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First record of *Orsilochides scurrilis* (Stål) (Hemiptera: Heteroptera: Scutelleridae: Pachycorinae) in the United States, with notes on the biology and distribution of U.S. species of *Orsilochides* Kirkaldy

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First record of *Orsilochides scurrilis* (Stål) (Hemiptera: Heteroptera: Scutelleridae: Pachycorinae) in the United States, with notes on the biology and distribution of U.S. species of *Orsilochides* Kirkaldy

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Abstract. *Orsilochides scurrilis* (Stål) (Hemiptera: Heteroptera: Scutelleridae) is reported from the United States for the first time based on a specimen collected in Santa Cruz County, Arizona. A key to separate the U.S. species of *Orsilochides* Kirkaldy is provided. In addition, host plant records and distribution of the other two species of *Orsilochides* that occur in the U.S., *Orsilochides guttata* (Herrich-Schäffer) and *Orsilochides stictica* (Dallas), are analyzed through a combination of digital photo records and museum specimens.

Key words. Adventive species, iNaturalist, BugGuide, Global Biodiversity Information Facility, host plants.

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Introduction

The genus *Orsilochides* Kirkaldy contains six species that can be found in the neotropics and southern United States. Eger et al. (2015) listed distributions of neotropical species of Scutelleridae, including the following five species of *Orsilochides* found in that region and their distributions: *Orsilochides glirina* (Bergroth) (Brazil), *Orsilochides leucoptera* (Germar) (Argentina, Bolivia, Brazil, Paraguay, and Peru), *Orsilochides scurrilis* (Stål) (El Salvador, Guatemala, Mexico, and Nicaragua), *Orsilochides stictica* (Dallas) (Guatemala, Honduras, Mexico, and USA (Texas) and *Orsilochides variabilis* (Herrich-Schäffer) (Belize, Colombia, Costa Rica, Guatemala, Mexico, and Nicaragua). Meanwhile, *Orsilochides guttata* (Herrich-Shäffer) is recorded only from the southern United States (Lattin 1964; Froeschner 1988).

Prior to this publication, two species of *Orsilochides* were recorded from the United States. Lattin (1964) reported *O. guttata* from Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, and South Carolina, and *O. stictica* from the United States for the first time, noting that its presence in the U.S. was restricted to a small area around Brownsville, Texas. However, Lattin's (1964) dissertation was not published and his work was not cataloged by Froeschner (1988). The only published records of *O. stictica* from the United States were those of Reid and Barton (1989), citing Lattin (1964), and Eger et al. (2015), who included Texas in the distribution of this species without further comment.

On 18 November 2020, S.D.C. found and collected a single specimen of *O. scurrilis* on *Ericameria laricifolia* (A. Gray) (Asteraceae) in Santa Cruz County, Arizona. Thereafter, she posted a photo of the specimen (Figure 1) on the SW U.S. Arthropods Facebook Page, which was viewed by A.W.M., who sent the photo to J.E.E. for

Figure 1. Live *Orsilochides scurrilis* specimen captured and photographed by Susan D. Carnahan.

verification of the specific identification. The authors suspected that this specimen represented the first record of the species in the U.S. and the first record of the genus in the state of Arizona. Because this genus has received limited attention in the U.S., this record also provided an opportunity to further investigate the distribution of *O. stictica* and *O. guttata* within the country. With all of this in mind, the authors began contacting museums and searching digital records in an effort to determine whether this was, in fact, the first U.S. record of *O. scurrilis* and to update the distributions of previously recorded U.S. species of *Orsilochides*.

Materials and Methods

Records for species of *Orsilochides* within the Global Biodiversity Information Facility (GBIF) were reviewed (GBIF 2020). GBIF is an international network and data infrastructure that contains a variety of open access records, including specimen records uploaded by participating museums and geotagged photo records from websites like iNaturalist (www.inaturalist.org) and BugGuide (www.bugguide.net). While BugGuide users may assign an identification to their own photo records, editors and experts on the site can override any user's identification. Intermittently, records from BugGuide are exported to GBIF where they may be retrieved by interested parties. iNaturalist takes a different approach and considers identifications by all users to be of equal importance. When users first upload a photo, a suggested identification based on a computer algorithm is provided to the user. Other users may refine, correct, or confirm initial identifications. Upon reaching a required level of community consensus, photo observations are deemed "research grade" and are available for export to GBIF. Given the wide diversity of arthropods, computer vision identifications are often unreliable for insects, and researchers interested in using the data should intensely scrutinize relevant records from any database to omit misidentifications or cases in which photos lack sufficient clarity to reliably elicit an identification. Photos that did not meet these criteria were omitted from this study.

