Rhabdoscelus obscurus

Scientific Name
Rhabdoscelus obscurus (Boisduval, 1835)


Figure 1: *Rhabdoscelus obscurus*, photo by Anthony O'Toole (http://www.ento.csiro.au/aicn/name_s/b_3568.htm)

Synonyms:
Calandra obscura Boisduval, *Rhabdocnemis beccarii* Faust, *Rhabdocnemis fausti* Gahan, *Rhabdocnemis interruptecostata* Faust, *Rhabdocnemis interruptocostatus* Schaufuss, *Rhabdocnemis maculata* Schaufuss, *Rhabdocnemis nudicollis* (Kirsch), *Rhabdocnemis obscura* Boisduval, *Rhabdocnemis obscurus* (Boisduval), *Rhabdocnemis promissus* (Pascoe), *Rhabdoscelis obscura* Boisduval, *Rhabdoscelus maculatus* Schaufuss, *Sphenophorus beccarii* Pascoe, *Sphenophorus insularis* Boheman, *Sphenophorus interruptecostatus* Schaufuss, *Sphenophorus nidicollis* Kirsh, *Sphenophorus obscura* BIoisduval, *Sphenophorus obscurus* Boisduval, *Sphenophorus promissus* Pascoe, *Sphenophorus sulcipes* Karsch, *Sphenophorus tincturatus* Pascoe

Note: Recent DNA work on weevil populations from Australia, Papua New Guinea, Hawaii, and Fiji suggests that the Australian population has enough differences to be considered a separate species (Sallam, 2013, personal communication). Because this issue has not been confirmed, this datasheet includes information on the Australian population as well.

Common Name
New Guinea sugarcane weevil, sugar cane weevil, New Guinea cane weevil borer, beetle borer, cane weevil borer, Hawaiian sugarcane borer

Type of Pest
Weevil

Taxonomic Position
Class: Insecta, **Order:** Coleoptera, **Family:** Dryophthoridae

Reason for Inclusion in Manual
FY2013 Additional Pests of Concern List

Pest Description
Illustrations of all stages can be found in Napompeth et al. (1972). Detailed descriptions of all stages can be found in Riley (1888), Terry (1907), and Muir and Swezey (1916).

This species is highly variable in morphology, color, and host preference (reviewed in Giblin-Davis, 2001).

Eggs: The eggs of *R. obscurus* are 1 to 2 mm (approx. $^{1}/_{16}$ in) in length, ivory white in color, and slightly curved (USDA, 1967). Eggs change from a translucent white with thick chorion to an opaque white as they age (Napompeth et al., 1972).

Larvae: The mature larvae are approximately 15 mm (approx. $^{9}/_{16}$ in) in length with a hard brown head and whitish, almost transparent body (USDA, 1967). The larvae are fleshy with two or more folds on each dorsal segment and are legless, oval-shaped grubs. Both the head and mandibles are highly sclerotized while the cervical shield is less sclerotized (Napompeth et al., 1972). The larvae are covered sparsely with fine, stiff hairs (USDA, 1967). The last few abdominal segments have longer stiff hairs that may help with larval movement within the tunnel (Napompeth et al., 1972). Both "the fifth and sixth abdominal segments are markedly expanded ventrad" (Zimmerman, 1968).

Pupae: When *R. obscurus* is ready to pupate, the weevil constructs a large cocoon made from host plant fibers. In southeastern Polynesia, this is the only known weevil to construct such a cocoon and can thus be used to identify the infestation (Zimmerman, 1968).

According to Napompeth et al. (1972), "after passing the 6th stadium, the full-grown larva transforms to a prepupa." "Its general body shape differs from that of the 6th instar larva by the absence of the posterior enlargement." "Pupation usually takes place within the cocoon which is found in the tunnel made by the larva. It usually takes the prepupa 24 to 48 hours to transform into the yellowish white exarate pupa." "Pupation takes place within a spirally woven fibrous cocoon." "The cocoon is a mass of fibers spirally woven into an elongated oval structure with a cavity in which pupation takes place." "The frass, masticated and left in the tunnel, is also utilized in making the cocoon." "However, the adult does not emerge from the cocoon immediately but remains inactive within it for a considerable period. Upon emergence from the cocoon, most of the adults are light in color while some are dark."

Adults: The adult (Figs. 1, 2) is rather large, ranging from 12 to 14 mm (approx. $^{1}/_{2}$ to $^{9}/_{16}$ in) in length. The body of *R. obscurus* is primarily reddish to reddish brown while the head is darker. The pronotum has a medium black stripe that extends from the apex to base with "less distinct black marks on middle of elytra, sides of thorax and undersides of body"

Figure 2. *Rhabdoscelus obscurus* (left) compared with *Cosmoplites sordidus* (right), from http://www.ctahr.hawaii.edu/nelsons/banana/

(USDA, 1967). The distal pilose section of the last segment on the antennae is wedge-shaped.

According to Napompeth et al. (1972) "the oblong body with a protruding rostrum and well developed prothorax are typical of the curculionid subfamily Calandrinae. The anterior end of the rostrum bears the sclerotized mandibles. The dorsal body coloration is predominantly brown with a lighter shade of brown on the prothorax. The coloration of the elytra varies considerably, but generally has lateral and central dark brown patches. The elytra are well developed with longitudinal grooves or striae. The hind wings are membranous and strongly developed. The tarsal formula is 4:4:4…. In the case of *R. obscurus*, two distinct morphological characteristics are present and they may be employed in distinguishing the sexes…. The rostrum of the male is shorter, less curved, and more robust than that of the female. It is also ventrally serrated with a double row of highly sclerotized tubercles, varying in number from 5 to 8 pairs…. Another morphological difference between the sexes may be found in the last abdominal tergite or the pygidium which usually protrudes slightly beyond the tip of the elytra in both sexes…. Variation in color patterns of the adults of *R. obscurus* was first observed by Muir and Swezey (1916). They reported that the median dorsal marking on the pronotum and those on the elytra varied in size and shape considerably among specimens collected from different localities in the Pacific."

