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New Species and Records of Crane Flies (Diptera, Tipuloidea) from Great Smoky Mountains National Park, Tennessee and North Carolina, U. S. A.

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ABSTRACT

A survey of crane flies (Diptera: Tipuloidea) was conducted at 11 reference sites through sampling associated with the All Taxa Biodiversity Inventory (ATBI) in Great Smoky Mountains National Park in Tennessee and North Carolina, U.S.A. Two new species of crane flies, *Ormosia* (*Oreophila*) *parviala* new species and *Tipula* (*Lunatipula*) *atreia* new species, are described here. *Ormosia parviala* is most easily distinguished by the reduced wings of the female. *Tipula atreia* is a small *Lunatipula*, distinguished primarily by a trilobed ninth tergite, a minute outer gonostylus, and the appendage of the ninth sternite with straight pale setae.

Significant range extensions are reported and discussed for ten species of crane flies: *Antocha* (*Antocha*) *obtusa* Alexander, *Ctenophora apicata* Osten Sacken, *Discobola nigroclavata* (Alexander), *Hexatoma (Eriocera) spinosa* Osten Sacken, *Limnophila* (*Idiolimnophila*) *emmelina* Alexander, *Limonia maculicosta* (Coquillett), *Tipula (Lunatipula) flavibasis* Alexander, *Tipula* (*Lindnerina*) *illinoiensis* (Alexander), *Tipula* (*Lunatipula*) *monticola* Alexander, and *Tricyphona* (*Pentacyphona*) *autumnalis* (Alexander).

INTRODUCTION

Created in 1934, the Great Smoky Mountains National Park (GRSM) is located in Tennessee and North Carolina and covers over 521,000 acres. It contains one of the largest tracts of forest in the eastern United States. In 1996 an All Taxa Biodiversity Inventory (ATBI) was begun in GRSM with the goal of identifying all life within its boundaries. An intensive pilot project sampling arthropods was begun in October 2000 at 11 plots. The goal of this project to evaluate protocols for large-scale arthropod sampling and the effectiveness of these collecting techniques. Research plots represent areas not only with common forest habitats (cove hardwood forest and spruce/fir forest) but also unique habitats (grassy bald) in the southern Appalachian Mountain region of Tennessee and North Carolina.

Knowledge of the crane fly (Diptera, Tipuloidea, fauna of GRSM is based primarily on two papers by C.P. Alexander (1940, 1941). Sampling by Alexander was conducted from June through September in 1939-1940 at selected locations in GRSM. During the time of Alexander's sampling, GRSM was still in an early stage of succession. Much of its area still showed the effects of the logging and settlement that was prevalent in this area during the early 20th century (Pyle, 1988). Since this time the forests have since become re-established and now cover about 95% of the Park's total area. While the reports of Alexander greatly increased our understanding of the crane fly fauna of the region, changes in the forest composition and sampling gaps in the early spring and late fall have left the current crane fly community of GRSM incompletely inventoried. Sampling between October 2000-2002 was conducted to fill in seasonal sampling gaps and survey crane flies in habitats not sampled previously.

Two years of sampling has resulted in the identification of over 9,000 crane flies, representing 57 genera and 177 species. Among these taxa, 72 species are new records for GRSM with two representing species new to science, and ten representing significant extensions to species distributions. This paper contains descriptions of these two new species, *Ormosia* (*Oreophila*) *parviala* n. sp. and *Tipula* (*Lunatipula*) *atreia* n. sp., and discussions of species showing significant range extensions. The additional 643 new records of crane flies for GRSM are listed in Petersen (2003).

METHODS AND MATERIALS

Sampling was conducted between October 2000 and October 2002 by use of Malaise/flight intercept traps, pitfall traps, and Lindgren funnel canopy traps set in 11 ATBI reference plots located throughout GRSM. Each plot contained two malaise traps, ten pit-fall traps, and two Lindgren funnel canopy traps. Malaise trap specimens were collected into 70% ethanol and pit-fall and Lindgren funnel traps were collected into ethylene glycol. Traps were run year-round with removal of samples bi-weekly. Details on collection sites and methodology can be found in Petersen (2003). Collection dates are given as "start date–end date" of trap collecting period. Collected material was taken to the University of Tennessee where crane flies were removed and identified. Sorted flies were preserved in 70% ethanol. Male genitalic features were studied by immersing removed genitalia in a warm sodium hydroxide solution for five minutes. Digital images were taken at the Academy of Natural Sciences, Philadelphia, PA, by a JVC-3CCD video camera attached to a Leica Leitz DMRB compound microscope and a Wild MZ6 stereomicroscope. All images were compiled using the Syncroscopy Auto-Montage imaging system and edited in Adobe Photoshop. Morphological terminology is based mainly on McAlpine et al. (1981).

TIPULOIDEA: LIMONIIDAE

Ormosia (Oreophila) parviala Petersen and Gelhaus, new species

Type Specimens.— HOLOTYPE, male: "Tennessee: Sevier Co., GSMNP (Great Smoky Mountains National Park)/ ATBI Plot Clingmans Dome/ Malaise (trap) 15, 35.56028 N -83.49528 W, (elevation 1,944 m)/Parker, Stocks, Petersen/ 10-24 May 2001" Malaise trap (in alcohol). Holotype deposited in the Academy of Natural Sciences, Philadelphia, PA.

