Darna pallivitta

Scientific Name
Darna pallivitta Moore

Synonyms:
Miresa pallivitta Moore,
Oxyplax ochracea Moore

Common Name
Nettle caterpillar, stinging caterpillar

Type of Pest
Moth

Taxonomic Position
Class: Insecta, **Order:** Lepidoptera,
Family: Limacodidae

Reason for Inclusion in Manual
Additional Pest of Concern List (2013)

Figure 1. *Darna pallivitta* eggs on the underside of a leaf; in a row (top) and in a cluster (bottom). These eggs are small (0.8 mm) and nearly translucent, and are easily overlooked (Images courtesy of Walter T. Nagamine, Hawaii Department of Agriculture.)

Pest Description
Eggs: Deposited in small clusters, a line, or singly, usually on the undersides of older leaves. Eggs are flattened, transparent ovals, 0.8 mm ($^1/_{32}$ inch) wide and 1.6 mm ($^1/_{16}$ inch) long, appearing as a glassy sheen on the leaf surface that can easily be overlooked (Fig. 1) (Chun et al., 2005). Eggs are initially yellow when newly deposited (Nagamine and Epstein, 2007).

Larvae: The larvae (Fig. 2) can be up to 25 mm (1 inch) long and are covered with many rows of stinging spines. Larvae vary from white to light gray, with a dark longitudinal stripe down the back (Chun et al., 2005). Larvae "have two rows of moderately long spiny tubercles which, like the body, are marbled with black and white on light gray. There is a dorsal white band and sometimes yellow or light orange flecks on the flanks anteriorly. The head is yellow. The larva leaves a viscous trail over the leaves as it progresses" (Holloway, 2006).

Common characteristics found in all instars of *D. pallivitta* include "basic limacodid form with retractile head, small thoracic legs smooth elastic cuticle and sucker disks on the ventrum without crochets, and an anal proleg with shagreened cuticle" (Nagamine and Epstein, 2007).

Pupae: The pre-pupa takes on a C-shaped form. It wets itself down and spins itself in brown silk which will eventually form a hardened brown outer shell (Nagamine and Epstein, 2007). Cocoons measure 8 to 10 by 10 to 13 mm ($^5/_{16}$ to $^3/_8$ by $^3/_8$ to $^1/_2$ inch). Pupation occurs within the cocoon about five days later (Fig. 3).

Adults: The adult moth is approximately 12.7 mm ($^1/_2$ inch) long, with females usually larger than males. The forewing is divided by a white diagonal marking, with the upper portion rust-colored and the lower portion lighter brown; the hind wings are uniform light brown; Holloway (2006) states that this is a distinctive characteristic. These nocturnal moths have not been observed feeding. Females are larger than males and have filiform antennae, whereas males have bipectinate antennae (Fig. 4) (Chun et al., 2005; Nagamine and Epstein, 2007).

Figure 2. Early (top) and late instar (bottom) larva of *D pallivitta* (Images courtesy of Walter T. Nagamine, Hawaii Department of Agriculture).

A more technical description of the life stages can be found in Nagamine and Epstein (2007) and Epstein (1996). Cock et al. (1987) provides a more detailed description of the mature larvae.

Figure 3. Newly emerged *D. pallivitta* adult from cocoon (left) and cocoon (right) about the size of a bean (Images courtesy of Walter T. Nagamine, Hawaii Department of Agriculture).

Figure 4. Adult male (left) and female (right) *D. pallivitta*. Notice the bipectinate antennae on the male, and the filiform antennae on the female.

Biology and Ecology

Darna pallivitta is a tropical pest that can cause significant damage to a wide range of agricultural, landscape, and endemic vegetation. To date, it has been detected on three Hawaiian Islands and intercepted as larvae and cocoons several times in California (Nagamine and Epstein, 2007).

The life cycle consists of egg, larva (8 to 11 instars), prepupa, pupa, and adult stages. The egg, larva, prepupa/pupa, and adult stages last 7, 53, 19, and 9 to 11 days respectively. No reports on the number of generations per year were found; however, the entire life cycle lasts on average 80 days (Nagamine and Epstein, 2007).

This species does not begin feeding until the second instar (Nagamine and Epstein, 2007). The larval feeding stage is long, lasting around 2 months (Chun et al., 2005). It feeds on "one surface of the leaf mesophyll in short tracks parallel to the midrib until the 4th or 5th instar. Later instars feed on the entire leaf minus the midrib (Nagamine and Epstein, 2007).