Size of adults is dependent on food quality and quantity during the larval stage. There are several color variations (approximately six in Hawaii) found in this species (Napompeth et al., 1972).

Biology and Ecology

Most information on biology is reported from the main host, sugarcane.

Before laying eggs, females usually chew a 3 mm (approx. $^{1}/_{8}$ in) deep cavity into the sugarcane stalk. Females then lay a single egg in each cavity. Oviposition may also occur in feeding scars, stalk cracks, and wounds. Females lay eggs on the internodes of sugarcane plants as well as on leaf sheaths and the midribs of the leaf blades (Napompeth et al., 1972). Each female can lay 120 to 150 eggs (Santo et al., 2000). After hatching, larvae bore into the stock towards the base (typically downwards). *Rhabdoscelus obscurus* has six larval instars, excluding the prepual stage (Napompeth et al., 1972). A plug of plant fibers usually blocks the entrance to the larval tunnel (Schreiner, 2000). Larvae feed on the pith (not fibers) and can occasionally break through the rind when tunneling up and down, making characteristic windows (Halfpapp and Storey, 1991). The thickness of cane rind, parasites, and cannibalism can influence mortality rates in larvae (CABI, 2002).

Mature larvae pupate within tunnels in fibrous cocoons. The cocoon is made with cane fiber and frass (Napompeth et al., 1972). The adult does not immediately emerge from the cocoon, and stays within it for approximately 12 days to harden (USDA, 1967). Once ready to emerge, the adult cuts the cocoon open with its appendages (CABI, 2002). Adults emerge from exit holes in the stalk which were previously made by larvae before pupation (Napompeth et al., 1972).

On palms, females lay eggs on the petiole and stem. After hatching, the larvae bore into the living tissue and produce frass-filled tunnels (Reddy et al., 2011b).

This species can have multiple generations per year. The life cycle takes about 13 weeks (Giblin-Davis, 2001). Under laboratory conditions, the egg stage lasts approximately four to five days; the larval stage lasts approximately 54 days; and the pupal stage lasts 17 to 25 days. In lab experiments, longevity of adults can be high, at around 160 days for both sexes (Napompeth et al., 1972).

Most activity occurs at dusk; during the day, weevils can be found hidden between leaves and stalks of cane crops as well as in cracks and wounds on host material. They can also be found in decaying organic debris on the ground. Adults feed on cane stalks and the inner surfaces of cane leaf sheaths. Both males and females produce attractants after feeding (CABI, 2002).

Damage

This species attacks the stalks of healthy, damaged, or stressed sugarcane; the pseudostems of bananas; and the sheaths or stems of palms (reviewed in Giblin-Davis, 2001).

Palm: Adult females bore into the outer layer of stems and leaf bases of maturing palm trees and lay their eggs in small cavities. Eggs hatch into larvae, which develop inside the trunks resulting in exudation of pinkish sap. Larval damage has been observed from just above and adjacent to the root mass to 2 m (approx. 6.5 ft) or more above the ground. The grubs then pupate in a cocoon of fibers inside the trunk. In young palms, the larvae mine the central portion of the stem, destroying the plants. Damage extends up and down the stem for a number of centimeters from the initial point of entry.

In older palms, *R. obscurus* mine the thicker leaf bases, as well as a short distance into the trunk. Older palms can be disfigured by the emergence holes made by the weevils and also by trunk splitting, rendering them unfit for sale. Heavy infestations may weaken the trunk sufficiently for the tree to collapse, with damage occurring mostly up to 1 m (approx. 3 ft) above the ground. Jelly-like exudates from holes in leaf bases and/or stems may be observed. Signs of infestation include pin holes all over the trunk 0.6 to 0.9 m (approx. 2 to 3 ft) above the ground. During heavy infestations, a large number of grubs feed inside the palm, tunneling through and destroying the tissues. This leads to secondary infection by pathogens, resulting in weakening and collapse of the palms (Githure, n.d.). Trunk staining can occur, especially with high larval populations. If a large area of the base is destroyed in some hosts, the palm can become susceptible to lodging (toppling of a plant during wind or rain) (Halfpapp and Storey, 1991). Trees can collapse and die with heavy infestations (Lake, 1998).

Sugarcane: *Rhabdoscelus obscurus* is a serious pest of sugarcane and is also one of the most important sugarcane pests in Hawaii. Fortunately, the tachinid parasite, *Lixophaga sphenophori*, has greatly helped to reduce the once annual losses of over half a million dollars in the state (USDA, 1967; Schreiner, 2000).

Damage is usually associated with cane damaged through other means, such as cane knife cuts, splits in stalks, rats, and other stem borers. Damage is initiated at approximately four months after planting. Damage is more severe on ratoon cane (the regrowth after harvest) due to reinfestation by the weevil, which remains in the stubble after harvest. Newly tunneled sugarcane stalks show an accumulation of frass in tunnels and reddening of the surrounding tissues. External signs of infestation are tiny exit or breathing holes 4 to 6 mm (approx. $^{3}/_{16}$ to $^{1}/_{4}$ in) in diameter (also called windows or ‘windowing’ which regulate atmospheric conditions within the tunnel) and frass exuding at internodes.

