

Blister Beetles (Insecta: Coleoptera: Meloidae)¹

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Introduction

The family Meloidae, the blister beetles, contains about 2500 species, divided among 120 genera and four subfamilies (Bologna and Pinto 2001). Florida has 26 species, only a small fraction of the total number in the U.S., but nearly three times that of the West Indies (Selander and Bouseman 1960). Adult beetles are phytophagous, feeding especially on plants in the families Amaranthaceae, Asteraceae, Fabaceae, and Solanaceae. Most adults eat only floral parts, but some, particularly those of *Epicauta* spp., eat leaves as well.



Figure 1. Adult *Epicauta floridensis* Werner (left), and *E. cinerea* Forster (right).

Credits: Lyle J. Buss, University of Florida



Figure 2. Adult *Pyrota lineata* (Olivier) a blister beetle.

Credits: Lyle J. Buss, University of Florida

A few adults are nocturnal, but most are diurnal or show no distinct diel cycle. Since adults are gregarious and often colorful, they tend to be conspicuous. However, larval blister beetles are seldom seen, except for first instar larvae (triungulins) frequenting flowers or clinging to adult bees. All blister beetle larvae are specialized predators.

1. This document is EENY-166 (originally published as DPI Entomology Circular 268), one of the Featured Creatures series of the Entomology and Nematology Department, UF/IFAS Extension. Published: October 2000. Revised: August 2003, September 2010 and December 2013. This document is also available on Featured Creatures website at <http://entomology.ifas.ufl.edu/creatures>. Please visit the EDIS website at <http://edis.ifas.ufl.edu>. Additional information on these organisms, including many color photographs, is available at the Entomology and Nematology Department website at <http://entnemdept.ifas.ufl.edu/>.
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Larvae of most genera enter the nests of wild bees, where they consume both immature bees and the provisions of one or more nest cells. The larvae of some Meloinae, including most *Epicauta* spp., prey on the eggs of acridid grasshoppers. A few larvae evidently prey on the eggs of blister beetles (Selander 1981). Of the Florida species, *Nemognatha punctulata* LeConte (misidentified as *Zonitis vittigera* (LeConte)) has been found in a nest of a *Megachile* sp. in Cuba (Scaramuzza 1938) and several members of the genus *Epicauta* have been associated with the eggpods of *Melanoplus* spp.

Distribution

Fourteen of the Florida species are limited largely or entirely to the Atlantic and/or Gulf coasts of the U.S. Twelve species are more or less widely distributed in the central and/or eastern states. Two species occur both in the southeastern U.S. and the West Indies. These two species belong to South and Central American groups and probably reached the continental U.S. from the islands. A third, weaker faunal link with the West Indies is represented by *Pseudozonitis longicornis* (Horn), which belongs to a group including one West Indian species and two relictual species in east Texas (Enns 1956, Selander and Bouseman 1960). No species is indigenous.

Description

Adults are soft-bodied, long-legged beetles with the head deflexed, fully exposed, and abruptly constricted behind to form an unusually narrow neck, the pronotum is much narrower at the anterior end than the posterior and not carinate (keeled) laterally, the forecoxal cavities open behind, and (in all Florida species) each of the tarsal claws cleft into two blades. Body length generally ranges between 3/4 and 2 cm in the Florida species. Blister beetles (Meloidea) are commonly confused with beetles in the family Oedemeridae (false blister beetles) (Arnett 2008) and the Tenebrionidae subfamily Lagriinae (long-jointed beetles).

First instar larvae of the family Nemognathinae found in flowers or attached to the hairs of bees are sometimes mistaken for those of Ripiphoridae. In both groups, the body is navicular (boat-shaped) and heavily sclerotized and there is a definite pattern of setation. Nemognathine larvae are distinctive in having one to two (not four to five) stemmata on each side of the head, an ecdysial line on the thorax, and no pulvilli (bladderlike appendages).

Keys to genera for adult beetles (Arnett 1960) and triungulin larvae (MacSwain 1956) are given in references. A key

to *Epicauta* species is in Pinto (1991). Adults of most of the Florida species are described by Enns and Werner (Enns 1956, Werner 1945).