PARATYPES: 4 males, topotypic, 10-24 May 2001, 1 male, 1 female, same data as holotype except: (MT15), 10-24 May 2001; 1 male, North Carolina: Swain Co., Andrews Bald (MT11), GRSM, 35.53889 N -83.49417 W, elevation 1757 m, 24 April - 10 May 2001, Malaise trap; 2 females, Tennessee: Sevier Co., Goshen Prong, GRSM, 35.61056 N -83.61056 W, elevation 895 m, 28 March - 9 Apr 2001, pitfall trap. Paratypes are deposited in the Academy of Natural Sciences (Philadelphia, PA, USA), Smithsonian Institution (Washington D. C., USA), University of Tennessee Entomology Museum (Knoxville, TN, USA), and Great Smoky Mountains National Park Museum (Gatlinburg, TN, USA).

Diagnosis.— Small species; overall coloration of thorax yellowish brown, with prescutum ranging from three distinct dark brown stripes to a broad dorsal darkening; halteres pale, stem slightly darker; male wing (Fig. 4) slightly suffused with brown, brown macrotrichia present in all cells, Sc poorly indicated and intersecting C at about branching of Rs, discal cell open by atrophy of m; female wing (Fig. 5) reduced in size and venation; male hypopygium (Fig. 1) with ventral gonostyle thorn shaped with a blackened tip; dorsal gonostyle a simple pale yellow rod.

MALE (N=8). From specimens in alcohol. Body Length: 2.8-3.8 mm; wing length 4.1- 4.7 mm. Body yellowish brown unless otherwise noted. Head: Dorsally with a wide brown stripe running from anterior margin to rostrum, broadest at mid-length. Rostrum yellow, very short. Palpi and antennae brown. Antenna: 0.7-1.0 mm long, apparently 15-segmented (last 2 flagellomeres fused), scape longer than wide, slightly lighter in color than remaining antenna. Pedicel pear shaped. Verticils exceeding the length of their respective segment, each flagellomere oval in shape. Thorax: Prescutum brown dorsally, rarely with three brown stripes and lateral brown spot. Tuberculate pits black. Scutum darkening to brown anteriorly. Membranous areas yellowish white. Halteres: 0.7-0.9 mm long, base and knob white with stem slightly darkened. Legs with femur tips slightly darkened, tarsi dark brown. Wing: (Fig. 4) Slightly suffused with light brown, otherwise unpatterned, stigma absent. Macrotrichia present in all cells, brown in color. Microtrichia of veins black. Venation: Veins pale brown, vein Sc exceedingly pale. Veins R_4 and Cu darker brown. Sc intersecting C at about the branching of Rs. R_2 entering at or slightly beyond fork of R_3+R_4. Anal veins divergent. Cell M_1 open by atrophy of m, CuA entering M at or slightly beyond fork of M. Abdomen: Intersegmental regions pale. Male Hypopygium: Simple in construction (Fig. 3). Rotated 180°. Ninth tergite with posterior margin slightly rounded. Ventral gonostylus having a "thorn-like" appearance (Fig. 1), a short slightly curved spine, darkened beyond base, surface of darkened area with microscopic denticles. Dorsal gonostylus longer than ventral gonostylus, appearing as a pale yellow rod, constricted slightly medially, when viewed posteriorly hav-

ing a slight curve, apex rounded; short, scattered setae found throughout. Gonapophyses seen as an unbroken sclerotized plate, shallowly excavated medially forming two weak lateral lobes (Fig. 2). Gonapophyses overlain with simple stout aedeagus, narrowing to a darkened rounded blunt tip; internal base extended anteriorly as sinuous rods, enclosing a rounded sperm pump.

FEMALE (N = 3). As in male except: Body length 4.2 mm; wing length 1.5 mm. Antenna: damaged, missing flagellum. Thorax: general coloration yellowish brown throughout, lateral spots absent. Wing: subapterous, more strongly suffused with brown than in male. Venation: poorly indicated (Fig. 5). Abdomen dark brown. Ovipositor elongate, with cerci curved upward (Fig. 5). Lighter in color than remainder of abdomen.

Etymology. *O. (O.) parviala* was named using the Latin prefix parv-, meaning small, and the Latin word ala, meaning wing. This "small wing" refers to the wing of the female, which is much reduced in size.

Discussion.— The subgenus *Oreophila* contains 16 species, 7 Oriental and 9 Nearctic. Except for the present species, the 8 other Nearctic species are western in distribution, with most occurring in the Pacific Northwest of the U. S. and Canada. *Ormosia (O.) parviala* n. sp. belongs to what Alexander (1943: 755) called the flaveola group (*O. (O.) absoroka* Alexander, *O. (O.) flaveola* Coquillett, *O. (O.) sequoiarum* Alexander). This group includes members that have the male hypopygium with: short ventral gonostyle with narrowing apex roughened with microscopic denticles; dorsal gonostyle a pale rod of nearly the same length as ventral gonostyle; aedeagus stout, narrowing to a darkened blunt tip; phallosome an unbroken oval sclerotized plate, simple in construction.

