Bagnalliella mojave (Thysanoptera: Phlaeothripidae) Thrips Inhabit Small and Isolated Yucca brevifolia (Agavaceae) Host Plants

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Bagnalliella mojave (Thysanoptera: Phlaeothripidae) thrips inhabit small and isolated *Yucca brevifolia* (Agavaceae) host plants

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Bagnalliella mojave Hood (Thysanoptera: Phlaeothripidae) (Hood 1927) is a wing-dimorphic thrips found only on *Yucca brevifolia* Engelmann (Liliales: Agavaceae) (Cott 1956). *Yucca brevifolia*, or Joshua tree, is a large, arborescent monocot endemic to the Mojave Desert in the southwestern U.S. The plant produces 1-3 branching, trunk-like stems that terminate in clusters of rigid, semi-succulent, pointed leaves (Webber 1953). *Bagnalliella mojave* lives between young leaves at the center of leaf clusters.

Joshua trees appear to compete for soil moisture, because plant size increases with increasing spacing from other *Yucca* plants (Yeaton et al. 1985). Availability of soil moisture likely affects the water content, growth, and size of plants. *Bagnalliella mojave* may require plants with high water-contents, because it is more abundant on younger *Y. brevifolia* and on more-succulent leaf-clusters on older plants (Cott 1956). I evaluated the dependence of *B. mojave* on host-plant water-content by examining its presence or absence on different sizes of *Y. brevifolia* growing together with *Yucca schidigera* Roezl ex Ortgies.

The study was conducted at the southern end of the Eldorado Mountains, 5.4 km northeast of Searchlight, Clark County, southern Nevada. The area (35°30'N, 114°53'W; elevation 1,140 m asl) contains outcroppings of weathered granite interlaced with washes. *Yucca brevifolia* at the study area have the short growth-form of *Yucca brevifolia* var. *jaegeriana* McKelvey (Fig. 1a). Rainfall at Searchlight averages 196 mm yearly, mostly during Dec-Mar and Jul-Sep (DRI 2014), and totaled 102 mm in 2011, 184 mm in 2012, and 177 mm in 2013 (CCRFCD 2014).

I searched for *B. mojave* during 2011-2013 by examining leaf clusters on differently-sized *Y. brevifolia* and recorded the locations of the 12 plants found to be inhabited. The rare aggregations of the thrips were recognized by the relatively large, apparently-black adults and frequently-present, red immatures. Wing morphs of adults, some treated with NaOH, were mounted on slides and identified as *B. mojave* following Cott (1956). I compared mounted females with those at the Entomology Research Museum, University of California, Riverside, and deposited vouchers (nos. 417188-417192). I photographed life stages under incident light and superimposed images at different focal planes with CombineZP (Hadley 2013). Second-instar larvae and brachypterous (Fig. 1f) and macropterous adults were collected from a single leaf-cluster during Jul 2011. First- and second-instar larvae (Fig. 1c,d), one propupa (Fig. 1e), and brachypterous adults were collected from a second leaf-cluster during Oct 2013. Both larval instars and brachypterous adults were collected from a third leaf-cluster during Jan 2014. Leaf clusters on *Y. brevifolia* likely support multiple generations of *B. mojave*, because leaf clusters on the first plant (Fig. 1a) found to contain *B. mojave* during Jul 2011 still contained thrips during Dec 2013. The single propupa (third instar) that was found in an aggregation of larvae and brachypterous adults suggests *B. mojave* pupates and completes its life cycle within the same leaf-cluster.

Sizes and spacing of *Y. brevifolia* plants inhabited or not inhabited by *B. mojave* were measured during 2013-2014. Each recorded plant was relocated, and the continued presence of the thrips on at least 1 leaf-cluster was verified with a hand lens. Plant size was measured by counting the number of leaf clusters. Plant spacing was measured as the distance from the inhabited plant to the nearest *Y. schidigera* and *Y. brevifolia* in 4 quarters (compass bearings N-E, E-S, S-W, W-N; point-centered quarter method, Greig-Smith 1964). The four, nearest *Y. brevifolia* were sampled for *B. mojave* by examining all leaf clusters that contained young leaves at or below eye-level (34 plants). Plants with all leaf-clusters above eye-level (14 plants) were not sampled. At each of the nearest *Y. brevifolia* sampled for thrips, I similarly counted the number of leaf clusters and measured the distances to the nearest *Yucca* plants. *Bagnalliella mojave* were found on 2 of the nearest *Y. brevifolia*, producing 14 plants inhabited by *B. mojave* and 32 plants not inhabited by *B. mojave*.

