

A new species of *Melanoplus* (Orthoptera: Acrididae: Melanoplinae) from the cedar glades of Tennessee, USA

Submitted October 1, 2010, accepted November 15, 2010

JOVONN G. HILL

Mississippi Entomological Museum, Box 9775, Department of Entomology and Plant Pathology, Mississippi State University, MS 39762, USA. Email: jgh4@entomology.msstate.edu

Abstract

Melanoplus ingrami n. sp. is described from the cedar glades of central Tennessee.

Key words

Melanoplus, cedar glade, Tennessee

Introduction

The cedar glades of the Central Basin of Tennessee (Fig. 1a) have long been noted for their unique flora (Gattinger 1887, 1901; Harper 1926; Quarterman 1950a, 1950b; Baskin & Baskin 1999). These glades possess fourteen endemic plants, the highest number of any of the Southeastern glade communities. While much attention has been given to the flora (See Quarterman 1993 and Baskin & Baskin 1999 for summaries) and vertebrate faunas of the glades (Jordan *et al.* 1968, Jordan 1986, Shultz 1930), little attention has been paid to the insect fauna: there is only one study, which attempted to focus on all invertebrates of a single glade, conducted from 1929 to 1930. (Meyer 1937).

To document the insect fauna of this unique habitat, the Mississippi Entomological Museum (MEM) selected the area as the destination for the 1997 and 2009 William H. Cross Annual Collecting Expeditions. No Orthopteran specialist was on staff at the MEM in 1997, but I became involved by 2009. From the start of the 2009 expedition, the Orthopteran fauna of the glades proved interesting, as the first grasshopper specimen collected proved to be an undescribed species of *Melanoplus*, the subject of the present paper.

Methods

Attempts to identify the *Melanoplus* specimens from the cedar glades were made with Blatchley (1920), Dakin & Hays (1970), Hebard (1934), Helfer (1972) and by checking material against Melanoplinae specimens in the MEM, Academy of Natural Sciences of Philadelphia (ANSP), and the United States National Museum.

Habitus and internal genitalia photographs were taken with a Leica Z16 stereoscope equipped with a Leica DFC420 camera at different stages during dissection. Images were then automontaged with Leica Application Suite. External genitalia drawings were made with a drawing tube mounted on a Leica MZ 12.5 stereomicroscope.

Measurements were made with a measuring reticle mounted inside a Leica MZ12.4 stereomicroscope. Abdomens in Orthoptera specimens can be contracted or distended, thus providing a wide range of variation; therefore, overall length of the specimens was

measured from the fastigium vertex to the distal end of the hind femur, viewed laterally. Tegminal length was measured laterally at its greatest length.

Results

Melanoplus ingrami, new species

Holotype.—Male: Tenn., Wilson Co. Cedars of Lebanon State Park, 36°05'31" 86°19'55"W, 4 June 2010, J.G. Hill; Collected in gravel zone of cedar glade. Academy of Natural Sciences Philadelphia.

Etymology.—This species is named in honor of Wayne (Buddy) Ingram, interpretive officer and naturalist of Cedars of Lebanon State Park, for his enthusiastic assistance with the logistics of this study and for sharing his vast knowledge of the glades and the region.

Male Description.—

Measurements.— In mm (n = 10). Length 16.6-19.4 (mean = 17.9); pronotum length 3.5-4.3 (mean = 3.9); tegmina length 3.0-4.3 (mean = 3.6); hind femur length 8.6-10.5 (mean = 9.5); cerci length 0.8-1.0 (mean = 0.9); basal width of cerci 0.4-0.7 (mean = 0.6); mid-cercal width 0.3-0.4 (mean = 0.3); cerci apex width 0.2-0.4 (mean = 0.2).

Color.—Antenna light brown. Antennal crescent complete. In living specimens (Fig. 1b), head, thorax, and tegmina brownish gray dorsally, in preserved (Fig. 2a, b.) dark gray dorsally and cream colored ventrally; dorsal surface of head with a dark triangle; pronotum, legs, and abdomen sprinkled with dark brown spots. A lateral, black postocular stripe extends from the caudal margin of the eye to the third, fourth, or fifth abdominal tergite. The stripe is absent from the metazona of the pronotum and is cut by a light diagonal stripe on the metathorax, whitish in living specimens. Below the postocular stripe, head, pronotum, and a portion of the anterior segment of the mesothorax grayish-white. Tegmina dark gray. Abdomen light brown sprinkled with dark spots. Hind femora with two faint dark stripes dorsally that may continue laterally on the medial area, and the knee black. Hind tibia glaucous to yellow-brown with black tipped spines.