The adults of *Ormosia (O.) parviala* n. sp. most closely resembles those of *O. absaroka* in overall appearance of the hypopygium (see Alexander 1943: Fig. 38), but differs by body coloration and overall body size, and development of female wings. In *O. absaroka*, the body is dark brownish gray, size above 4 mm, and with fully winged females. Adults of *O. flaveola* differ from *O. parviala* in possessing darker coloration of the legs (uniformly dark brown in *O. parviala*)and more suffused wings (lightly suffused in *O. parviala*). *O. parviala* differs from *O. sequoiarum* in possessing the lobed phallosome (uniformly rounded in *O. sequoiarum*), yellowish brown coloration (uniformly black in *O. sequoiarum*), uniform trichiation of all wing cells (sparse trichiation of cell in *O. sequoiarum*) and ninth tergum 9t of simple construction (posterior margin slightly emarginate in *sequoiarum*).

The male of *Ormosia parviala* will key to the subgenus *Oreophila* in Alexander and Byers (1981) of which it is the only eastern North American species. The species will key to the *Ormosia nigripila* group (couplet 12) in Alexander (1942) but differs from the two species keyed there in the structure of the thorn-shaped ventral gonostylus.

The female of *O. (O.) parviala* can be readily distinguished from all other species of *Oreophila* by its greatly reduced wings, apparently rendering it flightless. This is the second brachypterous crane fly described from the upper elevations of GRSM; the first being *Prionolabis rudimentus* Alexander, described in 1940. A reproductive advantage has been observed in species with reduced flight muscles due to wing reduction (Roff et al. 2002). Byers (1983) noted that in the apterous crane fly genus *Chionea*, reduced flight musculature in the female resulted in increased space in the thorax for egg production. Of the three females of

O. parviala collected, the preserving agent dissolved the wing musculature of the two female specimens that still contained eggs and it was not possible to determine whether a reduction in flight muscle had actually occurred. It has not been determined whether the musculature in the third female had been reduced or not. Byers (1969) offers further notes on wing reduction in crane flies.

Distribution. NORTH CAROLINA, TENNESSEE, Great Smoky Mountains National Park, U. S. A.

Habitat.— Ormosia (Oreophila) parviala has been identified from two high elevation (>1,750 m) sites in GRSM (Clingmans Dome and at Andrews Bald) and one low-elevation site (Goshen Prong). Vegetation of Clingmans Dome is dominated by Frasier fir, *Abies fraseri*, and Red spruce, *Picea rubens*. Andrews Bald is a cleared mountaintop that is dominated by native and introduced grass species. The Goshen Prong forest is representative of a secondary growth, deciduous cove hardwood forest (USGS 1999). This forest type is most common below 1,400 m in the many coves and valleys of GRSM. The presence of adults at three distinct habitats makes the association between species and habitat difficult to determine and it is more likely that this species will be found across forest types at the mid to upper elevations of GRSM (865-1,944 m). The larval habitat for this species is unknown, but based on knowledge of larval habitats for other species of *Ormosia* (Byers, 1996), the larva of *O. parviala* is likely to live in moist earth.

TIPULOIDEA: TIPULIDAE

Tipula (Lunatipula) atreia Petersen and Gelhaus, new species

Type Specimen. HOLOTYPE, male, "Tennessee: Blount Co., GSMNP (Great Smoky Mountain National Park)/ ATBI Plot Cades Cove/ (old field, 35.59251 N -83.84376 W, elevation 457 m), Malaise (trap) 03 UTM 024291-3942333/ Parker, Stocks, Petersen/ 9 -23 April 2001", (in alcohol). Holotype deposited at the Academy of Natural Sciences, Philadelphia, U.S.A.

Diagnosis. Small *Lunatipula* species (<12 mm wing length). Wing pale yellow; costal and subcostal fields suffused with brown; stigma faintly indicated, otherwise wing unmarked (Fig. 6). Posterior margin of male tergite 9 expanded into two large lateral lobes and a small medial lobe, forming a wide W-shaped notch (Fig. 9), medial lobe, pale, thin, approximately one- fourth length of lateral lobes. Eighth sternite slightly excavated medially, with two short rounded lobes each equipped with a single stout elongate seta (Fig. 15). Appendages of the ninth sternite covered with long, pale, straight setae (Fig. 13). Outer gonostyle a pale greatly reduced lobe (Fig. 11). Outer basal lobe excavated laterally with large and small spines along apex (Fig. 12).

MALE (N=1). From specimen in alcohol. Body Length: 11.5 mm; wing length 11.7 mm. Head—Uniformly brown, rostrum light brown, nasus present; palpi brown (terminal segment absent). Antenna: 3.5 mm long, just attaining wing origin when bent back, pedicel and scape yellowish brown, flagellum brown, flagellomeres weakly bicolorous with bases enlarged and darker in color than remaining portion of segment, first flagellomere lighter in color than others, terminal flagellomere small. Thorax: Prescutum yellowish brown with three broad, dark brown stripes, median stripe bisected by thin brown line, median line not

