Seasonal Patterns of Potato Tuberworm Moth Abundance as Determined by Pheromone Trapping[1,2]

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ABSTRACT

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Potato tuberworm moth population was monitored using water pan traps with rubber septa, impregnated with trans-4, cis-7-tridecadienyl acetate, in a 12-ha field in which 4 successive potato plantings were made over a 2 yr period. Tuberworm moth populations were directly related to the presence of potato foliage in successive crops and were annually highest in the spring plantings. Spring populations increased as the crop matured and decreased when vines were killed and potatoes were harvested. Following harvest, moth activity remained low until the late-summer planting emerged and, even with available host material, the late-summer planting did not support a high tuberworm population. After harvest of the late summer crop, the tuberworm population remained low until the next spring crop emerged.

The potato tuberworm, *Phthorimaea operculella* (Zeller), is a serious pest of potatoes in the major potato-producing areas of central and southern California (Bacon 1960). The larvae mine the foliage and stems of the plant but most economic damage occurs when the larvae infest the tubers. Control of the tuberworm primarily relies on the use of insecticides (Shorey et al. 1967, Bacon et al. 1972, Hofmaster and Waterfield 1972, Foot 1974). In some areas of California, insecticide treatments are typically applied at 10-day intervals and this often results in unnecessary applications (Kennedy 1975).

In order to evaluate tuberworm population levels in the field bait-potatoes are used for ovipositional activity or the foliage and stems are examined for mining activity. Both procedures are time consuming and impractical in aiding pest management decisions in the field.

Following the identification of the potato tuberworm sex pheromone (Roelofs et al. 1975, Persoons et al. 1976) and the testing of trap designs for the tuberworm (Kennedy 1975, Bacon et al. 1976), a new technique for evaluating tuberworm field populations became available. The present study was undertaken to determine population trends of the tuberworm over a 2-yr period in an untreated potato field.

Materials and Methods

Trapping studies were conducted during 1976 and 1977 at the University of California's Moreno Field Station in Riverside Co., which is typical of the commercial potato growing areas in inland valleys of southern California. Potato tuberworm populations were followed on 4 successive potato plantings (planted - Apr. 19 and Aug. 15, 1976; Apr. 5 and Aug. 16, 1977). All 4 plantings occurred within the same 12-ha experimental area and each planting within this area was ca. 0.5–1.0 ha and composed of 'Norgold' and 'White Rose' varieties. Standard commercial cultivation practices were utilized except that no insecticides were used to control potato tuberworm. Traps were transferred to each new planting as plants emerged. Four UC/Davis water pan traps (Bacon et al. 1976) were placed at ground level within each crop and rubber septa, impregnated with trans-4, cis-7-tridecadienyl acetate (Zoecon Corp.), were suspended within each trap. Trap pans were filled to within 2 cm of the top with water containing one ml of 70% liquid Vatsol® OT detergent/gal of water. Traps were placed 40 m apart in the middle row of each crop in a North-South direction. A one-m area was cleared of foliage around each trap. Traps were normally checked at 7 day intervals, and when populations were high they were checked more frequently. Rubber septa were replaced at ca. 80-day intervals. The number of moths caught was converted to the average number of moths/trap/night over successive 14-day intervals.

Results and Discussion

The population trends in relation to the crop cycle and time of year are illustrated in Fig. 1. Populations were higher in both spring plantings than in the late-summer plantings. In the spring planting of 1976 the population increased as the crop matured and reached a level of 200.1 moths/trap/night (June 18) before vines were chopped and rolled (June 22). After vine removal, moth activity decreased temporarily (156.1 moths/trap/night, July 2) before increasing to a peak of 279.0 moths/trap/night prior to harvest (July 16). After tubers were harvested (July 26), potato tuberworm populations decreased rapidly to 55.2 moths/trap/night (July 30). In the late summer planting (Aug. 15) the tuberworm population remained low throughout the growing season. This crop did not emerge until the 1st week of Sept. and at that time the population peaked at an average of only 22.2 moths/trap/night. At harvest (Jan 21) the population was 10.0 moths/trap/night.