Stalks can look healthy if the weevil attacks the bottom section of sugarcane when it is still soft and young; however, the injuries encourage secondary attack by microorganisms such as red rot pathogen, *Colletotrichum falcatum*, to which most of the losses in sugarcane farming are attributed (Githure, n.d.; University of Queensland, n.d.). During cyclonic winds, infested stems can become heavily damaged through splitting and twisting (Agnew, 1997).

Corn: Although corn is listed as a host by Napompeth et al. (1972) and Zimmerman (1968), specific symptoms for corn are not given. Corn is considered a secondary and infrequent host.

Pest Importance

Recently, cultivation of ornamental nurseries and betel nut has increased in the Pacific Islands. This has led to *R. obscurus* becoming an important pest in plants other than sugarcane. The larvae are known to feed on several palm species and can cause high mortality (Reddy et al., 2012). Older palms can become disfigured by weevil emergence holes and trunk splitting, causing the palms to become unmarketable. Trees can collapse and die during heavy infestations (Lake, 1998). When attacking betel nut, larvae often bore near the growing tip which can lead to tree death. This species has also become a pest of coconut trees in Guam (Reddy et al., 2011a). Larvae bore into the base of coconut trunks, weakening them. This can cause the trees to blow over during high winds (Reddy et al., 2012). In warm climates, this species can be a year-round pest (reviewed in Reddy et al., 2011a). *Rhabdoscelus obscurus* often attacks palms that are injured, sick, or stressed. It may also infest palm stumps, fronds, or damaged areas (Zimmerman, 1993).

Reddy et al. (2012) state that Guam and other Micronesian Islands are in the midst of a palm tree decline as this species becomes a more serious pest of palms. In Guam, this species is a serious pest of coconut palm (*Cocos nucifera*), betel nut (*Areca catechu*), champagne palm (*Hyophorbe lagenicaulis*), pritchardia palm (*Pritchardia pacifica*), pygmy date palm (*Phoenix roebelenii*), Alexander palm (*Archontophoenix alexandrae*), royal palm (*Roystonea regia*) and date palm (*Phoenix canariensis*) as well as sugarcane (*Saccharum officinarum*) (reviewed in Reddy et al., 2011b). Unless an effective control is devised, this weevil is likely to cause major or complete loss of palm production in Guam and other Micronesian Islands (Reddy et al., 2012). In Australia, this species has become common in rainforests where it attacks palms. It is considered a common palm nursery pest and has been found to move in transported palms (Agnew, 1997).

Rhabdoscelus obscurus is a serious pest of sugarcane and is especially serious in softer cane varieties. Losses can be as high as 10% or more (Zimmerman, 1968). This species was previously one of the most important sugarcane pests in Hawaii (USDA, 1967). It is most damaging in windward regions with warm temperatures and high rainfall (Santo et al., 2000). Fortunately, the tachinid parasite, *Lixophaga sphenophori*, has greatly helped to reduce the once annual losses of over half a million dollars in the state (USDA, 1967; Schreiner, 2000). Today, it is effectively controlled by the parasite and growing of resistant cultivars (Santo et al., 2000). However, this parasite has failed to control the pest in Fiji (USDA, 1967) where it is considered a highly destructive pest of sugarcane. This parasite was also introduced into Guam in 2005, but has yet to establish (Reddy et al., 2011b). Stalk damage of 2% in Fiji causes a 1.5% loss in obtainable sugar, a 3.3% loss in purity, and a 0.4% increase in dry matter and fiber. Overall, this loss is equivalent to $2 million Fiji dollars (about U.S. $1 million) (Tamanikaivoroi et al., 1996). If decreases in cane weights and non-harvested cane are taken into account, then actual losses may exceed $2 million Fiji dollars (Tamanikaivaroi, 1997). In Papua New Guinea, usually less than 2 to 8% of stalks are bored. Of these, most damage is only on the lower internodes (CABI, 2012).

When densities are high, serious damage can result. *Rhabdoscelus obscurus* infestations can considerably reduce the amount of commercial cane sugar from crops while also increasing levels of dextrans in cane juice (Agnew, 1997). Increased dextran causes difficulty in crystal sugar separation (University of Queensland, n.d.). When all stalks are damaged, sugar content can be decreased by as much as 1.5 units CCS (Commercial Cane Sugar) (Agnew, 1997). Due to the increasing popularity of green-cane harvesting and trash blanketing in such areas as far-northern Queensland, populations have increased in these areas. In Australia, the pest usually has four generations with infestations beginning in December or January. Infested stalks can potentially split when harvested mechanically and can fail to land in the harvest bin (Sallam et al., 2004). Crop losses in North Queensland were U.S. $3.5 million or more in the mid-1990s (Robertson and Webster, 1995).

Phytosanitary measures have been implemented in places like Queensland where infected planting material cannot be moved between districts. This pest moves easily and has already spread from New Guinea to most of the cane growing areas within the Pacific (CABI, 2002).

Known Hosts

Rhabdoscelus obscurus is considered a significant pest of sugarcane, palms, and banana and a secondary pest of corn.

Major hosts
Saccharum officinarum (sugarcane) and *Saccharum* spp. (sugarcane) (EPPO, 2012).

