HISTORY AND ECOLOGY IN NORTH AMERICA

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Lilioceris cheni
Air potato leaf beetle

Lilioceris cheni is a biological control agent approved in the USA for release against air potato.

CLASSIFICATION

RANKING	SCIENTIFIC NAME	COMMON NAME
Kingdom	Animalia	Animals
Phylum	Arthropoda	Arthropods
Class	Insecta	Insects
Order	Coleoptera	Beetles
Family	Chrysomelidae	Leaf beetles
Genus	*Lilioceris*	
Species	*Lilioceris cheni* Gressitt & Kimoto	Air potato leaf beetle

DESCRIPTION

Two genotypes have been released: Chinese and Nepalese. Eggs are pale yellow, cylindrical, and up to 1 mm long (**Fig. 1a**). Early instar larvae of the Chinese genotype are reddish (**Fig. 1b**) while those of the Nepalese genotype are more yellowish (**Fig. 1c**); both become gray in later instars (**Fig. 1d**). Late instars are up to 7 mm long and have a black head capsule. Larvae are frequently coated in a sticky secretion to which fecal matter adheres, and mature larvae often have a noticeable hump where the abdomen begins. Pupae are pale orange, up to 7 mm long, and enclosed in a foam-like matrix covered with soil and other particles (**Fig. 1e**). Adults are up to 9 mm long with bulging eyes and black heads, legs, abdomens, and antennae. The elytra of the Chinese genotype are typically red (**Fig. 1f**), while the Nepalese genotype elytra are a rusty orange (**Fig. 1g**).

LIFE CYCLE

Overwintering adults emerge in spring, feed on air potato foliage, and lay eggs (750–1900+ during their lifetime) in

