Lissachatina fulica

Scientific Name
Lissachatina fulica (Bowdich)

Synonyms:
Achatina fulica (Bowdich)

Common Names
Giant African snail, giant east African snail, escargot Géant, Achatine, Caramujo

Figure 1. Giant African snail (Image courtesy of Yuri Yashin, achatina.ru, Bugwood.org)

Type of Pest
Mollusk

Taxonomic Position
Class: Gastropoda, **Order**: Pulmonata, **Family**: Achatinidae

Reason for Inclusion
CAPS Target: AHP Prioritized Pest List for FY 2011

Pest Description
From Bequaert (1950):

"When full-grown, the shell of *L. fulica* consists of from 7 to 9 (very exceptionally 10) whorls, with a moderately swollen body-whorl and a sharply conical spire, which is distinctly narrowed but scarcely drawn out at the apex. The outline varies greatly, even in the same colony, from very slender to moderately obese, the broader specimens tending to be shorter for the same number of whorls. All whorls are decidedly convex, due to the broadly impressed sutures. The aperture is relatively short, even in the broadest specimens, being always shorter than the spire, often considerably so. The outer lip is usually sharp and thin, rarely somewhat thickened or even slightly expanded in very old specimens; it is very convex, evenly curved into a regular semi-ellipse, and inserted on the body-whorl at a sharp, open angle, the upper part of the body-whorl being scarcely or not flattened behind the lip. The columella is more or less concave, sometimes rather weakly so, in which case may be slightly or even much twisted; it tends to be more concave in the broader shells. It should be noted that in *L. fulica* all stages, from the nepionic shell on, have the umbilical slit completely closed and the columella truncate. In all specimens seen, which on general shape and sculpture were referable to *L. fulica*, both columella and parietal callus are white or bluish-white., without any trace of pink."

The newly hatched, nepionic shell is 5 to 5.5 mm. long and about 4.5 mm wide, of 2½ nearly smooth whorls, without any granulation or decussation and with only the weakest traces of vertical wrinkles. The first half post-nepionic whorl is more distinctly wrinkled vertically, but not yet decussate; after this the vertical growth striae become gradually stronger and are now cut by spiral engraved lines, into elongate, vertical welts; at first weak, the decussation gains in strength on the fourth and fifth whorls, where it is visible to the naked eye, after which it decreases again, being superficial on the sixth and usually lacking on the seventh and succeeding whorls. In young shells, the periostracum of the early post-nepionic whorls shows in addition to the decussation a superficial, microscopic criss-cross texture, as if a finely woven cloth had been pressed onto the surface; but no trace of this remains on older shells. In the largest full-grown adult shells, of 7 to 9 whorls, the body whorl is nearly even, the growth-striae being very low or superficial, except below the suture where they form short, strong folds, very lightly crenulating the irregular sutural line. When the periostracum is fresh and intact, the terminal whorls appear not only smooth, but also glossy…. When present in the adult, the darker markings appear almost at once on the first post-nepionic whorl as faint, vertical, straight, pale-brown streaks; in very young shells, these streaks stop at the periphery, forming there slightly deflected spots.

The egg is broadly ellipsoidal, 5 to 5.5 mm by 4 to 4.5 mm… white or slightly yellowish, with a very thin and brittle calcareous shell."

An identification guide for *L. fulica* can be found in USDA-APHIS (2007).

Biology and Ecology:
L. fulica is a nocturnal species; during the day, snails rest in areas that provide protection against light and desiccation (Raut and Barker, 2002).

L. fulica is a hermaphroditic snail but is required to mate to reproduce. Egg laying can begin around six months of age with snails remaining fecund for approximately 400 days (Smith and Fowler, 2003). Hatchlings of *L. fulica* will remain beneath the soil surface for a few to several days while consuming their eggshells and organic matter within the soil (Raut and Barker, 2002).

After emergence from the soil, immature larvae begin to feed voraciously; snails ranging from 5-30 mm prefer living vegetation while smaller and older snails prefer decaying vegetation and detritus (Smith and Fowler, 2003). Gradually, the smaller snails will disperse from their hatching site and establish home sites. Each day, the snails forage throughout the night and return to their home sites before dawn (Raut and Barker, 2002).