Minor hosts
Aiphanes horrida (=*A. caryotifolia*) (ruffle palm), *Archontophoenix alexandrae* (=*Ptychosperma alexandrae*) (Alexandra palm), *Archontophoenix cunninghamiana* (bungalow palm), *Areca catechu* (betelnut palm), *Bactris gasipaes* (peach palm), *Carica papaya* (papaya), *Carpentaria acuminata* (Carpentaria palm), *Caryota mitis* (Burmese fishtail palm), *Caryota urens* (wine palm), *Cocos nucifera* (coconut), *Dictyosperma album* (common princess palm), *Dypsis* spp., *Dypsis decaryi* (*Neodypsis decaryi*) (triangle palm), *Dypsis lutescens* (=*Chrysalidocarpus lutescens*) (Areca palm), *Dypsis madagascariensis* (=*Chrysalidocarpus madagascariensis*), *Dypsis nodifera* (=*Phloga nodifera*), *Elaeis guineensis* (oil palm), *Euterpe* spp., *Hyophorbe lagenicaulis* (champagne palm), *Inocarpus fagiferus* (=*I. edulis*)[1], *Licuala* spp. (licuala palm), *Metroxylon* spp., *Metroxylon sagu* (sago palm), *Metroxylon salomonense*, *Musa* spp. (banana), *Musa* x *paradisiaca* (plantain), *Normanbya normanbyi* (black palm), *Phoenix canariensis* (Canary Island date palm), *Phoenix roebelenii* (pygmy date palm), *Pigafetta filaris*, *Pritchardia martii* (loulu palm), *Pritchardia pacifica* (pritchardia palm), *Ptychosperma elegans* (cabbage palm), *Ravenala madagascariensis* (traveller's tree), *Roystonea* spp. (royal palm), *Roystonea regia* (=*R. elata*) (royal palm), *Sabal palmetto* (cabbage palm), *Syagrus romanzoffiana* (queen palm), *Wodyetia bifurcata* (foxtail palm), and *Zea mays* (corn) (Githure, n.d.; USDA, 1967; Napompeth et al., 1972; Halfpapp and Storey, 1991; Zimmerman, 1993; Muniappan et al., 2004; Reddy et al., 2005; EPPO, 2012).

Wild hosts
Arecaceae (plants of the palm family), *Poaceae* (grasses), and *Strelitzia reginae* (bird-of-paradise) (CABI, 2002).

[1]Zimmerman (1968) states that this species may not be a true host of *R. obscurus*.

Pathogen or Associated Organisms Vectored

This species is not known to vector any pathogens or associated organisms. However, organisms can invade tissues that have been damaged by *R. obscurus* including red rot, *Colletotrichum falcatum*, and other microbial decomposers (CABI, 2002). This disease can lower sugar content which decreases value (Agnew, 1997).

Known Distribution

Rhabdoscelus obscurus is native to New Guinea and surrounding islands but has spread to almost all of the sugarcane growing areas in the Pacific. This pest is present in Hawaii but exotic to the contiguous United States.

Asia: Indonesia (including Buru and Ternate), Japan (including Bonin Islands and Ryukyu Islands), Malaysia, Taiwan; **Oceania:** American Samoa, Australia[1], Christmas Island, Cook Islands, Federated states of Micronesia (including Caroline Islands, Fiji, French Polynesia (including Austral Islands, Gambier Islands, Marquesas Islands, Society Islands, and Tahiti), Guam, Hawaii[1], Mariana Islands, Marshall Islands, Nauru, New Caledonia, Niue, Northern Mariana Islands, Palau, Papua New Guinea (including New Britain and New Ireland), Samoa, Solomon Islands, Sunda Islands, Tonga, Vanuatu (Githure, n.d.; USDA, 1967; Zimmerman, 1968; Reddy et al., 2005; EPPO, 2012).

[1]Giblin-Davis et al. (2000) state that the populations in Hawaii and Australia are possibly sister species as there are pheromonal differences (see note at beginning of datasheet for more information).

Pathway

This species has been intercepted 19 times at U.S. ports of entry. All interceptions except for one originated from Hawaii; the other interceptions originated from American Samoa. All interceptions except for one occurred on host material (11 on *Saccharum officinarum*, 3 on *Saccharum* sp., 3 on *Cocos nucifera*, and 1 unspecified plant). All interceptions were found in baggage. Two additional interceptions of *Rhabdoscelus* sp. have also occurred (AQAS, 2012; queried March 12, 2012).

This species has already been spread by humans through movement of sugarcane. It has been introduced into Australia, Polynesia, Micronesia, and Hawaii (reviewed in Giblin-Davis, 2001). It was likely introduced into Hawaii alongside two cane varieties brought from Tahiti (Napompeth et al., 1972). This species may also move through infested palm material (Agnew, 1997).

Natural spread is possible through adult flight, although adults are infrequent fliers (Halfpapp and Storey, 1991). During a mark and recapture study, Van Zwaluwenburg and Rosa (1940) found that *R. obscurus* could move considerable distances through flight and wind dispersal (up to 0.5 km (0.3 mi) from release sites).

Potential Distribution within the United States

The most prevalent host material grown in the United States is corn (*Zea mays*), which is grown extensively in the Midwest. Although corn is listed as a host by Napompeth et al. (1972) and Zimmerman (1968), corn is considered a secondary and infrequent host. If introduced into the United States, this species is likely to cause more problems in areas where other host material is present, specifically palms and sugarcane.

According to the 2007 Census of Agriculture, there are four states that grow sugarcane for harvest: Florida, Hawaii, Louisiana, and Texas (NASS, 2009).

Survey

CAPS-Approved Method*: There are two CAPS-approved survey methods for *Rhabdoscelus obscurus*. Visual surveys may be used to detect larval populations before adults emerge. A trap and lure combination may be used to detect adult populations.

Visual Inspection

Visual inspection may be used in palms with highly suspect damage and signs of infestation are observed. If permission can be obtained by the property owner, remove a frond at the base of the petiole. Once the frond has been removed, inspect the base of the frond for tunneling, larvae, pupae, or adults.

