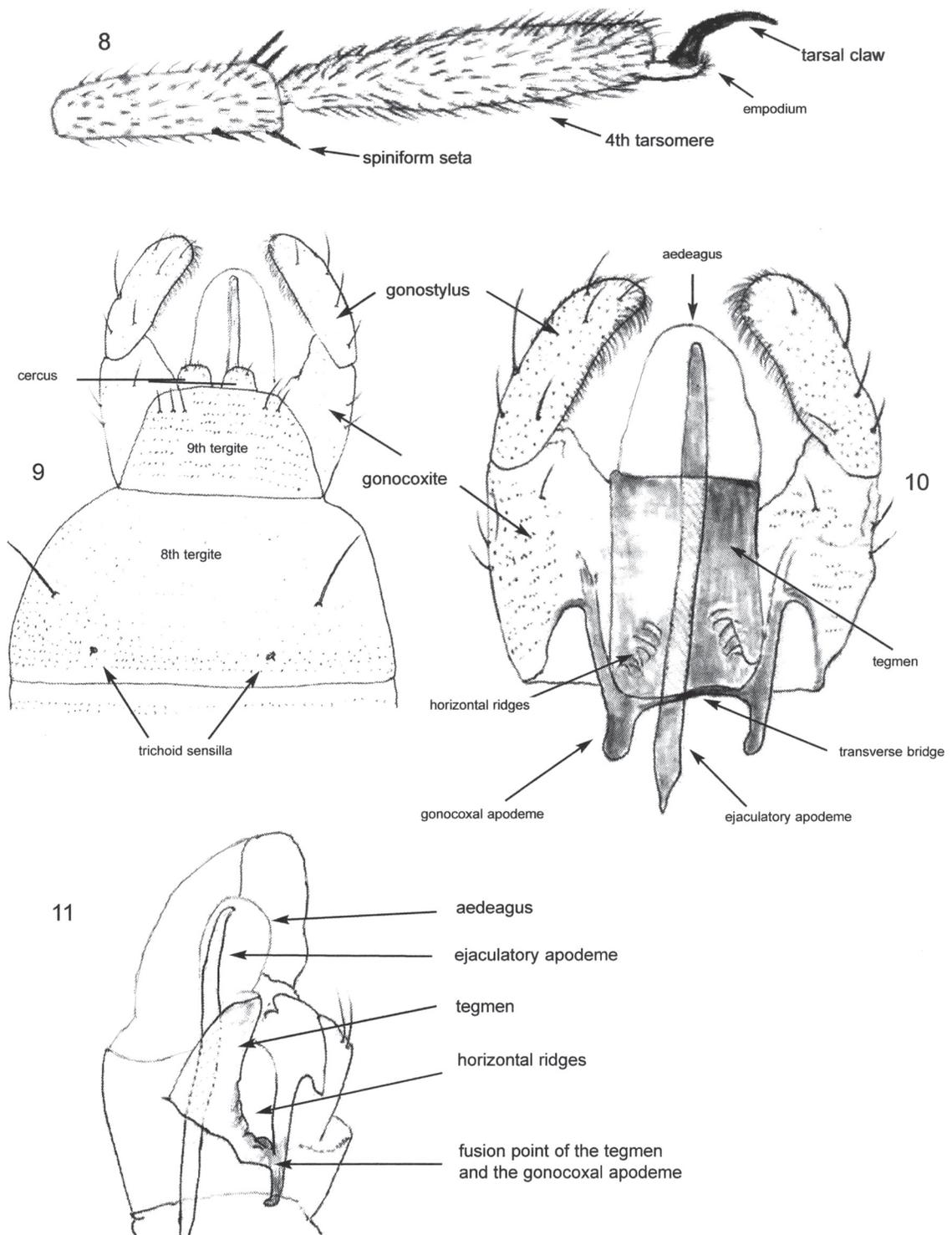


Figure 1. *Neostenoptera appalachiensis*, female, lateral view.



Figures 2–7. *Neostenoptera appalachiensis*. **2)** Male head, ventral view, detailing the oral opening. **3)** Male scape, pedicel, and flagellomeres 1–3, ventro-lateral view. **4)** Female scape, pedicel, and flagellomeres 1–4, ventral view. **5)** Female flagellomeres 1–2, ventral view. **6)** Female flagellomeres 8–10, ventral view. **7)** Male flagellomeres 9–11, ventral view.