Plant size was regressed (Systat version 10.2, Chicago, Illinois) against 4 measurements of plant spacing: (1) the mean distance (across the 4 quarters) to *Y. brevifolia*, (2) the mean distance to *Y. schidigera*, (3) the mean distance to the nearest *Y. brevifolia* or *Y. schidigera* in each quarter, and (4) the mean distance to *Y. brevifolia* and *Y. schidigera* within and across quarters. Numbers of leaf clusters were transformed log (N), and distances between plants were transformed log (m), to normalize residuals. Plant size was most related, positively, to mean distance to the nearest *Yucca* of either species in each quarter ($F = 11.6$; df = 1,44; $P < 0.001$; $R^2 = 0.21$; Fig. 2).

Mean distance to the nearest *Yucca* did not differ ($t = 0.73$; df = 44; $P = 0.47$) between plants inhabited (6.1 m, back-transformed) or not inhabited (6.6 m) by *B. mojave* (Fig. 2). Adding thrips presence or absence as an indicator variable to the regression of plant size against plant spacing significantly decreased the error variance ($F = 70.3$; df = 1,43; $P < 0.001$; partial $R^2 = 0.53$; Fig. 2). The 14 inhabited plants supported 2-16 leaf clusters (back-transformed mean = 5.8 clusters), and the 32 uninhabited plants supported 8-146 leaf clusters (33 clusters). Eleven plants, 6 with thrips and 5 without thrips, overlapped with 8-16 leaf clusters.

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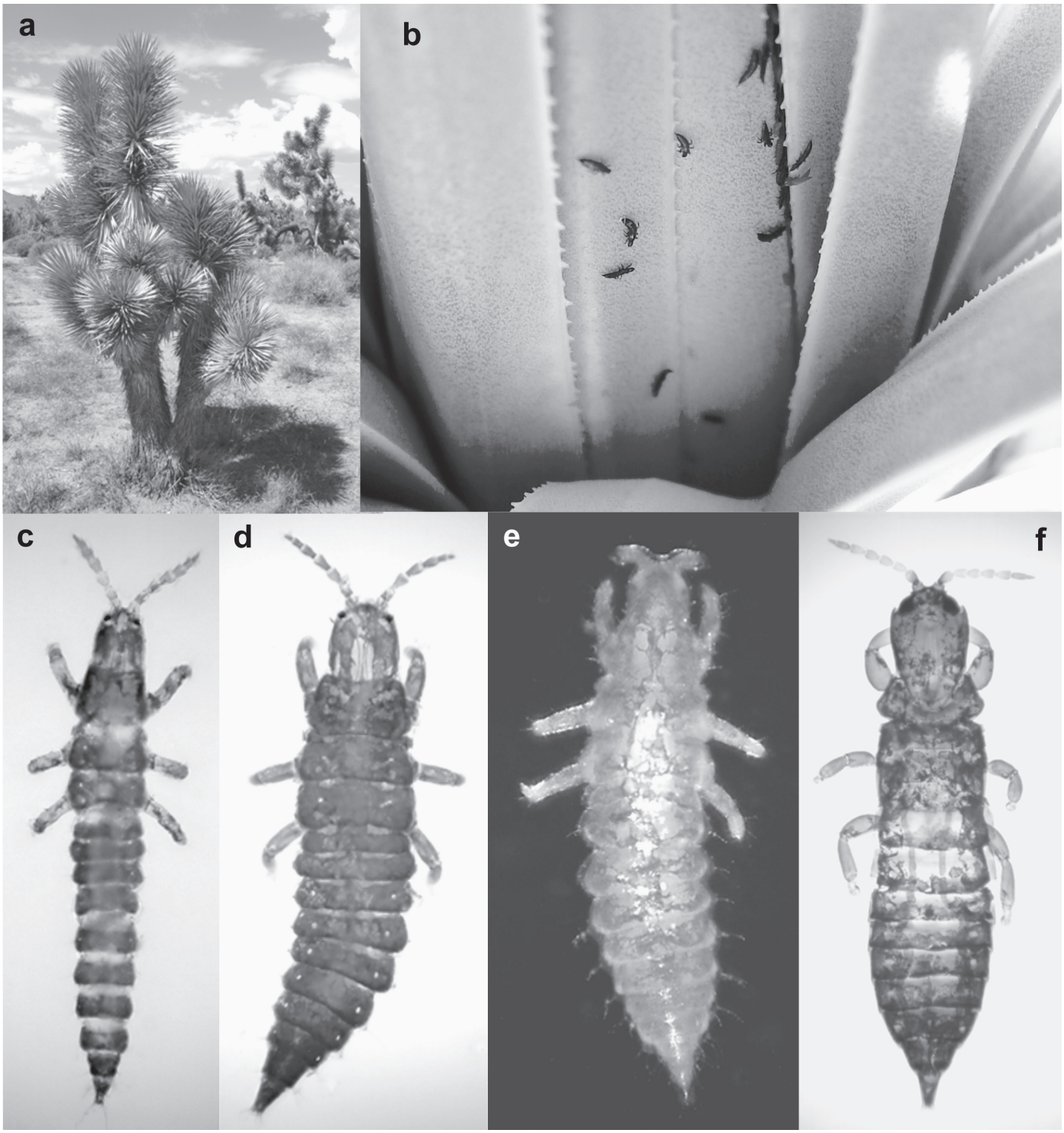