Field populations remained low throughout the winter until the 1977 spring planting emerged. As this crop developed, the potato tuberworm activity increased again to 79.5 moths/trap/night (Apr. 22). The population subsequently decreased during May and then increased in June, peaking at 122.1 moths/trap/night (July 1), and remaining over 100 moths/trap/night throughout July. Chopping and rolling the vines (Aug. 1) again reduced population levels. Unlike the previous spring, the 1977 crop was harvested soon after vine kill and the adult catch did not increase between vine kill and harvest. After harvest (Aug. 10) the population decreased to 36.7

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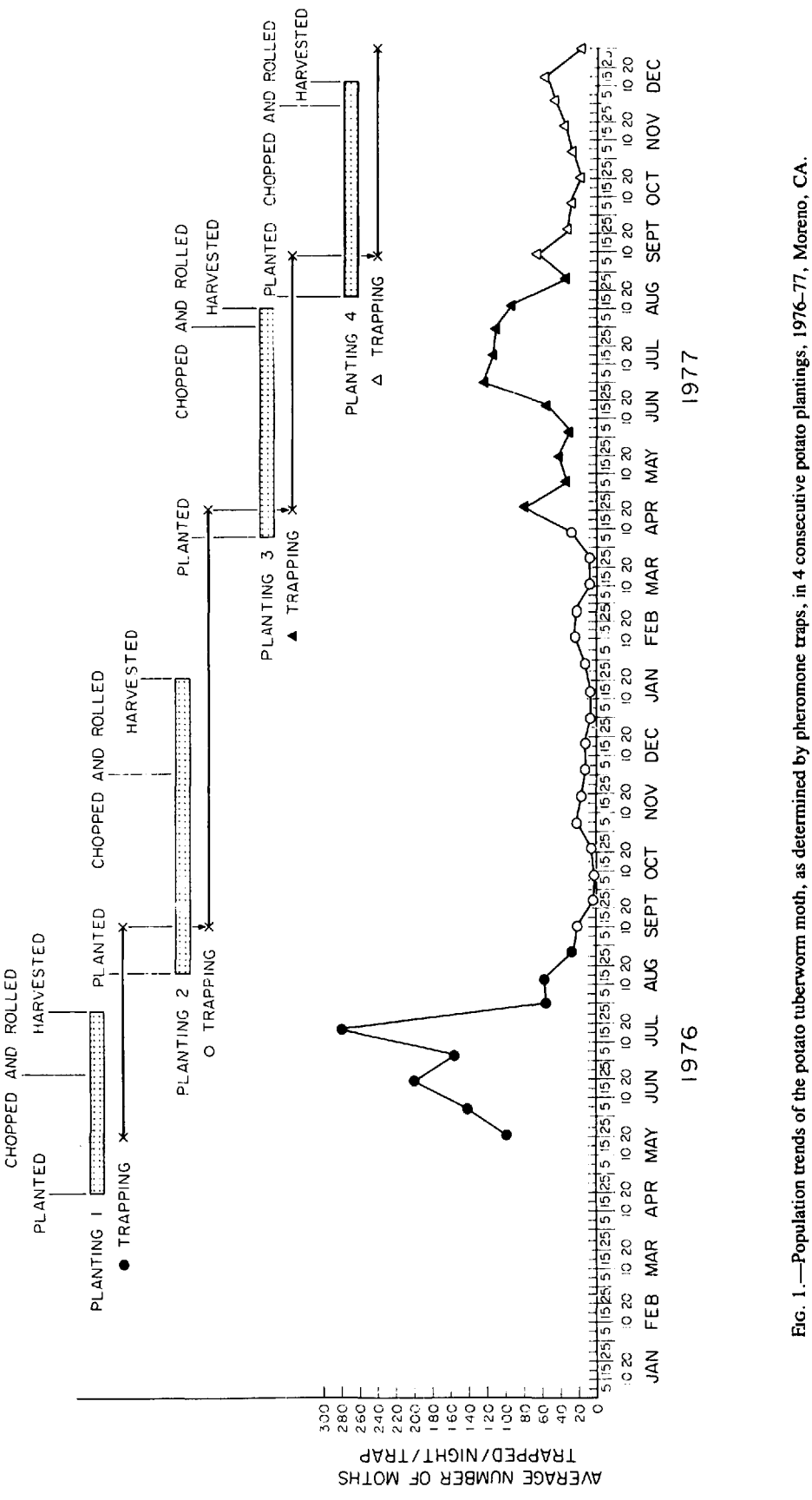

