NUISANCE PSYCHODA ALTERNATA (DIPTERA: PSYCHODIDAE) DEVELOPING IN POTTED PLANTS AT A COMMERCIAL NURSERY

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Abstract

Moth flies (Psychoda alternata Say) were reported emerging in large numbers from potted plants at a commercial nursery near Fort White, Columbia County, FL, and causing an annoyance and potentially a public health nuisance at neighboring residences. The distribution of its fly immature stages in the soil of recently re-potted plants was investigated. Two species of plants from the commercial nursery were selected, soil samples were taken at different depths and positions and each soil sample was extracted using a technique for nematode extraction from soil. Larvae and pupae of P. alternata moth flies were identified in the samples. Psychoda alternata is commonly found breeding in trickling filters and this is the first record of it being an important nuisance pest in newly potted plants.

Key Words: drain fly; trickling filter fly; nuisance; soil
Gold et al. 1985). Cases of urogenital myiasis caused by *P. alternata* have been related to poor human hygienic conditions (den Otter 1966; Hira et al. 1997; Yones et al. 2014; Saa- 
dawi et al. 2017), and ocular myiasis has also occurred (Kamimura 1967). *Psychoda alternata* is also known to be forensically significant, and recently was identified in human cadav-
ers (Lindgren et al. 2015). Therefore, *P. alternata* has the potential to be a significant public health problem for residences near commercial nurseries.

The County Health Department, Florida Department of Agriculture and Consumer Services, and Mosquito Control District were contacted by the affected homeowners to in-
vestigate the problem. A large commercial nursery bordered the affected houses and no other sources of these moth flies were located in this rural area. The nursery owner observed that 10-14 days after re-potting new plants large numbers of 2-4 mm sized moth flies would be seen on the foliage of some plants. An inspection of the ground under pots placed on a weed barrier indicated no larvae.

The main objective was to determine whether moth flies were developing in plant pots at this commercial nursery and to de-
termine the distribution of immature moth fly stages in the media of recently re-potted plant species that were observed to have adult flies associated with their vegetation.

Two species of recently re-potted plants from the commercial nursery were selected. *Camellia* (*Camellia japonica*) were propagat-
ed at the same nursery and then re-potted in 26.5-liter pots 7 days before collection. *Gardenia* (*Gardenia jasminoides*) were purchased from another nursery as small plants and then re-potted in 26.5-liter pots 14 days be-
fore collection. Three containers for each of the two species were returned to the labora-
tory for analysis during March 2019.

The soil used for re-potting all plants was composed of 55% pine bark (1.3 cm), 25% pine bark (2.2 cm), and 20% Canadian peat. Additives to the media mix were fertilizer (7.12 kg/m³ Nutricote, Arysta Life Science, Cary, NC), iron humate (5.93 kg/m³), do-
lomite (2.67 kg/m³), and synthetic gypsum 100 (1.48 kg/m³). Bifenthrin granules (1.78 kg/m³) were added to the potting media to comply with the USDA imported fire ant quarantine (APHIS 2018). The plants were irrigated twice per week, as needed, to wet the medium to the bottom of the pot, without runoff.

Twelve samples (150 ml each) of media were collected the day after bringing the plants to the laboratory. Samples were taken at 8-days after re-potting (DARP) for *Camel-
lia* and 15-DARP for *Gardenia*. To establish the distribution of insect larvae and pupae in the potting medium surrounding the roots of potted plants, twelve media samples were removed from each pot at 5-cm incre-
ments from the surface (0-5 cm) to the bot-
tom (25-30 cm). Six samples were from the perimeter of the medium, and six were from the center. There were 72 samples total with 36 for 8-DARP *Camellia* and 36 for 15-DARP *Gardenia*.

Samples were examined using a tech-
nique commonly applied for nematode extraction from soil. This technique was tested prior to use in the experiment and produced good results in the extraction of small fly larvae from soil. This technique may be useful for extraction and quantification of other small insect larvae from soil samples. Each 150-ml sample was washed thoroughly into a sieve (2-mm mesh) to re-
move the bigger fraction of the media fol-
lowed by passing media through a smaller sieve (37-μm mesh). The smaller fraction was transferred into a 100-ml centrifuge tube and centrifuged for 5 min at 3500 rpm. The supernatant was removed, and sugar solution (454 g sucrose/liter of water) was added to the remaining sample and re-
centrifuged for 5 min at 3500 rpm. At this stage, the supernatant was filtered through a 25-μm mesh sieve and transferred into 50-
ml tubes. The collected material was pre-
served in 70% isopropyl alcohol and exam-
ined under a stereo microscope to identify and count fly larvae and pupae. Taxonomic keys by Quate (1955) were used.