The reproductive potential for *L. fulica* is high. In the first year, individuals can lay up to 100 eggs. Fecundity is highest in the second year, with individuals laying up to 500 eggs. Fecundity declines in later years, but snails may live for

up to five years producing up to 1,000 eggs in their lifetime. The egg stage can last from 1 to 17 days (Raut and Barker, 2002).

Although *L. fulica* is considered a tropical species, it can remain active in temperatures ranging from 9-29°C (48.2-84.2°F). *L. fulica* can hibernate to survive temperatures of 2°C (35.6°F) and aestivate in temperatures of 30°C (86°F) (Smith and Fowler, 2003). Aestivation is when an animal becomes dormant during hot and dry weather conditions. *L. fulica* can remain in this state for several months (Smith and Fowler, 2003).

Humidity is an important indicator of activity with continuous activity being mainly limited to areas with 80% relative humidity (Smith and Fowler, 2003). Snails will begin to aestivate when the weather becomes dry; this may be cued by the air humidity (Raut and Barker, 2002). Aestivation occurs in moist soil but can occur at sites above-ground (Raut and Barker, 2002).

Symptoms/Signs

L. fulica prefers to feed on plants in the seedling or nursery stage. Damage by *L. fulica* to the seedling stage can be so severe that farmers change crop species grown. In more mature plants, the type of damage can vary depending on the plant species. Symptoms can range from defoliation to damage of stems, fruits or flowers (Raut and Barker, 2002).

Figure 2. Damage to Leaves of *Dieffenbachia* spp. Caused by *Achatina fulica* (Image courtesy of Department of Plant Industry, Florida)

Visual signs of *L. fulica* include rasping damage, defoliation, slime trails and/or ribbonlike excrement, Fig. 2 (USDA-APHIS, 1982).

Pest Importance

L. fulica is considered a significant pest of agricultural crops as well as a vector of a number of human, plant, and animal pathogens. If introduced into the United States, this species may have a high economic impact because of crop damage and the costs of control and survey measures (Venette and Larson, 2004). Efforts by the United States to eradicate *L. fulica* from Florida in the late 1960s into the 1970s cost an estimated $700,000 (Smith and Fowler, 2003). Raut and Barker (2002) also state that “opportunity losses associated with enforced changes in agricultural practice, such as limiting the crop species to be grown in a region to those resistant to *L. fulica*” may occur.

Other negative consequences because of *L. fulica* establishment could include damage to native plants, alterations to nutrient cycling in the environment, adverse effects to native gastropods (through competition or control measures applied), and effects on human health (Raut and Barker, 2002).

Known Hosts

This species is polyphagous. The following host list is from USDA-APHIS (2007).

Primary Hosts	**Common Names**
Albizia lebbeck	Woman's tongue
Albizia spp.	Albizia
Alsophila spp.	Alsophila
Alstonia scholaris	Devil tree of India
Amaranthus blitum	Purple amaranth
Amaranthus gangeticus	Molten fire
Amaranthus tricolor	Chinese amaranth
Amaranthus viridis	Green amaranth
Amaranthus spp.	Amaranth
Annona muricata	Soursop
Arachis hypogaea	Peanut
Artocarpus altilis	Breadfruit
Artocarpus heterophyllus	Jackfruit
Artocarpus spp.	Breadfruit
Asplenium nidus	Bird's nest fern
Averrhoa bilimbi	Blimb
Basella alba	Ceylon spinach
Basella rubra	Malabar spinach
Blechum brownei	Browne's blechum
Boerhavia diffusa	Boerhavia
Bougainvillea speciabilis	Bougainvillea
Bougainvillea spp.	Bougainvillea
Brassica oleracea	Kohlrabi
Brassica oleracea var. acephala	Cabbage
Brassica oleracea var. botrytis	Cauliflower
Brassica oleracea var capitata	Cabbage
Brassica oleracea var. italica	Sprouting broccoli
Brassica spp.	Cabbage
Bryophyllum pinnatum	Air plant
Cajanus cajan	Pigeonpea
Calophyllum inophyllum	Indian laurel
Canavalia gladiata	Sword jackbean
Canna edulis	Arrowroot
Canna indica	Canna
Canna spp.	Canna
Carica papaya	Papaya
Cassia (=Chamaecrista) mimosoides	Chamaecrista