extending posteriorly beyond transverse suture, lateral pair continued as broader stripe along scutum; pleural region yellowish brown with pale membranous areas, ventral half of katepisternum and meron dark brown. Halteres: Yellowish brown, sparse black setae present at base of knob. Wings (Fig. 6)— Overall pale yellow in color; costal and subcostal fields suffused with brown; stigma faintly indicated but clearly present, preceded by small white area extending to discal cell; remainder of wing unmarked. Venation— Sc longer than m-cu; cell M_1 longer than its petiole. Legs: Yellow, paler near base of femur and darkening slightly distally; tibia brown. Abdomen: Overall yellowish brown; tergites 3-6 vaguely marked medially with a wide brown stripe, widening to cover the posterior edge on tergite 6; tergites 7 and 8 uniformly brown; sternites pale yellow in color; sternites 5-7 marked along the posterior edge by pale brown. Male genitalia (Figs. 7-8): Male hypopygium with tergite 9 yellowish brown in color, trilobed (Fig. 9), lateral margins expanded into two large lateral lobes, broad at base and narrowing to slender, rounded apex, medial margin of each lobe sinuous; median lobe a short spine, one quarter the length of lateral lobes, separated from lobes by narrow U-shaped emarginations (Fig. 9). Posterior margin of sternite 8 slightly excavated, with two short rounded lateral lobes (Fig. 14); each lobe equipped with a single stout elongate seta that is slightly curved medially, surrounded by sparse fine yellow setae (Fig. 15). Appendage of the ninth sternite swollen, narrowing ventrally, covered with long straight yellow setae (Fig. 13). Inner gonostyle composed of both upper and lower beaks and outer basal lobe (Fig. 10); upper beak appearing as a large laterally compressed oval; distal edge slightly expanded to a rounded tip, the proximal end bearing a set of small sensory pegs. Lower beak a rounded lobe, bearing serrations along its darkened apex, along lateral surface a line of strong dark setae extending to mid-length. Outer basal lobe deeply excavated laterally with crenulated apical margin, with a large and small spine along apex (Fig. 8, 12). Outer gonostyle a small pale lobe; bearing sparse pale setae (Fig. 11). Aedeagus with each lateral lobe a strongly recurved spine (Fig. 13), their apex strongly attenuate.

FEMALE. Unknown.

Etymology. The name *atreia* refers to Atreus of Greek mythology. Just as *Tipula atreia* goes through its transition from larvae to adult stage, Atreus similarly goes through a metamorphosis between two distinct stages, from a relatively harmless youth stage into a very different vengeful and destructive adult (Tarrant 1985).

Discussion. Tipula (*Lunatipula*) *atreia* n. sp. most closely resembles *Tipula* (*Lunatipula*) *triton* Alexander in the morphology of the male genitalia. Similarities can be seen in the appearance of the trilobed 9th tergite and the minute outer gonostyle in the two species. After examination of the type specimen of *T. triton* by Gelhaus in 2001 (at MCZ, Harvard), it is clear that Alexander (1915: 488, fig. 65; 1942: 282 in key) mistakenly referred to the outer basal lobe (= outer pleural appendage in Alexander 1915) of *triton* as the outer gonostyle, an understandable confusion as the outer gonostyle is unusually reduced in *triton* (as in *atreia*, Fig.8).

Tipula atreia can be separated from *T. triton* based on the following characteristics: ninth tergite (Fig. 6) of *T. atreia* has the medial lobe greatly reduced when compared to the lobe of *T. triton* (Alexander 1942, fig. 32M); the two lobes of the adeagus on *T. atreia* are much more slender (Fig. 7) than the stouter lobes of *T. triton* (Alexander 1915: Fig. 78); the apex of the outer basal lobe of *T. triton*

is an elongate slender tip (Alexander 1915: Fig. 65), while that of *T. atreia* is stouter, crenulate with two acute points (Figs. 8, 12); the setae of the appendage of the ninth sternite of *T. atreia* are long, straight and yellow, whereas those of *T. triton* are darker, denser and crinkled.

Tipula atreia will key to *T. triton* in the key of Alexander (1942); note that the key in couplet 21 refers to the outer basal lobe mistakenly as the "outer dististyle."

Distribution.— TENNESSEE, Great Smoky Mountains National Park, U. S. A.

Habitat.— *Tipula* (*Lunatipula*) *atreia* has been collected from one location from the western end of Cades Cove in GRSM. This location is an open grassland cove that is surrounded by deciduous cove hardwood forest. The area of grassland where the specimen was collected is subject to early season inundation, but throughout the rest of the year is dominated by various native and introduced grasses.

RANGE EXTENSIONS

Seventy-two new records were discovered for GRSM during this sampling. Ten species listed below not only represent new records for the states of North Carolina and Tennessee, but also significantly extend the known range of each. Listed below each species name is the previous range of the species, the location information for collections made in GRSM, and a brief discussion or comments. The overall distribution for the species is taken from Oosterbroek (2002); additional Virginia records are from Byers (2002) where noted.

Of these species with significant range extensions, most were previously known only from northeastern North America. The occurrence of four species, *Ctenophora (Ctenophora) apicata*, *Limonia maculicosta*, *Tipula (Lunatipula) monticola*, and *Tricyphona (Pentacyphona) autumnalis*, only at sites above 1000 m, suggests these species may be limited to higher elevations in the southern Appalachians. The remaining species were found at elevations ranging from 594-1944 m and are more likely to represent continuous ranges from the north.

The addition of *Antocha* (*Antocha*) *obtusa* was added from prior ATBI sampling conducted in 1999, and *Hexatoma (Eriocera) spinosa* from sampling for a separate project. Unless otherwise noted, specimens from this study are housed in the collection of the University of Tennessee.

TIPULOIDEA: TIPULIDAE

Ctenophora (Ctenophora) apicata Osten Sacken

Previous distribution.— Canada (Ontario, Quebec, and Ontario), USA (Minnesota, Maine, south to New York and Connecticut). Also Virginia (Byers, 2002).

