

## NEW RECORDS AND ACCOUNTS

**New State Record of the Psyllid *Heterotrioza chenopodii* (Reuter, 1876) (Hemiptera: Psylloidea: Trioziidae) for Hawaii**

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**Abstract.** We report the first state record of a widespread palaeartic psyllid species, *Heterotrioza chenopodii* (Reuter, 1876), for the state of Hawaii. This species belongs to a small genus of 13 species feeding exclusively on host plants in the plant family Amaranthaceae (Lauterer 1982, Burckhardt and Ouvrard 2012, Ouvrard 2019). Recorded host genera are *Atriplex*, *Beta*, *Chenopodium*, and *Spinacia* (Ouvrard 2019). In Hawaii, a likely host plant is *Atriplex suberecta*, and possibly *A. semibaccata* and *Chenopodium oahuense*.

**Key words:** *Atriplex*, *Heterotrioza chenopodii*, Hawaiian Islands, host plant, Oahu, new state record

The native palaeartic distribution of *Heterotrioza chenopodii* (Reuter, 1876) is extremely broad, ranging from Scandinavia and North Africa in the west to Japan in the east (Ouvrard 2019). It is considered introduced in North and South America (Percy et al. 2012). Distribution records for this species in the continental US were recently reviewed, and the first record in North America dates from 1988 (Horton et al. 2018). Horton et al. (2018) also reported the presence of both morphological forms in North America (a photoperiod-induced polymorphism) (Lauterer 1982), with the long-winged form occurring in spring and summer (form *aestivalis*) and the shortwinged form in autumn (form *autumnalis*). All individuals collected in

the Hawaiian Islands in March, April, and November are the long-winged form.

All new state records are from Kaena Point, Oahu, both within the Natural Area Reserve and in the adjacent Kaena Point State Park, 3–21 m elevation, 21.57256°N–21.57542°N and 158.27275°W–158.27974°W. The species was collected during each of three standardized arthropod surveys conducted in March 2010 (by LCY and associates), April 2012 (by CBAK and associates), and April 2015 (by PDK and associates). In each survey, all vegetation within 5 m radius circular plots was swept in a non-targeted fashion, but potential host plants within the plots included the introduced *Atriplex semibaccata* (native to Australia)

and the Hawaiian native *Chenopodium oahuense* (both Amaranthaceae). Individuals were also captured in yellow pan traps and pitfall traps employed in the surveys. Subsequently, on November 28, 2016, PDK conducted a targeted search for the species on plants of *A. semibaccata*, *Atriplex suberecta*, and *C. oahuense*. Individuals were only found on *A. suberecta* (another Australian native introduced in the Hawaiian Islands). However, the habitat at the time was very dry. Despite checking plants for immatures, none were observed. Additional collecting will be required to confirm both the host plant and the host range. Twenty-three, eight, and six specimens, stored in 70% ethanol, have been deposited in the University of Hawaii Insect Museum, the Bernice P. Bishop Museum, and the Hawaii Department of Agriculture's Plant Pest Control Branch Collection, respectively.

Specimen color of *H. chenopodii* is variable, mature specimens often have dark brown to black dorsal coloration (which can be more pronounced in males) on the head and thorax, and also on the terminal part of the antennae, with the ventrum and abdomen paler green to yellow/cream (Fig. 1). This type of color pattern is also found in members of the *bicoloratus* group of trioizids feeding on *Metrosideros* (Percy 2017), but the latter are smaller in body size with rounded forewing apices. The simplest means of identifying *H. chenopodii* from other trioizid taxa in Hawaii is the shape and structure of the forewing. In *H. chenopodii* the forewing is distinctly broader in the middle, narrowing to an acute apex, with a relatively low cell  $cu_1$  and a short Rs vein. Of those Hawaiian taxa with a similarly short Rs vein, most have either a rounded forewing apex, with forewing widest in the apical third, or if with acute apex then the Rs vein is longer; in addition, all other Hawaiian trioizids have a relatively

high cell  $cu_1$ . On Oahu, the most similar wing shape to *H. chenopodii* is found in *Pariaconus ohiaicola* (Crawford 1918) (a common species whose host is *Metrosideros polymorpha*; Percy 2017) but the paramere of *H. chenopodii* is shorter and broader. In addition, *H. chenopodii* has an unusual pair of processes on the apical part of the aedeagus (see images in Horton et al. 2018). Lastly, no Hawaiian trioizids are known from the dry lowland habitats in which *H. chenopodii* occurs or from host plants in the family Amaranthaceae.