Primary Hosts	**Common Names**
Cassia occidentalis	Septic weed
Centrosema pubescens	Flor de conchitas
Cestrum nocturnum	Night Queen
Cichorium endivia	Endive
Cichorium intybus	Chicory
Chrysanthemum spp.	Chrysanthemum
Cinnamomum tamala	Indian bay leaf
Citrullus vulgaris (=lanatus)	Watermelon
Citrus limon	Lemon
Citrus reticulata	Tangerine
Citrus sinensis	Sweet Orange
Citrus spp.	Citrus
Clitoria ternatea	Butterfly pea
Colubrina asiatica	Asian nakedwood
Corchorus capsularis	Jute
Corchorus spp.	Corchorus
Cosmos spp.	Cosmos
Crinum spp.	Crinum lily
Crotalaria anagyroides	Crotalaria
Crotalaria pallida var. obovata	Smooth rattlebox
Cucumis melo	Cantaloupe
Cucumis sativus	Cucumber
Cucumis spp.	Melon
Cucurbita maxima	Winter squash
Cucurbita pepo	Field pumpkin
Cucurbita spp.	Gourds
Cyathea lunulata	Tree fern
Daucus carota	Carrot
Dioscorea alata	Greater Yam
Dioscorea bulbifera	Air Yam
Dioscorea spp.	Yam
Dolichos spp.	Beans
Epipremnum aureum	Golden pothos
Erythrina lithosperma (=subumbrans)	Erythrina
Erythrina spp.	Erythrina
Falcataria moluccana	Peacocks plume
Ficus hispida	Fig
Fragaria x ananassa	Strawberry
Gazania rigens	Treasure-flower
Glycine max	Soybean
Glycine spp.	Beans
Gossypium herbaceum	Cotton
Gossypium spp.	Cotton
Grewia mariannensis	
Gynandropis speciosa	The queen’s plume
Hevea brasiliensis	Rubber
Hibiscus esculentus	Okra

Primary Hosts	**Common Names**
Hibiscus mutabilis	Dixie rosemallow Land-lily
Hibiscus rosa-sinensis	China rose
Hibiscus spp.	Hibiscus
Hemigraphis colorata	Broad leaf flame ivy
Impatiens balsamina	Balsam
Indigofera suffruticosa	Anil de pasto
Ipomoea alba	Tropical white morning-glory
Ipomoea pes-caprae	Beach morning glory
Pachystachys coccinea	Cardinal's guard
Lablab purpureus	Lablab Bean
Lactuca indica	Lettuce
Lactuca sativa	Lettuce
Lactuca spp.	Lettuce
Lagenaria leucantha	Haired gourd
Lageneria siceraria	Bottle Gourd
Lagenaria vulgaris	Gourd
Lagenaria spp.	Gourds
Laportea crenulata	Tree nettle
Leucaena leucocephala	White leadtree
Catharanthus) *rosea*	Madagascar periwinkle
Luffa aegyptiaca	Dishcloth gourd
Luffa acutangula	Angled luffa
Luffa cylindrica	Smooth luffa
Luffa spp.	Vegetable sponge
Manihot esculenta	Cassava
Melanolepis multiglandulosa	Alom
Mimosa invisa (=diplotricha)	Giant false sensitive plant
Morinda citrifolia	Indian mulberry
Momordica charantia	Balsam apple
Momordica cochinchinensis	
Momordica spp.	Momordica
Musa acuminata x balbisiana	French plantain
Musa paradisiaca	Plantain
Musa sapientum	Banana
Musa spp.	Bananas
Pachyrhizus erosus	Yam bean
Parkia spp.	Parkia
Passiflora foetida	Fetid passionflower
Passiflora spp.	Passion flower
Pauinia cupana	Guarana
Vigna radiata	Bean
Phaseolus vulgaris	Kidney bean
Physalis peruviana	Peruvian groundcherry
Piper nigrum	Pepper
Pipturus albidus	Waimea pipturus
Pipturus argenteus	Native mulberry
Portulaca grandiflora	Purslane
Portulaca oleracea	Little hogweed