A few days before molting, the larvae become sessile and darken to a greyish-black. After molting is complete, the larvae usually consume the cast skin and then continue feeding on plant material (Nagamine and Epstein, 2007).

Figure 5. Young *D. pallivitta* larvae consume guinea grass (*Panicum maximum*). The bottom image is a close-up of the top image. Notice the green balls of frass on the upper right portion of the bottom photo (Image courtesy of Walter T. Nagamine, Hawaii Department of Agriculture).

Using capture histories from Hawaii, the moth seems to be more active in the summer months but is also active throughout the year. Rainfall/moisture does not seem to be a factor in activity, but elevation and temperature play a role.

Females have a high fecundity potential, laying an average of 479 eggs, with 55% of these hatching. Females can begin mating on the day of the emergence and lay eggs the day after. The adults live for about 10 or 11 days. Diapause is not expressed by *D. pallivitta*, and continuous and overlapping generations have been observed (Nagamine and Epstein, 2007). Populations usually increase during the summer months (Reimer, 2010).

During the day, adults are inactive and retreat into vegetation. They can usually be found in an upside-down, perching position (Chun et al., 2005).

Damage

Darna pallivitta can cause significant leaf damage and defoliation (Fig. 5). When *D. pallivitta* larvae are present, a distinctive black or green frass can also be seen on the vegetation (Fig. 5).

Smaller larvae only feed on the leaf surface which creates a “window pane” effect. Larger larvae eat the entire leaf except for the hard midrib (Hara et al., n.d.). Defoliation of an entire potted plant can occur in just a few days when there is a heavy infestation (Chun et al., 2005).

Pest Importance

In general, *D. pallivitta* is considered a minor pest in its native range (Cock et al., 1987). *Darna pallivitta* is a generalist feeder and has been observed feeding on ornamentals, crops, and endemic plants both in Hawaii and in its native range. Its high fecundity can cause rapid outbreaks. *Darna pallivitta* disperses slowly but has spread in Hawaii by the movement of ornamentals around the islands (Chun et al., 2005). Economic losses to the nursery industry can occur through damage to affected ornamentals. This species also threatens endemic plants and palm species in Hawaii due to larval feeding (Nagamine and Epstein, 2007). Agricultural crops damaged by *D. pallivitta* include coffee and macadamia (Jang et al., 2009).

In one outbreak, as many as 2,000 larvae per palm frond were recorded, and palm leaf area was reduced by up to 60%. Spread of *D. pallivitta* into natural areas may negatively impact threatened and endangered species such as *Vigna oahuensis* (Koop, 2006).

Nagamine and Epstein (2007) also state that this species could have a potentially negative impact on tourism due to stately trees becoming unsightly or being removed and the human health effects of the larval spines. “The nettle caterpillar’s stinging, spiny hairs have a physical effect on human skin much like fiberglass. In addition, the spines release a mixture of histamines produced by a poison gland, causing further irritation (burning and itching) that might require medical attention. If spines get into the eyes, the irritation can be acute” and prompt medical attention is necessary (Chun et al., 2005). Skin irritation can take up to 5 days to resolve (Hossler, 2010).

Known Hosts

Darna pallivitta is considered highly polyphagous, feeding on at least 45 host species from multiple genera and families; its two preferred families are the palms (Arecaceae) and grasses (Poaceae) and can also feed on coffee and macadamia. Nursery stock and potential agricultural damage are high for this Lepidopteran pest, with the potential to damage endemic Hawaiian plant populations. It has been observed feeding on both weedy and ornamental plants common in residences and agriculture (Nagamine and Epstein, 2007).

Known Hosts of Concern[1]

Cocos nucifera (coconut palm), *Coffea arabica* (coffee), *Cordyline terminalis* (ti plant), *Dracaena* spp., *Ficus* spp., *Iris* spp., and *Musa* spp. (bananas and plantains).

It has been observed completing its life cycle on:
Acacia koa[2], *Adenostemma* spp., *Adonidia merrillii* (=*Veitchia merrillii*) (Manila palm), *Areca* spp., *Averrhoa carambola* (starfruit), *Breynia* spp., *Caryota* spp. (fishtail palm), *Cocos* spp. (coconut palm), *Coffea arabica* (coffee), *Commelina diffusa* (honohono grass), *Cordyline terminalis* (ti plant), *Dracaena* spp. (cane plant, 'Compacta', 'Lisa', & 'Massangeana' varieties), *Ficus* spp. (fig), *Iris* spp., *Phoenix* spp. (Phoenix palm), *Pipturus albidus* (mamaki)[2], *Pritchardia hillebrandii*[2], *Rhapsis* spp. (Rhapsis palm), *Vigna marina* (beach pea)[2] (Chun et al., 2005; Hara, 2006; Holloway, 2006).