In addition to these photo records, GBIF also compiles digitized vouchers of physical specimens from participating museums. Similar to examining specimens in person from collections, when analyzing either the photo

records or the digitized voucher records, there is a possibility that observational notes such as dates or locations could be entered incorrectly, either by the original observer or by subsequent parties transferring data. It should be noted that GBIF (2020) contained some records of physical specimens that raised suspicion as outliers. In one case, three specimens of *O. stictica* were reported from Tennessee. Follow-up with staff at the institution that provided those records revealed that these specimens were actually from Texas, so these records were omitted. In another instance, an institution from outside of the US included a record of *O. guttata* from New York in the database. In that case, when contact with the institution could not be made successfully, the record was omitted, as a labeling error seemed likely.

After analyzing the photo records, inquiries were made to several arthropod museums in an attempt to corroborate the indicated distributional changes with physical voucher specimens. Museum staff at the following museums searched their collections for *Orsilochides* specimens: Hasbrouck Insect Collection at Arizona State University (ASUHIC), the Florida State Collection of Arthropods (FSCA), the Louisiana State Arthropod Museum (LSAM), the Mississippi Entomological Museum (MEM), the New Mexico State University Arthropod Collection (NMSU), Texas A&M University Insect Collection (TAMU), University of Arizona Insect Collection (UAIC), and the University of Texas at Austin Biodiversity Center Insect Collection (UTIC). Additionally, online databases of arthropod collections were searched. The Symbiota Collections of Arthropods Network (SCAN) returned U.S. *Orsilochides* spp. specimen records from the following collections: Monte L. Bean Life Science Museum at Brigham Young University (BYUC), TAMU, Archbold Biological Station Arthropod Collection (ABS), and the Stuart M. Fullerton Collection of Arthropods at University of Central Florida (UCFC). These records also were included in the GBIF data set and can be retrieved from GBIF (2020). Specimen records from the personal collection of J.E.E. (JEEC) also were included in this study. Label data for material studied are given as they appear on the label and are given only for those specimens we examined that represent new distribution records.

Images used in Figures 2–4 were captured by Sangmi Lee at ASUHIC using a mounted Canon EOS 6D Mark II with a 1.4× Tele converter and 65 mm macro lens, and stacked using Zerene Stacker software. Images used in Figures 5–10 were captured by J.E.E. using a Leica DMC6200 digital camera attached to a Leica Z16 APO Macroscope, and stacked using Leica software. All images were retouched in Adobe Lightroom and combined in Adobe Photoshop by A.W.M.

Material Studied

Orsilochides scurrilis: USA: ARIZONA, Santa Cruz Co., Salero Ranch, 31.60988, -110.90709, 4293 feet elevation, 18.XI.2020 Susan D. Carnahan, *Ericameria laricifolia*, ASUHIC0163996.

Orsilochides stictica: 1 male: USA: TEXAS, Travis Co., Zilker, 01.III.1996, J. Clement, UTIC. 2 females: USA: TEXAS, Bastrop Co., N30.300, W97.294, 21.III.2008–28.IV.2008, Malaise, J.C. Abbott, UTIC. 1 female: USA: TEXAS, San Patricio Co., Welder Wildlife Foundation, Sinton, 12 km NE @ TX 77, N28.11267, W97.41769, 23–26.V.2011, J.C. Abbott #2504 & Ent. Class, UTIC. 1 female: USA: TEXAS, Travis Co., Camp Mabry Nat. Guard, Austin, N30.623, W97.767, 16.VI–8.VII.2004, Malaise, J.C. Abbott, UTIC. 1 female: USA: TEXAS, Travis Co., Camp Mabry Nat. Guard, Austin, N30.623, W97.767, 08.III–25.III.2005, Malaise, J.C. Abbott, UTIC. 1 female: USA: TEXAS, Travis Co., 4D-2222 Ecolab, Colorado R., Austin, N30.349, W97.790, 26.III.2008–23.IV.2008, J.C. Abbott, UTIC.