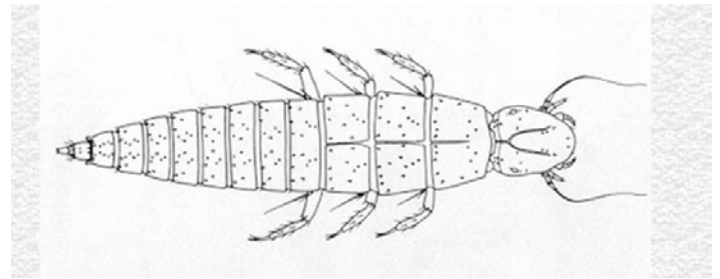


Figure 3. *Nemognatha plazata* Fabricius, first instar larva.

Life Cycle

Eggs are laid in masses in the ground or under stones (Meloinae) or on the food plants of adults (Nemognathinae). Larval development is hypermetamorphic, with four distinct phases.

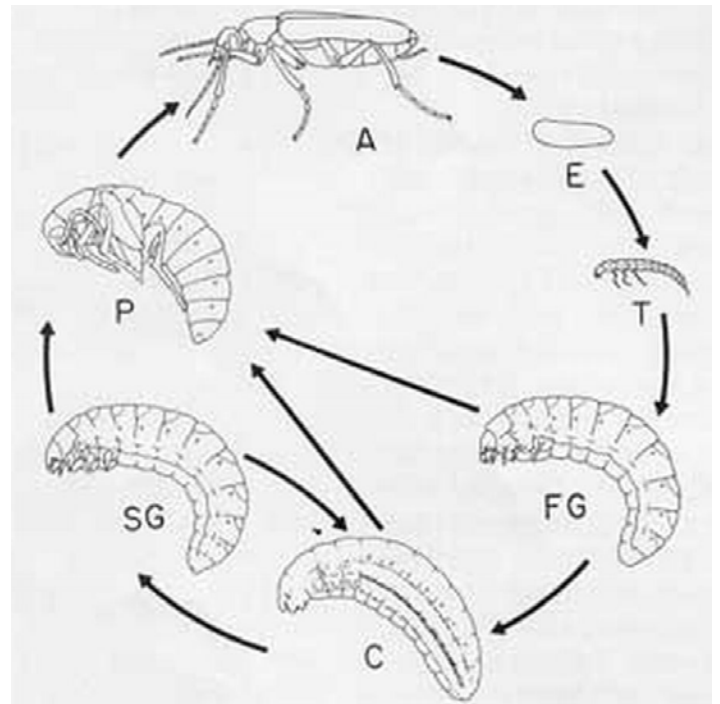


Figure 4. Blister Beetle Life Cycle A = adult, E = egg, T = first instar or triungulin, FG = first grub phase, C = coarctate phase in instar six or seven, SG = second grub phase, P = pupa.

In the first instar or triungulin (T) phase, the larva reaches its feeding site on its own (most Meloinae) or attaches to an adult bee and is carried there (Meloini (not in Florida) and Nemognathinae). After feeding to repletion, the larva, through ecdysis, becomes scarabaeiform and enters a period of rapid growth (first grub phase, FG) that lasts until the end of instar five or six. In some species that prey on bees the FG larva uses only a single cell, while in others it digs into nearby cells and devours their contents.

In Meloinae, the fully fed FG larva generally excavates a chamber apart from the feeding site. In instar six or seven, the larva typically becomes heavily sclerotized and immobile (coarctate phase, C). In this phase the musculature undergoes profound degeneration and respiration is reduced to an extremely low level, permitting survival for more than a year, if necessary. When development resumes, the muscles regenerate and, through ecdysis, the larva once again becomes scarabaeiform (second grub phase, SG); at this point it may or may not excavate a pupal chamber. Nemognathinae are unusual in that the SG larva and following pupa and adult are encapsulated by the cast but intact skins of the last instar FG larva and the C larva.

Several alternative developmental pathways have been identified. In response to high temperature, many *Epicauta* larvae pupate directly from the FG phase or fail to diapause in the C phase; both patterns are conducive to multivoltinism. Rarely, a larva pupates directly from the C phase. Presumably in response to adverse environmental conditions, larvae of several genera of Meloinae can return to the C phase after reaching the SG phase. Most species pass the winter or dry season as coarctate phase larvae, while a few do so as diapausing eggs, triungulin larvae, or adults.

Adults commonly live three months or more. Females typically mate and oviposit periodically throughout their adult lives.