New distribution records.— North Carolina: Haywood Co., Purchase Knob, GRSM, 35.59194 N -83.06028 W, 19 July - 2 August 2001, 1 male, 1 female. Tennessee: Cocke Co., Albright Grove, GRSM, 35.73333 N -83.28056 W, 1 -14 August 2001, 1 female.

The occurrence of this species in GRSM extends its range south from Virginia. *Ctenophora apicata* was rarely encountered, with only 3 specimens col-

lected from two locations, Purchase Knob, a northern hardwood forest, and Albright Grove, an old growth montane cove hardwood forest.

Tipula (Lindnerina) illinoiensis (Alexander)

Previous distribution.— Canada (Manitoba, Ontario, and Quebec), USA (Minnesota, Illinois, Pennsylvania, and New Hampshire); Russia: FE (Magadan obl.); Korea.

New distribution records.— Tennessee: Sevier Co., Twin Creeks, GRSM, 35.68500 N -83.49000 W; 4 males, 26 April -15 May 2001. Tennessee: Sevier Co., Goshen Prong, GRSM, 35.61056 N-83.54278 W; 2 male, 1 female, 27 April - 8 May 2001; 4 males, 8 - 21 May 2001. North Carolina. Haywood Co., Purchase Knob, GRSM, 35.59154 N –83.06028 W; 5 males, 1 female, 15 May - 8 June 2001. Tennessee: Sevier Co., Indian Gap, GRSM, 35.61083 N 83.44361 W; 2 females, 10 - 28 May 2001.

This species was one of the most common species of *Tipula* found during this sampling, and across a range of forest types and elevations. Surprisingly, it had not previously been recorded any closer to GSNP than Pennsylvania and Illinois, and was absent from the earlier surveys of GSNP by Alexander (1940, 1941). The fact that this species is little known from the southern Appalachians is likely due to its early emergence date (late April-early June).

Tipula (Lunatipula) flavibasis Alexander

Previous distribution.— USA (Kansas and Pennsylvania).

New distribution records.— Tennessee: Sevier Co., Twin Creeks, GRSM, 35.68500 N -83.49000 W; 7 males, 30 July -13 Aug 2001; 4 males, 3 females, 13 - 27 August 2001; 1 male, 27 August - 10 Sep 2001. Tennessee: Sevier Co., Goshen Prong, GRSM, 35.61056 N - 83.54278 W; 4 males, 3 females, 27 August - 17 September 2001. North Carolina: Haywood Co., Purchase Knob, GRSM, 35.59194 N -83.06028 W; 1 male, 1 female, 2 - 20 August 2001.

Since its original description from Kansas in 1918, this species has only been documented twice, from Kansas (Young, 1978) and western Pennsylvania (Young and Gelhaus 2000). Collection of *T. flavibasis* in GRSM marks an extension of its range 1100 km east from Kansas and 600 km south from Pennsylvania.

Tipula (Lunatipula) monticola Alexander

Previous distribution.— Canada (Ontario to Quebec), USA (Maine south to Pennsylvania); also Virginia (Byers, 2002)

New distribution records.— North Carolina: Swain Co., Andrews Bald, GRSM, 35.53889 N -83.49417 W; 1 male, 6 - 22 June 2001. North Carolina: Haywood Co., Cataloochee, GRSM, 35.58639 N -8308167 W; 1 male, 15 May - 8 June 2002.

This species was found from two locations in GRSM, one upper and one mid elevation. Collection dates of the two adults corresponds with those recorded from Pennsylvania, where this species has been widely collected (Young and Gelhaus, 2000).

TIPULOIDEA: LIMONIIDAE

Antocha (Antocha) obtusa Alexander

Previous distribution.— Canada (Quebec), USA (Michigan, New York, south to Kansas). Also Virginia (Byers, 2002)

New distribution records.— Tennessee: Sevier Co., Greenbrier Cove, Middle Prong Little River, GRSM,, 11 June 1999; at blacklight, CR & KA Parker, 2 males. Tennessee: Blount Co, Little River, 1.2 km south of Townsend, GRSM; 2 males, 9 June 1999,; at blacklight, CR & KA Parker., 2 males.

The larval stage of this species is aquatic and adults were collected along two large rivers in GRSM.

Discobola nigroclavata (Alexander)

Previous distribution.— USA (Maine, south to New York and Massachusetts).

New distribution records.— Tennessee: Cocke Co., Snakeden Ridge, GRSM, 35.74333 N -83.22000 W; 1 female, 10 - 24 Sept 2001; 1 female, 1 - 14 Aug 2001; 1 female, 14 August - 10 September 2001. North Carolina: Swain Co., Clingmans Dome, GRSM, 35.56028 N - 83.49528 W; 2 males, 4 females, 31 July - 16 August 2001. North Carolina: Haywood Co., Cataloochee, GRSM, 35.58639 N - 83.08167 W; 1 female, 2 - 20 August 2001; 2 females, 20 August 11 September 2001. North Carolina: Haywood Co., Purchase Knob, GRSM, 35.59194 N - 83.06028 W; 2 females, 20 August - 11 September 2001; 1 female, 2-20 Aug 2001. Tennessee: Sevier Co., Indian Gap, GRSM, 35.61083 N -8-3°.44361 W; 1 male, 1 female, 3 - 26 Sept 2001. Tennessee: Sevier Co., Twin Creeks, GRSM, 35.68500 N - 83.49900 W; 1male, 1 female, 8 - 15 Oct 2001.

