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A NEW SPECIES OF FLIGHTLESS PYGMY MOLE CRICKET FROM A FLORIDA SAND RIDGE (ORTHOPTERA: TRIDACTYLIDAE)

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ABSTRACT

A new species of Tridactylidae, *Ellipes eisneri*, is described from the Brooksville Ridge in Florida. This is the second species of flightless tridactylid that is known to inhabit deep, well drained sand formations in Florida. It is associated with an algal layer occurring a few mm beneath the surface. When not feeding near the surface, *E. eisneri* retreats down vertical burrows. The range of the species is not well known, but it could be restricted to the Brooksville Ridge. The habits of this species are convergent with those of the previously described *Neotridactylus archboldi* Deyrup & Eisner. There is a good chance that there are additional species of upland pygmy mole crickets in other sandy areas of southeastern North America.

Key Words: *Ellipes*, *Neotridactylus*, Florida endemics, soil crusts, Brooksville Ridge, pygmy mole cricket

RESUMEN

Se describe una nueva especie de Tridactylidae, *Ellipes eisneri*, del Brooksville Ridge en el estado de Florida. Este es la segunda especie conocida de un tridactílido no volante que habita las formaciones de arena profunda y con amplio drenaje en Florida. Es asociada con la capa de algas que ocurre unos pocos mm debajo de la superficie. Cuando no esta alimentandose sobre la superficie, *E. eisneri* regresa por los tuneles verticales. No se conoce bien el rango geográfico de esta especie, pero puede estar restringido al Brooksville Ridge. Los habitos de esta especie estan convergentes con los de *Neotridactylus archboldi* Deyrup & Eisner, una especie descrita anteriormente. Hay una buena posibilidad de que existen otras especies de tridactílidos en las áreas arenosas del sureste de America del Norte.

The pygmy mole crickets (Tridactylidae) are small (usually 12 mm long or less) burrowers, usually found in sandy habitats. They superficially resemble miniature versions of mole crickets (Gryllotalpidae), but the two groups differ in many ways, and are not at all closely related. Pygmy mole crickets are not members of the Ensifera, the lineage that includes the crickets (Gryllidae) and katydids (Tettigoniidae), but rather an early offshoot of the Caelifera, the lineage that includes the grasshoppers (Acrididae) and pygmy grouse locusts (Tetrigidae) (Blackith 1987). Blackith (1987) suggests that the antiquity of both the Tridactylidae and the Tetrigidae is correlated with their specialization as algal feeders, since algae are an ancient and conservative group that appear to present special challenges. Some of these challenges might be nutritional deficiency, defensive compounds, the problem of harvesting sufficient quantities of algae, and the tendency of algae to dry up and disappear in non-saturated habitats. The latter problem generally restricts pygmy mole crickets to wet habitats, such as rain forests, swamps and marshes, and the edges of streams, lakes, or standing water. Most species have well developed wings that allow individuals to disperse if their habitat becomes too dry. Species that live around water usually have enlarged setae modified as flattened "swimming plates" on their hind tibiae, or dense rows of swimming hairs on the enlarged hind tibial spurs.

In the sandy uplands of Florida evolution has allowed pygmy mole crickets to colonize habitats that are dry for much of the year. These habitats are Florida scrub, high pine, and scrubby flatwoods, all of which were primevally maintained by fires started by lightning. These fires in the natural ecosystems appear to have had frequencies of roughly 5-50 years. For more detail on these fire-structured habitats, see Myers & Ewel (1990). A consequence of these relatively frequent fires is that there are usually patches of bare sand here and there among the trees, shrubs, and herbaceous vegetation. Light easily penetrates the upper layers of the silica sand of these bare patches. At a depth of 3-4 mm there may be a subsurface soil crust, composed of algae, cyanobacteria, lichens, fungi, mosses, and bacteria (Hawkes & Flechter 2002). In upland habitats of the Lake Wales Ridge of peninsular Florida, this crust sustains a species of pygmy mole cricket, *Neotridactylus archboldi* Deyrup & Eisner (Deyrup & Eisner 1996). The gut of *N. archboldi* has been shown to contain filamentous algae (Deyrup & Eisner 1996). This species is flightless; its migrations are short and vertical: down into the sand during dry periods, up to the