Larvae mine the thicker leaf bases in older palms and may extend a short distance into the trunk. To check, another visual inspection method entails cutting a “window” in the crown of a highly suspect tree. Based on the size of the tree, multiple fronds are cut from one side of the crown from near the tip to the start of the trunk to reveal any tunneling occurring in the crown. This method will affect the appearance of the palm and access to the canopy may be difficult. Therefore, only highly suspect trees should be used and permission must be obtained from the property owner.

Symptoms that may be observed while visually inspecting a plant include bark discoloration, oozing sap, and larval feeding.

Trapping

1.1 Trap and Lure

The approved trap is a palm weevil bucket trap, which can either be made or ordered.

There are three attractants needed to trap for *Rhabdoscelus obscurus*: two lures and a food bait that is prepared on site. The two lures are 1) an aggregation pheromone (2-methyl-4-octanol) and 2) ethyl acetate. The food bait should consist of split sugarcane chopped into 2 to 5 cm long ($^{3}/_{4}$ to 2 in) pieces.

All three attractants (the two lures and food bait) are required to report negative data for *Rhabdoscelus obscurus*. The pheromone and ethyl acetate lures should be replaced every six weeks (42 days). The food bait should be replaced every 7 to 9 days.

IPHIS Survey Supply Ordering System Product Names:

Palm Weevil Bucket Trap,
Rhabdoscelus obscurus Aggregation Lure, **and**
Palm Weevil Lure, Ethyl Acetate

Note: Do not include lures for other palm pests in the same trap when trapping for *Rhabdoscelus obscurus*.

1.2 Trap Construction

Traps may either be purchased or constructed on site and should not be any smaller than five gallons. Traps should have the following features:

- Rough texture on the outside of the bucket to allow weevils to crawl up the outer surface (attach burlap, ground cloth, or some other material to the outside of the container) (Figure 3).
- Holes large enough (approx. 3 cm (1 $^{1}/_{5}$ in)) to permit weevil entry in the side of the bucket, cut near the rim (Figure 4).

- Sufficient space at the bottom for a liquid mixture that is used to trap and kill the weevils that enter the trap.
- A tight-fitting lid to prevent contamination of the trap contents.

Figure 3. Homemade *R. ferrugineus* trap covered with burlap (Image courtesy of Amy Roda, USDA-APHIS).

Figure 4. Homemade *R. ferrugineus* trap with entrance holes (Image courtesy of Amy Roda, USDA-APHIS).

Use a wire to attach the two lures to the trap lid, allowing the lure to suspend about one-half inch above the liquid (Figure 5).

1.3 Food Bait Preparation

Completely cover the food bait with a liquid solution. The liquid is critical as the weevils are attracted to the humidity and it prevents the weevils from crawling out of the trap. A 50 to 50 solution of propylene glycol (low-toxicity anti-freeze such as RV & Marine Antifreeze) and water helps minimize evaporation and the chance of the trap drying and the beetles escaping. Enough water and propylene glycol should be added to completely cover the bait and in a quantity that will remain until the next servicing date. Surrounding environmental conditions will dictate how quickly the trap will dry out; and the quantity of liquid or frequency of servicing may need to be adjusted.

Figure 5. Lid of homemade bucket trap with hanging lure (Image courtesy of Amy Roda, USDA-APHIS).

1.4 Trap Placement

Traps should be placed on the ground not suspended from trees. When placing traps, they should be strapped to the host trees. Although native palm weevils can be attracted to the food baits, research has shown that catches of *Rhabdoscelus obscurus* were significantly higher in traps strapped to host trees as opposed to traps placed between trees or away from trees (Reddy et al., 2011a).

1.5 Trap Servicing
Collect insect specimens from the trap and replace food baits every seven to nine days. The pheromone and ethyl acetate lures should be replaced every six weeks (42 days). The release rates and longevity of the lures are also based on temperature (i.e., the release rate increases at higher temperatures). Lures may need to be changed more frequently in hot, dry regions such as Texas and California. It is also of crucial importance to keep enough water and propylene glycol in the traps to completely cover the food bait.

1.6 Survey Site Selection
Areas with host plant material should be targeted. These can be sugarcane fields (considered the main host of this species) as well as areas that have other host material, mainly palms. Nurseries as well as residential or public areas where palms are used as ornamentals can also be targeted for survey. Surveys should not be targeted in corn fields, as this is considered a secondary and infrequent host.

*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/.

Literature-Based Methods:
Trapping: Pheromone traps in combination with host material are used as a type of population control where the pest is prevalent. Giblin-Davis et al. (1996) determined that approximately 3 mg per day of synthetic pheromone with insecticide-treated plant host tissue was highly attractive as bait for palm weevils.

Chang and Curtis (1972) reported that male *R. obscurus* produce an aggregation pheromone that is attractive to both male and female weevils, but did not identify the compound. Furthermore, the authors found that split-cane traps baited with mated or virgin male *R. obscurus* were more attractive than traps with or without female weevils. The aggregation pheromone of Hawaiian *R. obscurus* was later identified as 2-methyl-4-octanol; while the pheromone compounds of Australian *R. obscurus* are 2-methyl-4-octanol, (*E*2)-6-methyl-2-hepten-4-ol (rhynchophorol) and 2-methyl-4-heptanol (Giblin-Davis et al., 2000). However, 2-methyl-4-heptanol has not shown any noticeable behavioral effect on *R. obscurus* (Giblin-Davis et al., 2000). In previous studies, the addition of ethyl acetate and cut sugarcane to pheromone traps significantly increased trap catches when added to pheromone lures (Muniappan et al., 2004; Reddy et al., 2005). Robertson et al. (1998) state that the best aggregation lure for *R. obscurus* is a combination of rhynchophorol and octanol along with ethyl acetate and 5 cm (approx. 2 in) lengths of split cane. The lures are reported to be commercially available (Muniappan et al., 2004).

