THE SEASONAL ACTIVITY OF *TRACHYPHLOEUS BIFOVEOLATUS* (COLEOPTERA: CURCULIONIDAE) IN WESTERN WASHINGTON[1]

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ABSTRACT

Trachyphloeus bifoveolatus Beck breeds in untended grassland fields and pastures and can be a nuisance pest to nearby homeowners when adults migrate in the fall and spring. This insect is univoltine and overwinters as an adult. Eggs are deposited on the foliage of the host plant during May and June and larvae start appearing in late May. Larvae feed on the root systems of these plants during May, June and July. Pupae are found in small earthen pockets 2- to 5-cm below ground from July to mid-August. New generation adults appear in late July and within a month most begin leaving the fields to seek overwintering sites. However, evidence suggests that most of the eggs deposited the following yea are laid by adults that remain in the field over winter. Adults that left the field in the fall apparently do not return to breeding sites in substantial numbers the following spring.

INTRODUCTION

Trachyphloeus bifoveolatus Beck locally known as the gray grass weevil, breeds primarily in untended fields and pastures in western Washington, Oregon, and British Columbia and is usually a pest only when adults migrate in the spring and fall. At these times this small (4-mm long), nocturnal, flightless beetle often gathers around buildings in large numbers, enters homes and thus becomes a general nuisance. Often they are the cause of much alarm. Although considered a nuisance pest, Cram (1964) reported the weevil injurious to strawberries.

The insect is largely confined to the coastal states and provinces of temperate North America. This weevil was first recorded from North America in 1876 as *Trachyphloeus asperatus* (LeConte and Horn 1876). It was next collected from New York in 1917 (Buchanan 1937). In Canada it has been found in Nova Scotia, New Brunswick, Prince Edward Island, Ontario, and British Columbia (Brown 1940, 1950, 1965; Cram 1964). In the Pacific Northwest it has been found in Washington and Oregon (Hatch 1971). Lindroth (1957) reports it is common in both Europe and North America.

This study was undertaken because almost nothing is known about the biology of this interesting and unusual pest. This paper provides information on the life history of *T. bifoveolatus* in western Washington.

MATERIALS AND METHODS

The study site, located 8 km NE of Arlington, WA, was a frequently mowed, perennial, 207 m x 98 m grassland. It was bordered on the southeast by a 28-m long aluminum quonset building and residence. A mobile home and garage were located in the southwest portion of the SW quadrant. Vegetation consisted of Kentucky bluegrass, *Poa pratensis* L.; perennial rye grass, *Lolium perenne* L.; interspersed with white clover, *Trifolium repens* L.; and narrow leaf plantain, *Plantago lanceolata* L.; and a few miscellaneous weed species. Soil type was sandy loam.

The study site was visited at 1- to 2-week intervals during the spring and summer months and at irregular intervals during the fall and winter months between June 1980 and October 1982. During each visit seven soil cores (10.5 cm dia. and 9 cm deep) were taken with a cylindrical core cutter. Individual coring sites were spaced ca 40 m apart on a diagonal between the SE and NW corners of the field. Individual cores were dismantled in the laboratory and specimens of the various life stages were collected with the aid of dry sieve screening alone, or in combination with a water flotation process. Light colored larvae and pupae contrasted with the reddish brown soil and were easily recovered during the dry screening process. Adults were not easily distinguished from soil particles and were generally removed from washed soil and vegetative residue that was spread out to dry on white paper. Upon drying, the adults would crawl away from the drying mass and were easily detected against the white paper.

Preliminary investigations showed that eggs were almost exclusively deposited on the vegetation. To recover eggs, vegetation and thatch were cut off at ground level of each core and shaken vigorously in a two-liter capped jar containing 500 ml of 10% NaCl solution. The contents of the jar were filtered through milk filter paper after each of several washings of the vegetation. Eggs were then counted by searching the filter paper under a binocular microscope.