FIG. 1.—Population trends of the potato tuberworm moth, as determined by pheromone traps, in 4 consecutive potato plantings, 1976–77, Moreno, CA.

moths/trap/night (Aug. 26). The 1977 fall planting emerged in early Sept. and at this time the population increased slightly on Sept. 10 (65.2 moths/trap/night). Moth activity then decreased and remained low throughout the remainder of the growing season, increasing only slightly as the crop matured. Prior to chopping and rolling (Nov. 29) the population reached 36.4 moths/trap/night (Nov. 18) and at harvest (Dec. 12) was 58.2 moths/trap/night. After harvest the population level dropped to 17.0 moths/trap/night.

In Riverside Co., the potato tuberworm can be a serious pest on the spring potato crop. Volunteer plants from the previous year support a low tubermoth population until the spring crop emerges. During the spring cropping season, populations build-up as the crop matures and peak at the time when the tubers are setting (last half of the season). Unpublished data indicates that most of the tuber infestation occurs late in the cropping season and corresponds with the time when populations, as determined by pheromone trapping, are at their highest levels. Even after vine kill, however, tubers can be subjected to another buildup of moth activity if harvest is delayed as occurred in the 1976 spring crop.

Potato tuberworm damage to the tubers of the late summer crop usually is not a serious problem. An insecticide application is often required early in the fall season, however, to control tuberworms which mine the merging plants, causing serious economic damage. This early infestation on the emerging late summer crop probably is caused by moths migrating from nearby spring-planted fields which already have been harvested. Although host material is readily available, fall tuberworm populations, as determined by pheromone trapping, are relatively low compared to those in the spring planting. Oatman and Platner (1973) reported that parasitization of the potato tuberworm was far more prevalent in the late-summer planting than in the spring planting (77.4 vs. 29.4%, respectively) and this, together with the lower temperatures during the late fall, could account for lower population levels

REFERENCES CITED

Bacon, O. G. 1960. Control of the potato tuberworm in potatoes. J. Econ. Entomol. 53: 868–71.

Bacon, O. G., N. F. McCalley, W. D. Riley, and R. H. James. 1972. Insecticides for the control of potato tuberworm and green peach aphids on potatoes in California. Am. Potato J. 49: 291–95.

Bacon, O. G., J. N. Seiber, and G. G. Kennedy. 1976. Evaluation of survey trapping techniques for potato tuberworm moths with chemical baited traps. J. Econ. Entomol. 69: 569–72.

Foot, M. A. 1974. Field assessment of several insecticides against the potato tubermoth, *Phthorimaea operculella* (Zell.) at Pukekohe. N.Z. J. Exp. Agric. 2: 191–7.

Hofmaster, R. N., R. L. Waterfield. 1972. Insecticide control of the potato tuberworm in late-crop potato foliage. Am. Potato J. 49: 383–90.

Kennedy, G. G. 1975. Trap design and other factors influencing capture of male potato tuberworm moths by virgin female baited traps. J. Econ. Entomol. 68: 305–8.

Oatman, E. R., and G. R. Platner. 1973. Parasitization of the potato tuberworm in southern California. Environ. Entomol. 3: 262–4.

Persoons, C. J., S. Voerman, P. E. J. Verwiel, F. J. Ritter, W. J. Nooyen, and A. K. Minks. 1976. Sex pheromone of the potato tuberworm moth, *Phthorimaea operculella:* isolation, identification and field evaluation. Entomol. Exp. Appl. 20: 289–300.

Roelofs, W. L., J. P. Kochansky, R. T. Cardé, G. G. Kennedy, C. A. Hendrick, J. N. Labovitz, and V. L. Corbin. 1975. Sex pheromone of the potato tuberworm, *Phthorimaea operculella.* Life Sciences 17: 699–705.

Shorey, H. H., A. S. Deal, R. L. Hale, and M. J. Snyder. 1967. Control of the potato tuberworms with phosphamidon in southern California. J. Econ. Entomol. 60: 892–93.