Results and Discussion

The specimen of *O. scurrilis* collected by S.D.C. was deposited into the ASUHIC. This specimen is the first reported U.S. record for the species and the first reported record of the genus *Orsilochides* in Arizona.

Among Scutelleridae from the United States, species of *Orsilochides* can be recognized by having stridulatory areas ventrally on at least abdominal segments 5–6, a short metathoracic ostiolar peritreme, and the abdominal sternites rounded laterally, not compressed. *Orsilochides scurrilis* is a distinctly and uniquely colored bug (Fig. 1–4), so it should be recognizable; however, separating *O. guttata* and *O. stictica* is more subtle. Here we present a key to species of *Orsilochides* spp. now known to occur in the United States, which should facilitate recognition of the three relevant species.

Figures 2–4. *Orsilochides scurrilis*. **2)** Lateral view. **3)** Ventral view. **4)** Dorsal view. Dimensional lines = 1.0 mm.

Key to species of *Orsilochides* occurring in the United States

1. Abdominal venter black, lateral margins with pale impunctate callus (Fig. 5–6); length 9.2–11.9 mm . . . . . ***O. guttata* (Herrich-Schäffer)**

— Abdominal venter light brown to yellow with contrasting punctures, often in patches, lateral margins lacking callus, at least partially punctate **2**

2. Head light brown to yellow, concolorously punctate, sutures between clypeus and mandibular plates bordered in black or reddish brown; dorsal coloration reddish brown, usually with distinct pattern of transverse yellow markings (Fig. 2–4); length 7.7–9.6 mm . . . . . ***O. scurrilis* (Stål)**

— Head light brown with black punctation, sutures between clypeus and mandibular plates not bordered in by darker coloration; dorsal coloration light brown to orange-brown, usually with vague transverse markings (Fig. 8–10); length 6.4–8.8 mm . . . . . ***O. stictica* (Dallas)**

Updated information on distributions for US species of *Orsilochides* can be seen in Table 1, along with earliest reported records for each species in each state. It should be noted that while our search only returned records from the listed counties, more intensive collecting efforts and exhaustive examination of arthropod collections would likely reveal that *O. guttata* is widely distributed across much of its previously reported range in Alabama, Florida, Georgia, Louisiana, and Mississippi. The digital photo records from GBIF (2020) suggest that *O. guttata* has recently expanded its range northward into southern and central Arkansas, and westward into eastern Texas. However, no physical specimens could be located to corroborate the presence of *O. guttata* in Texas or Arkansas. Meanwhile, both photo records and specimen data from UTIC and TAMU indicate that *O. stictica* has a much greater range within Texas than previously indicated (Lattin 1964). Photo records from GBIF (2020) also indicate that the species may now be found in Louisiana and Mississippi, although voucher specimens could not be located to further corroborate distribution in those states.

While it is possible that the three species covered here underwent distributional changes within the U.S., our study did not reveal the presence of a fourth species, *O. variabilis*, in the United States. Lattin (1964) commented on the presence of this species in Mexico near the U.S. border and noted that expansion into the U.S. was likely, but its absence in our study suggests that the species may already have reached the northern limits of its potential distribution.

Reid and Barton (1989) reared *O. guttata* on cuttings of *Croton capitatus* Michaux in the laboratory. They provided developmental times for each life stage and described and figured the immature stages. There is little information on the biology of the other species of *Orsilochides* outside of plant associations. Available literature suggests that *Orsilochides* spp. are associated with a wide variety of plants but are not considered to be among the scutellerid genera that are economically significant (Eger et al. 2015). Table 2 provides a summary of plant association records from the literature for the three *Orsilochides* species recorded in the U.S. and also includes several new records for these species, based on information provided by the authors and users of iNaturalist and BugGuide whose observations were included in GBIF (2020). There are limited records in the literature of plant associations for *O. scurrilis* and *O. stictica* and none indicate that nymphs were present on these plants. *Orsilochides stictica* has only had a single plant association previously reported, but GBIF (2020) records suggest that the species has a preference for Malvaceae, as *Sida rhombifolia* Linnaeus and *Pavonia lasiopetala* Scheele both had multiple records of association with both adults and nymphs. A number of associated plants have been reported for *O. guttata*, but plants in the families Euphorbiaceae and Malvaceae are the only ones that have been associated with immatures. In Florida, all life stages of this species are commonly found on *Croton glandulosus* Linnaeus and *Cnidoscolus stimulosus* (Michaux) Engelm. & A. Gray, suggesting that Euphorbiaceae are preferred hosts.