Sallam et al. (2004) used split-cane traps, bundles of six to eight split lengths of sugarcane, wrapped in black plastic with the ends left open to evaluate adult borer population fluctuations. Sallam et al. (2007) evaluated several types of traps when surveying for *R. obscurus* and found that the 'water trap' was the most effective at catching adults. This trap is described as a 20 cm (approx. 7 $^{7}/_{8}$ in) diameter pot with a plastic bag inserted to hold water, with pheromone lures and cane pieces held together in a plastic container suspended over the water from a square of wire mesh. This trap can attract borers from adjacent fields (Sallam et al., 2007).

Muniappan et al. (2004) and Reddy et al. (2005) used plastic bucket traps baited with the pheromone lure in combination with a food volatile compound (ethyl acetate) and cut sugarcane. The trap consisted of 19 L (approx. 5 gal) white plastic-tapered containers (37 cm height x 30 cm inner diameter base (approx. 14 $^{9}/_{16}$ by 11 $^{13}/_{16}$ in)). Two holes (17.5 cm long and 7.5 cm wide (approx. 6 $^{7}/_{8}$ by 2 $^{15}/_{16}$ in)) were cut on opposite sides of the container to allow weevil entry into the trap. Twenty drainage holes, each 3 mm (approx. $^{1}/_{8}$ in) in diameter, were made in the base. Each assembled trap was placed at the base of a mature coconut tree in the field and strapped securely against it. Such a set-up helped the weevils walk into the trap. At each location, inter-trap distance was set at 100 m (approx. 328 ft). The pheromone lure was sealed in a polymer membrane release device optimized for the Australian population of *R. obscurus* ((E2)-6-methyl-2-hepten-4-ol and 2-methyl-4-heptanol) and was suspended halfway inside the trap with a wire. Release devices for ethyl acetate lures were hung in the trap. The pheromone and ethyl acetate were changed at 4-month intervals. Fresh sugarcane sections were15 cm (approx. ½ ft) long and split in the middle along their length. The cut sugarcane was placed directly in the bucket trap and replaced weekly.

A later study by Reddy et al. (2011a) found that ramp and ground traps caught significantly more adults than bucket and pitfall traps. Ground traps (≥ 15 ¾ by 9 $^{13}/_{16}$ in) were cheaper and easier to handle than ramp traps. Out of the eight colors tested, brown was the most effective.

<u>Time of year to survey:</u>
In Australia, adult populations begin building up in sugarcane fields beginning in December and peak in March and April. During winter, populations remain low (Sallam et al., 2007). Sallam et al. (2004) state that adults establish in sugarcane fields around the time that the first millable internode is expanded.

Key Diagnostics/Identification

<u>CAPS-Approved Method*:</u> Morphological. The genus *Rhabdoscelus* can be identified through morphological characteristics. Key characteristics include: mesocoxae separated by more than the width of a mesocoxa, spotted or blotched elytra, pile raised in irregular vittae and pustules, and moderately large elytral strial punctures (Zimmerman, 1993).

This species has high variability in its general appearance, including size, color, and pattern which can cause confusion when identifying (Zimmerman, 1968), as evident by its numerous synonyms over the years.

Detailed descriptions of all stages of this species can be found in Riley (1888), Terry (1907), and Muir and Swezey (1916).

Brodel (2013a) provides important morphological characters of Dryophthoridae, showing how to differentiate this family from Curculionidae.

A Dryophthoridae key by Zimmerman (1968) as modified by C. F. Brodel (2013) is found in Brodel (2013b).

A key to domestic and PPQ-intercepted genera of Dryophthorinae can be found in Brodel (2002). This key includes several genera of importance, including *Rhabdoscelus*, *Metamasius*, and *Rhynchophorus*.

*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

Modified by C. F. Brodel (7/2013):

Rhabdoscelus obscurus resembles in shape, size, and coloration other sugarcane- and palm-attacking dryophthorid weevils distributed throughout the Americas and Southeast Asia.

This weevil can easily be confused with the 11 other recognized species of *Rhabdoscelus* (International Weevil Community Website, n.d.) that occur from the Pacific Islands westward to Japan, eastern Asia, Indonesia, and Australia. *Rhabdoscelus maculatus*, for instance, has red and black dorsal patterns resembling those of *R. obscurus* (Karunaratne et al., 2011). Separating these species from each other will be difficult in the absence of both taxonomic literature and representative specimens of each species. A key to all species of *Rhabdoscelus* is not known to have been published; however, Zimmerman (1993) provides a key that distinguishes *R. obscurus* from the only other species of *Rhabdoscelus* present in Australia, *R. interstitialis*. Fortunately, *R. obscurus* has demonstrated its invasiveness far more than any other species of *Rhabdoscelus*; therefore, it is likely that any detected specimen of a *Rhabdoscelus* will be *R. obscurus*.

Additionally, surveyors and trappers will not easily be able to separate *Rhabdoscelus* from the dryophthorid genera *Cosmopolites*, *Metamasius*, and *Sphenophorus* that will probably appear frequently in traps because they infest many of the same hosts as *Rhabdoscelus*. Anderson (2002) provides a key to Dryophthoridae that includes these three genera but not *Rhabdoscelus* due to the Asian origin of the genus. Zimmerman (1968) presents a key to both larvae and adults of all dryophthorid genera occurring in southeastern Polynesia, but logically does not include the American genera *Metamasius* and *Sphenophorus*. Brodel (2002) modifies Anderson’s key to address all dryophthorid genera intercepted at U.S. ports of entry from all origins; however, it uses taxonomic terminology, few pictorials, and no glossary. To overcome these shortcomings, Brodel

(2013) has composed a shortened key that modifies that of Zimmerman (1968) so that *Rhabdoscelus* and the above-named genera can be taxonomically separated with minimal to moderate difficulty. Its use of digital images enables users to determine to the family Dryophthoridae easily and then to separate the four genera in just two couplets.

