

Taro Planthopper *Tarophagus colocasiae* (Matsumura) (Insecta: Hemiptera: Delphacidae: Delphacinae)¹

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Introduction

The taro planthopper, *Tarophagus colocasiae* (Matsumura), is a sap-feeding insect in the family Delphacidae. Like other delphacids, *Tarophagus colocasiae* has a characteristic movable spur extending from the tibia, or fourth leg segment. Adults can be either capable of flight or have incompletely developed wings, leading to two separate morphological forms (Figure 1). Originally native to Southeast Asia, Indonesia, and islands in the Pacific Ocean, *Tarophagus colocasiae* was first discovered in the continental United States at a garden center in Winter Haven, FL in 2015 (Halbert and Bartlett 2015). No other species from its genus is currently found in the continental United States.

Synonymy

In 1989, the genus *Tarophagus* was revised based on morphological differences in the male genitalia and other distinguishing characters. Asche and Wilson (1989) split the species, *Tarophagus proserpina*, into three species: *Tarophagus persephone* (Kirkaldy), *Tarophagus proserpina* (Kirkaldy), and *Tarophagus colocasiae* (Matsumura). Because of this, some ambiguity exists as to what currently valid species is being described in older literature (articles from before 1989), within which *Tarophagus colocasiae* is identified as *Tarophagus proserpina*. However, each of the three newly delineated species have similar external

appearances and host plants, and therefore likely have similar life histories (development and behavior).



Figure 1. Adult *Tarophagus colocasiae* (Matsumura). The individual on the right is a brachypter with reduced wings.

Credits: Alexander Tasi, UF/IFAS

Distribution

The current distribution of *Tarophagus colocasiae* includes much of mainland and maritime Southeast Asia, as well as islands throughout the Pacific. Specific collection records are present from, but not limited to, Thailand, Taiwan, Indonesia, Borneo, Papua New Guinea, Micronesia, Guam, and Hawaii (Bartlett 2018). In addition to the recent detection in Florida, the planthopper has also been reported from Cuba and Jamaica in the Caribbean (Bartlett 2018).

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The initial Florida collection was made in Polk County on taro (*Colocasia esculenta* (L.) Schott) (Halbert and Bartlett 2015) (Figure 2). However, given that Polk County is landlocked and that the initial detection in Cuba was in December of 2014 (González Vázquez et al. 2016), slightly prior to the first discovery in Florida, it is possible that this planthopper entered the state somewhere else and spread from there to the center of the state.

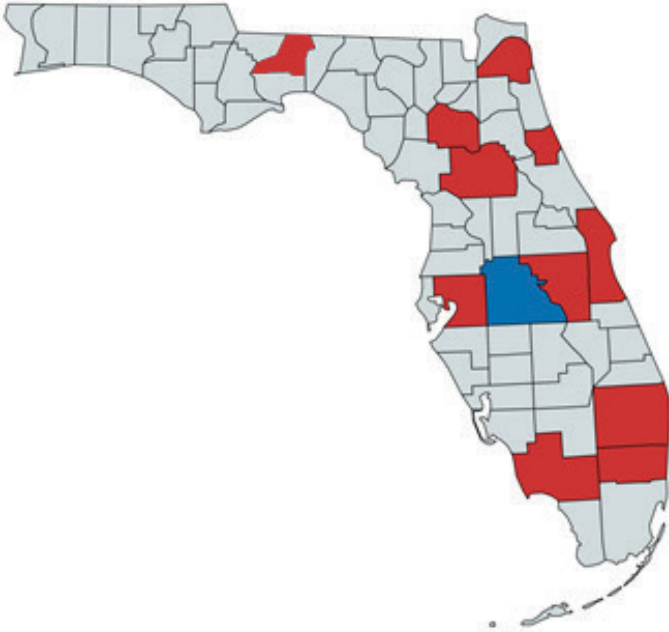


Figure 2. Florida counties where *Tarophagus colcasiae* has been found as of December 2019. Polk County (where the initial find was made) is colored blue.

