Instars of Narrow-Winged Saltbush Grasshopper, Aeoloplides tenuipennis (Scudder, 1897) (Acrididae: Melanoplinae), with Notes on Habitat and Identification

Author: Behrstock, Robert A.
Source: Journal of Orthoptera Research, 24(2) : 49-54
Published By: Orthopterists' Society
URL: https://doi.org/10.1665/034.024.0202
Instars of narrow-winged saltbush grasshopper, *Aeoloplides tenuipennis* (Scudder, 1897) (Acrididae: Melanoplinae), with notes on habitat and identification

ROBERT A. BEHRSTOCK

10359 S Thicket Place, Hereford, AZ 85615, USA. Email: rbehrstock@cox.net

Abstract

Early stages of narrow-winged saltbush grasshopper, *Aeoloplides tenuipennis*, have not been figured in the literature, hindering their separation from economically harmful or benign species of grasshoppers and hampering ecological or taxonomic investigations. During June and July 2015, five instars of *A. tenuipennis* were collected or photographed at two sites in Cochise County, Arizona, U.S.A. These are illustrated alongside a brief morphometric table. Notes on habitat, identification and polychromatism, and a comparison with 4th and 5th instars of the widespread snakeweed grasshopper, *Hesperotettix viridis viridis*, are included.

Key words

Nymph, Arizona, Chenopodiaceae, polychromatism, San Pedro Riparian National Conservation Area, Whitewater Draw, Cochise County, snakeweed, *Hesperotettix viridis viridis*

Introduction

Identifying and counting grasshopper nymphs is one of the first steps in making timely, economically sound, and environmentally safe decisions in pest management (Berry et al. 1996-2000 a, b). In the western United States, the instars (nymphal stages) of most grasshoppers harmful to crops or rangeland have been described (e.g., Pfadt 1994, Johnson 2008, Brust et al. 2014, and see bibliography in Dysart 1996-2000). In contrast, species present in small numbers, occupying unusual habitats, or specializing on plants avoided by livestock generally do not pose an economic threat and their nymphs are less likely to attract attention. Nonetheless, early life history studies of “less important” species may yield ecological and systematic rewards, shedding light on poorly-known genera, highlighting behaviors, and fostering an understanding of specializations allowing numerous similar species to coexist.

The narrow-winged saltbush grasshopper, *Aeoloplides tenuipennis* (Fig. 1), is a common western species ranging from eastern California, Arizona and southwestern New Mexico north through Utah and southern Nevada to southern Idaho (Wallace 1955, Richman et al. 2014). Doubtless, it is present in the Mexican state of Sonora (one of my collecting sites is only 5 km north of the Mexican border), and perhaps in Chihuahua, but its range south of the U.S. border has not been clarified. It and its food plants inhabit Lower Sonoran life zone desert scrub, alkali flats, and grasslands. The nine similarly-appearing members of its genus (Eades et al. 2015) are recently derived, and largely allopatric (Fig. 2). They appear to have resulted from a Mexican progenitor that spread northward along three geographic fronts (Wallace 1955). All are stenophagous, specializing on saltbush and its relatives. In southeastern Arizona, *A. tenuipennis* is abundant on fourwing saltbush, *Atriplex canescens*; it also occurs on cattle saltbush, *Atriplex polycarpa*, seepweed or seabe, *Suaeda ssp.*, greasewood, *Sarcobatus vermiculatus*, and introduced prickly Russian thistle, *Salsola tragus* (Ball et al. 1942, Wallace 1955). Historically, these plants were considered members of the goosefoot family (Chenopodiaceae); however, current evidence places them with the amaranths (Amaranthaceae). The specialized chenopod diet includes noxious plants such as prickly Russian thistle (tumbleweed), and *A. tenuipennis* is generally considered innocuous to beneficial where cattle are grazed. Consequently, it has been ranked 368th out of 377 species in a pest-status scoring of western rangeland grasshoppers (Dysart 1996-2000). Little has been published on the nymphs of *A. tenuipennis*, and no illustrations have been presented, even on photo websites such as Flickr or BugGuide.Net that have a voracious appetite for images of Orthoptera.

