SPATIAL DISTRIBUTION OF *PHYLLOPHAGA VANDINEI* (COLEOPTERA: SCARABAEIDAE) EMERGENCE WITHIN AND AROUND A MAMEY SAPOTE ORCHARD

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Cone emergence cages have been used to monitor a variety of soil-borne coleopterans, including *Conotrechulus nenuphar* (Herbst) (Jenkins et al. 2006), *Curculio caryae* (Horn) (Coleoptera: Curculionidae) (Mulder et al. 2000)*, and Phyllophaga vandinei* Smyth (Jenkins & Goenaga 2008). *Phyllophaga* species (Coleoptera: Scarabaeidae), have broad host ranges and are pests of a number of economic crops in Puerto Rico (Wolcott 1948; Martorell 1945, 1976).

The cage, a cone shaped piece of galvanized screen with a boll weevil trap (Great Lakes IPM, Vestaburg, MI) at the top and modified to allow entry to larger beetles such as *Phyllophaga* spp., traps adults that have emerged from pupation in the soil under cage. Jenkins & Goenaga (2008) demonstrated that, in the case of *P. vandinei*, the cage is an effective means of monitoring adult populations but may not be useful as an accurate indicator of the presence of larvae beneath the cage in the field. We have noted that adults may cluster at the base of a cage at dawn, burrow under the cage and re-emerge the following night inside the cage. Light trap data and surveys on host trees reveal that adults of *P. vandinei* fly for a brief period after dusk (approximately 30-45 min) and at dawn, between which time they feed on the foliage of the host plant and mate (Jenkins, unpublished data). At dawn the adults return to the soil and are most often found in dense aggregations at the base of vertical objects, including host trees, irrigation stakes, and cone emergence cages (Jenkins, unpublished data). Jenkins & Goenaga (2008) concluded that cone emergence cages continued to capture adult beetles when left in place longer than a year (the beetle's life cycle is less than a year). However, the traps that had been in place the longest were all on the western side of trees, indicating that trap location with respect to the host tree could be a critical factor in the effectiveness of the cone emergence cage.

This study was designed to determine whether cone emergence cages placed to the west side of the host trees captured more adults than traps placed to the east of the trees. Previous studies already indicated that cages to the west capture more beetles than cages to the north and south (Jenkins & Goenaga 2008; Jenkins, unpublished data). We also compared the number of adults captured by cages placed immediately at the base of the tree to adults captured in cages placed between trees (within a row) and cages placed in an adjacent field, with the assumption being that the host trees are focal points for these aggregations.

Cone emergence cages were placed in an orchard of mamey sapote (*Pouteria sapota*: Sapotaceae) in Isabela, Puerto Rico in Mar 2008, with 20 traps at the east base of the trees, and 20 to the west base of the same trees. Twenty cages were placed within rows but between trees 3 m from the base of the trees. Additionally, 20 cages were placed in a grid of 4 rows of 5 traps 3 m apart in a grass field 10 m south from the southeast border of the mamey sapote orchard. All cages were on the southeast corner of the orchard: previous studies have shown that *P. vandinei* populations were higher in this area than other locations at the station. Cages placed in 2008 were left in place and used again in 2009. All cages were checked for adult *P. vandinei* weekly between Mar and Jul in 2008 and 2009. The mean number of adult beetles emerging in each treatment (cage placement) was compared by ANOVA (SAS Institute 2006) and means were separated using Student-Newman-Keuls Multiple Range Test procedure ($P \leq 0.05$).

In 2008, analysis indicated ($P = 0.0015$) that the mean number of adult *P. vandinei* emerging in cone emergence cages placed to the west of host trees was larger than in cages placed to the east of host trees, or in cages placed between trees or in an adjacent field (Table 1). In 2009, analysis indicated ($P = 0.0002$) that the mean numbers of adult *P. vandinei* emerging in cone emergence cages placed at the base of host trees (to the east

TABLE 1. MEAN NUMBER (±SEM) OF ADULT *P. VANDINEI* EMERGING IN CONE EMERGENCE CAGES PLACED AT THE BASE OF A HOST TREE (*POUTERIA SAPOTA*: SAPOTACEAE) (EAST OR WEST OF THE TREE), BETWEEN TREES, OR IN AN ADJACENT FIELD IN 2008 AND 2009 (N = 20). MEANS FOLLOWED BY THE SAME LETTER WITHIN A COLUMN WERE NOT DETERMINED TO BE SIGNIFICANTLY DIFFERENT: FOR 2008 DATA, $DF = 76, 3$, $F = 5.68$, $P = 0.0015$; FOR 2009 DATA, $DF = 76, 3$, $F = 7.68$, $P = 0.0002$.

	2008	2009
West of tree	8.4 ± 7.8 a	9.2 ± 1.8 a
East of tree	3.3 ± 9.1 b	8.1 ± 2.1 a
Between trees	3.2 ± 5.1 b	3.2 ± 1.2 b
Adjacent field	3 ± 0.9 b	0.7 ± 0.2 b

or the west) were larger than in cages placed between trees or in an adjacent field in 2009 (Table 1).

There were numerically fewer beetles captured in cages placed in the field in 2009. This can be explained by the fact that the cages having been in place for more than a year effectively excluded oviposition by gravid females.

Summary

Evidence to support the hypothesis that more *P. vandinei* would be caught in traps placed to the west of the tree was only observed in 2008. In 2009 cages placed to the east of host trees were as effective as cages placed to the west of the tree and cages placed at the base of the tree trapped more beetles than cages placed between host trees or cages placed in an adjacent field. Cone emergence cages placed in an adjacent field caught significantly fewer adults the second year but cages within the orchard caught similar numbers of beetles the first and second years, except traps to the east of the tree, which caught more beetles the second year. This suggests that oviposition may be occurring not at the base of the host trees as has been thought, but in adjacent grass fields.

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