Primary Hosts	**Common Names**
Portulaca spp.	Nine-O'Clock
Prunus persica	Peach
Pueraria montana var. lobata	Kudzu
Raphanus sativus	Radish
Ricinus communis	Castor
Sanchezia nobilis	Sanchezia
Scaevola sirecea	Naupaka
Sesamum indicum	Sesame
Spilanthes acmella	Paracress
Spinacea oleracea	Garden spinach
Tabernaemontana divaricata	Pinwheel flower
Tagetes erecta	African marigold
Tagetes patula	Indian marigold
Tagetes spp.	Marigolds
Tectaria spp.	Halberd fern
Tectona grandis	Teakwood
Tephrosia candida	White hoarypea
Tephrosia vogelii	Vogel's tephrosia
Theobroma cacao	Cacao
Thespesia populnea	Portia tree
Trichosanthes dioica	Pointed gourd
Triticum aestivum	Wheat
Vigna radiata	Mung bean
Vigna sinensis unguiculata	Blackeyed pea
Vitis vinifera	Grape
Vigna marina	Notched cowpea
Xanthosoma maffafa	Golden delicious

Secondary Hosts	**Common Name**
Abelmoschus esculentus	Okra
Allangana lamarcana	Ballabhi-anga
Allium cepa	Onion
Alocasia indica	Arum
Alocasia macrorrhizos	Giant taro
Aloe indica	Aloe
Amorphophallus campanulatus (=paeoniifolius)	Elephant-Foot Yam
Antigonum lepiotus	Antigonon
Alocasia spp.	Elephant ear
Arctium lappa	Greater burrdock
Areca catechu	Betel nut palm
Averrhoa carambola	Carambola
Bauhinia accuminata	White dwarf orchard tree
Beta vulgaris	Common beet
Bikkia mariannensis	
Boehmeria nivea	Chinese grass
Brassica campestris	Field mustard
Broussonetia papyrifera	Paper mulberry

Secondary Hosts	Common Name
Callicarpa cana	
Camellia sinensis	Tea
Capparis cordifolia	Maiapilo
Capsicum annuum	Cayenne pepper
Capsicum baccatum	Locoto
Capsicum spp.	Chili peppers
Senna sophera	Kasuandi
Catharanthus roseus	Periwinkle
Cerbera manghas	Madagascar ordeal bean
Cereus hildmannianus	Hedge cactus
Cereus spp.	Cactus
Cleome gyandra	Spiderwisp
Clerodendron inerme	Glory bower
Coccinia cordifolia	Coccinea
Cocos nucifera	Coconut
Coffea arabica	Arabian coffee
Coffea canephora	Robusta coffee
Coffea spp.	Coffee
Colocasia antiguorum	Arum
Colocasia esculenta	Dasheen or taro
Dalbergia sissoo	Indian rosewood
Dhalia spp.	Dhalias
Dieffenbachia seguine	Dumbcane
Dracaena spp.	Dracaena
Edgaria darjeelingensis	Squash
Elaeis guineensis	Oil palm
Epipremnum pinnatum	Pothos
Eranthemum spp.	Eranthemum
Eucalyptus deglupta	Indonesian gum
Eucalyptus spp.	Australian gum
Eugenia spp.	Star apple
Euphorbia pulcherrima	Poinsettia
Euphorbia trigona	Sandmat
Ficus tinctoria	Fig
Galinsoga parviflora	Gallant-soldier
Gardenia augusta	Gardenia
Gliricidia sepium	Madre de Cacao
Commelina benghalensis	Tropical day flower
Gomphrena globosa	Globe amaranth
Helianthus annuus	Sunflower
Hernandea ovigera	
Ipomoea batatas	Sweet potato
Jasminum sambac	Jasmine
Kakanchoe pinnatum	Kalanchoe
Lycopersicon esculentum	Tomato
Mentha repens	Hortela
Monstera deliciosa	Split leaf philodendron
Montanoa hibiscifolia	Tree daisy