This species was described by Alexander (1942) from one female specimen from New York, one female from Massachusetts, and one male from Maine. This marks the first documented collection of this species since the original description. While not found in large numbers, this species was found widely at many locations and all elevations throughout GRSM.

Hexatoma (Eriocera) spinosa (Osten Sacken)

Previous distribution.— Canada, USA (Newfoundland, south to Illinois and Pennsylvania).

New distribution records.— North Carolina: Swain Co.,Ocunaluftee River, site 2, at black light, 18 June 2001, D. R. Jones, R. C. Harrington, 1 male ; North Carolina: Swain Co., Confluence of Ravens Fork and Oconaluftee River, 16 August 2001, at black light trap, D. R. Jones, R. C. Harrington, 2 males; same as preceding, but 28 August 2001, 1 male, 1 female; same as preceding but 18 June 2001, 1 male. In collection of Clemson University and The Academy of Natural Sciences.

The records here mark a extension of distribution of over 550 km southward. The predaceous larva has been reared from under rocks in rapid water (Alexander 1920).

Limnophila (Idiolimnophila) emmelina Alexander

Previous distribution.— Canada (Ontario), USA (Massachusetts south to Virginia).

New distribution records.— Tennessee: Sevier Co., Goshen Prong, GRSM, 35.61056 N - 83.54278 W; 2 males, 9 - 27 Apr 2001; 3 males, 6 females, 27 April-8 May 2001. North Carolina: Haywood Co., Purchase Knob, GRSM, 35.59194 N - 83.06028 W; 4 males, 23 April -15 May 2001; 1 male, 15 May - 8 June 2001. Tennessee: Sevier Co., Twin Creeks, GRSM, 35.68500 N -83.49900 W; 1 male, 11-26 April 2001.

The new records here mark a small southern extension.

Limonia maculicosta (Coquillett)

Previous distribution.— Canada, USA (Alaska to Vermont, south to California and Virginia); Belgium, Finland, Sweden; Russia: FE (Kamchatka); Japan (Honshu).

New distribution records.— Tennessee: Cocke Co., Snakeden Ridge, GRSM, 35.74333 N -83.22000 W; 1 male, 1 female, 25 April 9 May 2001; 1 male, 16 July - 1 Aug 2001. North Carolina: Swain Co., Clingmans Dome, GRSM, 35.56028 N -83.49528 W; 2 males, 24 May - 6 Jun 2001; 1 male, 1 female, 6 - 25 June 2001; 25 June - 16 August 2001. North Carolina: Swain Co., Andrews Bald, GRSM, 35.53889 N - 83.49417 W; 1 male, 6 - 22 June 2001; 1 female, 10 - 24 May 2001.

This species occurs at the mid to upper elevations of GRSM.

Tricyphona (Pentacyphona) autumnalis (Alexander)

Previous distribution.— Canada (Ontario to New Brunswick), USA (Wisconsin and Pennsylvania); also Virginia (Byers, 2002)

New distribution records.— North Carolina: Swain Co., Clingmans Dome, GRSM, 35.56028 N - 83.49528 W; 1 male, 16 -29 August 2001.

The record of this species in GRSM marks a range extension from its southernmost previously known distribution in Virginia. The finding of this species at only the high elevation site seems to indicate that it may be restricted to the upper elevations of the southern Appalachian Mountains.

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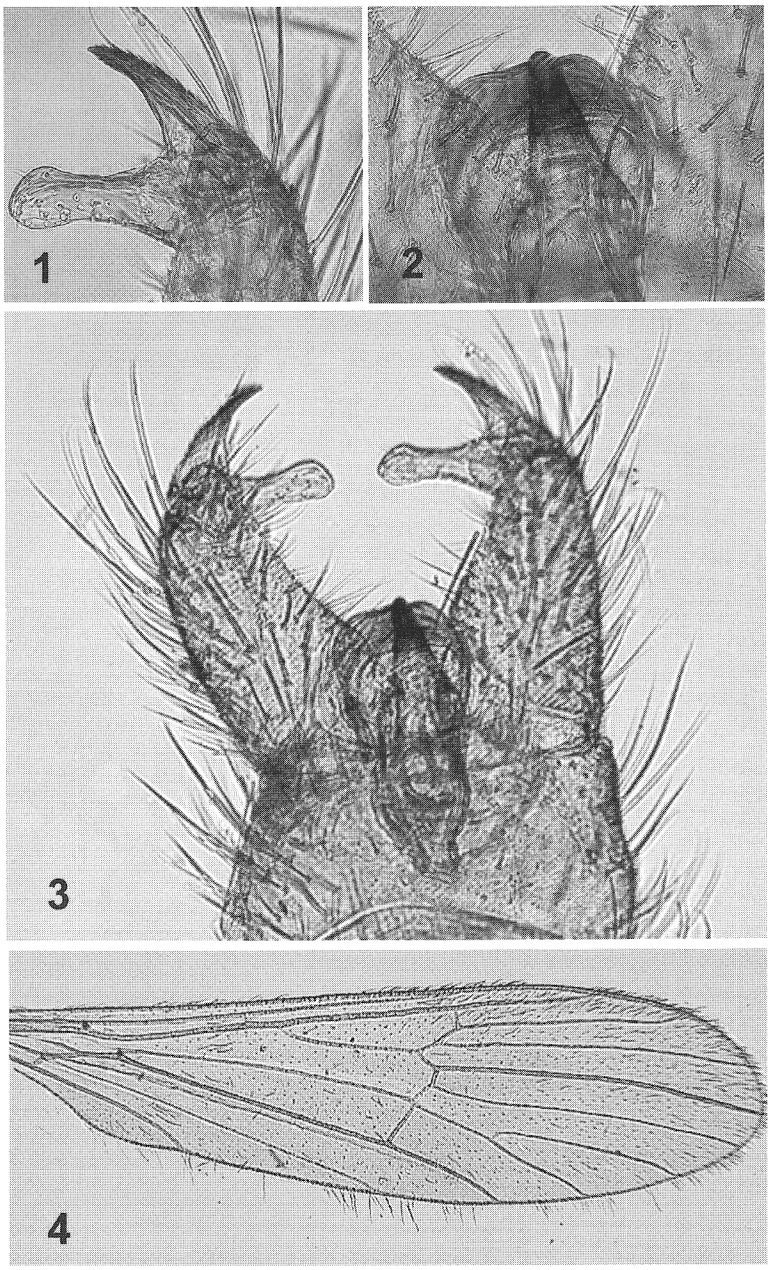


