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Rediscovery of *Aztecacris gloriosus* (Hebard, 1935) (Orthoptera: Acrididae): associated plants and orthopterans, and an attempted intergeneric copulation

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Abstract

After being unrecorded for approximately 70 years, *Aztecacris gloriosus* (Hebard, 1935) (Orthoptera: Acrididae) is documented from several sites in the Pajarito Mountains, Santa Cruz County, Arizona, USA. An association with Broom Snakeweed (*Gutierrezia sarothrae*) (Asteraceae) is suggested. The known range of the species is small and limited to Santa Cruz County. Habitat and associated orthopterans are discussed, as is an attempted mating by a male *Melanoplus* on a female *A. gloriosus*. Photos of *A. gloriosus* and its habitat are presented.

Key words

Aztecacris gloriosus, Atascosa Gemmed Grasshopper, Sycamore Canyon, Orthoptera, Acrididae, food plants, *Gutierrezia sarothrae*, distribution, Arizona, intergeneric copulation

Introduction

Hebard (1935) described the colorful melanopline *Perixerus gloriosus* from a series of adults and immatures taken 21 September 1922, and 21 and 22 September 1924. All were found on the south slope of Atascosa Peak (1,957 m) in the Atascosa Mountains, a small range (*c.* 9.7 km E-W and 9.7 km N-S) in southwestern Santa Cruz County, Arizona, USA. He mentioned an additional specimen taken 31 August 1927, probably from the same locality. Roberts (1947) erected the genus *Aztecacris* for *Perixerus gloriosus* (from southern Arizona) and two congeners known from the highlands of Mexico from Veracruz to Jalisco: *A. laevis* (Rehn) and *A. variabilis* (Rehn), from the vicinity of Guadalajara, Jalisco. He discussed their differences from the remaining true *Perixerus* Gerstaecker, and *Dasyscirtus* Bruner and suggested at least a superficial similarity to *Poecilotettix* Scudder. Ball *et al.* (1942, Graeme Davis *in litt.*) collected *A. gloriosus* at least into the late 1930s and presented dates for eggs, larvae, and adults, summarized the few known food plants, and extended the range slightly westward to the community of Ruby. Helfer (1987), referred to *A. gloriosus* as the Atascosa Gemmed Grasshopper, and stated: "No specimens have been found since the severe drouth of the 1940's." Queries to The Academy of Natural Sciences of Drexel University, California Academy of Sciences, Essig Museum, University of California, Berkeley (database search), Florida State Collection of Arthropods, Natural History Museum of Los Angeles County, New Mexico State University, University of Arizona, University of California, Riverside, University of Michigan Museum of Zoology, and University of New Mexico failed to produce records of specimens collected more recently than the late 1930s. Whether the lack of more recent records is due to drought or collecting bias, *A. gloriosus* has remained unrecorded for approximately 70 years.

Methods

On 27 September, Margarethe Brummermann and Bob Beatson searched for insects in Sycamore Canyon, Santa Cruz County, Arizona, USA. Sycamore Canyon, part of the Coronado National Forest, is located in the Pajarito Mountains, a small range (c. 12 km E-W and 10 km N-S) located just south of the Atascosa Mountains and just north of the U.S.-Mexico border. Their highest point is Pajarito Peak (1,596 m). Sycamore Canyon is well-known among naturalists. Rugged, narrow, and steep-walled, it straddles the Mexican border and serves as a migration and dispersal corridor for both north- and southbound plants and animals. Its south flowing, intermittent stream with some permanent pools and diverse community of riparian plants have produced many records of Neotropical birds, reptiles, and insects whose ranges barely extend northward into the U.S. Several days after their visit, Brummermann informed us that she had photographed an unfamiliar grasshopper that was strongly patterned with green and red. At the same time, she and Beatson posted their photos to BugGuide.com where David J. Ferguson identified them as the long-missing *Aztecacris gloriosus* (BugGuide.com 2011). Their grasshopper, a female, was perched on rocks along the canyon bottom; thus, an association with a food plant cannot be stated. The surrounding slopes support open oak woodland and scrub characteristic of the Sonoran Desert. The site is *ca* lat 31.4184° N, long 111.1957° W at an elevation of 1,180 m and is *ca* 5 km west-southwest of Hebard's original collection from the slopes of Atascosa Peak.