Secondary Hosts	Common Name
Moringa oleifera	Horseradish tree
Morus alba	White mulberry
Muntingia calabura	Strawberry tree
Nerium spp.	Oleander
Nicotiana spp.	Tobacco
Ochrosia mariannensis	Lipstick tree
Ochrosia oppositifolia	Bwa sousouri
Operculina turpethum	St. Thomas lidpod
Opuntia spp.	Cholla cactus
Pandanus spp.	Screwpine
Pemphis acidula	Small-leafed mangrove
Phalaenopsis spp.	Moth orchids
Pisum sativum	Garden pea
Pisum spp.	Pea
Pluchea indica	Pluchea
Pisidium guaja	Guava
Psychotria mariana	
Tradescentia spathacea	Moses in the cradle
Rosa spp.	Roses
Ruta graveolens	Common rue
Saccharum officinarum	Sugarcane
Salvia spp.	Sage
Sanseveria trifasciata	Snake Plant
Sechium edule	Chayote
Semibarbula orientalis	Moss
Sinapis arvensis	Charlock mustard
Solanum melongena	Eggplant
Solanum tuberosum	Potato
Swietenia mahogoni	Mahogany
Symphytum officinale	Common comfrey
Synedrella nodiflora	Synadrelia
Thea sinensis	Tea
Tradascantia spathacea	Moses in the boat or oysterplant
Trema orientale	Oriental trema
Trichosanthes anguina	Snake gourd
Tridax argentea	Tridex
Vanda spp.	Vanda orchid
Vanilla spp.	Vanilla
Vernonia scandens	Vernonia
Xanthosoma brasiliense	Cakakib
Zea mays	Corn
Zinnia linearis	Zinnia

Pathogens Vectored

Human Pathogens
L. fulica vectors the nematode *Angiostrongylus cantonensis* which can cause eosinophilic meningoencephalitis in humans as well as *A. costaricensis* which causes abdominal angiostrongylosis (Thiengo et al., 2010).

Plant Pathogens
L. fulica has been implicated in transmitting *Phytophthora palmivora*, *P. colocasia*, and *P. parasitica*; however, the relative importance of *L. fulica* as a transmission agent has not been well established (Raut and Barker, 2002).

Known Distribution

Andaman Islands, Annobon, Antigua, Bangladesh, Barbados, Bhutan, Bismarck Archipelago, Bonin Islands, Brazil, Brunei, Burma, Cambodia, Caroline Island, Ceylon, China, Christmas Island (Indian Ocean), Comoros, Cook Islands, Cote d'Ivoire, Ethiopia, Federated States of Micronesia, French Polynesia, Ghana, Guadeloupe, Hawaii, Hong Kong, India, Indonesia, Ivory Coast, Japan, Kenya, Laos, Madagascar, Malaya, Malaysia, Maldives, Mariana Islands, Marshall Islands, Martinique, Mauritius, Micronesia (Federated States), Morocco, Mozambique, Nepal, New Caledonia, Nicobar Islands, Nigeria, Palau, Papua New Guinea, Philippines, Reunion, Saint Lucia, Samoa, Seychelles, Singapore, Society Islands, Solomon Islands, Somalia, South Africa, Sri Lanka, Taiwan, Tanzania, Thailand, Togo, Tokelau, Tonga, Trinidad and Tobago, Vanuatu, Venezuela, Viet Nam, Virgin Islands of the United States, Wake Island, Wallis and Futuna, (Robinson, 2002; Prasad et al., 2004; Venette and Larson, 2004; NAPPO, 2008)

Potential Distribution within the United States

Lissachatina fulica has been found and subsequently eradicated several times in the United States. This pest was found in the gardens of San Pedro, California in the late 1940s (Abbott, 1949), in Arizona in 1958 (Mead, 1959a) and in Florida in the late 1960s (USDA-APHIS, 2007). In 2004, it was discovered that *L. fulica* was being imported by the pet trade and educational institutions; over 6,700 snails were confiscated from nine states and Puerto Rico to prevent establishment (USDA-APHIS, 2007).

If *L. fulica* were to establish, it would most likely survive in the lower southeastern portion of the United States. Based on host availability and climate, states at increased risk include Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Texas. Portions of California and Arizona also have an increased risk.