Credits: Alexander Tasi using mapchart.net, based on communications with Susan Halbert, Florida Division of Plant Industry, and specimens vouchered in the Florida State Collection of Arthropods

Description and Life Cycle

Eggs

Adult females oviposit (lay eggs) within the petioles, or leaf stalks of host plants. Matsumoto and Nishida (1966) noted that oviposition sites of *Tarophagus proserpina* (likely *Tarophagus colcasiae*) on taro (*Colocasia esculenta*) could easily be recognized by the dark residue of sap that had oozed out from oviposition puncture wounds, and onto the petiole surface (Figure 3). These exudates also match descriptions from González Vázquez et al. (2016) of damage associated with *Tarophagus colcasiae* on taro plants in Cuba.

The eggs themselves are ivory colored, slightly over a millimeter long, and are oriented roughly perpendicular to the petiole surface (Figure 4). Mean incubation time of the eggs under laboratory conditions was found to be around 14 days (Matsumoto and Nishida 1966).



Figure 3. Sap oozing from oviposition puncture wounds made by *Tarophagus colcasiae* on a taro (*Colocasia esculenta*) petiole. Credits: Alexander Tasi, UF/IFAS

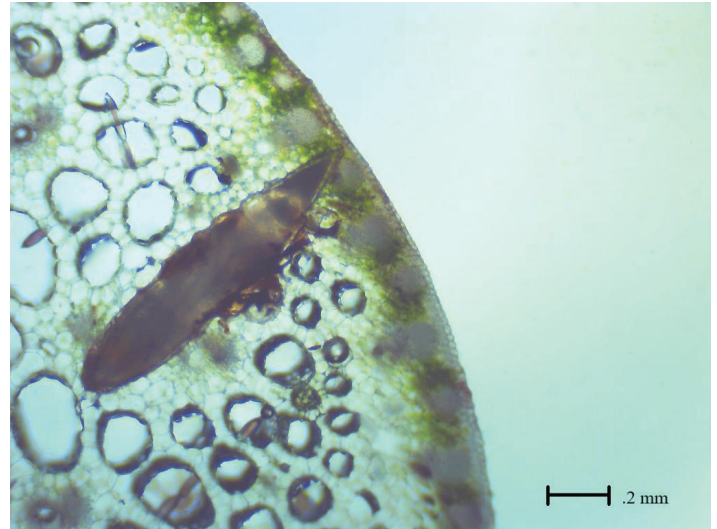


Figure 4. Light micrograph of a *Colocasia esculenta* petiole viewed in cross section and magnified 40 times, showing the orientation of a *Tarophagus colcasiae* egg.

Credits: Alexander Tasi, UF/IFAS

Nymphs

After the eggs hatch, *Tarophagus colcasiae* passes through five nymphal (juvenile) stages (called instars), before molting into an adult. The fifth instar takes around five days to develop, while each of the previous four instars takes around three days (Matsumoto and Nishida 1966). Nymphs start out paler than adults and darken as they mature (Bartlett 2018) (Figure 5). Like the adults, nymphs have characteristic tibial spurs and are capable of hopping. The juvenile planthoppers are gregarious and feed by inserting their piercing-sucking mouthparts into plant tissue and ingesting the sugar-rich phloem (one of two vascular fluids) that its host plant uses to transport energy. Heavy feeding can cause taro plants to severely yellow and wilt (Tasi pers. obs. 2020).



Figure 5. Two *Tarophagus colocasiae* nymphs, showing changes in coloration that occur with maturation.

Credits: Alexander Tasi, UF/IFAS

Adults

The adults are small (between 2.5 and 4.1 mm or 0.1 and 0.16 in long), and mostly dark brown in color, with white markings on the thorax, just behind the head (Halbert and Bartlett 2015). Feeding, and consequent damage to the host plant, is much the same as it is for nymphs. Long hind legs provide adults with the ability to jump rapidly to escape predation. Adult males can be identified by ornamentation on the opening of their last abdominal segment, or pygofer, which is a distinctive feature for the genus, *Tarophagus*, and varies between each species (Bartlett 2018) (Figure 6). However, given the small size of the planthoppers, a powerful hand lens or microscope is required to distinguish between these slight differences in anatomy. Experts can also distinguish between the species by extracting and comparing differences in the morphology of the male genitalia (Asche and Wilson 1989). However, given that there is only one known species currently present in the continental United States, an aggregation of brown and white planthoppers on taro in Florida could be suspected with reasonable certainty to be *Tarophagus colocasiae*.

