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Dichroplus notatus (Orthoptera: Acrididae): a grasshopper genus and species new to the United States

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Abstract

Based upon 18 specimens collected at two sites in southeastern Arizona during 2009 and 2010, *Dichroplus notatus* is added to the orthopteran fauna of the United States. Habitat descriptions, lists of sympatric orthopterans and comments on its taxonomic position are presented.

Resumen

Basado en 18 especímenes recogidos en dos lugares durante 2009 y 2010 en el sudeste de Arizona, se presenta un registro nuevo de *Dichroplus notatus* que no estaba reportado previamente por los estados unidos. Las descripciónes del hábitat, listas de orthopteros simpatricos, y commentarios sobre su posición taxonómica son incluidos.

Key words

*Dichroplus notatu*s, range extension Acrididae, grasshopper, distribution, Sky Island, Arizona

Introduction

From 2008 through the present, the authors have surveyed Orthoptera and other insects at Fort Huachuca, a United States Army installation in Cochise County, in the southeastern corner of Arizona. The Fort, located on the east side of the Huachuca Mountains, covers *ca* 288.35 km^2. Habitats include extensive mesquite grasslands characteristic of the Chihuahuan Desert, oak grassland with yuccas and agaves, pine-oak forest, sycamore-lined riparian corridors, and mixed conifer forest of pine and fir. Average temperatures in the lower grasslands range from a January low of 1°C to a June high of 34°C. Rainfall averages 35.6 cm/year and is bimodal, with variable and unpredictable winter rain and snow and pronounced summer rains. At higher elevations, temperatures are lower and rainfall is often considerably greater.

The orthopteran fauna is rich, and includes a number of Mexican species with limited ranges north of the Mexican border. To date, we have documented nearly 70 species of grasshoppers and with less effort, four species of katydids and crickets, and two of mantids and walking sticks. One grasshopper was noteworthy as belonging neither to the known fauna of Arizona (Ball *et al.* 1942), nor being represented by more recent collections at the University of Arizona. Its distinctive patterning led us to the melanopline species *Dichroplus notatus* Bruner.

Bruner (1908) described *D. notatus* from three specimens taken in the state of Guerrero, Mexico. Roberts (1947) summarized available specimens (as *Trigonophymus notatus*), listing material from the Mexican plateau and both slopes from Chiapas to Durango at elevations of 1524 to 2743 m. The northernmost record he noted was San Antonio, Durango; we have been unable to confirm Mexican records further north.

Methods

During July 2009, five individuals of *D. notatus* were collected at Sawmill Canyon in the Huachuca Mountains, Cochise County, Arizona (lat 31° 27′ 09.90″ N, long 110° 22′34.05″ W). The site is on Fort Huachuca, immediately southwest of the town of Sierra Vista, and 13.4 km north of the Mexican border. The collection dates were: 21 July (one male), 23 July (two females), and 28 July (two males). These five specimens were sent to Daniel Otte at the Academy of Natural Sciences. Subsequent searches on 29 July, 19 August, 25 August, 2 September, and 22 September failed to produce additional specimens, suggesting that *D. notatus* is a spring species in southeastern Arizona.

On 19 May 2010, Behrstock searched unsuccessfully for *D. notatus* in Sawmill Canyon. Both authors returned on 2 July 2010, and collected three specimens (two males and one female). One male and the female were preserved in ethyl alcohol for DNA extraction. Dave Beaudette (Sierra Vista, AZ) was also at Sawmill Canyon that day. After becoming familiar with the species, he was able to locate three additional individuals and photographed one male sunning itself on a rock. The authors returned on 9 July 2010, and collected two specimens (one female and one male). On 22 July, Behrstock visited Sawmill and observed seven *D. notatus* (four collected). On 28 July, Behrstock collected one male *D. notatus*, which was preserved in ethyl alcohol. On 3 August, the authors observed four individuals of *D. notatus* (3 males and one female), two of which (one male and one female) were collected. All were located on exposed substrate with scattered rocks and sparse vegetation.