Figs. 1-4. *Ormosia* (*Oreophila*) *parviala* new species. Fig. 1 male, dorsal and ventral gonostyles. Fig 2, male, aedeagus and fused gonopophyses plate. Fig. 3, male, hypopygium, 150X. Fig 4, male, wing, 21X.

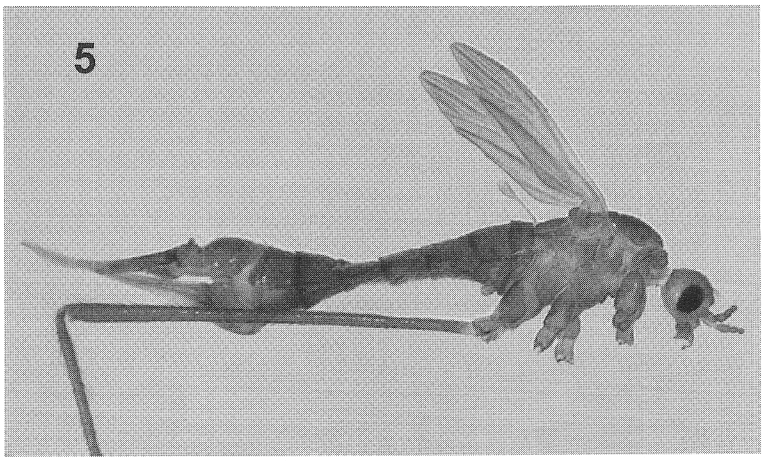
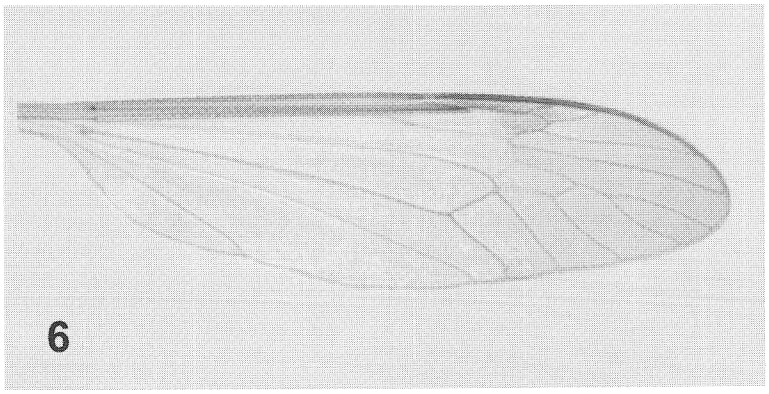
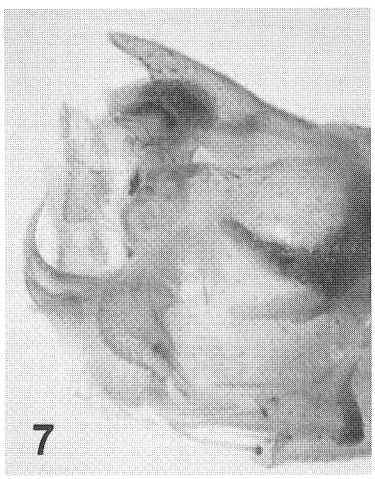
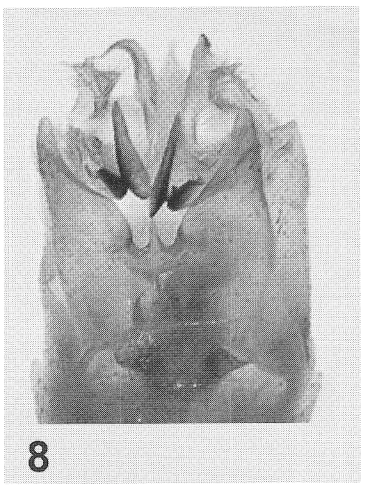


