

Belocaulus spp.*

*In April 2013, the family Veronicellidae, a target on the 2013 and 2014 AHP Prioritized Pest Lists, was broken down into six genera of concern, including *Belocaulus* spp. Information in the datasheet may be at the family, genus, or species level. Information for specific species within the genus is included when known and relevant; other species may occur in the genus and are still reportable at the genus level.

Portions of this document were taken directly from the New Pest Response Guidelines for Tropical Terrestrial Gastropods (USDA-APHIS, 2010a).

*Information for specific species within the genus is included when known and relevant. Other species may occur in the genus and are still reportable at the genus level.



Figures 1 & 2. *Belocaulus angustipes* specimens from Jacksonville, Duval County, Florida (about 30 mm) (Bill Frank, <http://www.jaxshells.org>).

Scientific Name

Belocaulus angustipes (Heynemann, 1885)

Synonyms:

Belocaulus angustipes

Angustipes ameghini (Gambetta, 1923)

Veronicella ameghini Gambetta, 1923

Common Name

No common name, leatherleaf slugs

***Belocaulus angustipes*:** black velvet leatherleaf, Paraguayan black velvet leatherleaf

Type of Pest

Mollusk

Taxonomic Position

Class: Gastropoda, **Order:** Systellommatophora, **Family:** Veronicellidae

Reason for Inclusion in Manual

CAPS Target: AHP Prioritized Pest List – 2011 through 2015*

*Originally listed under the family Veronicellidae.

Pest Description

Veronicellidae are anatomically distinct from many other terrestrial slugs in that they have a posterior anus, eyes on contractile tentacles, and no pulmonate lung. The sensory tentacles are bilobed. This family also lacks a mantle cavity (Runham and Hunter, 1970).

Although this family is fairly easy to tell apart from others, species within this family can be difficult to distinguish due to similar morphology between species and multiple color variations within a single species. Taxonomy is based on the morphology of the hermaphroditic reproductive system.



Figure 3. *Belocaulus angustipes* specimens from Jacksonville, Duval County, Florida (Bill Frank, <http://www.jaxshells.org>).

Belocaulus angustipes

Eggs: Eggs are oval and 6 mm (approx. $\frac{1}{4}$ in) long by 3 mm (approx. $\frac{1}{8}$ in) wide (Dundee, 1977).

Adults: “This slug can measure up to 55 mm [approx. $2\frac{3}{16}$ in] when fully extended. It is jet black in color with similarly colored tentacles. There is a pale, inconspicuous tan stripe down the center of the back, which may not be visible. The mantle extends over the entire length of the body. The dorsal surface of the mantle may appear velvety or wrinkled. The pneumostome (breathing pore) and anus [are] located posteriorly. The foot appears tripartite because the mantle of this species has black flecks along the margins” (White-McLean, 2011). This species is small and will weigh no more than 1.2g (Rueda et al., 2002).

Biology and Ecology

The biology of Veronicellidae is not well known; they are known to be nocturnal herbivores (Runham and Hunter, 1970). A *Belocaulus* sp. in Ecuador has been found to move in an unusual way by lowering itself from tree branches using a mucus thread (similar to a spider on a thread) (Wiktor and Stawarczyk, 2011).

Belocaulus angustipes

This slug has a subtropical native range in northern Argentina, Paraguay and southern Brazil, and prefers undisturbed, shaded habitats (Reuda et al., 2002). In the Gulf Coast States, *B. angustipes* can be common where St. Augustine grass is found (Walls, 2009). It can also be found in disturbed areas near homes, like drainage ditches (Capinera et al., 2011). This slug is active mostly at night when temperatures are between 20° to 24°C (68° to 75°F) and can live for several years (Walls, 2009). This species becomes inactive at very low humidity and near freezing temperatures; during hot, dry summer conditions, it will disappear into the soil and aestivate until conditions become more favorable (Walls, 2009).

This slug is oviparous (Rueda et al., 2002). In the Gulf Coast area, egg-laying occurs two times each year, from March to June and September to mid-November (Dundee, 1977). According to Dundee (1977), “the egg mass is coiled and the eggs are attached together by a gelatinous, fecal-containing strand. The slug deposits the strands while it is curled in the form of a circle.” When newly hatched, slug weight was found to be 0.016 g (Dundee, 1977). Adults can lay one to five egg masses per breeding season, which they shallowly bury in the soil, with eggs hatching in 20 to 28 days depending on the temperature (Dundee, 1977; Walls, 2009). This species can live up to 5 years (White-McLean, 2011).

Work was previously done by Dundee et al. (1975) showing the possible presence of a pheromone for *B. angustipes*. This would help explain the aggregative behavior of this slug (Dundee et al., 1975).

Damage

Due to their apparent lack of host specificity, few reports as to specific damage caused by Veronicellidae species to agriculture have been published in the malacological or agricultural literature.

Visual signs of Veronicellidae can include chewing or rasping damage to plants, presence of eggs, juveniles and adults, mucus and slime trails, and/or ribbon like feces.

Belocaulus angustipes

Belocaulus angustipes does not seem to be causing any issues in areas of the United States where it has been introduced; however, it has the potential to become a lawn pest and is a disease carrier.

Pest Importance

Veronicellidae can be pests in tropical regions of America, Africa, and Asia where distribution is limited (Runham and Hunter, 1970). This family can also transmit pathogens to humans indirectly when they consume vegetables and fruits that have been contaminated with mucus and feces. The slugs can also transmit pathogens to plants and livestock. Displacement of native mollusk species may also occur (USDA-APHIS, 2010a).

Belocaulus angustipes

Walls (2009) stated that this slug has the potential to become a lawn pest. While it is not considered a serious agricultural pest, it is a disease carrier (Rueda et al., 2002). This species does not seem to be causing any issues in areas of the United States where it has been introduced.