Methods

A basin surrounded by farmland and Chihuahuan Desert scrub/Desert grassland, receives 330 mm of rainfall/year (WeatherDB 2015) and collects runoff and sediments from surrounding North-South oriented mountain ranges. Alluvial soils adjacent to managed wetlands support extensive stands of fourwing saltbush. Other shrubs at the collecting site were a few small mesquites. Ground cover included plains bristlegrass, Setaria macrostachya (Poaceae), peppergrass, prickly Russian thistle, Coulter’s horseweed, golden crownbeard, hairyseed bahia, Bahia absinthifolia (Asteraceae), burroweed, Isocoma tenuisecta (Asteraceae), silverleaf nightshade, copper globemallow, and trailing windmills. Specimens were collected by shaking foliage over the mouth of an insect net. The area sampled was 20 × 30 m and included both individual plants and clumps of fourwing saltbush. All visits to Whitewater Draw were made during mid-morning to mid-day and temperatures were 32°C (90°F).

On 1 July, three nymphs (one 4th instar and two 5th instars) of the snakeweed grasshopper, Hesperotettix viridis viridis, were collected for comparison with A. tenuipennis. They were netted from burroweed growing at roadside in dry, shrubby habitat along Middlemarch Road in the Dragoon Mountains, Cochise County, Arizona (31.852363°N, -109.973765°W) at an elevation of 1,644 m (5,394 ft.).

Nymphs were held in a refrigerator for one day prior to being photographed. Individuals selected for photos were further relaxed in a freezer for 3 min. This additional short chill did not appear to alter their coloration. Chilled nymphs were then photographed live with a Nikon D7000 camera, Nikon strobe, and a sigma 180mm lens. All nymphs were then preserved in 70% isopropyl alcohol.

First through 5th instars were identified by wing bud (wingpad) characteristics (Brust et al. 2014, Capinera et al. 2001). Measurements of instars included: body length taken from the anterior-most point of the head rearward and parallel with the body axis to the rearmost point of the body (terminal abdominal appendages or the tip of the subanal plate); length of the hind femur measured from the anterior-most point of the femur (dorsal to the articulation with the coxa) to the tip of the dorsal lobe of the hind knee; and head depth measured from the highest point on the occiput to the lowest point on the labrum. Antennal segments of the flagellum (i.e., beyond the pedicel) were counted. These proved very difficult to discern on early instars before the segments are differentiated and more heavily pigmented; thus, rather broad ranges are presented. Measurements were made with a Wild M5 microscope fitted with an optical reticle.

Adult grasshoppers often appear strikingly different from their fifth instars, both in form and coloration. In order to confirm the nymphal series with a known adult, eleven 5th instar nymphs were collected on 9 July 2015, at WDSWA and placed in a fine mesh butterfly rearing cage with a supply of fourwing saltbush. Results by 16 July, three adult male A. tenuipennis had eclosed in the rearing cage, confirming the identity of the 5th instar nymphs collected at WDSWA.

During all visits to WDSWA, nymphs of A. tenuipennis were present in large numbers, individual bushes harboring perhaps 20-40/m². Approaching any saltbush elicited an explosive, popcorn-like spectacle as adults and various instars reacted to shadows or movement, launching toward cover in the center of the bush, a behavior reported by Wallace (1955) and Barnum (1964). On 9 July, nymphs and adults were noted on saltbush, prickly Russian thistle, and on open ground where they were resting or basking. Disturbed adults abandoned prickly Russian thistle and jumped or flew to cover in taller fourwing saltbush. By 9 July, most nymphs appeared to be 4th and 5th instars; only a few smaller nymphs were present. On
22 July, fourwing saltbush and prickly Russian thistle at SPRNCA held smaller numbers of nymphs, mostly 5th instars, and a very few younger ones.

**Discussion**

*Aeoloplides tenuipennis* overwinters in the egg stage. Eggs hatch perhaps as early as April, certainly during May and June. I encountered one 1st instar nymph on 22 June. Other records of nymphs include: ARIZONA, May and June (Ball *et al.* 1942); 27-28 July, Yuma County (Rehn & Hebard 1908); 18 August, Coconino County (Wallace 1955); and 11 July, Pima County (Wallace 1955); CALIFORNIA, 19 July, Riverside County and 27 July, Mono County (Wallace 1955); NEVADA, nymphs on various Chenopodiaceae as late as 22 August at the Nevada Test Site, primarily Nye County (Barnum 1964).