Annotated List of Species in Florida

In the following list, seasonal distribution is not mentioned for species that are active in the adult stage from spring to late summer or early fall. In general, summaries of food plants do not pertain exclusively to Florida. Most distributions and some host data are from Pinto (1991).

Subfamily Meloinae

Epicauta batesii Horn - Eastern and southeastern U.S., from New Jersey to southern Florida and west to Mississippi. Adult hosts: unknown.

E. cinctea (Forster) - The clematis blister beetle. Eastern North America from Atlantic coast west to the Great Plains, southern Canada south to Texas and the Gulf Coast. Three major color forms: gray tinged with blackish, margined (black with ash gray margins), and black. Adult hosts: *Clematis* spp.



Figure 5. Adult clematis blister beetle, *Epicauta cinerea* Forster, margined color form.

Credits: Lyle J. Buss, University of Florida

E. excavatifrons Maydell - Coastal Mississippi and Alabama, and south to Marion County, Florida. September-October. Adult hosts: recorded from grass.

E. fabricii (LeConte) - The ashgray blister beetle. Eastern North America, from eastern Canada to the Gulf of Mexico, less common west of the Mississippi. Florida, from the panhandle south to Highlands County. April-May. Adult hosts: commonly on Fabaceae, including alfalfa, *Baptisia*, bean, pea, and sweetclover; sometimes attacks potato and glandless cotton. Often taken at lights.



Figure 6. Adult *Epicauta fabricii* (LeConte), the ashgray blister beetle. Credits: John L. Capinera, University of Florida

E. floridensis Werner - The “Florida” blister beetle. Eastern U.S., west to Texas, Oklahoma and Missouri, north to Illinois. Probably statewide in Florida. Adult hosts: *Ipomoea* (Convolvulaceae), *Schrankia* (Fabaceae), and (in captivity) *Solanum* (Solanaceae).



Figure 7. Adult “Florida” blister beetle, *Epicauta floridensis* Werner.
Credits: Lyle J. Buss, University of Florida

E. funebris (= *pestifera*) Horn - The margined blister beetle. Eastern U.S., west to Texas and South Dakota and north to Massachusetts. Florida, from the panhandle south to Indian River County. Adult hosts: Many Fabaceae and Solanaceae, including alfalfa, beet, eggplant, potato, soybean, sugar beet, and tomato. Also taken on *Amaranthus* (Amaranthaceae), and *Cynanchum nigrum* (L.) (Apocynaceae).



Figure 8. Adult margined blister beetle, *Epicauta funebris* Horn.
Credits: James Castner, University of Florida

E. heterodera Hom - Southern U. S., coastal Mississippi to Georgia and south in Florida to Osceola County. Recorded from coastal, southeastern North Carolina. September-November. Adult host: *Helenium* and other Asteraceae.



Figure 9. Adult female *Epicauta heterodera* Horn, a blister beetle.
Credits: Lyle J. Buss, University of Florida



Figure 10. Adult *Epicauta heterodera* Horn (Gyllenhal), a blister beetle.
Credits: Lyle J. Buss

E. obesa (Chevrolat) - Southeastern Canada, south through eastern U.S. to Veracruz and Oaxaca, Mexico. In Florida, recorded in Alachua and Orange counties. Adult hosts: Recorded on *Clematis* (Ranunculaceae) in all regions; and

Amaranthus, alfalfa, *Tribulus* (Zygophyllaceae), and tomato in Oklahoma and Arkansas.

E. pensylvanica (De Geer) - The black blister beetle. Southern Canada from Alberta to the Atlantic Coast south, throughout much of the United States, but not the Pacific Coast states, to northern Mexico. Adult hosts: Wide variety of plants, including many Asteraceae, and such crops as alfalfa, beet, and potato. It is most commonly taken on inflorescences of *Solidago*.



Figure 11. Adult *Epicauta pensylvanica* (De Geer), the black blister beetle.

Credits: John L. Capinera, University of Florida

E. sanguinicollis (LeConte) - Known only from South Carolina, Georgia and Florida. In Florida, recorded in Alachua, Citrus, Sumter, and Brevard counties. Adult hosts: Asteraceae, *Schrankia* (Fabaceae), and cotton.

E. strigosa (Gyllenhal) - From eastern Texas to the Atlantic and then north along the coast to Massachusetts, probably statewide in Florida. Adult hosts: Principally on cotton, okra, Asteraceae, *Opuntia* (Cactaceae), *Ipomoea* (Convolvulaceae), and *Vigna* (Fabaceae).