It has also been observed feeding, but not reproducing on:
Alpinia purpurata (red ginger), *Alyxia stellata* (=*A. oliviformis*) (maile), *Arachis pintoi* ('Golden Glory' perennial peanut), *Arundina graminifolia* (bamboo orchid), *Beaucamea recurvata* (ponytail palm), *Canavalia cathartica* (maunaloa vine), *Clidemia hirta* (Koster's curse), *Cordyline marginata*, *Cuphea* spp. (cigar plant), *Davallia fejeensis* (rabitsfoot fern), *Desmodium uncinatum* (Spanish clover), *Dypsis decaryi* (=*Neodypsis decaryi*) (triangle palm), *Erythrina sandwicensis* (wiliwili), *Gardenia* spp. (gardenia), *Jasminum multiflorum* (Chinese star jasmine), *Macadamia* spp. (macadamia nut), *Mimosa pudica* (sleeping grass), *Molineria capitulata* (=*Curculigo capitulata*) (whale back), *Monstera* spp. (monstera plant), *Musa* spp. (banana), *Neomarica* spp. (walking iris), *Ophiopogon* spp. (mondograss), *Panicum repens* (wainakugrass, torpedograss), *Paspalum conjugatum* (hilograss), *Paronychia* spp. (chickweed), *Paspalum urvillei* (Vasey's grass), *Pennisetum purpureum* (napiergrass), *Psidium* spp. (guava), *Tillandsia cyanea* ('Pink Quill' bromeliad), *Tibouchina* spp., *Trembleya phlogiformis* (glory bush), *Urochloa mutica* (=*Brachiaria mutica*) (California grass), *Wedelia* spp., and *Zingiber zerumbet* (shampoo ginger) (Chun et al., 2005; Koop, 2006).

Pathogen or Associated Organisms Vectored

Darna pallivitta is not a known vector and does not have any associated organisms. However, the larvae can become a health hazard as they are capable of causing dermatitis with skin contact. This is caused by the stinging spines on the larvae.

Known Distribution

Asia: Borneo[3], China, Indonesia (Java), Japan, Malaysia, Taiwan, and Thailand.
Oceania: Hawaii (Cock et al., 1985; Chun et al., 2005; Holloway, 2006).

[1] Hosts were cited by common name in Chun et al. (2005).

[2] These species are native to Hawaii (Hara, 2006).

[3] Holloway (2006) states that Borneo is a questionable record

It is established and spreading in Hawaii and Japan (Cock et al., 1985; Chun et al., 2005). As of 2010, it is found on three islands of Hawaii: the Big Island (island of Hawaii), Oahu, and Maui (Reimer, 2010).

Pathway

There are no interceptions of this pest at U.S. ports of entry (AQAS, 2012; queried May 24, 2012). However, between 2002 and 2004, this species was intercepted 6 times by the California Department of Agriculture (CDFA). All instances occurred on Hawaiian nursery stock or cuttings (Koop, 2006). This species was initially found in Hawaii at a nursery on *Rhapis* spp. (rhapis palms). It was most likely introduced from Taiwan (Chun et al., 2005). Within Hawaii, *Darna pallivitta* has dispersed slowly by the movement of ornamentals around the islands (Chun et al., 2005).

The adult is a good flier and can potentially spread naturally through flight once established in an area. Adults are strongly attracted to lights and can potentially move to other areas on commercial flights if cargo is loaded at night (Koop, 2006).

Potential Distribution within the United States

Darna pallivitta has been detected on three Hawaiian Islands and intercepted as larvae and cocoons several times in California (Koop, 2006).

Darna pallivitta would probably only be able to establish in southern California, Florida, Puerto Rico, the U.S. Virgin Islands and potentially southern Texas as well (Koop, 2006). Jang et al. (2009) report that while precipitation does not seem to be a factor in *Darna pallivitta's* range expansion in Hawaii, there is evidence to suggest higher elevations and lower temperatures are potential limitations to the spread of *D. pallivitta*. *Darna pallivitta* is not likely to establish in more northern states as the pest is sensitive to cooler temperatures (Koop, 2006).