An internet search yielded four or five *Aeoloplides* nymphs photographed in habitat, and five more posed for keys. These included Russian thistle grasshopper, *A. turnbulli*, California saltbush grasshopper, *A. californicus*, and Southern Coast bush grasshopper, *A. fuscipes* (Pfadt 1994, Brust *et al.* 2014, BugGuide.Net 2015, flickriver.com 2015, flickrhivemind.net 2015). Based on these photos, nymphs of *A. turnbulli* and *A. californicus* are especially similar to *A. tenuipennis* which is not surprising as Wallace (1955) considered *turnbulli*, *californicus*, *tenuipennis*, and little saltbush grasshopper, *A. minor*, to constitute a subgroup within the genus. Barnum (1964, p. 38) stated it was “impractical” to attempt to separate nymphs of *A. tenuipennis*, from those of little saltbush grasshopper, *A. minor*, which was sympatric in his Nevada study area. A male nymph of *A. fuscipes* of southern and southwestern California (Strohecker *et al.* 1968), photographed 6 April 2011, by Alice Abela in San Luis Obispo County, California, differed markedly from its photographed congeners in possessing a dark stripe that began in the rear portion of the eye, and continued rearward across the head and pronotum into the wing pads. It also exhibited three dark brown bands on the outer, inner, and upper surfaces of the hind femur, black lateral stripes on the abdominal segments, generally dark hind tibia, and much dark pigmentation on the tarsi of the front and middle legs. It lacked a wedge at the base of the hind femur, a feature present on some other members of the genus.

Using the Lucid nymph grasshopper key (Brust *et al.* 2014),...
the nymphs used in this study (whose range is outside the key’s coverage) are identified as, or being close to, A. turnbulli. Character states yielding a near identification for green A. tenuipennis I collected are: instar number = 4, presence of spine on throat = yes, portion of month collected = late June, body length = 12.68 mm, hind femur length = 8.86 mm, outer femur face pattern = either mottled or spotted or light or dark bands, hind tibia color = blue, head - face angle = near vertical, predominant head color = tan or green, compound eye appearance = lighter spots within eye, antennae shape = filiform. Ignoring the ‘head profile pattern’ character yielded an identification of A. turnbulli. On pale green specimens, the choice ‘= mottled or blotchy’ would have been correct. However, the key required the response ‘horizontal stripe or patch behind or below eye,’ a variable character on A. turnbulli and A. tenuipennis and lacking in some nymphs. Brust et al. (2014) note that certain characters may be selected or skipped while working through the key. By selecting the most significant characteristics, I was able to distinguish various color morphs of Aeoloplides nymphs from the other sixty or so nymphal species included using only seven character states.

Hebard (1935, p. 300) referred to the adults of A. tenuipennis, which exhibit striking ranges in wing and body length, and pigmentation, as “one of the most plastic species found in the arid southwest,” attributing the variety of topomorphs to their feeding on certain plants. Even within the small geographic area sampled at WDsWA, nymphs of A. tenuipennis were notably polychromatic, occurring side-by-side on fourwing saltbush in green, pink, pale yellow, ivory, and rusty morphs that exhibited sparse to heavy maculation.

First instars of A. tenuipennis are pale yellowish-greenish with a near vertical face, sparse minute fuscous speckles over much of the body, a pale stripe on the midline of the pronotum, short, filiform antennae, no stripe on the hind femur, and milky white spots separated by pale reddish spaces on the surface of the compound eye (Fig. 3A); their presence on chenopods is a useful characteristic.

Table 1. Collection date, instar number, number of individuals measured (n), body length (BL) range and mean, hind femur length (HF) and mean, ratio of mean FL to mean BL, head depth (HD) range and mean, and antennomere counts (ANT) for instars of Aeoloplides tenuipennis collected at Whitewater Draw Wildlife Area and Hesperotettix viridis collected in the Dragoon Mountains.

