N O T E

Partial Life Cycle of *Phyllophaga ephilida* Say (Coleoptera: Scarabaeidae) in South Louisiana[1]

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Phyllophaga ephilida (Say) is widely distributed in the Americas (Tashiro 1987, Turfgrass Insects of the United States and Canada, Cornell Univ. Press, Ithaca, NY, 391 p.). In Louisiana, this beetle is a serious pest of sweet potatoes and preplant, soil-incorporated insecticides are routinely applied to prevent damage from the grubs and other soil pests. During the day, adult beetles burrow into the soil or hide under leaves and debris. Eggs are deposited in grassy areas or bare soil. Third instars gouge shallow channels on the surface of sweet potato roots. Damaged roots cannot be sold on the fresh market and are either sold to a cannery at a greatly reduced price or are discarded.

Knowledge of the life cycle of *P. ephilida* could improve the management of this pest in sweet potatoes. The duration of the life cycle of *Phyllophaga* species varies from 1-4 yrs depending on the species and geographic latitude (Vittum et al. 1999, Turfgrass Insects of the United States and Canada, 2nd Edition, Cornell Univ. Press, Ithaca, NY, 422 p.). Rolston and Barlow (1980, J. Georgia Entomol. Soc. 15:445-453) postulated that *P. ephilida* is univoltine in south central Louisiana. This inference was based on their observation that during the fall season only third instars were collected in sweet potato fields. In Georgia, *P. ephilida* is reported to exhibit a 2-yr life cycle (Fattig 1944, *Phyllophaga* or May Beetles of Georgia, Emory Univ., Georgia Mus. Bull. 2:1-32), whereas more northern species of *Phyllophaga* can take up to 5 ys to complete development (Watschke et al. 1995, Managing Turfgrass Pests, Lewis Publ, Boca Raton, FL, 361 p). The number of generations of *P. ephilida* in the subtropical latitudes of south Louisiana has not been determined conclusively in previous studies. Thus, the purpose of this study was to determine the generation time of *P. ephilida* in south Louisiana.

The study was conducted at the Louisiana State University Agricultural Center, Burden Research Plantation (East Baton Rouge Parish, LA) from May 2002 through August 2003. Six saran (BioQuip, Gardenas, CA) screen cages (1.8 × 1.8 × 1.8 m)

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were erected, and the soil floor was covered with black plastic. Six plastic pots (height = 50.5 cm, diam = 51.5 cm) were placed in each cage, filled with sandy loam soil, and planted with sweet potato slips during June and July 2002. A battery-powered black-light trap was operated in a sweet potato field in Saint Landry Parish, LA, during June and July 2002. *Phyllophaga* adults were collected daily and transported to Baton Rouge. Twenty *P. ephilida* adults were selected from the captured insects and released into the plastic pots. The genders of the adults were not determined. Adults were supplied with fresh pecan leaves daily and confined to the pots with a flexible mesh netting (1.02 mm). The netting was supported by four 25–cm tall wood stakes, creating a small space above the soil surface. Duct tape was used to firmly hold the netting to the sides of the pots. Beetles were released into the plastic pots from the beginning of June until the end of July 2002. Pots were periodically irrigated to maintain adequate soil moisture. A granular formulation of Talstar® (FMC, WY, IL) was applied around the exterior of the cages to prevent imported fire ants (*Solenopsis* sp.) from entering the pots. In October 2002, two pots were checked for the presence of *P. ephilida* to determine (1) if the attempt to infest the pots with larvae was successful, and (2) the developmental stage(s) present during the fall. Pots were protected from freezing during the winter by covering them with black plastic. Starting in April 2003, on a weekly basis, two pots were removed and carefully checked for larvae, pupae and adults. The soil was searched by hand and inspected visually. The transition from the first to the second instar was not determined. Larvae were placed in Quinters solution (Baker Chemical Co, Phillipsburg, N J) before being preserved in 80% alcohol. Species determinations of adult *P. ephilida ephilida* collected from the soil were made by A. Diagne and confirmed by C. Carlton (Entomology Department, LSU AgCenter, Baton Rouge, LA). The specimens were deposited in the LSU Entomological Museum.

Third-instars were found in October 2002 and during late spring from 28 April through 9 June (Table 1) indicating that the beetle overwintered in the soil in this stage. This corroborates the observations of Rolston and Barlow (1980) concerning the presence of third instars in the soil during the fall. Fattig (1944) reported a hatching period of 15–20 d for *P. ephilida*. No first and second instars were found, and we could not determine the transition of these stages. We first detected pupae in midMay (3 pupae). Eventually, we found 26 pupae in earthen chambers between 10–15 cm below the soil surface. Two pupae were held in an incubator until eclosion and identified using genitalia characters as *P. ephilida*.

In July, teneral adults were first observed, and their numbers increased during subsequent weeks. A total of 27 adults was collected in the soil close to the surface (within 30 cm) and appeared ready to emerge. In Louisiana, adults are active from the end of May to the beginning of August. The univoltine character of *P. ephilida* in this area can be inferred from our sampling. We collected 56 larvae from 25 October 2002-9 June 2003, 26 pupae from 12 May to 21 July 2003, and 27 adults from 26 May to 21 July 2003.

The life cycle duration of an insect is related to geographical latitude and concomitantly to the climatic conditions. The 3-yr cycle of *P. ephilida* in northern latitudes of the US and southern Canada is reduced to 2 yrs in the central US (Tashiro 1987). In the south Louisiana latitudes, *P. ephilida* is univoltine. The exact geographical transition zones of voltinism have not been determined for *P. ephilida* and may vary from year to year with the weather.

Knowledge of its life cycle has the potential to improve the management of *P. ephilida* in sweet potatoes. In Louisiana, sweet potatoes are planted in May and June

Table 1. Number of larvae, pupae and adults of *Phyllophaga ephilida* collected in caged pots at the LSU AgCenter Burden Research Plantation, Baton Rouge, LA 2002, 2003

Date of collection	Numbers collected by sample date		
	3rd instar larvae	Pupae	Adults
25 Oct. 2002	8	0	0
28 Apr. 2003	9	0	0
05 May 2003	13	0	0
12 May 2003	8	3	0
18 May 2003	8	1	0
26 May 2003	1	6	3
02 June 2003	7	7	4
09 June 2003	2	1	3
16 June 2003	0	0	6
23 June 2003	0	1	3
30 June 2003	0	1	2
07 July 2003	0	2	1
14 July 1003	0	1	4
21 July 2003	0	3	1
Total	56	26	27

with roots present in the soil from late June through harvest in September or October and sometimes November. Overwintering larvae will not damage sweet potato roots during the next growing season if they have a univoltine life cycle, for they will emerge as adults in May and June before roots are present in the soil. If a 2-yr cycle occurs, 1st-year overwintering larvae would remain in the field through the entire growing season and damage roots throughout the summer and the fall. Growers routinely apply soil insecticides before planting to control several soil insect pests. These applications will control overwintering *P. ephilida* larvae in the spring. However, these applications will only indirectly reduce sweet potato damage in the fall caused by *P. ephilida* through the reduction of the number of adult beetles emerging from production fields in May and June. The subsequent generation is responsible for damage to the fall crop. To control fall populations, growers may need to make a midseason insecticide application that is timed to coincide with the peak flight activity of *P. ephilida*. The univoltine life cycle suggests that early-planted crops may escape root injury by maturing before 3rd instars are present in the field.

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