Head slightly wider than pronotum. Disk of pronotum with lateral margins diverging posteriorly; median carina distinct, but low on the prozona, and slightly elevated and arching on the metazona; anterior and median sulci present laterally, indistinct near the dorsal carina, posterior sulci dissecting the dorsal carina; posterior pronotal margin slightly rounded. Tegmina ovate, tips rounded; dorsal margins attingent, typically extending about halfway



Fig. 1a. A cedar glade where *Melanoplus ingrami* was collected. For color version, see Plate X.



Fig. 1b. Field photo of adult male *M. ingrami*. For color version, see Plate X.

along the second abdominal tergite. Cercus (Fig. 5b) broader at base than apex, narrowed at middle, with apex rounded. Furculae distinct, raised comma-shaped protuberances, extending about one fourth length of the supra-anal plate. Supra-anal plate (Fig. 5a) triangular; slightly longer than wide; with the median groove distinct with elevated sides anteriorly, and becoming less distinct posteriorly. Internal genitalia: (Figs 3a-c, 4a-k). Cingulum with arching apodemes and a prominent zygoma that has a distinct dorsal carina medially. Dorsal valves of aedeagus tapered from base to apex, curving anteriorly while diverging distally. Ventral valves of aedeagus much thicker and shorter than dorsal valves; blunt at tip. The dorsal valves are overlapped by the ventral valves for much of their length, leaving only a portion of the dorsal valves visible, depending on the viewing angle. Epiphallus (Fig. 4l-m) with base of lateral lophi wider than arcus.

Female.—

Measurements.—In mm (n = 10). Length 17.1-22.2 (mean = 20.4); pronotum length 4.6-5.5 (mean = 4.9); tegmina length 3.4-4.6 (mean = 4.1); hind femur length 11.1-12.3 (mean = 11.9); dorsal angle of upper ovipositor valves 135°.

Much larger, plumper than male. (Fig. 2c, d) Coloration similar to male, but with a faint diamond-shaped pattern on the dorsal surface of the pronotum and with the postocular stripe extending to the eighth or ninth abdominal tergite, depending on the individual. Glaucous coloration typically covers less of the hind tibia than in males, but the amount varies between individuals of each sex. Cercus (Fig. 5c) triangular. Upper valves of ovipositor (Fig. 5c) armed with several teeth anteriorly.

Paratypes.— Other than the holotype, all specimens examined in this study are designated as paratypes. Specimens are deposited in the Academy of Natural Sciences of Philadelphia (ANSP), Mississippi Entomological Museum (MEM), and the University of Michigan Museum of Zoology (UMMZ).

TENNESSEE: **Davidson Co.**: Couchville Cedar Glade NA, 36°06'04"N 86°31'46"W, J. G. Hill, Collected in cedar glade, W. H. Cross Exp., 22 July 2009 (2 ♂♂, 1 ♀), 24 July 2009 (8 ♂♂, 3 ♀) MEM, 18 September 2009 (1 ♂). **Marshall Co.**: Wilson School Rd. Cedar Glade Nat. Area, 35°39'43"N 86°47'44"W, J. G. Hill, J. L. Seltzer, Collected in gravel zone of cedar glade. 1 June 2010 (14 ♂♂, 8 ♀♀) MEM. **Rutherford Co.**: Flat Rock Cedar Glade Nat. Area. 36°51'31"N 86°17'44"W, J. G. Hill, Collected in gravel zone of cedar glade. 2 June 2010 (1 ♀) MEM. **Wilson Co.**: Cedars of Lebanon State Park, 36°04'52"N 86°18'55"W, J. G. Hill. Collected in cedar glade, W. H. Cross Exp. 20 July 2009 (1 ♂, 1 ♀) MEM, 24 July 2009 (1♂) MEM, 25 July 2009 (1 ♀) MEM, 36°05'31" 86°19'55"W, 4 June 2010. J. G. Hill; Collected in gravel zone of cedar glade. (1 ♂, 1 ♀) ANSP, (1 ♂, 1 ♀) MEM, (1 ♂, 1 ♀) UMMZ; Cedars of Lebanon State Forest, 36°05'21"N 86°22'45"W, J. G. Hill, Collected in cedar glade, W. H. Cross Exp, 21 July 2010 (7 ♂♂, 4 ♀♀) MEM; 36°05'26"N 86°21'34"W, 20 July 2010 (2 ♂♂, 5 ♀♀); 36°05'44"N 86°21'23"W, 21 July 2010 (4 ♂♂, 4 ♀♀), same data as previous, except J. A. MacGown (collector) (1 ♂) MEM; 36°05'45"N 86°21'27"W, 21 July 2010 (1 ♂, 1 ♀) MEM. Vesta Cedar Glade Nat. Area. 36°04'36"N 86°23'45"W, J. G. Hill, Collected in cedar glade, W. H. Cross Exp, 23 July 2010 (7 ♂♂, 1 ♀) MEM, 1 June 2010, J. G. Hill, J. L. Seltzer, Collected in gravel zone of cedar glade (4 ♂♂, 1 ♀) MEM.