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soil crust after a series of rains. *Neotridactylus archboldi* was found on the Lake Wales Ridge, a fossil sand dune area extending down the center of Florida through Lake, Polk, and Highlands Counties. It seemed reasonable to expect that other sandy uplands would also have pygmy mole crickets. Moreover, there are examples of endemic flightless insects restricted to ridges in peninsular Florida (Deyrup 1990, 1996), and it seemed possible that various isolated upland areas might have their own species of pygmy mole crickets. My search for more pygmy mole crickets has not been very intensive, and has sometimes been thwarted by a series of droughts that have kept the mole crickets deep underground. Most of the specimens that I have seen from sites off the Lake Wales Ridge resemble *N. archboldi*, but it is always possible that these are cryptic species. I did find, however, a series of specimens that clearly represent an undescribed species on the Brooksville Ridge, a large ridge that extends north and south through Hernando, Pasco, Citrus, and Levy Counties. This species belongs to the genus *Ellipes* rather than *Neotridactylus*.

A key to the three New World genera of Tridactylidae is provided by Gunther (1975). *Ellipes* is characterized by the extreme reduction of the hind tarsi, which are represented by a minute flap concealed between the huge hind tibial spurs (Fig. 2A). *Ellipes* also lacks the prosternal spur found in *Neotridactylus*.

Ellipes eisneri, new species

Description: Holotype male. Measurements in mm: length of head and body: 3.30; length of pronotum: 0.75; width of pronotum: 1.02; width of head across eyes: 0.75; length of hind femur:1.92; length of hind tibia:1.25; length of forewing: 0.72. Coloration: background color of a fresh specimen pale salmon; head blackish brown with narrow cream line along inner orbits and coronal and frontal sutures; antennae cream, terminal segments tinged with brown; pronotum with an irregular median light brown transverse band, interrupted medially; front legs pale cream, almost white; middle legs cream with dark markings as in Fig. 1; hind femora pale salmon, with a small basal brown chevron, a median transverse brown band, a brown dorsal subapical wedge, apical crescents of hind femora reddish brown, hind tibiae and tarsi cream; wings blackish brown basally, color more dilute apically, anal area pale; tergites 5-8 with irregular brown median spots; basal segment of cerci black, apical segment white; ventral cercus-like organ (*Paraproctfortsatz* of Gunther 1977) white.

Structural character states: antennae 10-segmented; front tibia with 4 teeth (Fig. 2B); swimming plates of hind tibiae absent; hind tibial spurs with dorsal rows of well-separated fine hairs, not dense rows of flattened hairs (Fig. 2A); scraper present on the underside of the forewing, forewing abbreviated, hind wings absent.

Locality of holotype male (as on specimen label, except for abbreviations): FLORIDA: Citrus County; near Inverness; Withlacoochee Forest, Citrus Area; Forest Road 13, 1.3 mi. south of State Road 44; sandhill habitat with bare sand; dug from vertical burrow. 3 April 1995. M. Deyrup, collector.

Deposition of holotype male: Florida State Collection of Arthropods, Gainesville, FL. Description: Allotype female. Measurements in mm: length of head and body: 3.55; length of pronotum: 0.87; width of pronotum: 1.15; width of head across eyes: 0.87; Length of hind femur: 2.05; length of hind tibia: 1.47; length of forewing: 0.75. Coloration: as in holotype, except: pronotal brown band not interrupted medially; middle femora with a dark stripe connecting the median and subapical bands, delimiting an irregular pale rectangle; apical crescents of hind femora pale brown, lighter than femoral maculations; hind tibiae pale brown, pale at base. Structural characters: similar to male, including 10 segmented antennae, except stridulatory apparatus absent on wing.