Rhabdoscelus obscurus should less likely be confused with the red palm weevil, *Rhynchophorus ferrugineus* (FitzGibbon et al., 1998), as well as two other species in the genus, *R. cruentatus* and *R. palmarum.* Even though these are dryophthorids and some have coloration patterns similar to those of *R. obscurus*, they typically measure at least 8 or 9 mm longer (personal measurements of collection specimens) than the *maximum* length recorded by Zimmerman (1993) for *R. obscurus*. The Hawaii Biodiversity Information Network states that "*Rhabdoscelus obscurus* grows to only 0.5 inches, which is smaller than the 1.5 inch long red palm weevil." *Rhabdoscelus obscurus* are much wider also, giving them a more robust appearance than the other genera discussed above.

References

Agnew, J. R. 1997. Australian sugarcane pests. Bureau of Sugar Experiment Stations, Indooroopilly, AU.

Anderson, R. S. 2002. Classification of the nearctic Curculionidae. I. Dryophthorinae Schoenherr 1825. *In* R. H. Arnett, Jr., M. C. Thomas, P. E. Skelley, and J. H. Frank, eds. CRC Press, Boca Raton. pp. 728-730.

Brodel, C. F. 2002. A key to domestic and PPQ-intercepted genera of Dryophthorinae (Coleoptera: Curculionidae). USDA-APHIS-PPQ. 6 pp. Available online: http://caps.ceris.purdue.edu/webfm_send/2092.

Brodel, C. F. 2013a. Important morphological characters of Dryophthoridae. USDA-APHIS-PPQ. 1 p. Available online: http://caps.ceris.purdue.edu/webfm_send/2207.

Brodel, C. F. 2013b. Dryophthoridae key by Zimmerman (1968) as Modified by C. F. Brodel (2013). Available online: http://caps.ceris.purdue.edu/webfm_send/2208.

AQAS. 2012. All *Rhabdoscelus* spp. interceptions. Accessed March 23, 2012 from: https://mokcs14.aphis.usda.gov/aqas/HomePageInit.do.

CABI. 2002. Crop Protection Compendium. Wallingford, Oxon., UK. Accessed from: http://www.cabi.org/cpc/.

CABI. 2012. Crop Protection Compendium report – *Rhabdoscelus obscurus* (sugarcane weevil borer). Wallingford, Oxon., UK. Accessed June 28, 2012 from: http://www.cabi.org/cpc/.

Chang, V. C. S. and G. A. Curtis. 1972. Pheromone production by the New Guinea sugarcane weevil. Environmental Entomology 1: 476-481.

EPPO. 2012. EPPO Plant Quarantine Information Retrieval System, Version 5.0.5540. European and Mediterranean Plant Protection Organization.

FitzGibbon, F., P. G. Allsopp, and P. J. De Barro. 1998. Sugarcane exotic pests- Pest risk analysis database. BSES Publication CD98001.

Giblin-Davis, R. M. 2001. Borers of Palms. *In* F. W. Howard, D. Moore, R. M. Giblin-Davis, and R. G. Abad (eds.) Insects on Palms. CABI Publishing. 267-304.

Giblin-Davis, R. M., A. C. Oehlschlager, A. Perez, G. Gries, R. Gries, T. J. Weissling, C. M. Chinchilla, J. E. Pena, R. H. Hallett, H. D. Pierce Jr., and L. M. Gonzalez. 1996. Chemical and Behavioral Ecology of Palm Weevils (Curculionidae: Rhynchophorinae). Florida Entomologist, 79(2): 153-167.

Giblin-Davis, R. M., R. Gries, B. Crespi, L. N. Robertson, A. H. Hara, G. Gries, C. W. O'Brien, and H. D. Pierce Jr. 2000. Aggregation Pheromones of Two Geographical Isolates of the New Guinea Sugarcane Weevil, *Rhabdoscelus obscurus*. Journal of Chemical Ecology, 26(12): 2763-2780.

Githure, C. n.d. *Rhabdoscelus obscurus*. EcoPort Foundation. Accessed November 6, 2009 from: http://ecoport.org/ep?Arthropod=20025&entityType=AR****&entityDisplayCategory=full.

Halfpapp, K. H. and R. I. Storey. 1991. Cane Weevil Borer, *Rhabdoscelus obscurus* (Coleoptera: Curculionidae), a Pest of Palms in Northern Queensland, Australia. Principes, 35:199-207.

International Weevil Community Website. No date. Accessed July, 2013 from: http://weevil.info/taxonomy/term/31685/literature.

Karunaratne, M. D. S. U., M. M. S. C. Karunaratne, and H. M. R. K. Ekanayake. 2011. Biology of the palm weevil, *Rhabdoscelus maculatus*, in selected foliage palm nurseries in Sri Lanka. Tropical Agricultural Research & Extension 14(3): 70-75.

Lake, J. 1998. Getting control of weevil borers and leaf beetles in palms. The Nursery Papers, 1998(02): 1-4.

Muniappan, R., J. Bamba, J. Cruz, and G. V. P. Reddy. 2004. Field Response of Guam Populations of the New Guinea Sugarcane Weevil, *Rhabdoscelus obscurus* (Boisduval) (Coleoptera: Curculionidae), to Aggregation Pheromones and Food Volatiles. Micronesica, 37(1): 57-68.

Muir, F. and O. H. Swezey. 1916. The cane borer beetle in Hawaii and its control by natural enemies. Hawaiian Sugar Planters' Assoc. Exp. Sta. Entomol. Ser. Bull. No. 13. 102 p.