Diagnosis.—Males of this species key to the *Melanoplus tribulus* group in Blatchley (1920) and *Melanoplus moresi* Blatchley in Hebard (1934). In fact, *M. moresi* Blatchley and *Melanoplus rusticus* (Stål), another member of the *tribulus* group, occur in the forests adjacent to the glades. However, *M. ingrami* differs from members of the *tribulus* group mainly in the coloration of the body, the broken postocular stripe, the raised carina on the metazona, and unique internal male genitalia. At this time, the species group to which *M. ingrami* belongs is uncertain.

Habitat.—Quarterman *et al.* (1993) broke the heterogeneous glade habitat into several zones. *Melanoplus ingrami* seems to primarily be a denizen of the gravel zone of the cedar glades, as this is where the majority of individuals were encountered. The gravel zone of the cedar glades is the most xeric of the communities next to bare rock and is characterized by shallow (0-5 cm) gravel-covered soil, little canopy cover, and patchy herbaceous cover. Plants commonly found in areas where *M. ingrami* was collected include *Bouteloua curtipendula*, *Croton monathogynus*, *Dalea gattingeri*, *Echinacea tennesseensis*, *Grindelia lanceolata*, *Hedyotis* spp., *Leavenworthia* spp., *Manfreda virginica*, *Nostoc commune*, and *Rattibida pinnata*. On one occasion two individuals were collected in the grassy barren zone of the glades. This species was not found along disturbed roadsides that had a similar *gestalt* of cedar glades, in some cases adjacent to undisturbed glade habitat, a fallow hay-field, and several types of forest, which indicates that this species may be a cedar glade dependent species. The discovery of this novel species and the unique nature of the habitat have since spurred further studies of the Orthopteran fauna of the cedar glades.