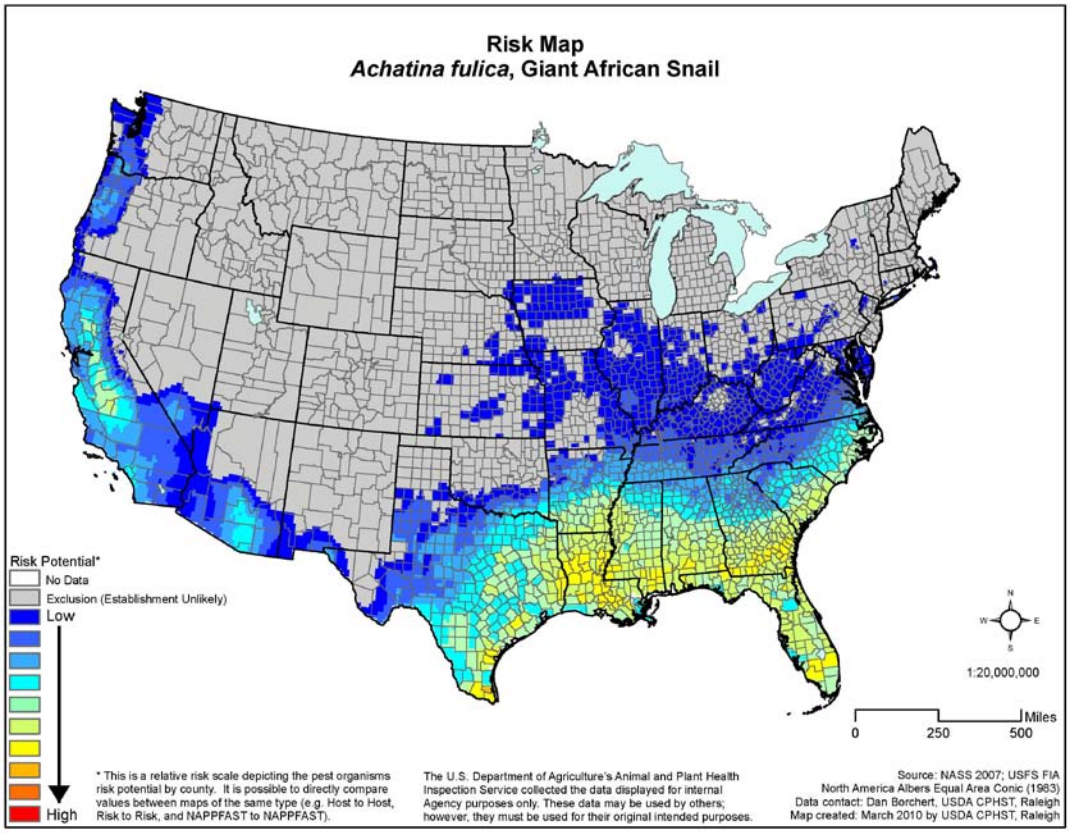

Figure 2. Risk map for *Lissachatina fulica* within the continental United States. Values from low to high indicate increased risk based on host availability and climate. Map courtesy of USDA-APHIS-PPQ-CPHST. Check www.nappfast.org for the most recent map updates.

Survey

CAPS-Approved Method*:

Visual. Specifics on survey information for *L. fulica* can be found in the New Pest Response Guidelines for Giant African Snails (USDA-APHIS, 2007).

Literature-Based Methods:

Visual inspection is considered the best method when surveying for *L. fulica*. Surveys should be carried out during episodes of rain (USDA-APHIS, 2007), after dark in moist, sheltered areas (USDA-APHIS, 1982). Visual signs of *L. fulica* include rasping damage, defoliation, slime trails and/or ribbonlike excrement (USDA-APHIS, 1982).

Traps can be used to survey for *L. fulica*, but they should be used as a supplement to the visual inspections (USDA-APHIS, 2007). Slug baits can be used to attract *L. fulica* but other means should be used to trap the snails due to the slow-acting effects of the molluscicides (USDA-APHIS, 2007). Man-made refuges can also be used when surveying for *L. fulica* as well as placing calcium carbonate, compost piles or plant debris in areas where surveyors can regularly monitor them (USDA-APHIS, 2007).

Identification

CAPS-Approved Method*:

Morphological. Identification should be verified by a malacologist at the National Identification Services (NIS).

Literature-Based Methods:

A key identification feature in *L. fulica* is the columella which ends abruptly; this feature is constant throughout the lifespan of the snail (USDA-APHIS, 2004).

*For the most up-to-date methods for survey and identification, see Approved Methods on the CAPS Resource and Collaboration Site, at http://caps.ceris.purdue.edu/.

Easily Confused Pests

This pest may be confused with *Euglandina rosea* or *Orthalicus* spp. both of which are present in the United States. This pest may also be confused with pests not currently present in the United States including *Achatina achatina*, *Archachatina marginata* and *Limicolaria aurora*.

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