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Cover Page Footnote

We thank Mark Wetter and the Wisconsin State Herbarium for plant identification; Yolanda Chen, David Hawthorne, Whitney Cranshaw, and Andrew Norton for sampling advice.

***Leptinotarsa decemlineata* (Coleoptera: Chrysomelidae) Observed Feeding on *Chamaesaracha* sp. in Eastern Colorado.**

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Abstract

Egg, larval, and adult life stages of Colorado potato beetle, *Leptinotarsa decemlineata* (Say), were observed feeding on or attached to a previously undocumented host plant belonging to the genus *Chamaesaracha* in eastern Colorado on July 2017. At one site, *L. decemlineata* were more abundant on *Chamaesaracha* sp. than the accepted ancestral host plant, *Solanum rostratum* (Dunal). While future studies should confirm the ancestral status of the observed *L. decemlineata* and suitability of *Chamaesaracha* sp. for completion of development, our observations suggest a need for further characterization of the ancestral host range of *L. decemlineata*.

Keywords: Colorado potato beetle, host plant, ancestral range

The Colorado potato beetle, *Leptinotarsa decemlineata* (Say) (Coleoptera: Chrysomelidae), is a globally distributed agricultural pest and specialist of plants in the family Solanaceae (Tower 1906, Hsiao et al. 1978, Jacques 1988). Prior to 1859, *L. decemlineata* (then called *Doryphora 10-lineata*) was only known from the observations of Thomas Nuttall and Thomas Say of the leaf beetle apparently feeding on buffalo bur, *Solanum rostratum* (Dunal), along the Missouri River somewhere between the Platte and Yellowstone Rivers (Casagrande 1985). Since then, *L. decemlineata* has incorporated potato (*Solanum tuberosum* (L.)) into its host range and rapidly spread across potato-growing regions of the USA (including the Great Lakes region), Europe, and parts of east Asia (Walsh 1866, Riley 1869, Grapputo et al. 2005, Liu et al. 2012). There has been considerable discussion concerning the origin of pest lineages of *L. decemlineata*. Several authors have suggested a Mexican origin (Hsiao 1981; Jacobson and Hsiao 1983; Casagrande 1985, 1987; Lu and Lazell 1996), due to high levels of observed genetic diversity among Mexican *L. decemlineata* and the Central American distribution of several other *Leptinotarsa* species (Jacques 1988). Others suggest an origin in the eastern foothills of the Rocky Mountains, noting the early observations of Nuttall and Say and the first outbreak on potato in the plains of Nebraska (Walsh 1865). Recent population genetic data provide compelling evidence for the Great Plains origin, and suggest that

Mexican *L. decemlineata* belong to a highly divergent genetic lineage (Izzo et al. 2017).

Since it became a pest of potato crops, *L. decemlineata* has been observed utilizing several other cultivated and uncultivated Solanaceae plants (Hare 1900, Latheef and Harcourt 1974, Hsiao et al. 1978, Whitaker 1994, Mena-Covarrubias et al. 1996, Horton et al. 1988), making it a potential model for research on rapid host plant adaptation. However, it is uncertain whether the propensity for adaptation to new host plants is novel and unique to pest lineages or if ancestral populations have already been utilizing multiple plant species. The role of *S. rostratum* as the ancestral host plant of *L. decemlineata* has not been questioned in the literature. Here we report observations of *L. decemlineata* in eastern Colorado feeding and ovipositing on a previously undocumented host plant in the genus *Chamaesaracha*, and discuss potential implications for our understanding of *L. decemlineata* host plant adaptation.

Materials and Methods

Observations were made of host plant associations of *L. decemlineata* in eastern Colorado in July 2017. Visited areas included Pawnee and Comanche National Grasslands, areas where *L. decemlineata* had previously been observed on *S. rostratum* (W. Cranshaw and A. Norton, pers. comm.). Photos were taken of host plants, and identification of *Chamaesaracha* plants was confirmed by the Wisconsin State Herbarium. Voucher specimens of adult *L. decemlineata* are being maintained (kept in 100% ethanol at -20°C)

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Table 1. Observation sites of *Leptinotarsa decemlineata* host plant associations in eastern Colorado, 2017.