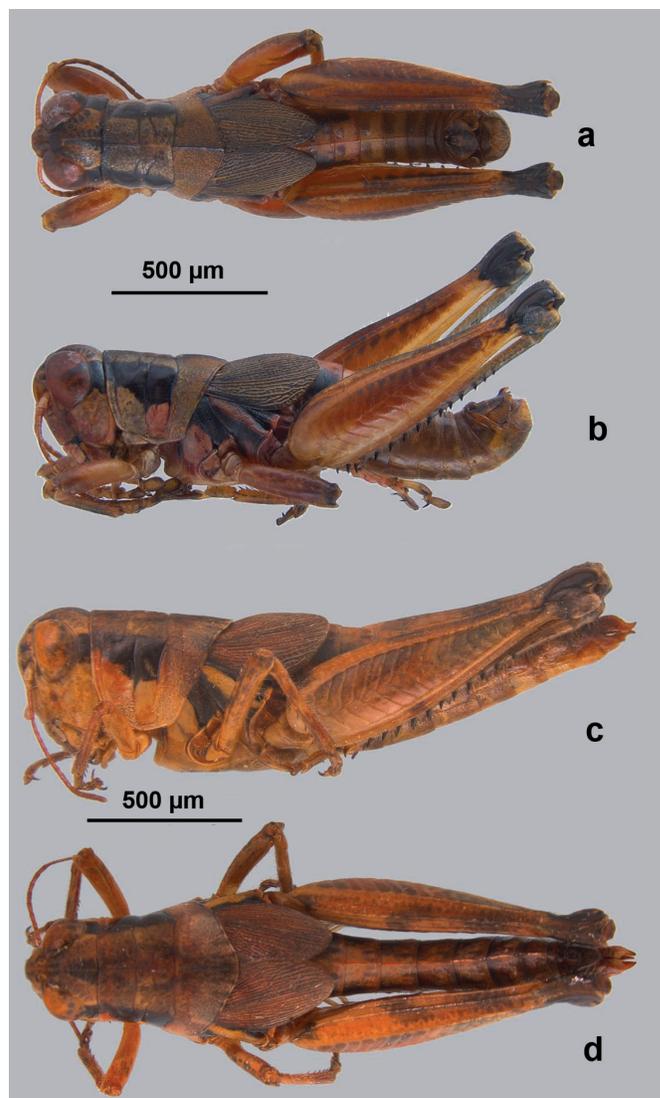


Fig. 2. Habitus of *Melanoplus ingrami*. a. Dorsal view of holotype male. b. Lateral view of holotype male. c. Lateral view of paratype female. d. Dorsal view of paratype female. For color version, see Plate XI.

Acknowledgements

I thank Buddy Ingram for his logistical assistance with the survey of the cedar glades insect fauna, Dan Otte and David Nickle for allowing access to the ANSP and USNM respectively, Matt Dakin for his assistance in attempts to identify the specimens. This project was funded by the William H. Cross Collecting Expedition Fund. This is publication J-11904 of the Mississippi Agricultural and Experiment Station. Specimens were collected under a permit from the Tennessee Natural Heritage Program.

Literature Cited

- Baskin J.M., Baskin C.C. 1999. Cedar Glades of the Southeastern United States, pp. 206-219. In: Andersen R.C., Fralish J.S., Baskin J.M. (Eds) Savannas, Barrens, and Rock Outcrop Plant Communities of North America. Cambridge University Press, New York.
- Blatchley W.S. 1920. The Orthoptera of Northeastern America: with Special Reference to the Faunas of Indiana and Florida. Nature Publishing Company, Indianapolis.

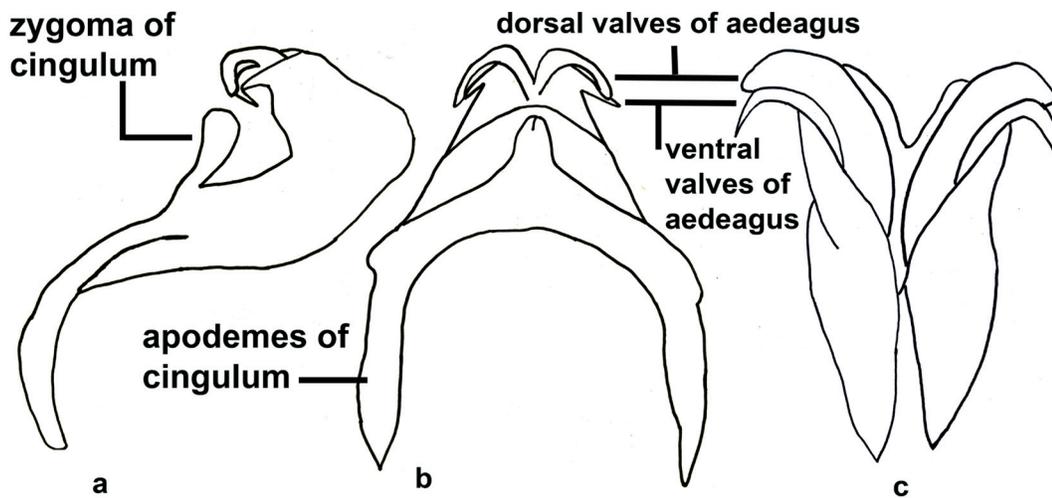


Fig. 3. Ectophallus showing cingulum and emerging aedeagus. a. Lateral view. b. Dorsal. c. Close-up rear view of aedeagus.



Fig. 4. Internal male genitalia of *Melanoplus ingrami*. a-d. Dorsal, lateral, ventral and caudal views of phallic complex, respectively. e-g. Close up dorsal, lateral and caudal views of aedeagus. h. Close-up caudal view of aedeagus with cingulum and membranous material removed. i-k. Phallic complex with cingulum removed. l-m. Epiphallus caudal and dorsal views, respectively. For color version, see Plate XI.