On 13 July 2010, Sullivan blacklighted for insects in the mouth of Copper Canyon at the south end of the Huachuca Mountains (lat 31° 21′ 44.22″N, long 110° 18′01.08″ W). The site is at an elevation of 1834 m and is 12.35 km southeast of the Sawmill Canyon site. The location is an open, south-facing exposure that slopes gently to grasslands and the Mexican border 3.22 km distant. One *D. notatus* specimen was taken at the blacklight.

Results

Specimens of *D. notatus* are the first records of this genus and species for the United States. The Sawmill Canyon collecting site represents a range extension of at least 665 km from the northernmost point in the State of Durango, Mexico, the closest Mexican state from which *D. notatus* is known.

Sawmill Canyon supports a mixed forest comprised mainly of conifers and oaks with a diversity of understory grasses and

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Fig 1. *Dichroplus notatus*. Male. Sawmill Canyon, Huachuca Mountains, Cochise County, Arizona. 28 July 2009. Robert A. Behrstock/ Naturewide Images. For color version, see Plate III.

forbs. Trees and shrubs at the collecting site are: Alligator juniper (*Juniperus deppeana*), Border pinyon (*Pinus discolor*), Apache pine (*P. engelmannii*), Chihuahua pine (*P. leiophylla*), Arizona white oak (*Quercus arizonica*), Netleaf oak (*Q. rugosa*), Wright silktassel (*Garrya wrightii*), and Velvet ash (*Fraxinus velutina*). Grasses include: Spidergrass (*Aristida ternipes*), Cane bluestem (*Bothriochloa barbinodis*), Side-oats grama (*Bouteloua curtipendula*), Blue grama (*B. gracilis*), Brome grass (*Bromus* sp.), Lovegrass (*Eragrostis* sp.), Prairie junegrass (*Koeleria macrantha*), Bullgrass (*Muhlenbergia emersleyi*), Deergrass (*M. rigens*), Pringle's speargrass (*Piptochaetium pringlei*), Bluestem (*Schizachyrium* sp.), and Bristlegrass (*Setaria* sp.) (Schlichting 2006, Behrstock pers. obs.).

The specimens were taken on an east-facing slope at an elevation of *ca* 1896 m. Portions of the slope were cleared many years ago as a fire break. Where soil has washed away, there is much bare rock substrate with scattered patches of vegetation including: prickly pear cactus (*Opuntia* sp.); Hedgehog cactus (*Echinocereus* sp); Huachuca agave (*Agave parryi* var. *huachucensis*); Mountain yucca (*Yucca schottii*), Hairy mountain mahogany (*Cercocarpus montanus* var. *paucidentatus*), saplings of pine and juniper, and a number of grasses and forbs. Most of the *D. notatus* were taken in this open rocky habitat. A few others were located on oak-leaf and pine-needle litter under the tree canopy.

While blacklighting on 13 July 2010, Sullivan took one *D. notatus* at his collecting sheet. It is not clear whether the grasshopper *D. notatus* taken at a light trap was actually attracted to the UV light. No additional *D. notatus* have been taken or observed at the Copper Canyon site since the initial specimen was collected. Vegetation at the site—which has been grazed by cattle—includes: Alligator Juniper, Border pinyon, Arizona white oak, Emory oak (*Quercus emoryi*), Silverleaf oak (*Quercus hypoleucoides*), Desert spoon or Sotol (*Dasylirion wheeleri*), and various bunch grasses. On the afternoon of 15 July the authors returned to this location. Other orthopterans documented by the authors at this site included: *Tomonotus ferruginosus*, *Trimerotropis modesta*, *Achurum sumichrasti*, *Eritettix simplex*, *Opeia obscura*, *Syrbula montezuma*, *Poecilotettix pantherinus*, and *Melanoplus aridus/desultorius*.

Discussion

Situated between the Chihuahuan and Sonoran deserts, the Huachuca Mountains are one of the borderland's sky islands—isolated mountain ranges whose flora and fauna exhibit a strong affinity with the Sierra Madre of northwestern Mexico. Of the world's many sky island formations, those of the Madrean Archipelago are considered a planetary "megadiversity center".