Further study is required to determine whether *O. scurrilis* is established in Arizona and to determine its feeding habits within the U.S., but neotropical plant associations for this species published by Dominguez and Carrillo (1976) and Maes (1998), as well as the host plant information reported for the other species, may help to focus that search.

In this digital age, citizen science outlets such as BugGuide and iNaturalist are valuable resources for improving understanding of arthropod distributional patterns. The utility of these databases is readily apparent in aiding in the early detection of invasive pest species (Maistrello et al. 2016; Eger et al. 2020), but these data also can be useful to those seeking to improve understanding of arthropods that have received limited attention based

Table 1. Distributional information for species of *Orsilochides* occurring in the United States. New records are given in bold type.

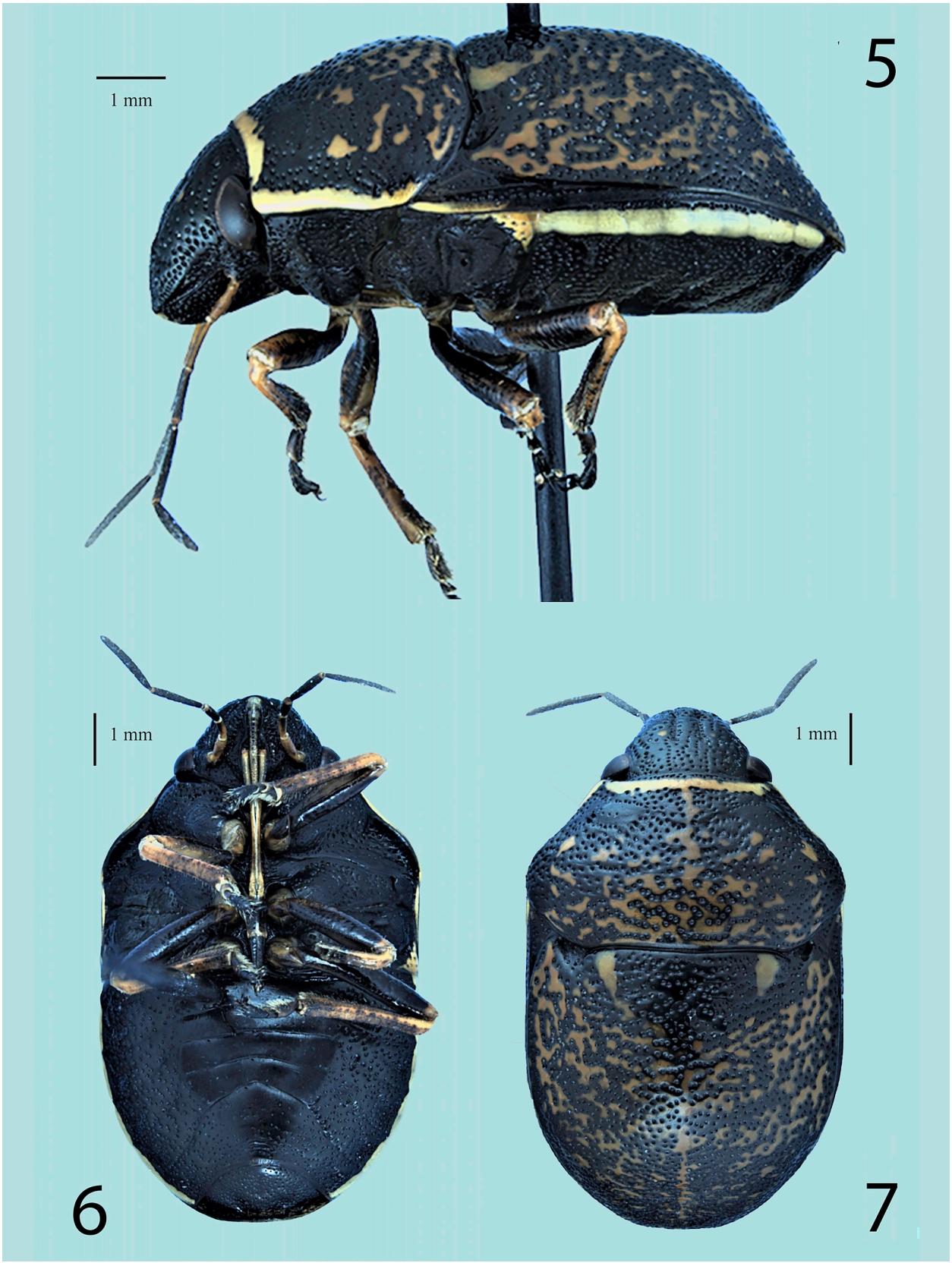
State	Oldest state record (source)	Counties/parishes	Source
Orsilochides guttata			
Alabama	1926 (Blatchley 1926)	Lee, Mobile, Monroe	(Lattin 1964)
		Choctaw	(Reid and Barton 1989)
		Baldwin, **Jefferson**, **Marion**, **Perry**, **Pickens**	Photo records (GBIF 2020)
Arkansas	2013 (GBIF 2020)	**Drew**, **Pulaski**, **Saline**	Photo records (GBIF 2020)
Florida	1904 (Van Duzee 1904)	Widespread	(Lattin 1964), (Blatchley 1926), (GBIF 2020)
Georgia	1837 (Herrich-Schäffer 1837)	Brooks, Chatham, Tift	(Lattin 1964)
		Decatur	Specimen record from NMSU
		Walton, **Ware**	Photo records (GBIF 2020)
Louisiana	1925 (Lattin 1964)	Livingston	(Lattin 1964)