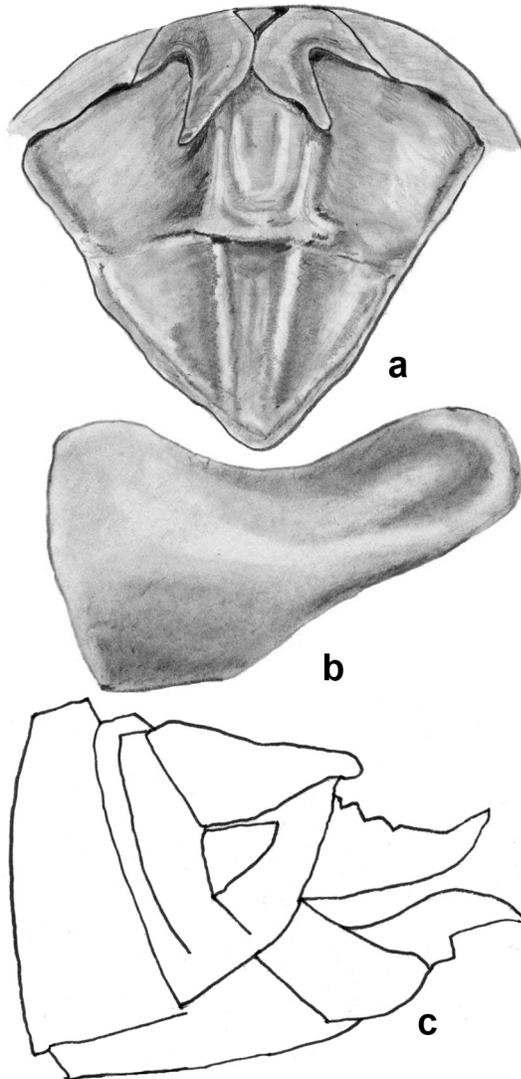


Fig. 5. External terminalia. a. Supra-anal plate. b. Male cercus. c. Terminalia of female abdomen.

- Quarterman E. 1950a. Ecology of cedar glades. I. Distribution of glade flora in Tennessee. *Bulletin of the Torrey Botanical Club* 77: 1-9.
- Quarterman E. 1950b. Major plant communities of Tennessee cedar glades. *Ecology* 31: 235-254.
- Quarterman E., Burbanck M.P., Shure D.J. 1993. Rock outcrop communities: limestone, sandstone, and granite, pp 35-86. In: Martin W.H., Boyce S.G., Echternacht A.C. (Eds) *Biodiversity of the Southeastern United States: Upland Terrestrial Communities*. John Wiley & Sons, INC. New York.

- Dakin M.E., Hays K.L. 1970. A Synopsis of Orthoptera (*Sensu Lato*) of Alabama. Agricultural Experiment Station Bulletin 404, Auburn, University.
- Gattinger A. 1887. *Tennessee Flora*. Nashville, TN: A. Gattinger.
- Gattinger A. 1901. *Flora of Tennessee and Philosophy of Botany*, Nashville, TN: Gospel Advocate Publishing Co.
- Harper R.M. 1926. The cedar glades of middle Tennessee. *Ecology* 7: 48-54.
- Hebard M. 1932. The Dermaptera and Orthoptera of Illinois. *Bulletin Illinois Natural History Survey* 20: 125-279.
- Helfer J.R. 1972. *How to Know the Grasshoppers, Cockroaches, and their Allies*. W.M. C. Brown Co. Dubuque, IA.
- Jordan O.R. 1986. The herpetofauna of the Cedars of Lebanon State Park, Forest, and Natural Area. *Association of Southeastern Biologist Bulletin* 33: 206-215.
- Jordan O.R., Carton J.S., Ellis R.F. 1968. The amphibians and reptiles of a Middle Tennessee cedar glade. *Journal of the Tennessee Academy of Science* 43: 72-78.
- Meyer A.M. 1937. An ecological study of cedar glade invertebrates near Nashville, Tennessee. *Ecological Monographs* 7: 403-443.
- Schultz H.H. 1930. *Birds of the Cedar Glades of Middle Tennessee*. Thesis, George Peabody college for Teachers, Nashville, TN.