In addition to a morphological examination, DNA sequences for two mitochondrial regions, cytochrome oxidase I [COI] and cytochrome B [cytB], were sequenced from individuals collected on *Atriplex suberecta*. Hawaiian samples had identical sequences for the two regions, and these sequences were nearly identical to sequences from an individual collected in Bulgaria, Europe (GenBank Accession numbers: MG988841, MG989165; Percy et al. 2018): COI 99.3% similarity, cytB 99.7% similarity, and all differences were at synonymous sites. The Hawaiian sequences have been deposited in GenBank with Accession numbers: MT162454, MT162455 (COI) and MT176418, MT176419 (cytB) for respectively: T4-PDK980-15 1m/1f "swept from various Chenopodiaceae," and T4-PDK981-15 1f ex *Atriplex suberecta*. The DNA voucher specimens are in the private collection of DMP (University of British Columbia).

The placement of *Heterotrioza* in a recent phylogenomic study by Percy et al. (2018) places this genus with several trioizid taxa that are almost exclusively Austro-Pacific in distribution, suggesting that the origins of *Heterotrioza* may be within the eastern range of the genus. Nevertheless, it is almost certain that the occurrence in the Hawaiian Islands is from recent introduction based on the



**Figure 1.** *Heterotrioza chenopodii* specimens collected on Oahu (imaged after preservation in ethanol); A, male dorsum; B, male lateral; C, female lateral.

absence of historic records and relatively minor mitochondrial gene divergence from Western Europe.

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### Literature Cited

- Horton, D.R., E. Miliczky, T.M. Lewis, W.R. Cooper, T.D. Waters, C.H. Wohleb, R.S. Zack, D.L. Johnson, and A.S. Jensen.** 2018. New North American records for the Old World psyllid *Heterotrioza chenopodii* (Reuter) (Hemiptera: Psylloidea: Trioziidae) with biological observations. *Proc. Entomol. Soc. Wash.* 120:134–152. <https://doi.org/10.4289/0013-8797.120.1.134>
- Lauterer, P.** 1982. New data on the occurrence, bionomics and taxonomy of some Czechoslovakian Psylloidea. *Acta Musei Moraviae, Scientiae Naturales* 67: 133–162.
- Ouvrard, D.** 2019. Psyllist—the world Psylloidea database; <http://www.hemipteradatabases.com/psyllist>. (Accessed December 5, 2019).
- Percy, D.M.** 2017. Making the most of your host: the *Metrosideros*-feeding psyllids (Hemiptera, Psylloidea) of the Hawaiian Islands. *ZooKeys* 649: 1–163. <https://doi.org/10.3897/zookeys.649.10213>
- Percy, D.M., A. Crampton-Platt, S. Sveinsson, A.R. Lemmon, E.M. Lemmon, D. Ouvrard, and D. Burckhardt.** 2018. Resolving the psyllid tree of life: phylogenomic analyses of the superfamily Psylloidea (Hemiptera). *Syst. Entomol.* 43:762–776. <https://doi.org/10.1111/syen.12302>
- Percy, D.M., A. Rung, and M.S. Hoddle.** 2012. An annotated checklist of the psyllids of California (Hemiptera: Psylloidea). *Zootaxa* 3193:1–27.
- Reuter, O.M.** 1876. *Catalogus Psylloidearum in Fennia hactenus lectarum*. Meddelanden Societas pro Fauna et Flora Fennica 1:69–77.