Their uniqueness is attributable to many factors. The large number of mountain ranges in the archipelago—about 40— serve as faunal stepping stones connecting a northern cordillera (Rocky Mountains) to a southern cordillera (Sierra Madre Occidental) and possess faunal elements of both. Their extremely varied geological composition, including a vertical relief of *ca* 1524 m, has fostered the development of numerous soil types with diverse associated floras—over 1000 species of plants in the Huachuca Mountains alone. The position of the mountain ranges, straddling two major floral and faunal realms, bridges the Neotropics and the Holarctic/

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Fig 2. *Dichroplus notatus*. Female. Sawmill Canyon, Huachuca Mountains, Cochise County, Arizona. 9 July 2010. Robert A. Behrstock/ Naturewide Images. For color version, see Plate III.

Nearctic and places them at the convergence of three major climatic zones (tropical, subtropical, and temperate). Their proximity to the Neotropics allowed them to escape the massive extinctions wrought by glaciations at higher latitudes (Warshall 1995). All of these factors contribute to the region's extreme species richness.

Orthoptera present with *D. notatus* during July 2009 and July-August 2010 were: *Eumorsea balli*, *Phrynotettix tshivavensis*, *Arphia conspersa*, *Leprus intermedius*, *L. wheeleri*, *Trimerotropis modesta*, *T. pallidipennis*, *Achurum sumichrasti*, *Ageneotettix deorum*, *Amblytropidia mysteca*, *Amphitornus coloradus*, *Eritettix simplex*, *Mermeria texana*, *Opeia obscura*, *Psoloessa texana*, *Rhammatocerus viatorius*, *Syrbula montezuma*, *Aidemona azteca*, *Conalcaea huachucana*, *Melanoplus aridus/ desultorius* and *Eremopedes balli*. Many of these are widespread and found in a variety of habitats; we suspect that 1896 m is at the upper elevational range for some of these species. Several (*e.g.*, *Achurum sumichrasti*, *Rhammatocerus viatorius*, *Aidemona azteca*, and *Conalcaea huachucana*) are more likely to be found near the Mexican border and the eumastacid *Eumorsea balli* is an infrequently encountered local endemic.

We observed neither breeding behavior nor nymphs of *D. notatus* during July and August. In Oaxaca, Descamps (1975) found nymphs numerous and outnumbering adults during November and December; by January, adults predominated in withered grasses where they spent the dry season. He refers to records of adults in Mexico from June to September.

Once several distinctive markings were noted, field recognition of adult *D. notatus* was straightforward, permitting separation from similar species (*e.g.*, *Ageneotettix deorum* and *Psoloessa texana*). The orange ground color, black, urn-shaped spot on the dorsum of the pronotum, broad black stripes on the hind femur, blue hind tibia, and pale dorsal stripe at the junction of the tegmina, are all useful characteristics that could be appreciated with close-focus binoculars. The underparts of the female may be yellow or orange.

The taxonomic position of *Dichroplus notatus* is uncertain. Fontana *et al.* (2008) followed earlier authors, listing it from Mexico. However, Amédégnato, Cigliano, Otte, and Rowell (*in litt.*), suggested that that it belongs to another, perhaps as-yet undescribed genus, and that *Dichroplus* (*sensu stricto*) is a South American taxon. Furthermore, Amédégnato and Carbonell (2001) stated that *D. notatus* is not a *Dichroplus* and its genus is uncertain. We offer specimens preserved in ethyl alcohol to anyone wishing to develop a DNA-based phylogeny that includes this species. Specimens are deposited at the Department of Entomology, Academy of Natural Sciences (Philadelphia), the Department of Entomology, University of Arizona (Tucson), and The Haden Collection, (Patrick H. Sullivan, Curator) Sierra Vista, Arizona.

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of Basel, Switzerland) commented on the taxonomy and distribution of *Dichroplus*. Carl Olson (Entomology Dept., University of Arizona, Tucson) has provided numerous courtesies during our studies. Enrique González Soriano (Colección Nacional de Insectos, Instituto de Biologia, UNAM, Mexico City) generously helped with our literature search. Rick Romea (Hereford, Arizona) aided with the identification of plants from Sawmill Canyon. To all, our thanks.

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