The effects of depth and position (pe-
riphery or center) on the distribution of moth fly larvae and pupae were analyzed us-
ing a two-way ANOVA, and means were compared using Student’s t-test (P<0.05) in JMP Statistical Analysis Software (SAS Institute, Cary, North Carolina, USA). Before analysis, data were transformed using square-root transformation to normalize the data distribution.

Four hundred and forty-four larvae and pupae of \textit{Psychoda alternata} were found in the samples (Figure 1). \textit{Psychoda alternata} totaled 60% of all insect pupae in all samples, 56% of the insect pupae in 8-DARP \textit{Camellia}, and 81% of the pupae in 15-DARP \textit{Gardenia}. Only mature larvae were found in the

![Figure 1](image_url)  

Figure 1. Distribution (mean +/- std. error) of \textit{Psychoda alternata} larvae and pupae at 5 to 30 cm depth in (top) 8-DARP \textit{Gardenia} and (bottom) 15-DARP \textit{Camellia} pots at a commercial nursery near Fort White, Columbia County, Florida in March 2019.
samples. Considering the duration of the life cycle and the short time of the pupal period (20-40 h, El Bardicy et al. 2009), egg deposition may have occurred soon after re-potting, with only one generation occurring inside the pots without an overlapping generation. In other studies in which populations of *P. alternata* were stable with overlapping generations (Ali et al. 1991, Ali and Kok-Yokomi 1991), pupae were found in low percentages, between 8 and 23%, due to the short duration of the pupal stage.

In 8-DARP *Camellia* (Figure 1, top), number of *P. alternata* larvae (F=1.60; p=0.20) were not associated with layer depth in the pots while pupae were more abundant in the first three layers (0-15 cm) (F=5.11; p=0.003), with a significant difference in relation to deeper layers. In 15-DARP *Gardenia* (Fig 1, bottom), pupae were not associated with depth (F=1.00; p=0.44), while larvae were more abundant (F=3.37; p=0.02) deeper in the pot soil, with a significant difference in relation to the upper layers, although the overall larval abundance was very low compared to the numbers of *P. alternata* pupae.

In 8-DARP *Camellia*, pupae were significantly more abundant (F=6.27; p=0.02) in the exterior perimeter of the potting soil compared with the central area of the pots, whereas larvae were found in similar numbers at the perimeter and the central area of the pots (F=2.23, p=0.15). In 15-DARP *Gardenia*, both larvae (F=1.00; p=0.44) and pupae (F=1.86; p=0.19) were uniformly dispersed in the media, showing no preference for either the perimeter or central area of the pots.

*Psychoda alternata* has not been previously reported as an important nuisance pest in newly potted plants. For both species of sampled plants, the potting medium was identical, and provided all the necessary requirements for *P. alternata* development regardless of plant species. Moreover, the bifenthrin treatment applied to the potting medium, as part of the fire ant quarantine protocol to prevent establishment and movement of fire ant colonies, was ineffective for control of the *P. alternata*, potentially indicating some level of pesticide resistance in this insect population.

In order to complete its development, *P. alternata* needs high relative humidity, oxygen, decaying organic material and microorganisms for larval development, locations for pupation, and for the imagoes to hatch (den Otter 1966; El Bardicy et al. 2009). *Psychoda alternata* is a principal member of the invertebrate grazing fauna community which inhabits the biological filters of sewage treatment plants (Learner 2000), but it can inhabit other environments with decaying organic material and sufficient moisture (Haseman 1907; Turner 1925; Saunders 1928; Redborg et al. 1983). Ali and Kok-Yokomi (1991) and Ali et al. (1991) reported massive emergences of the species at a turf cultivation facility in Florida, where nutrient-rich wastewater was used for irrigation. In addition to these other locations, *P. alternata* has the potential to be a significant problem in commercial nurseries, although it appears to be a pest in the newly-placed media of re-potted plants, completing only one generation per pot.

Due to the nursery industry practices of replotting plants, the potential synchronous emergence of very high populations of these flies may represent a problem that mosquito control districts may be called upon to resolve and remediate. Additionally, if large populations of these flies move through densely populated areas, this may represent a potential health problem, especially for the elderly and other vulnerable segments of the population.

REFERENCES CITED