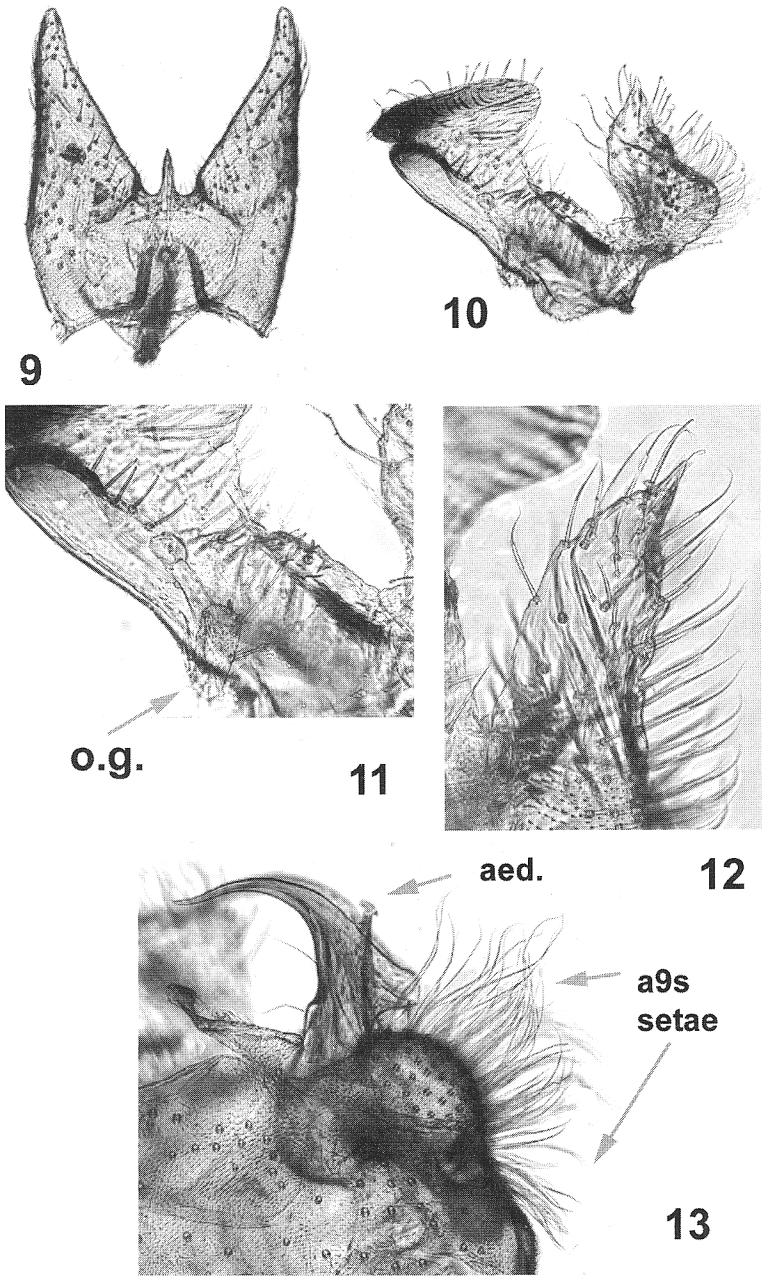
Fig. 5. *Ormosia* (*Oreophila*) *parviala* new species female, lateral view showing reduced wing, 23X.







Figs. 6-8. *Tipula (Lunatipula) atreia* new species. Fig 6, male, wing, 8X Fig. 7, male, hypopygium, lateral view. Fig. 8, male, hypopygium, dorsal view.



Figs. 9-13. *Tipula (Lunatipula) atreia* new species, male. Fig. 9. Ninth tergite, dorsal, 44X. Fig. 10. Inner and outer gonostylus, lateral view, 59X. Fig. 11. Closeup of base of inner gonostylus, showing minute outer gonostylus, 100X. Fig. 12. Detail of outer basal lobe of inner gonostylus, 125X. Fig. 13. Aedeagus and appendage of ninth sternum, 73X. Labels: o.g.=outer gonostylus; aed = aedeagus; a9s setae = straight setae of the appendage of the ninth sternum.

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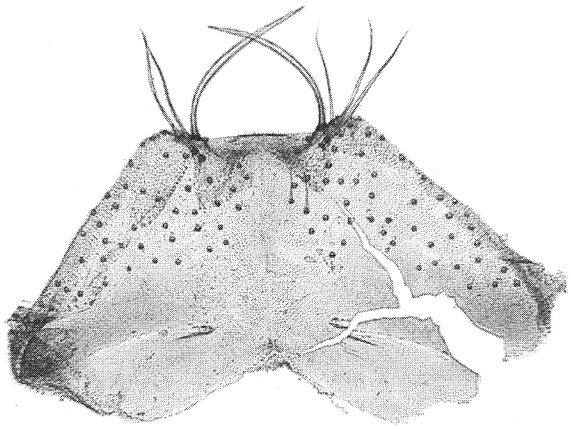

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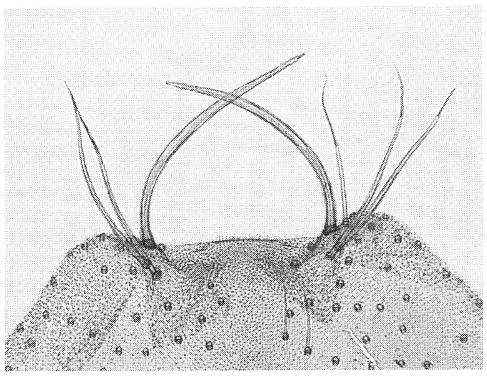

Figs. 14-15. *Tipula (Lunatipula) atreia* new species, male eighth sternite, Fig. 14, 43X, Fig. 15, 63X.