Locality, site, date, collector of allotype female same as holotype male.

Deposition of allotype female: same as for holotype male.

Paratypes: 4 males, 3 females: same locality, site, date, collector as holotype; dry pinned specimens. 2 males, 10 females: FLORIDA: Citrus County; "Pine Oak Estates;" State Road 488, 3.7 mi. south of junction with U.S. 41; sandhill area with bare sand. 4 April 1996. M. Deyrup, collector. Specimens individually in vials of alcohol.

Deposition of paratypes: 1 male, 1 female (dry): Florida State Collection of Arthropods, Gainesville, FL. 1 male, 1 female (dry): Philadelphia Academy of Sciences, Pennsylvania. Remaining type material temporarily deposited in the arthropod collection of the Archbold Biological Station, Lake Placid, FL.

Diagnosis: Differs from other known *Ellipes* in being flightless (forewings abbreviated, hind wings absent), its pale salmon and brown coloration, and its occurrence in xeric habitats. The antennae have 10 segments in both sexes.

Etymology: This new species is named in honor of Dr. Thomas Eisner, in gratitude for his many studies on the natural history of Florida arthropods, including another species of pygmy mole cricket, *Neotridactylus archboldi*. The scientific work of Tom Eisner is remarkable for its scope, creativity, and sheer volume, but beyond the science he has always cheerfully confessed that a large part of his inspiration comes from aesthetics: the beauty of arthropods, the elegance of their design. It is hoped that he will find *Ellipes eisneri* a beautiful insect.

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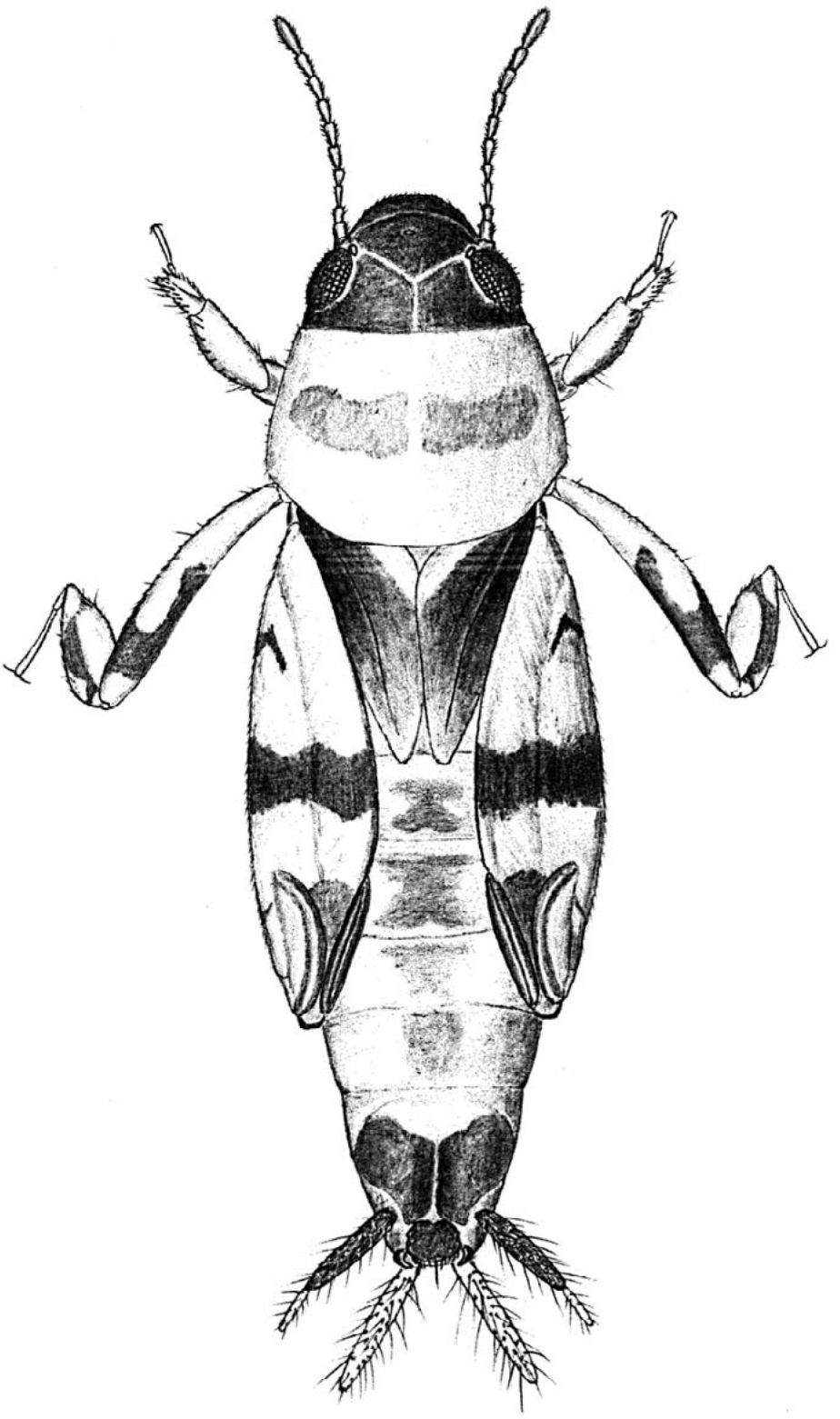