Figures 8–11. *Neostenoptera appalachiensis*. **8)** Female tarsomeres 3–4 and tarsal claw. **9)** Male abdominal segments 8–9 and genitalia, dorsal view. **10)** Male genitalia, tergite 9 and cercus removed, dorsal view. **11)** Male genitalia, right gonopod removed, lateral view.

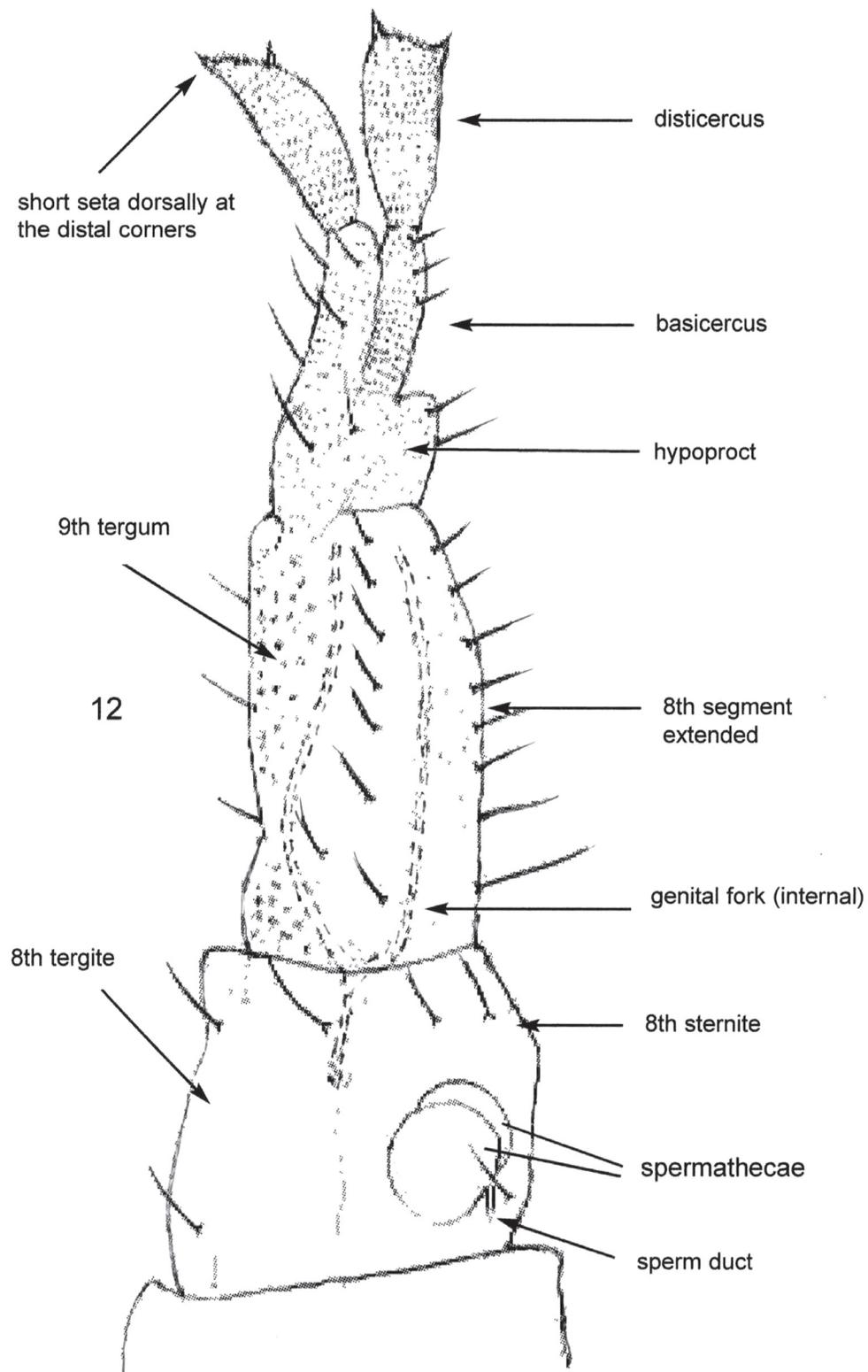


Figure 12. *Neostenoptera appalachiensis* female abdominal segments 8–10, lateral view.