		Bossier, **Caddo**, **Grant**, **Natchitoches**, **Ouachita**, **St. Tammany**, **Union**, **Vernon**	Photo records (GBIF 2020)
Mississippi	1927 (Lattin 1964)	Covington, Forrest, Lauderdale, Leake, Harrison	(Lattin 1964)
		Covington, Rankin, Simpson	(Reid and Barton 1989)
		Choctaw, **Forrest**, **Grenada**, **Jackson**, **Lamar**, **Lincoln**, **Marshall**, **Tallahatchee**, **Yalobusha**	Photo records (GBIF 2020)
North Carolina	1867 (Walker, 1867)	Moore, New Hanover	(Lattin 1964)
South Carolina	1904 (Van Duzee 1904)	Beaufort	(Lattin 1964)
Texas	2014 (GBIF 2020)	**Angelina**, **Bowie**, **Cass**, **Dallas**, **Harris**, **Harrison**, **Houston**, **Jasper**, **Liberty**, **Montgomery**, **Nacogdoches**, **Polk**, **Rusk**, **San Jacinto**, **Smith**, **Tyler**	Photo records (GBIF 2020)
Orsilochides scurrilis			
Arizona	2020 (This paper)	**Santa Cruz**	Specimen in ASUHIC
Orsilochides stictica			
Texas	1935 (Lattin 1964)	Cameron, Hidalgo	(Lattin, 1964)
		Angelina, Bastrop, Brazoria, Brazos, Burleson, Harris, Kleberg, Montgomery, San Patricio, Travis, Waller	Specimen records from JEEC, TAMU, & UTIC
		Austin, Bexar, Chambers, Fort Bend, Galveston, Hays, Jasper, Leon, Liberty, Neuces, Polk, Williamson	Photo records (GBIF 2020)
Louisiana	2015 (GBIF 2020)	**East Baton Rouge, Jefferson, Lafayette, New Orleans, Orleans, St. Helena, St. Martin, St. Tammany, Tangipahoa, West Feliciana**	Photo records (GBIF 2020)
Mississippi	2020 (GBIF 2020)	**Jones, Pearl**	Photo records (GBIF 2020)

Table 2. Plant species associated with species of *Orsilochides* occurring in the United States. New records are given in bold type.