Hosts

Tarophagus colocasiae is a major pest of plants in the genus *Colocasia* (Halbert and Bartlett 2015). *Colocasia esculenta*, or taro, is grown for its edible, starchy tuber in many parts of the world. In the United States, plants from the family Araceae in the genera *Colocasia*, *Alocasia*, and *Xanthosoma* are commonly sold as landscape ornamentals, colloquially known as “elephant ears.” Given that caged nymphs were also reported to survive for twenty-four hours on *Caladium bicolor* (Aiton) Vent., and *Xanthosoma* sp., among several other plant species, these plants may also be considered potential hosts in Florida (Duatin and de Pedro 1986).

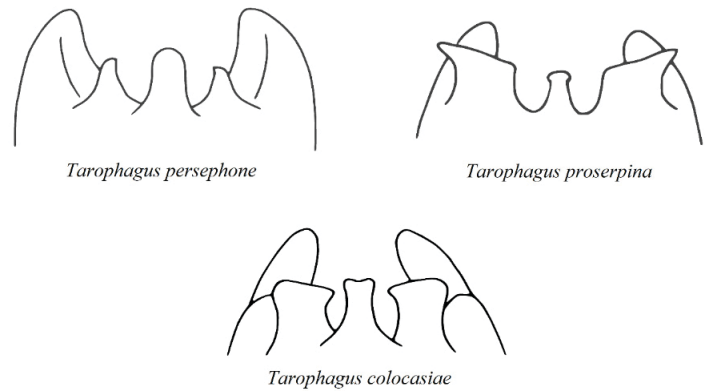


Figure 6. Generalized views of male pygofer opening ornamentation in the genus *Tarophagus*.

Credits: Adapted from Asche and Wilson (1989)

Economic Importance

The economic impacts of *Tarophagus colocasiae* in Florida are currently unknown. Impacts would largely result from cosmetic damage, loss of nursery plants due to the unsightly and injurious results of feeding and oviposition, or regulatory quarantines imposed to prevent the spread of this insect. Wirth et al. (2004) estimated that annual Florida nursery sales of *Colocasia esculenta* were worth \$868,000, accounting for .05% of total industry sales. While not commonly grown commercially for food in the continental United States, taro is a valued food plant in Hawaii, where it contributed \$2.32 million to the economy in 2005 (Cozad et al. 2018). If *Tarophagus colocasiae* does infest and damage caladiums, it could be quite problematic for Florida nursery owners, who grow more than 95% of the caladium tubers used in the United States, Canada, Europe, and Asia (Deng 2012). *Tarophagus* planthoppers have also been implicated in the spread of *Colocasia* bobone disease virus, although that disease has only been reported at present from the Solomon Islands and Papua New Guinea (Yusop et al. 2019). Visible bobone disease symptoms on taro include stunting, thickened leaves, irregularly shaped galls on petioles, and necrosis, although infected plants generally recover (Revill et al. 2015).

Management

For delphacid planthoppers generally, invertebrate predators are the most important natural enemies: with wolf spiders (Lycosidae) attacking adults and nymphs, and mirid bugs (Miridae) feeding on eggs embedded within plant tissues (Denno and Peterson 2000). The predatory mirid bug, *Cyrtorhinus fulvus* Knight, has been used for biological control of *Tarophagus* species with variable success (Asche and Wilson 1989, Halbert and Bartlett 2015). Parasitoid wasps also attack delphacid eggs and nymphs but are generally considered less effective at controlling populations

than predators (Denno and Peterson 2000). Successful management of the planthopper in a nursery setting would rely on integrated use of both insecticide applications and the considered maintenance of natural enemy populations. Some wolf spider species are commercially available as an augmentative biological control option.

Interestingly, *Tarophagus colocasiae* itself has been proposed as a biological control agent for ornamental *Colocasia esculenta*, which can be an invasive aquatic weed in the United States (Cozad et al. 2018) (Figure 7). While no formal biocontrol program of this plant is ongoing in the United States, the natural spread of *Tarophagus colocasiae* across Florida may have a deleterious effect on established invasive taro populations.



Figure 7. Wild taro (*Colocasia esculenta*) growing by a boat ramp in Lake Alfred, Florida.

Credits: Alexander Tasi, UF/IFAS

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