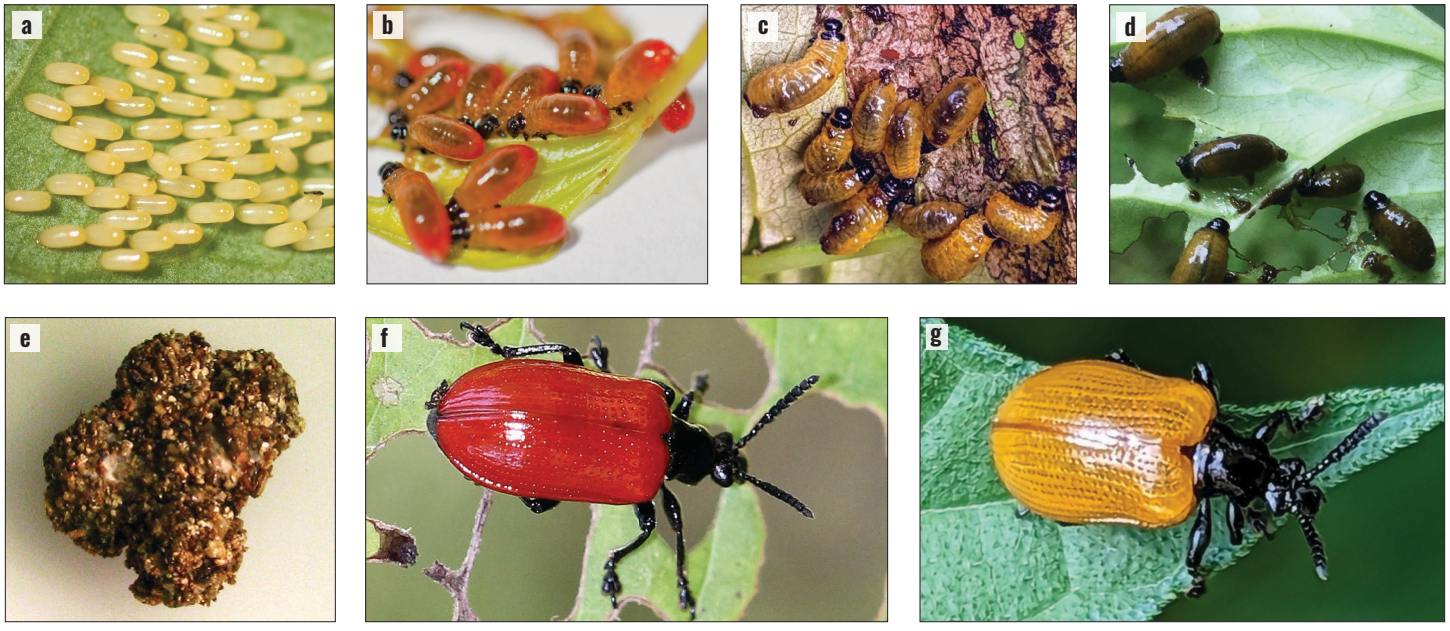

Figure 1. *Lilioceris cheni* (a) eggs on leaf; (b) early instar larvae (Chinese genotype); (c) early instar larvae (Nepalese genotype); (d) late instar larvae; (e) pupal foam-like matrix covered with soil and other particles; (f) adult (Chinese genotype); (g) adult (Nepalese genotype) (a,b,f: Melissa C. Smith, USDA ARS Invasive Plant Research Laboratory; c: Irvin Louque, iNaturalist.org CC BY-NC-ND 4.0; d: Carrie Seltzer, iNaturalist.org CC BY-NC 4.0; e: William A. Overholt, University of Florida; g: Thomas Herman, iNaturalist.org CC BY-NC 4.0)

loose clusters on the undersides of expanding air potato leaves (**Fig. 1a**). Adults chew through the veins of a young leaf prior to ovipositing, causing leaf edges to cup or curl inwards (**Fig. 2a**). Through four instars, larvae feed on air potato leaves, skeletonizing leaves from the undersides (**Fig. 2b**); they also feed on vine growing tips and occasionally newly forming bulbils. At maturity, larvae enter the soil and orally secrete a foam-like substance in which to pupate. The foam-like substance becomes covered with soil and other particles and hardens (**Fig. 1e**). Many pupae are often found in the same foam matrix. Emerging adults feed on air potato foliage (**Fig. 2c**), and occasionally newly forming bulbils (**Fig. 2d**), before overwintering in soil and plant litter. Adults can live longer than one year, and there are multiple overlapping generations per year.

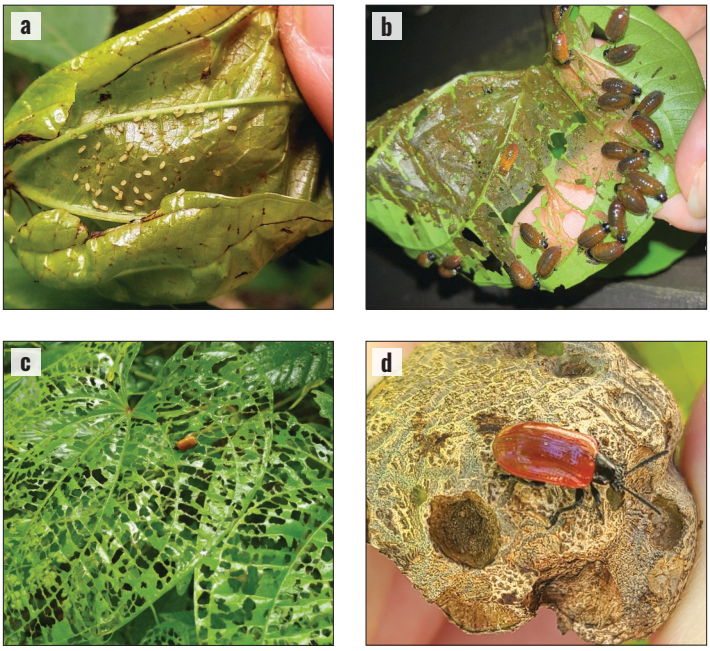

Figure 3. *Lilioceris cheni* (a) oviposition damage results in leaf cupping; (b) larvae and (c) adults both feed on air potato leaves, leading to skeletonization; larvae and (d) adults also occasionally feed on newly forming bulbils (a: Irvin Louque, iNaturalist.org CC BY-NC-ND; b: Jade Fortnash, iNaturalist.org CC0; c: Charity Littleknees Schaffer, iNaturalist.org CC BY-NC 4.0; d: Sandrae34242 iNaturalist.org CC BY-NC 4.0)

DAMAGE

Adult and larval feeding reduces photosynthetic capacity, stunts vine growth and biomass, and reduces bulbil production.

FIELD IDENTIFICATION

Red or orange adult *Lilioceris cheni* (**Fig. 1f,g**) may be observed on air potato leaves and stems throughout the growing season. Egg clusters can be readily observed on the undersides of air potato leaves that curl inward due to damage caused by ovipositing adults (**Fig. 2a**). Red, yellow, or gray larvae (**Fig. 1b–c**) can be observed feeding on air potato leaves throughout the growing season. In the absence of larvae and adults, heavily skeletonized leaves (**Fig. 2b**) can be indicative of *L. cheni* presence at the site. Heavy feeding also often induces a plant volatile response that can be identified by a floral-like smell.

Lilioceris egena is an additional biocontrol agent released against air potato in the USA. Larval and adult *L. egena* (**Fig. 4c,d**) are virtually indistinguishable from *L. cheni* in the field. The two species can be differentiated based on male genitalia or by non-experts based on behavioral differences; *L. cheni* can be observed feeding and ovipositing on air potato leaves and stems while *L. egena* primarily feeds and oviposits on bulbils.