Figure 12. Adult *Epicauta strigosa* (Gyllenhal), a blister beetle.

Credits: Jeff Hollenbeck

E. tenuis (LeConte) - South Carolina, Georgia, and Florida. Recorded in Florida from Baker and Volusia counties south to Highlands County. May-June.

E. torsa (LeConte) - Oklahoma and east Texas, east on the Coastal Plain to Georgia and north to Massachusetts; probably statewide in Florida. April-June. Adult hosts: *Ilex* (Aquifoliaceae), *Sapindus* (Sapindaceae), and *Albizia*, *Amorpha*, and *Robinia* (Fabaceae).

E. vittata (Fabricius) - [The striped blister beetle](#). Known from southern Ontario and Quebec in Canada and in all states in the U.S. east of longitude 100° except Texas, North Dakota, Maine, New Hampshire and Vermont. Represented in Florida where it occurs commonly throughout the state (except in the Keys), extreme southern Georgia and southeastern South Carolina by the "lemniscate" or southeastern coastal race (Adams and Selander 1979). Adult hosts: Wide variety of plants, including Amaranthaceae (*Amaranthus*), Solanaceae (*Solanum*) and Fabaceae (*Medicago*, alfalfa), and such crops as bean, beet, cotton, potato, and tomato. Attracted to lights.



Figure 13. Adult *Epicauta vittata* (Fabricius), the striped blister beetle.

Credits: James Castner, University of Florida

Lytta polita Say - The bronze blister beetle. Georgia border south to Charlotte and Highlands counties. December-June. Has been taken in large numbers at lights.

Pyrota limbalis LeConte - Washington, D.C., south to Highlands County, Florida. One record at light.

P. lineata (Olivier) - Northern Florida, including the panhandle, south to Polk County. August-October. Several Asteraceae and *Gerardia* (Scrophulariaceae).



Figure 14. Adult bronze blister beetle, *Lytta polita* Say.
Credits: James Castner, University of Florida



Figure 15. Adult *Pyrota lineata* (Olivier) a blister beetle.
Credits: Lyle J. Buss, University of Florida

P. mutata (Gemminger) - Northern Florida, including the panhandle, south to Polk County. *Cicuta*, *Daucus*, *Eryngium*, and several other Umbelliferae.

P. sinuata (Olivier)- Coastal Plain from Mississippi to North Carolina, south in Florida to Highlands County. *Gerardia* (Scrophulariaceae).

Subfamily Nemognathinae

Nemognatha nemorensis Hentz - North Florida, south to Pinellas and Brevard counties. Several Asteraceae, including *Bidens*, *Erigeron*, *Heterotheca*, and, particularly, *Rudbeckia*.

N. piazzata Fabricius - Represented in Florida by the nominate race (Mississippi to West Virginia south), which occurs

statewide, including the Keys. *Cirsium* and *Tetraognotheca* (Asteraceae).



Figure 16. Adult *Nemognatha nemorensis* Hentz, a blister beetle.
Credits: Sean McCann

N. punctulata LeConte - Bahama and Cayman islands, Cuba, Jamaica, and the southeastern U.S. Recorded in Florida only from the Keys and Dade County. *Bidens* and "thistle" (Asteraceae). Not common.



Figure 17. Adult *Nemognatha punctulata* LeConte, a blister beetle.
Credits: Sean McCann

Pseudozonitis longicornis (Horn) - Kansas and east Texas along the Coastal Plain to South Carolina; recorded in Florida from Highlands County south to the Keys. March-July. At lights. Rare.

P. pallida Dillon - Oklahoma and eastern Texas, east to Florida where it extends southward through Dixie and Alachua counties to Hillsborough County. At lights. Not common.

P. schaefferi (Blatchley) - A taxonomically isolated species known only from Florida (Pinellas, St. Johns, and Volusia counties) and Myrtle Beach, South Carolina (Kirk 1969). February-May.

Tetraonyx quadrimaculata (Fabricius) - Trinidad, Lesser Antilles, Puerto Rico, Hispaniola, and the U.S. Coastal Plain from northern Florida (Alachua and Putnam counties) to Alabama and North Carolina. Convolvulaceae (*Ipomoea*) and Fabaceae (*Bradburya*, *Coelosia*) in the U.S. and these families and Bignoniaceae, Euphorbiaceae, and Verbenaceae in the West Indies. Reported damaging grapefruit flowers in Puerto Rico.