Survey

CAPS-Approved Method*:

The CAPS-approved method is a trap and lure combination. There are two approved traps: Jackson trap (Fig. 6) and the large plastic delta trap (Fig. 7). The length of effectiveness for the lure is under review (it is dependent on the lure manufacturer).

Any of the following Trap Product Names in the IPHIS Survey Supply Ordering System may be used for this target:

1) Jackson Trap Body
2) Large Plastic Delta Trap Kits, Orange
3) Large Plastic Delta Trap Kits, Red
4) Large Plastic Delta Trap Kits, White

The Lure Product Name is *Darna pallivitta* Lure.

Trap color is up to the State and does not affect trap efficacy.

IMPORTANT: Do not include lures for other target species in the trap when trapping for this target.

Trap spacing: When trapping for more than one species of moth, separate traps for different moth species by at least 20 meters (65 feet).

Survey Site Selection: Surveys should occur at locations most at risk for *D. pallivitta*. *Darna pallivitta* has exhibited a preference for tall grass fields and forest and grass interfaces over forest areas (Jang et al., 2009).

Figure 6. Jackson Trap (Image courtesy of John Crowe).

Trap placement: Traps should be suspended 1 m (3.3 ft) above the ground, if possible (L. Carvalho, personal communication, 2012). Traps may be hung from garden stakes, trees, or plants (L. Carvalho, personal communication, 2012).

Figure 7. Large plastic delta trap (Image courtesy of John Crowe).

Time of year to survey: In Hawaii, the moth seems to be more active in the summer months but is active throughout the year.

*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/.

IMPORTANT: States/Territories that are known to have *Darna pallivitta* establishment (e.g., Hawaii) cannot conduct a survey for the pest using CAPS/Farm Bill funding without specific permission from CAPS/Farm Bill program managers.

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Literature-Based Methods:

Trapping: Siderhurst et al. (2007) identified two pheromone components, *n*-butyl (*E*)-7,9-decadienoate (*E*7,9-10:COOn-Bu) and ethyl (*E*)-7,9-decadienoate, for *D. pallivitta*. The *n*-butyl ester pheromone component attracted male moths at equal or greater rates than trapped virgin females. The ethyl ester, however, did not increase trap captures at the levels and ratios tested.

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pheromone component *n*-butyl ester attracted male moths at equal or greater rates than trapped virgin females. The ethyl ester did not increase trap captures at the levels and ratios tested. The synthetic pheromone lures (2.5 mg of E7,9-10:COOnBu) tested by Siderhurst et al. (2007) outperformed virgin female moths as attractant baits.

Visual survey: Visual inspection for the larvae and their frass can also be used as a survey tool.

Key Diagnostics/Identification

CAPS-Approved Method*:

Morphological. Final identification should be performed by an expert in the family Limacodidae.

Larva: The distinctive stinging spines and 4 orange spots on the dorsal side of its body in later instars are unlike moth larvae of the United States. Its frass can also be distinctive in color and shape. A short description of the larva can be found in Passoa (2007), found here: http://idtools.org/id/leps/lepintercept/Passoa_SouthernUS_concerns2.pdf.

Adult: The bronzy brown forewings traversed by an oblique white fascia are distinctive (Holloway, 2006). The valve of the male genitalia lacks a costal process. A screening key for CAPS target Lepidoptera in the Eastern and Midwestern United States (male) can be found in Passoa (2009), found here: http://caps.ceris.purdue.edu/webfm_send/2011.

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Easily Confused Pests

Some of the caterpillars from the Nymphalidae family also are covered in spines, though non-stinging. Butterflies in the family include *Nymphalis californica* (California tortoiseshell), *Vanessa atalanta* (red admiral), *Vanessa cardui* (painted lady), *Vanessa tameame* (Kamehmeha butterfly), and *Vanessa virginiensis* (American lady). *Vanessa tameame* is native to Hawaii. *Vanessa cardui* occurs almost worldwide, including the United States, with the exception of South America, Australia, and the Arctic. Both *N. californica* and *V. virginiensis* are present in the United States, although *N. californica* primarily occurs in the western United States.

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This datasheet was developed by USDA-APHIS-PPQ-CPHST staff. This pest is included as a target in the Palm Survey. Additional information can be found in the **Palm Commodity-based Survey Guidelines**. Cite this document as:

Molet, T. 2013. CPHST Pest Datasheet for *Darna pallivitta*. USDA-APHIS-PPQ-CPHST.

Revisions

July 2016: NAPPFAST map removed.