Napompeth, B., T. Nishida, and W. C. Mitchell. 1972. Biology and rearing methods of the New Guinea Sugarcane Weevil *Rhabdoscelus obscurus*. Technical Bulletin, 85.

NASS. 2009. United States Summary and State Data. Volume 1. Geographic Area Series, Part 51. AC-07-A-51. United States Department of Agriculture, National Agricultural Statistics Service.

Reddy, G. V. P., Z. T. Cruz, J. Bamba, and R. Muniappan. 2005. Development of a semiochemical-based trapping method for the New Guinea sugarcane weevil, *Rhabdoscelus obscurus* in Guam. Journal of Applied Entomology, 129(2): 65-69.

Reddy, G. V. P., S. Balakrishnan, J. E. Remolona, R. Kikuchi, and J. P. Bamba. 2011a. Influence of trap type, size, color, and trapping location on capture of *Rhabdoscelus obscurus* (Coleoptera: Curculionidae). Annals of the Entomological Society of America 104(3): 594-603.

Reddy, G. V. P., R. K. Vander Meer, A. Moore, M. Quintanilla, J. Bamba, J. C. Borja, J. Mafnas, and A. E. Badilles. 2011b. Semiochemical-based trapping methods for weevil pests in Guam. Western Pacific Tropical Research Center, University of Guam.

Reddy, G. V. P., P. Shi, C. R. Mann, D. M. H. Mantanona, and Z. Dong. 2012. Can a semiochemical-based trapping method diminish damage levels caused by *Rhabdoscelus obscurus* (Coleoptera: Curculionidae)? Annals of the Entomological Society of America 105(5): 693-700.

Riley, C. V. 1888. A Sandwich Island sugar-cane borer (*Sphenophorus obscurus* Boisd.). Insect Life 1(6): 185-189.

Robertson, L. N. and D. E. Webster. 1995. Strategies for managing cane weevil borer. Proceedings of the Australian Society of Sugar Cane Technologists, 17: 83–87.

Robertson L. N., R. M. Giblin-Davis, and A. C. Oehlschlager. 1998. Field experiments to optimise lures for mass-trapping of cane weevil borer. Project Report, Bureau of Sugar Experiment Stations PR98003, 1–7.

Sallam, M. N. 2013. Trap and lure for *Rhabdoscelus obscurus*. Personal communication to T. P. Molet on April 18, 2013 from M. N. Sallam (Research Officer, Entomology, BSES Limited).

Sallam, M. N., D. R. Peck, C. A. McAvoy, and D. A. Donald. 2007. Pheromone trapping of the sugarcane weevil borer, *Rhabdoscelus obscurus* (Boisduval) (Coleoptera: Curculionidae): an evaluation of trap design and placement in the field. Australian Journal of Entomology, 46(3): 217-223.

Sallam, M. N., C. A. McAvoy, G. D. Publisi, and A. M. Hopkins. 2004. Can economic injury levels be derived for sugarcane weevil borer, *Rhabdoscelus obscurus* (Boisduval) (Coleoptera: Curculionidae), in far-northern Queensland? Australian Journal of Entomology 43: 66-71.

Santo, L.T., S. Schenck, H. Chen, and R. V. Osgood. 2000. Crop Profile for Sugarcane in Hawaii. Hawaii Agriculture Research Center. Accessed March 23, 2012 from: http://www.ipmcenters.org/cropprofiles/docs/hisugarcane.html.

Schreiner, I. 2000. New Guinea Sugarcane Weevil (*Rhabdoscelus obscurus* Boisduval). Agricultural Pests of the Pacific: Agricultural Development in the American Pacific.

Tamanikaiyaroi R. 1997. Cane weevil borer (*Rhabdoscelus obscurus* Boisd.) damage on Mana cane in Western Vitilevu. Journal of South Pacific Agriculture, 4(1/2): 49-54.

Tamanikaiyaroi, R., S. S. Johnson, and R. A. Wood. 1996. Loss in cane quality caused by the cane weevil borer (*Rhabdoscelus obscurus* Boisd.) in the Fiji sugar industry. Proceedings of the International Society of Sugar Cane Technologists, 22(2): 599-603.

Terry, F. W. 1907. The sugar cane borer (*Sphenophorus obscurus*) in the Hawaiian Islands. Hawaiian Sugar Planters' Assoc. Exp. Sta. Div. Entomol. Circ. No. 3. 22 p.

USDA. 1967. Insects not known to occur in the Continental United States: New Guinea sugarcane weevil (*Rhabdoscelus obscurus* (Boisduval)). Coop. Econ. Ins. Rpt., 17: 749-750.

University of Queensland. n.d. Zoology and Entomology: *Rhabdoscelus obscurus*. Accessed November 6, 2009 from: https://www.gpdd.info/references/137_xx_nd_University_Queensland_15804.pdf.

Van Zwaluwenberg, R. H. and J. S. Rosa. 1940. Field movement of sugar cane beetle borer adults (abstract). Hawaiian Planters Record 44: 3-6.

Zimmerman, E. C. 1968. "*Rhynchophorinae* of southeastern Polynesia." Pacific Insects, 10: 47-77.

Zimmerman, E. C. 1993. Australian weevils (Coleoptera: Curculionoidea). Volume III. Nanophyidae, Rhynchophoridae, Erirhinidae, Curculionidae: Amycterinae, literature consulted. CSIRO Australia and Entomological Society of America Publishing.

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 *Rhabdoscelus obscurus*. USDA-APHIS-PPQ-CPHST.

Revisions

July 2016: NAPPFAST map removed.