During the morning of 2 October 2011, we visited Sycamore Canyon, failing to locate *A. gloriosus*. At 17:10 hrs, we stopped at Japanese Tank, a small pond in Warsaw Canyon. While searching nearby vegetation, we discovered a population of *A. gloriosus*. The site (lat. 31.4515° N, long. 111.2706 W), 1.93 km south of the Ruby Road (FR 39) and 5.8 km north of the Mexican border, is a dry, south-facing slope at an elevation of 1,335 m (Fig. 1). The nearest town is Nogales, Arizona, 34.3 km to the southeast. About 1 h was spent collecting, and noting plants and other species of orthopterans. On 5 October 2011 we returned, examining additional areas in Warsaw Canyon, and along the Ruby Road both east and north of Warsaw Canyon.

On 9 October 2011, Tom Miscione and Robert Troup located three *A. gloriosus* 0.44 km north of the Ruby Road (lat. 31.4673° N, long. 111.2054° W) at an elevation of 1,370 m. This road is north of Sycamore Canyon and east of Warsaw Canyon. They collected one female. On 13 October, we visited FR 4186 (just east of the road sampled by Miscione and Troup), sampling sites for a distance of 6.6 km, and made many stops along the Ruby Road east and north of Warsaw Canyon.

Fig 1. *Aztecacris gloriosus* habitat with Broom Snakeweed (*Gutierrezia sarothrae*) in foreground. Warsaw Canyon, Pajarito Mountains, Santa Cruz County, Arizona, USA. 5 OCT 2011. Robert A. Behrstock/Naturewide Images. For color version, see Plate XI.

Results

On 2 October 2011, we located 10 adult *A. gloriosus* (9 females and 1 male) (Figs 2 and 3). Voucher specimens were taken including some preserved in ethyl alcohol for DNA analysis. Revisiting the locale on 5 October, we found an additional seven individuals (6 females and 1 male), several of which were collected.

The collecting site was an open, south-facing slope with a sparse cover of Blue Oak (*Quercus douglasii*), Emory Oak (*Q. emoryi*), and Velvet Mesquite (*Prosopis velutina*). Understory plants included a thin mantle of dry grasses, Broom Snakeweed (*Gutierrezia sarothrae*), Graham's Mimosa (*Mimosa grahamii*), and a scattering of Palmer's Century Plant (*Agave palmeri*); cholla cactus (*Cylindropuntia* sp.), Rainbow Cactus (*Echinocereus pectinatus*), Pancake Nipple Cactus (*Mammillaria heyderi gummifera*), and prickly pear cactus (*Platyopuntia* sp.) (Tom Van Devender pers comm., USDA 2012).

On 13 October, after checking many clumps of *Gutierrezia sarothrae* and just before exiting the west end of FR 4186, we stopped at

Fig 2. Adult *Aztecacris gloriosus*. Male. Warsaw Canyon, Pajarito Mountains, Santa Cruz County, Arizona. 2 OCT 2011. Robert A. Behrstock/Naturewide Images. For color version, see Plate XI.

Fig 3. Adult *Aztecacris gloriosus*. Female. Warsaw Canyon, Pajarito Mountains, Santa Cruz County, Arizona. 2 OCT 2011. Robert A. Behrstock/Naturewide Images. For color version, see Plate XI.

a lone roadside Turpentine Bush (*Ericameria laricifolia*) (Asteraceae). The site (lat. 31.46277° N, long. 111.19437° W) is at an elevation of 1,323 m. It is an open slope with Emory Oak and Pointleaf Manzanita (*Arctostaphylos pungens*). One male *A. gloriosus* was clinging to a vertical stem inside the shrub. Other grasshoppers present on the same plant were *Melanoplus aridus/desultorius*, *M. differentialis nigricans*, *M. gladstoni*, and *M. lakinus*.

Discussion

Nearly all the *A. gloriosus* collected or observed on 2 and 5 October were on or close to blooming Broom Snakeweed, a low growing shrub with numerous small, yellow blossoms. On some slopes, this shrub formed extensive stands that continued for many hundreds of meters. Much habitat without snakeweed was examined and lacked *A. gloriosus*. However, on 2 October, at least a linear kilometer of Broom Snakeweed was investigated nearby along the Ruby Road and yielded no *A. gloriosus*.