Fig. 1. *Ellipes eisneri*, new species, male, dorsal habitus. Markings matched to live specimen. Extent of maculations on pronotum and tergites highly variable in this species; in some specimens they are lacking.

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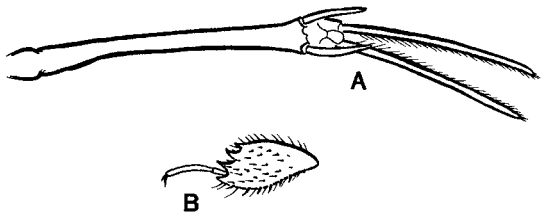


Fig. 2. *Ellipes eisneri*, new species. A. Dorsal view of right metatibia; small oval between the apical tibial spurs is the vestigial metatarsus. B. Lateral external view of left protibia and protarsus.

In keeping with the long tradition of Blatchley (1920), Helfer (1953) and Capinera et al. (2001), I am assigning an informal common name to *Ellipes eisneri*, "Eisner's Pygmy Mole Cricket." Not all orthopterists retain the old name, "pygmy mole crickets" for the Tridactylidae, because these insects are not crickets. Some papers (e.g., Gunther 1985) use the name "pygmy mole grasshoppers." There is, however, no rule that vernacular names must be phyletically correct, rather than being based on correlates of habitus or ecology, as in the "naked mole rats." Even from a phyletic standpoint, it is a dubious advance to put "grass" in the name of a lineage whose evolutionary and trophic divergence may well antedate the grasses. There is also the name "false mole crickets" (Naskrecki 2001), but this remains ambiguous (a false mole cricket could still be a cricket), and is annoyingly negative.