Zonitis cribricollis (LeConte) - Widely distributed in Florida, south to Dade County *Achillea*, *Coreopsis*, *Helianthus*, and *Rudbeckia* (Asteraceae). Rare.

Zonitis vittigera (LeConte) - Eastern U.S. and southeastern Canada. Represented in Florida, where it occurs south to Highlands County, by the nominate, eastern race. Numerous Asteraceae and *Psoralea* (Leguminosae).

Medical and Veterinary Importance

Blister beetles received their common name because their hemolymph produces blistering on contact with human skin. Hemolymph is often exuded copiously by reflexive bleeding when an adult beetle is pressed or rubbed against the skin. Blisters are most common on the neck and arms, due to exposure to adult beetles attracted to outdoor lights at night. General handling of adults seldom results in blistering unless the hemolymph contacts the relatively thin skin between the fingers. Unless blistering is extensive, medical treatment beyond first aid is probably not necessary. The blistering on the individual shown in the photograph, while uncomfortable, was not painful. The blisters soon diminished on their own.

The blistering agent is cantharidin, an odorless terpene (exo-1,2-*cis*-dimethyl-3,6-epoxyhexahydro-phthalic anhydride) occurring elsewhere only in beetles of the family *Oedemeridae* (Arnett 2008). Cantharidin or cantharides (dried, pulverized bodies of adult beetles) were once employed extensively in human and veterinary medicine, primarily as a vesicant and irritant. Cantharidin is still used in the U.S. today, as the active ingredient in a proprietary wart remover (Epstein and Epstein 1960, Kartal Durmazlar et al. 2009). Taken internally or absorbed through the skin, cantharidin is highly toxic to mammals. There is an extensive literature dealing with its reputed aphrodisiacal

properties and numerous reports of human poisonings, both accidental and deliberate. Cantharides is sometimes specified as the Eurasian Spanishfly, *Lytta vesicatoria* (Linnaeus). However, other genera, particularly *Mylabris* and *Epicauta*, have been more commonly used. Recorded cantharidin content of adult beetles (by dry weight) ranges from less than 1% to 5.4%. Biological synthesis and function are not fully understood. It is widely assumed that cantharidin confers chemical protection from predators, but there is little evidence for this. In at least some species, females receive large quantities of cantharidin from males during copulation. In any case, females incorporate the material in a coating applied to the eggs.



Figure 18. Blisters resulting by smashing a single blister beetle on the neck. While uncomfortable, no medical treatment was implemented and the blisters soon diminished on their own.

Cases of fatal poisonings of valuable horses by ingestion of blister beetles trapped in baled alfalfa hay (Kinney et al. 2006, Mackay and Wollenman 1981, Schoeb and Panciera 1979) have revived interest in the pathology of cantharidin toxicosis and led to the development of a highly sensitive technique for detection of the compound (Ray et al. 1979). Research is available to indicate the amount of cantharidin levels present in common species, as well as the estimated number of beetles necessary to provide a lethal dose to horses (Kinney et al. 2006, Sansome 2002).

Poisonings have been traced to several species of blister beetle. Blister beetles pose a potential threat if horse owners use alfalfa as a source of hay. However, alfalfa is not commonly grown in Florida and blister beetles rarely are abundant. Most poisonings in Florida result from importation of alfalfa hay from western states experiencing grasshopper population outbreaks (Capinera, personal communication).

Crop Damage

Several of the Florida blister beetles feed on cultivated plants. Species of *Epicauta*, particularly the margined blister beetle, *E. funebris*, and the **striped blister beetle**, *E. vittata*, often damage alfalfa, beet, potato, tomato, and other crops by defoliation. Because of the beetles' gregarious behavior, their attacks can be locally catastrophic. In small gardens, it may be sufficient simply to pick the beetles from the plants.



Figure 19. Crop damage caused by adult margined blister beetles, *Epicauta pestifera* Werner.

Credits: Lyle J. Buss

Insect Management Guide: Vegetables, http://edis.ifas.ufl.edu/TOPIC_GUIDE_IG_Vegetables

Insect Management Guide: Field Crops and Pastures, http://edis.ifas.ufl.edu/TOPIC_GUIDE_IG_Field_Crops_and_Pastures

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