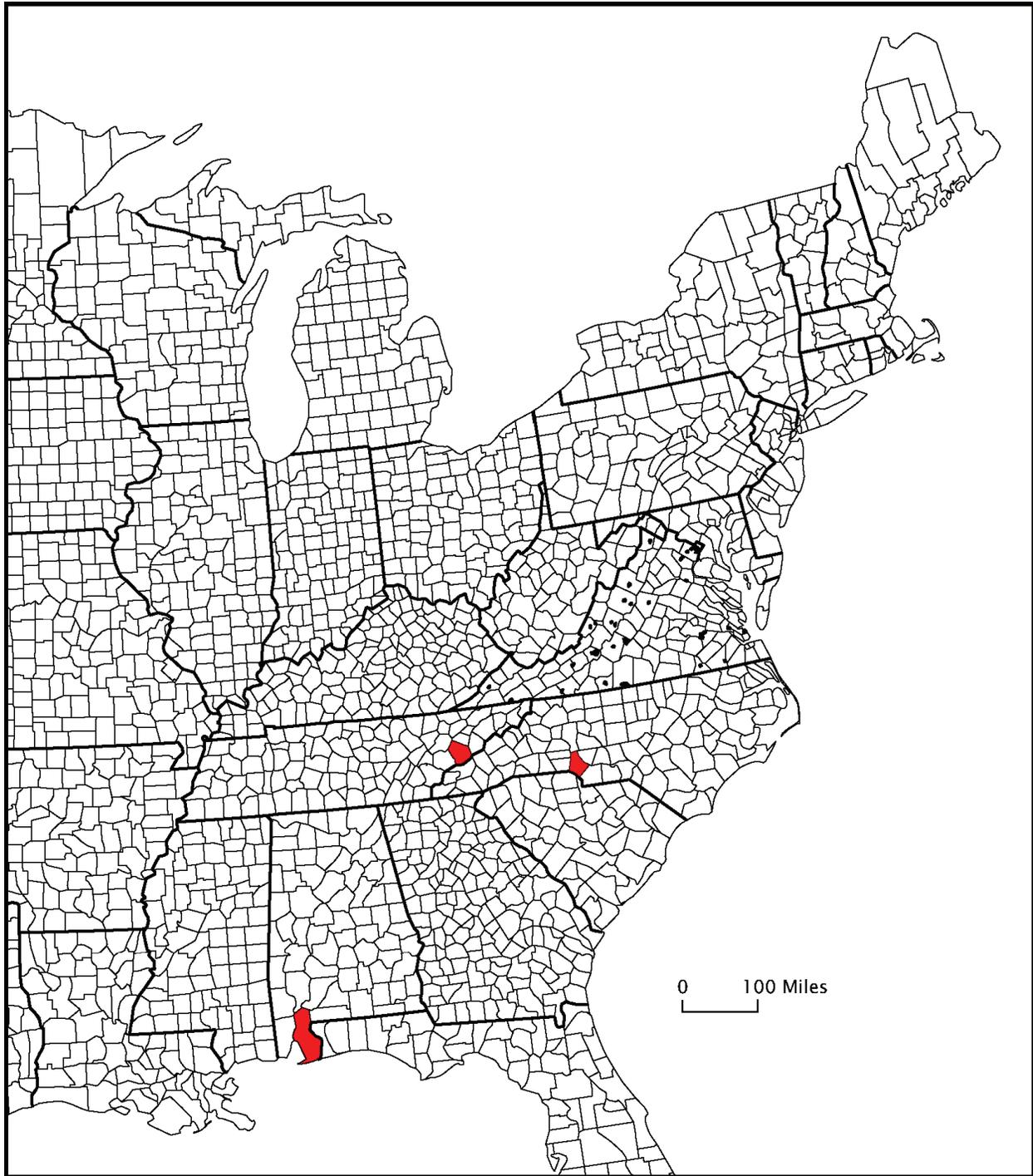


Figure 13. County-level collection localities of *N. appalachiensis* from: Alabama: Baldwin Co.; North Carolina: Mecklenburg Co.; Tennessee: Sevier Co.