Habitat: All specimens were found in open sandhill habitats with a sparse cover of grasses, especially *Aristida beyrichiana* Trin. & Rupr., and various herbs: *Pityopsis graminifolia* (Michx.) Nutt., *Polygonella robusta* (Small) Horton, *Paronychia* sp., and *Balduina angustifolia* (Pursh) Robinson. There were scattered trees of *Pinus palustris* Mill., *Quercus laevis* Walt., *Q. incana* Bartr. and small clonal groups of *Q. geminata* Small. The openings where pygmy mole crickets occurred had a dark gray soil crust a few millimeters below the surface. The sand was a yellow entisol with no visible horizon in the top 25 cm. The specimens from the type locality (Withlacoochee State Forest) were collected from Candler fine sand, according to maps of the Citrus County soil survey (Pilny et al. 1988). This is an excessively drained, nutrient-poor, moderately to strongly acid, fine sand occurring on sites where the water table is at least 2 m below the surface throughout the year; the surface layer is dark grayish brown, the subsurface layer pale brown or yellowish brown (Pilny et al. 1988). The paratypes from the Pine-Oak Estates site were in an area mapped as Astatula fine sand, whose characteristics are very similar to Candler fine sand, but the subsurface layer tends to be yellow or orangish yellow (Pilny et al. 1988). Attention to soil type, even among soils that are almost exclusively sand, may be important for understanding the distribution of burrowing arthropods. Halloran et al. (2000) provide evidence that Astatula fine sand is less stable than Satellite sand for burrow construction by *Geolycosa* spiders and *Myrmeleon* antlions.

Comments

The discovery of this new species hints that there may be additional species of upland pygmy mole crickets still to be found. *Ellipes eisneri* and *Neotridactylus archboldi* are a pair of species that must have evolved from flying, semiaquatic lineages in their respective genera. This seems likely because all the genera of Tridactylidae around the world, not just *Ellipes* and *Neotridactylus*, are composed of species that can fly and occur in wet areas, so these are probably characteristics of early Tridactylidae before the appearance of the various synapomorphies that define the genera. Now that we know of two lineages that have made the transition to exploiting soil crusts of sandy uplands, it seems possible that there are additional lineages that have made this same transition, especially since one of the associated adaptive character states (loss of flying ability) tends to isolate lineages.

Several areas in the southeastern U.S. have ancient sand deposits with commonly occurring patches of open sand. Any of these areas might have concealed pygmy mole crickets. The insects can be found by searching for their trails just after a rain, as described by Deyrup & Eisner (1996). Most specimens of *E. eisneri* were obtained a few days after a rain, based on a more difficult clue: the small dark tumulus of subsurface sand left by the insect as it retreats down a vertical burrow after the surface sand dries out. If the sand is dry near the surface, but damp a few centimeters down, it may be possible to lure pygmy mole crickets up to the surface by watering with a watering can. A gallon of water on a square meter works well for *N. archboldi*, the subsurface foraging trails appearing in an hour or so after watering. Because the main obstacle to finding upland tridactylids is the need to be at the right place at the right time, surveys for new species or new locality records would be good projects for local naturalists or students in an ecology class. Even if no pygmy mole crickets are found, the time spent searching for them might not be wasted. There are many other interesting arthropods burrowing just below the surface of the sand, such as blind, flightless scarabs of the genus *Geopsammodius* (formerly placed in the genus *Psammodius*) (Deyrup & Woodruff 1991).

The geographic range of *E. eisneri* is unknown, but it has not yet been found co-occurring with *N. archboldi*, or specimens that appear to be

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N. archboldi, on the Lake Wales Ridge, the Northern Mount Dora Ridge, the Atlantic Coastal Ridge, and the Trail Ridge. It is possible that *E. eisneri* is restricted to the Brooksville Ridge, which has an endemic grasshopper, *Melanoplus withlacoocheensis* Squitier & Deyrup (Squitier et al. 1998), a genetically distinct population of the gopher tortoise (Osentoski & Lamb 1995), and a morphologically distinguishable population of a species of ant, *Dorymyrmex elegans* (Trager). It would be premature to worry about the conservation status of *E. eisneri*, but the fact remains that there is only one protected site known for the species, and that site is only protected as long as management of the Withlacoochee State Forest continues to hold to its current enlightened goal of maintaining natural habitats and natural biological diversity in the forest. It would be appropriate, therefore, to sample more widely on the Brooksville Ridge during a period of wet weather and map the range of *E. eisneri* to determine whether it is a rare or endangered species.

Acknowledgments

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