Orthopterans at the Japanese Tank site were conspicuous on 2 and 5 October 2011 and included: *Taeniopoda eques*, *Schistocerca nitens*, *Arphia pseudonietana*, *Lactista azteca*, *Leprus wheeleri*, *Trachyrhachys kiowa*, *Trimerotropis pallidipennis*, *Acantherus piperatus*, *Ageneotettix deorum*, *Amphitornus coloradus*, *Boopedon flaviventris*, *B. nubilum*, *Hesperotettix viridis*, *Mermeria bivittata*, *Opeia* sp., *Paropomala pallida*, *Rhammatocerus viatorius*, *Syrbula montezuma*, *Barytettix humphreysi*, *Melanoplus lakinus*, and *M. aridus/desultorius*. Many of these are

Fig 4. Male *Melanoplus lakinus* attempting to mate with female *Aztecacris gloriosus*. Warsaw Canyon, Pajarito Mountains, Santa Cruz County, Arizona. 2 OCT 2011. Robert A. Behrstock/Naturewide Images. For color version, see Plate XI.

widespread generalists; however, several, including *Taeniopoda eques*, *Acantherus piperatus*, *Rhammatocerus viatorius*, and *Barytettix humphreysi* are characteristic of the Mexican border region.

Hebard found *A. gloriosus* from 1,676-1,890 m elevation. Our records are from lower elevations—approximately 1,280-1,335 m. Without naming it, he stated: "The food plant grows in small scattered and widely separated patches on the steep mountain slopes." (1935:128). Ball *et al.* (1942) suggested the principal food plant of *A. gloriosus* was the shrub Wright's Baccharis (*Baccharis wrightii*), but that it also associated with Desertbroom (*Baccharis sarothroides*), goldeneye (formerly *Gymnolomia*, now *Heliomeris*), and brittlebush (*Encelia*). All of these plants are members of the aster family (Asteraceae). We first encountered *A. gloriosus* in an area with a fairly dense stand of Broom Snakeweed, and later in Turpentine Bush. Both of these are also members of the Asteraceae. We conclude that populations of adult *A. gloriosus* are small and dispersed and, where present, opportunistically associate with Broom Snakeweed and other members of the Asteraceae that bloom after the summer rains.

We noted a preponderance of female *A. gloriosus*. Based upon all individuals seen, we encountered five or six females for each male. Late in the season, populations of some acridids may exhibit skewed sex rations (pers comm. David J. Ferguson). However, the *A. gloriosus* we encountered seemed fresh. It is possible that males had matured much earlier in the season and were already dwindling, were more adept at hiding, or may have been utilizing a habitat we were not investigating—perhaps the higher slopes sampled by Hebard.

The known range of *A. gloriosus* appears to be confined to Santa Cruz County, Arizona, USA. The three sites reported above, the town of Ruby just to the northwest (Ball *et al*. 1942), and the vicinity of Hebard's type specimens on the south slope of Atascosa Peak define a polygon *ca* 46 km^2. Based on this species' limited distribution and the paucity of recent information, the Arizona Game and Fish Department (2004) suggested: "Life history studies, population surveys, and range distribution studies need to be performed." Fontana *et al.* (2008) listed *A. gloriosus* for Mexico where it undoubtedly occurs a few kilometers southward of Arizona in the state of Sonora. However, we are unaware of published records of *A. gloriosus* for the country of Mexico (Eades *et al.* 2011). The Atascosa and Pajarito Mountains are part of a series of small mountain ranges that comprise the Tumacacori Highlands. The majority of these highlands are located in Santa Cruz County. At their southern end in Sonora, Mexico is the Sierra La Esmeralda, which should be searched for *A. gloriosus*.

On 2 October, we observed a male, long-winged morph of *Melanoplus lakinus* attempting to mate with a female *A. gloriosus* (Fig. 4). After being photographed, the pair was collected to confirm the identity of the male. Many of the female *M. lakinus* present at the collecting site exhibited a wine-colored suffusion on the dorsum of the head and pronotum, and on the femora. The coloration and its pattern were comparable to, but not as intensely red, as that found on *A. gloriosus*. The similarity in pigmentation may have encouraged the mating. Intergeneric copulations are frequently noted among various Melanoplinae, a subfamily lacking the elaborate pre-copulatory signaling behaviors characteristic of other Acrididae (*e.g.*, Gomphocerinae, Oedipodinae) that could serve as isolating mechanisms (Otte 1981).

We offer specimens preserved in ethyl alcohol to anyone pursuing a DNA-based phylogeny of the Melanoplinae. Specimens are deposited at the Department of Entomology, University of Arizona (Tucson), with David J. Ferguson (Belen, New Mexico), and The Haden Collection, (Patrick H. Sullivan, Curator), Hereford, Arizona.

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