Location	Lon	Lat	Elevation (m)	Date	Host plant associations		
					<i>S. rostratum</i>	<i>S. elaeagnifolium</i>	<i>Chamaesaracha</i> sp.
Pawnee Natl. Grassland	40.7871	-103.9571	1531	7/19/17	present/ utilized	absent	absent
Comanche Natl. Grassland (Rd.)	37.7979	-103.5076	1330	7/19/17	present/ utilized	absent	present/ utilized
Comanche Natl. Grassland (Picket Wire Canyon)	37.6331	-103.5891	1332	7/20/17	present/ barely	present/ not	present/ significantly



Figure 1. Floral display (A) and *Leptinotarsa decemlineata* life stages (B, C D) on *Chamaesaracha* sp. Taken in Picket Wire Canyon, Comanche National Grassland, Colorado, USA on 20 July 2017.

in the Schoville laboratory at University of Wisconsin-Madison.

Results

Leptinotarsa decemlineata were observed at low densities on *S. rostratum* at three sites (Table 1). At each site, all life stages (except pupae) were observed feeding on or attached to *S. rostratum*. *Solanum elaeagnifolium* (Cavanilles), another documented host plant of *L. decemlineata* in southwestern USA, was equivalently abundant as *S. rostratum* in Picket Wire Canyon, Comanche National Grassland. However, no *L. decemlineata* (nor any evidence of its activity) were observed on this plant during the course of our observations.

At both Pawnee and Comanche National Grasslands, a plant identified to genus *Chamaesaracha* was found in close proximity to *S. rostratum*, and all *L. decemlineata* life stages observed feeding on or attached to it

(Fig. 1). Notably in Picket Wire Canyon, *L. decemlineata* were more frequently found on *Chamaesaracha* than on *S. rostratum*, despite the presence of large, healthy *S. rostratum* plants in the immediate vicinity.

The *Chamaesaracha* plants likely belong to *C. conoides* (Moricand ex Dunal), but *C. coronopus* (Dunal) could not be excluded due to lack of measurements of distinguishing morphological features (M. Wetter, pers. comm.). Further investigations based on fresh material sampling will likely resolve this uncertainty.

Previously documented host plant associations of *L. decemlineata* were obtained from Jacques (1988), Jolivet and Hawkeswood (1995), Jolivet and Verma (2002), and Clark et al. (2004). Although Jolivet and Hawkeswood (1995) and Clark et al. (2004) have records of *Chamaesaracha* spp. (*C. conoides*, *C. coronopus*, and *C. sordida* (Dunal)), none of them document associations between *Chamaesaracha* spp. and

L. decemlineata. The only leaf beetles *Chamaesaracha* spp. have been associated with are *Lema daturaphila* (Kogan & Goeden), *L. trabeata* (Lacordaire), *L. trivittata* (Say), and *Parorectis sublaevis* (Barber).

Discussion

The occurrence of *L. decemlineata* on another host plant in the ancestral range raises an important question: Have ancestral lineages of *L. decemlineata* historically utilized *Chamaesaracha* in addition to *S. rostratum*? One critical piece of evidence yet to be ascertained is the origin of the *L. decemlineata* associated with *Chamaesaracha*. If these *L. decemlineata* belong to the pest lineage, their association would represent a secondary colonization of eastern Colorado, and yet one more plant added to the pest lineage's host range. The pest status of *L. decemlineata* could be tested by genetic analysis and population assignment methods.

Our observations in Picket Wire Canyon suggest *Chamaesaracha* might be a preferred host plant in the putative ancestral range, as healthy and untouched *S. rostratum* were often found next to it. However, these observations could be an artifact of the time of year. Archives of weather data from the closest city (La Junta; www.wunderground.com) document a maximum temperature of 37°C (98°F), which would likely have been realized or exceeded at the time and location of observations, and it could be that *Chamaesaracha* contains more water or is less enriched in feeding deterrents relative to *S. rostratum* under these conditions. In this case, the association with *L. decemlineata* might only be transitional. Repeated reports are needed to confirm host plant utilization throughout the season and across years. Additional experiments could also be done to verify the sufficiency of *Chamaesaracha* for *L. decemlineata* development and reproduction.

Confirmation of the ancestral status of the observed *L. decemlineata* and suitability of *Chamaesaracha* for completion of development would strongly support the hypothesis that ancestral *L. decemlineata* lineages have historically utilized *Chamaesaracha* in addition to *S. rostratum*. Historic utilization of multiple host plants by ancestral populations would suggest the possibility that *L. decemlineata* may have had genetic variation for broad host use, which could have led to its success invading agricultural habitats. These observations suggest a need for further characterization of the ancestral host range of *L. decemlineata*.

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