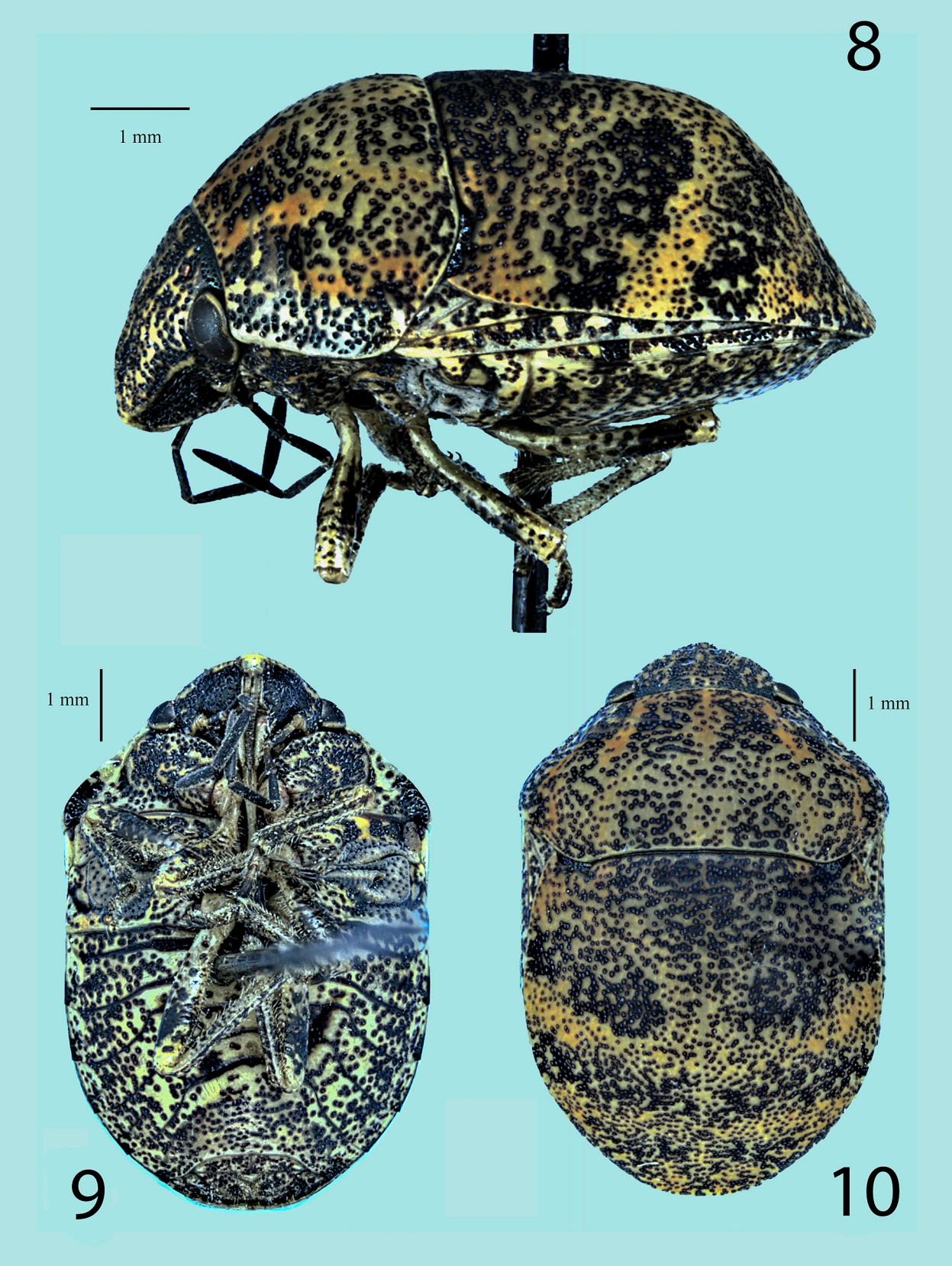
Plant family	Plant species	Associated life stage (if noted)	Source
Orsilochides guttata			
Anacardiaceae	*Schinus terebinthifolius* Raddi	Adult	(Cassani 1986)
Asteraceae	*Berlandiera subacaulis* Nutt.	Adult	(Olson 1989)
Convolvulaceae	*Ipomoea pes-caprae* (L.) R. Br.		(Blatchley 1926)
	***Silphium integrifolium* Michx.**	**Adult**	(GBIF 2020)
Euphorbiaceae	***Cnidoscolus stimulosus* (Michx.) Englem. & A. Gray**	**Adults, nymphs**	(Personal observation, J.E.E.)
	Croton capitatus Michaux	Adults, nymphs	(Reid and Barton 1983)
	Croton glandulosus L.	Adults, nymphs	(Reid and Barton 1983)
	***Croton punctatus* Jacq.**	**Adult**	(GBIF 2020)
Malvaceae	*Alcea rosea* L.		(Lattin 1964)
	***Hibiscus aculeatus* Walter**	**Adults, nymphs**	(GBIF 2020)
	Kosteletzkya virginica (L.) C. Presl. ex A. Gray		(Lattin 1964)
Rosaceae	*Crataegus* sp.		(Dozier 1920), as 'red haw'
Orsilochides scurrilis			
Arecaceae	'palmas infermes'		(Dominguez and Carillo 1976)
Asteraceae	***Ericameria laricifolia* A. Gray**	**Adult**	(Personal observation, S.D.C.)
Malvaceae	*Gossypium* sp.		(Maes 1998)
Nyctaginaceae	*Bougainvillea* sp.		(Maes 1998)
Poaceae	*Saccharum* sp.		(Maes 1998)
Orsilochides stictica			
Apocynaceae	***Asclepias viridis* (Walter) A. Gray**	**Adult**	Photo records (GBIF 2020)
Asteraceae	***Parthenium hysterophorus* L.**	**Adult**	Photo records (GBIF 2020)
Euphorbiaceae	***Croton capitatus* Michaux**	**Adult**	Photo records (GBIF 2020)
	***Hibiscus laevis* All.**	**Adult**	Photo records (GBIF 2020)
Lamiaceae	***Salvia azurea* Michx. Ex Lam.**	**Adult**	Photo records (GBIF 2020)
Malvaceae	***Sida rhombifolia* L.**	**Adults, Nymphs**	Photo records (GBIF 2020)
	***Pavonia lasiopetala* Scheele**	**Adults, Nymphs**	Photo records (GBIF 2020)
	***Urena lobata* L.**	**Adult**	Photo records (GBIF 2020)
Verbenaceae	*Lantana* sp.		(Palmer and Pullen 1995)