<table>
<thead>
<tr>
<th>Date</th>
<th>Instar</th>
<th>n</th>
<th>BL (μm)</th>
<th>FL (μm)</th>
<th>FL/BL</th>
<th>HD (μm)</th>
<th>ANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>22 June</td>
<td>1</td>
<td>1</td>
<td>7.30</td>
<td>3.46</td>
<td>0.47</td>
<td>2.38</td>
<td>c. 12</td>
</tr>
<tr>
<td>22-28 June</td>
<td>2-7</td>
<td>7</td>
<td>7.69-9.53</td>
<td>3.84-5.23</td>
<td>0.56</td>
<td>2.53-3.23</td>
<td>2.87</td>
</tr>
<tr>
<td>28 June-9 July</td>
<td>3-4</td>
<td>11.07-12.00</td>
<td>5.38-5.84</td>
<td>0.48</td>
<td>3.23-3.46</td>
<td>3.32</td>
<td>c. 16-19</td>
</tr>
<tr>
<td>28 June</td>
<td>4-6</td>
<td>10.92-14.00</td>
<td>6.30-7.07</td>
<td>0.54</td>
<td>3.69-3.92</td>
<td>3.82</td>
<td>c. 18-20</td>
</tr>
<tr>
<td>22-28 June</td>
<td>5-5</td>
<td>15.07-17.53</td>
<td>7.38-8.46</td>
<td>0.50</td>
<td>4.40-4.92</td>
<td>4.53</td>
<td>20-23</td>
</tr>
<tr>
<td>Hesperotettix viridis</td>
<td>11 July</td>
<td>4</td>
<td>11.23</td>
<td>7.07</td>
<td>0.63</td>
<td>3.38</td>
<td>3.38</td>
</tr>
<tr>
<td>11 July</td>
<td>5-2</td>
<td>15.38-15.53</td>
<td>8.00-8.30</td>
<td>0.52</td>
<td>3.69-3.76</td>
<td>3.72</td>
<td>c. 20-21</td>
</tr>
</tbody>
</table>

Pfadt (1994) noted differences in maculation among color forms of A. turnbulli. Tan or gray nymphs usually had three dark marks on the exterior face and marginal areas of the hind femur but these marks were faint or absent in green forms. Similarly, green forms of A. tenuipennis exhibited lightly or unpatterned hind femur forms. I would characterize as yellow, ivory, or rufous exhibited denser and more widely spread maculation on all parts of the body, including crisply annulated antennules, dense pigmentation outlining the dorsal pronotal stripe, and denser and darker speckling on the head, pronotum, abdomen, and hind tarsi (Figs 3F, H, I.).

Barnum (1964) mentioned the difficulty in distinguishing green or tan nymphs of A. tenuipennis (which may or may not possess a pronotal stripe), from the very similar nymphs of the snakeweed grasshopper, Hesperotettix viridis, a widespread species found in much of the U.S.A. In southeastern Arizona and southwestern New Mexico, green nymphs of A. tenuipennis and the subspecies H. v. viridis of the western U.S.A. are likely to occur sympatrically where their host plants (chenopods and bushy asters, respectively) coexist on silty flats, fallow fields, or Chihuahuan Desert scrub. Separation of the two in southeastern Arizona appears straightforward, as H. v. viridis exhibits (at least in the last four instars), a gleaming white dorsal stripe from the occiput toward or reaching the base of the supra-anal plate, various white lines and maculations on the margins and lateral fields of the of the pronotum, white diagonal bands on the meso- and metathorax, and white longitudinal carinae on the face of the hind femora (Fig. 3J, Brust et al. 2014). A. tenuipennis is a pale pastel green and H. v. viridis is closer to emerald green. Yellow, pink, or heavily maculated individuals of A. tenuipennis are not likely to be confused with H. v. viridis.

Adults of A. tenuipennis, A. turnbulli, A. californicus and A. minor are very similar, as are their nymphs, whose subtle differences may be overshadowed by variation in color or maculation. Except in limited zones of sympathy, their various instars are perhaps best identified by noting their distribution. In zones of sympathy, identification may depend on rearing a sample of nymphs.
Acknowledgements

Thanks to W. Eugene Hall (Collections Manager, Entomology Collection, University of Arizona, Tucson) for providing a microscope and lab space, and Jim Garrett (Manager, Arizona Game and Fish Dept., Whitewater Draw Wildlife Area, Elfrida) for courtesies extended to me. Thanks also to David Ferguson (Belen, New Mexico) and Sidney W. Dunkle (Tucson, Arizona) for providing copies of important references, and to Mimi Kamp (Bisbee, Arizona) and Elizabeth Makings (Arizona State University Herbarium, Tempe) for identifying several plants. Special thanks to Aileen Thompson (Stellenbosch University, South Africa) for preparing the distribution map.

References