PREFERRED HABITAT

Populations of the Chinese genotype do not do as well at very cold and hot sites compared to the Nepalese genotype, though extreme winter temperatures reduce overwintering survival of both genotypes. Both genotypes are also sensitive to insecticides used in mosquito abatement programs. Low-lying areas subject to regular flooding or storm surge may reduce beetle survival because pupation occurs in the soil.

HISTORY AND CURRENT STATUS

Lilioceris cheni is native to Asia. The Chinese genotype was released in Florida, USA beginning in 2011. It was subsequently released in Georgia beginning in 2015 and Texas beginning in 2017. The Nepalese genotype was collected from higher altitude and latitude sites in order to complement the effects of the Chinese genotype. The Nepalese genotype was first released in Florida, Georgia, and Louisiana in 2016 and in Alabama, Texas, and Mississippi in subsequent years.

As of 2024, *L. cheni* has reportedly established in all six states where it has been released as well as South Carolina (**Fig. 3**).

Figure 3. *Lilioceris cheni* reported distribution in North America (Manrique et al. 2023; iNaturalist.org, 21 December 2024)

Following a very large mass-rearing and distribution program, *L. cheni* is now well-established and very effective throughout Florida. It significantly reduces vine density, length, and cover, corresponding to a reduction in bulbil production at some sites. Increased beetle attack is also correlated with reduced bulbil production in Georgia, Louisiana, and Mississippi. However, while this species reduces the severity of air potato infestations in some agricultural and natural ecosystems, vegetative propagation via bulbils continues, especially in South Florida. Beetle populations are also limited at very cold sites in the Southeast as well as at hot sites in Florida. Populations of both genotypes are limited in areas with active mosquito abatement programs.

NONTARGET EFFECTS

None reported.

Lilioceris egena
Air potato bulbil beetle

Lilioceris egena is a biological control agent approved in the USA for release against air potato.

CLASSIFICATION

RANKING	SCIENTIFIC NAME	COMMON NAME
Kingdom	Animalia	Animals
Phylum	Arthropoda	Arthropods
Class	Insecta	Insects
Order	Coleoptera	Beetles
Family	Chrysomelidae	Leaf beetles
Genus	*Lilioceris*	
Species	*Lilioceris egena* (Weise)	Air potato bulbil beetle

DESCRIPTION

Eggs are cylindrical, up to 1 mm long, and pale yellow at first (**Fig. 4a left**), darkening to a greenish-gray as the larvae inside develop (**Fig. 4a right**). Early larval instars are translucent white while later instars are grayish-red (**Fig. 4b**). Late instars are up to 7 mm long and have a black head capsule. Pupae are peach-colored and are often enclosed in a foam-like matrix covered with soil and other particles. Adults are up to 10 mm long with bulging eyes and black heads, legs, abdomens, and antennae (**Fig. 4c**). The elytra are brownish-orange to bright red (**Fig. 4c,d**).

LIFE CYCLE

Adults feed on air potato bulbils (**Fig. 5a**) and lay eggs (900+ during their lifetime) on the surface of or within fallen bulbils. Very rarely, females may oviposit on air potato leaves. Through four instars, larvae feed primarily within air potato bulbils (**Fig. 5b**), though some early instars may feed on the undersides of young air potato leaves (**Fig. 5c**). Newly hatched larvae are unable to penetrate bulbils on their own and must rely on adult feeding holes; however, later instars can pierce bulbil skin. Several larvae can be found feeding in a single bulbil (**Fig. 5b**). At maturity, larvae enter the soil and orally secrete a foam-like substance in which to pupate. The