Fig. 1. a. *Yucca brevifolia* supporting 13 leaf clusters and inhabited by *Bagnalliella mojave*. b. *B. mojave* adults and immatures on bases of young leaves at center of leaf cluster. c-f. Dorsal aspect of life stages illuminated from above: c, First-instar larva; d, Second-instar larva; e, Third instar (propupa); f, Brachypterous female mounted in euparal on slide.

Yucca brevifolia plants inhabited by *B. mojave* are smaller than expected based on their spacing from other *Yucca* plants and likely compete less for soil moisture. This agrees with Cott's (1956) observation that the thrips occurs mostly on younger plants. Absence of *B. mojave* in more-succulent leaf-clusters on older, larger plants, as described by Cott (1956), may have been due to lower than average rainfall. *Bagnalliella mojave* appears to be a rare phytophagous thrips mostly limited to small, isolated Joshua trees with high leaf water-contents.

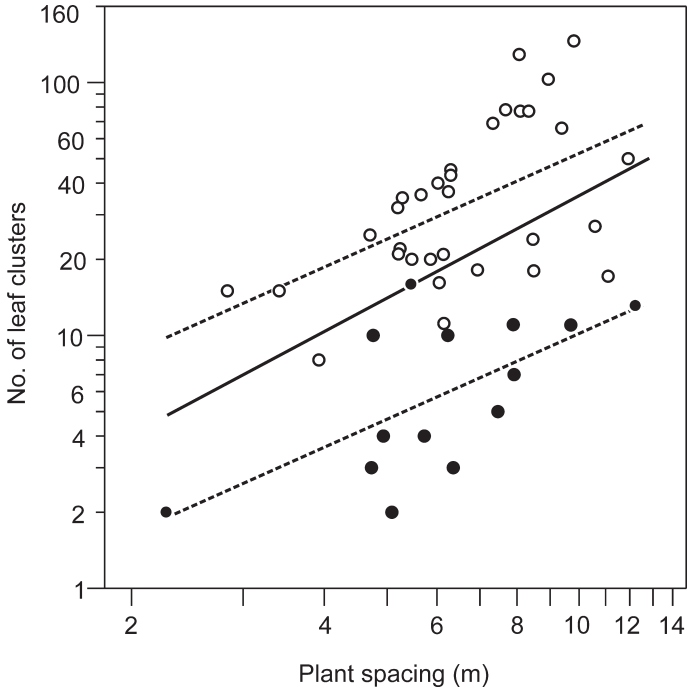

Fig. 2. Number of leaf clusters on *Yucca brevifolia* vs. mean distance from plant to nearest *Yucca schidigera* or *Y. brevifolia* in 4 quarters. *Yucca brevifolia* plants are inhabited (closed circles) or uninhabited (open circles) by *Bagnalliella mojave*. Axes are log scales. Solid line is *Y* regressed on *X*. Dashed lines are the same regression with thrips presence or absence added as an indicator variable.

Summary

I found *Bagnalliella mojave* Hood (Thysanoptera: Phlaeothripidae) restricted to small, isolated *Yucca brevifolia* Engelmann (Liliales: Agavaceae) that likely compete less for soil moisture and have high leaf water-contents.

Key Words: Joshua tree, leaf water-contents, Mojave Desert, wing-dimorphic thrips

Sumario

Se encontro el trips *Bagnalliella mojave* Hood (Thysanoptera: Phlaeothripidae) limitado a plantas pequeñas y aisladas de *Yucca brevifolia* Engelmann (Liliales: Agavaceae) que probablemente compiten menos por la humedad del suelo y tienen un alto contenido de agua en las hojas.

Palabras Clave: árbol de Joshua, contenido de agua foliar, desierto de Mojave, trips de ala dimorfica

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