Known Food Sources*

Belocaulus angustipes

This species consumes a wide variety of plants including grasses and other tender plants (Walls, 2009). This species has been recorded feeding on both living and decayed leaves (Capinera et al., 2011).

*Terrestrial mollusks do not show host specificity and can feed on multiple crops as well as other materials, like decaying organic matter.

Pathogen or Associated Organisms Vectored

Human and Animal Pathogens

Species of this family have been found to carry several nematode parasites, including *Angiostrongylus cantonensis* (rat lungworm), *A. costaricensis*, and *A. malaysiensis*. *Angiostrongylus cantonensis* can cause symptoms similar to meningitis in humans including headache, stiff neck, tingling or painful feelings in the skin, lowgrade fever, nausea, and vomiting (USDA-APHIS, 2010a).

Belocaulus angustipes is considered an important intermediate host of *A. costaricensis* in southeastern Brazil with prevalence rates of 8.3% (Rea et al., n.d.; Rambo et al., 1997). Although it plays an important role in transmitting disease causing organisms in the tropics, there is no evidence that this species is a problem in areas where it occurs in the United States (Capinera et al., 2011).

Note: While most cases of human infections result from consumption of raw or partially cooked snail meat, government inspectors, officers and field surveyors are at-risk due to the handling of live snail, samples, and potential exposure to mucus secretions. ***Wear gloves when handling mollusks and wash hands thoroughly after any mollusk survey or inspection activities.***

Plant Pathogens

Unknown.

Known Distribution

Distribution lists may not be all inclusive.

Belocaulus angustipes

This species is originally from South America.

Central America: Introduced into Honduras; **South America:** Argentina, Brazil, Paraguay and Columbia (Thompson, 2008).

Pathway

Belocaulus angustipes

Walls (2009) stated that this species was introduced into the United States on plants from South America, most likely from Brazil or Argentina. Capinera et al. (2011) stated that this species can be found in greenhouses and nurseries, specifically under potted plants, where it is likely to move with the nursery stock. *Belocaulus angustipes* can burrow into the soft soil and enter the root balls of plants through the drainage holes in the bottom of plant containers. This species could continue to spread in the United States through natural and human-assisted spread.

Potential Distribution within the United States

No risk documents exist for any of the tropical terrestrial mollusks that give potential distribution in the United States. Host material is unlikely to limit their distribution since they are all polyphagous, but these species are limited by climate. If introduced, the tropical terrestrial mollusks would most likely be limited to the southern part of the United States and possibly the West Coast where the climate is similar to native ranges. This is supported by detections of these species which have all been in either the southern United States or West Coast (USDA-APHIS, 2010a).

Belocaulus angustipes

This species was first detected in the United States in 1960 at Mobile, Alabama and New Orleans, Louisiana. It has also been found in Florida since the early 1980s. Its current distribution is Alabama, Florida, Louisiana, Mississippi, and Texas (Walls, 2009), as well as South Carolina. It is likely more widespread in the southern United States. It was introduced from South America (Rueda et al., 2002).

Survey

CAPS-Approved Method*

Visual. See the Introduction to the mollusk manual for specific information on visual surveys.

Survey Site Selection

New introductions of terrestrial mollusks will likely be related to commerce and human-assisted movement. The habitat and land-use type of each survey site may be variable, ranging from agricultural land, to residential or industrial features. When planning the survey route for a particular site, examine the following microhabitats:

- Near heavily vegetated areas, especially gardens and fields where plants have been damaged by feeding;
- Under rocks, asphalt or cement pieces that are in loose contact with the ground surface;
- Discarded wooden boards and planks, fallen trees, logs, and branches;
- Damp leaf litter (not wet or soggy), compost piles, and rubbish heaps; and
- Under flower pots, planters, rubber mats, tires and other items in contact with the soil.

Trap Placement

Trapping **cannot** be used alone, but can be used to supplement visual surveying. Trapping for terrestrial mollusks is not species specific and will attract non-target species, including non-mollusks. Platform or baiting traps can be used to supplement visual inspection. Trap placement can occur in the same areas that visual surveys occur.

Time of year to survey

Most species of terrestrial mollusks are active during nocturnal hours, when environmental conditions are cool and wet. Some species may also be active during daylight, especially during overcast and rainy days in the spring and fall. If possible, plan surveys during spring and fall, and during early morning and overcast days. Many slugs and snails have diurnal patterns of activity, so early morning and evening hours may be the best time to carry out a survey (Pearce and Örstan, 2006).

*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/>.

Key Diagnostics/Identification

CAPS-Approved Method*:

Morphological and Molecular: Differentiation from the native species is only by dissection and only if the specimen is mature enough. All veronicellid samples should be sent to Dr. Robinson for morphological identification. All specimens will then be confirmed through molecular diagnostics performed at the CPHST Mission lab.

A key to terrestrial mollusks (including Veronicellidae) is found here:
<http://idtools.org/id/mollusc/index.php>.

In April 2013, the family Veronicellidae, a target on the 2013 and 2014 AHP Prioritized Pest Lists, was broken down into six genera of concern. When conducting a general mollusk survey, if samples are negative for Veronicellidae, then negative data may be reported for each of these six genera: *Belocaulus*, *Colosius*, *Laevicaulis*, *Sarasinula*, *Semperula*, and *Veronicella*. All positives must be reported at the species level.

Refer to “Appendix N - Data Entry Guide for Selected Taxonomic Groups” of the most recent year’s CAPS Guidelines for additional information on data entry for mollusks.
https://caps.ceris.purdue.edu/caps_agreement_guidelines.

*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 Species

Capinera et al. (2011) state that this species has a distinctive black velvety appearance that is unlikely to be confused with other slugs found in Florida.

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