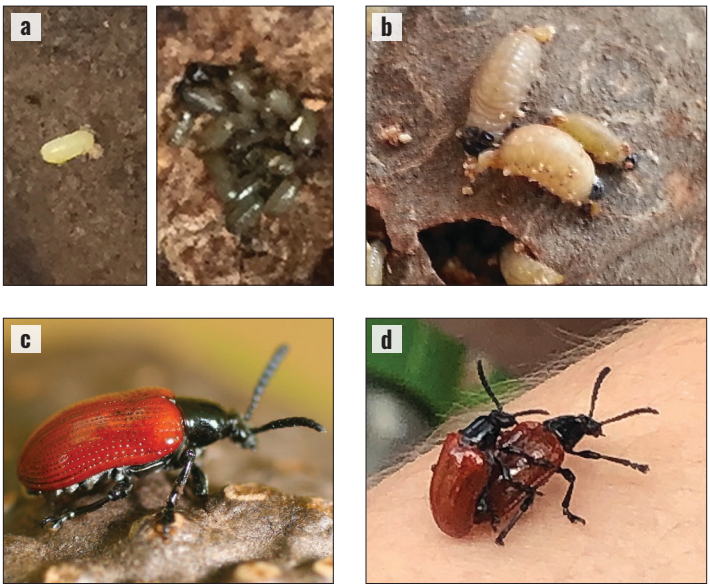

Figure 4. *Lilioceris egena* (a) eggs (young egg left, older eggs right); (b) larvae; (c,d) adults (a–c: F. Allen Dray Jr., USDA-ARS Invasive Plant Research Lab; d: Natimnatalie, iNaturalist.org CC BY-NC 4.0)

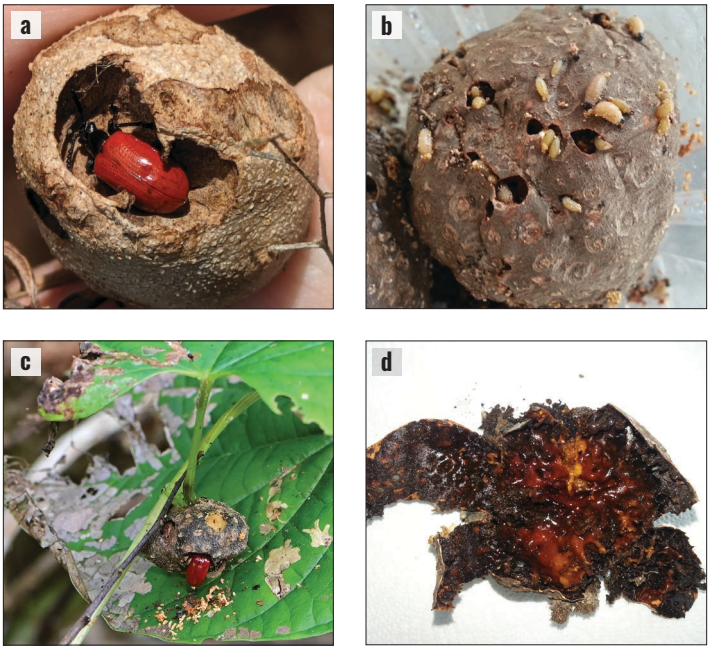

Figure 5. *Lilioceris egena* (a) adult and (b) larvae feeding in an air potato bulbil; (c) feeding damage to a bulbil and air potato leaves; (d) damage to an air potato bulbil (a: Logan Crees, iNaturalist.org CC BY-NC 4.0; b,d: F. Allen Dray Jr., USDA-ARS Invasive Plant Research Lab; c: Kinmatsu Lin iNaturalist.org CC BY-NC 4.0)

foam-like substance becomes covered with soil and other particles and hardens. Two to eight individuals are often found in the same foam matrix which may be found attached to a bulbil or be free in the soil. Emerging adults feed on fallen air potato bulbils over the short Florida winters. Adults live four months on average, and there are multiple overlapping generations per year.

DAMAGE

Adult and larval feeding (**Fig. 5**) prevents bulbils from sprouting, reducing air potato's ability to reproduce and spread.

FIELD IDENTIFICATION

Lilioceris egena adults (**Fig. 4c,d, 5a,b**) and larvae (**Fig. 4b,5b**) may be observed feeding on air potato bulbils throughout the growing season. Egg clusters (**Fig. 4a**) can be readily observed on the undersides of air potato bulbils. In the absence of larvae and adults, bulbils with extensive feeding holes can be indicative of *L. egena* presence at the site.

Larval (**Fig. 4b**) and adult (**Fig. 4c,d**) *L. egena* are virtually indistinguishable from those of *L. cheni* (**Fig. 1f,g**), another biocontrol agent released against air potato in the USA. The two species can be differentiated based on male genitalia or by non-experts based on behavioral differences; *L. egena* primarily feeds and oviposits on bulbils while *L. cheni* can be observed feeding and ovipositing on air potato leaves and stems.

PREFERRED HABITAT

It is too early following release to determine the preferred habitat of *L. egena*; however, its establishment throughout Florida indicates it is well adapted to a range of climate and habitat conditions.

HISTORY AND CURRENT STATUS

Lilioceris egena is native to Southeast Asia. Beetles originally sourced from China were released in Florida, USA beginning in 2021. This species has only recently been confirmed as established in Florida (**Fig. 6**), so it is too early to determine its final distribution and impact.

NONTARGET EFFECTS

None reported.

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Figure 6. *Lilioceris egena* reported distribution in North America

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SUGGESTED CITATION

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