on their negligible economic impacts. The costs of materials and labor associated with organized, funded sampling efforts are barriers that are difficult to overcome when there is little to no tangible economic benefit from improving understanding of the target organism, but open-access records such as those compiled by the users of BugGuide or iNaturalist afford researchers a wider range of data than a small team could ever collect on their own. However, when using these data sets, the limitations of this material also should be considered.

With photographic records, identifiers are not always able to examine key features that would be examined readily on a physical specimen, so identification must be based on general habitus of the insect and cannot be



Figures 5–7. *Orsilochides guttata*. **5)** Lateral view. **6)** Ventral view. **7)** Dorsal view. Dimensional lines = 1.0 mm.



Figures 8–10. *Orsilochides stictica*. **8)** Lateral view. **9)** Ventral view, **10)** Dorsal view. Dimensional lines = 1.0 mm.

made with the same degree of certainty that is possible with physical specimens. Additionally, identifiers on these sites are often volunteers and their level of expertise can be inconsistent or unavailable to those retrieving the data. Conversely, photographs can contain reviewable behavioral evidence such as plant associations, aggregation behavior, or predation that only can be provided by the original observer through label data when examining physical specimens. Experts and identifiers can address some of these limitations and maximize the benefits of photo records through improved communication with the naturalists recording these observations. By providing feedback on additional photo angles that may facilitate more accurate identification, detailing gaps in biological understanding that naturalists should record, and pointing out records of uncommon species in an area, identifiers can encourage observers to collect records and specimens that could improve understanding of the biology of a wide range of insect species.

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