Adult migration activity was also monitored. For this we recorded the number of weevils found at 19 areas, each measuring 17 dm^2, on the horizontal perimeter of a concrete slab that supported the aluminum quonset building in the SE quadrant of the field. These areas served as aggregation sites for the migrating adults. Weevils found in each area

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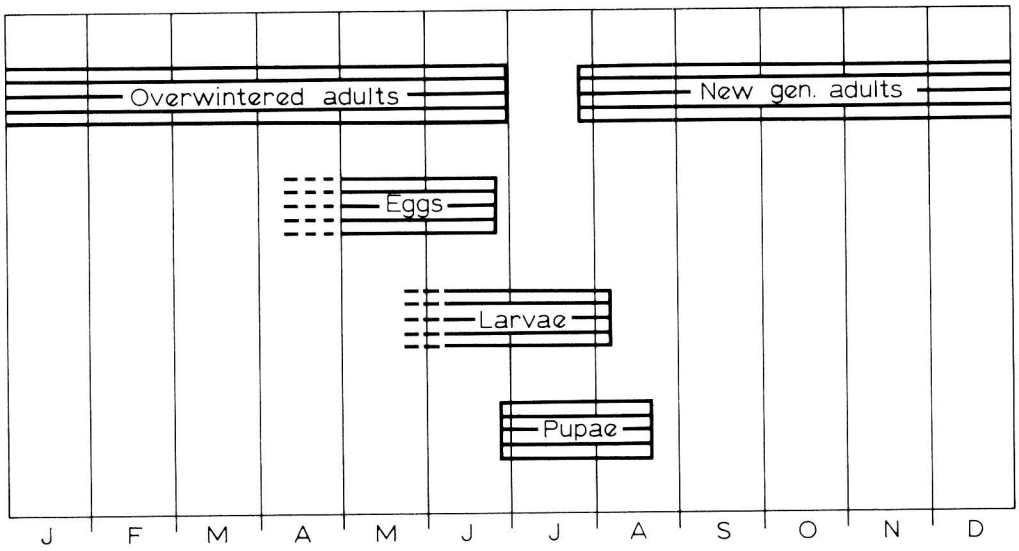

Fig. 1. Generalized life cycle and seasonal occurrence of the life stages of *T. bifoveolatus* in western Washington. Broken lines indicate probable occurrence.

were counted and removed each time the study site was visited.

RESULTS AND DISCUSSION

Figure 1 provides a generalized life cycle and seasonal occurrence bar graph of the life stages for *T. bifoveolatus* based upon sampling of populations in soil cores from the grassland study site from 1980-1982. *T. bifoveolatus* overwinters as an adult. Egg laying probably commences sometime in May and continues through early June. Larvae hatch from late May through mid-June and, after feeding below ground on the roots of host plants for approximately 3 to 4 weeks, they pupate. Pupae can be found from late June through mid-August. New generation adults begin appearing in late July. Although most of the new adults left the field in the fall, some were always found in soil cores throughout the fall and winter months.

Numbers of larval, pupal and adult life stages recovered from soil cores at the various sampling periods during the years 1980-1982 are shown in Fig. 2. The numbers of each life stage recovered from the actual area sampled per visit (606 cm^2) were transformed to numbers of insects per 929 cm^2 (1 sq. ft.) for presentation. Adults were found in soil cores throughout the winter months, though in low numbers. Because procedures for quantitative recovery of eggs were not perfected, it was not determined precisely when oviposition commenced. Gravid weevils were recovered from soil cores as early as March 11, but eggs were not recovered from soil cores until mid-May. Single, translucent, oval eggs, measuring 0.87 mm x 0.34 mm, are laid indiscriminately on the grassland vegetation. Washings of above ground vegetative material yielded virtually all the eggs recovered from core samples. Only an occasional egg was recovered from soil washings. Overwintered adults were found in cores until the end of June. These adults were always gravid. New generation adults start appearing in mid to late July. Dissections of these new adults showed that they were not sexually mature until the following spring.

Special care was taken while searching for young larvae in the cores brought back to the laboratory for analysis. However, because the 1st instars are so small (ca. 0.7-mm long), some undoubtedly escaped detection. Our findings suggest that in western Washington, larvae first appear in the latter half of May and early June. By mid-July larval numbers in the field reached their zenith and declined rapidly soon thereafter. Larvae were not found in cores after early August.

Measurements of head capsule widths of larvae collected from soil cores failed to indicate the number of instars for this weevil. Widths ranged from 0.24 mm for 1st instars to 0.8 mm for last instars but with no distinct frequency patterns between the two extremes. There are at least three and possibly four instars. The larval stage lasts for approximately one month in western Washington.

Pupation occurs in small earthen pockets in the top 4- to 5-cm of soil. The pupal stage lasts only about 2 weeks. Pupation begins in mid-July and is completed by mid-August. Henceforth, populations in the field consist solely of adults of the new generation.

In all years, but particularly in 1982, a substantial decline in the weevil population occurred sometime during the late larval or early pupation period. Cadavers of late larval instars and pupae infected with the entomophagous fungus, *Beauveria bassiana* (Bals.) Vuill. were found on occasion but

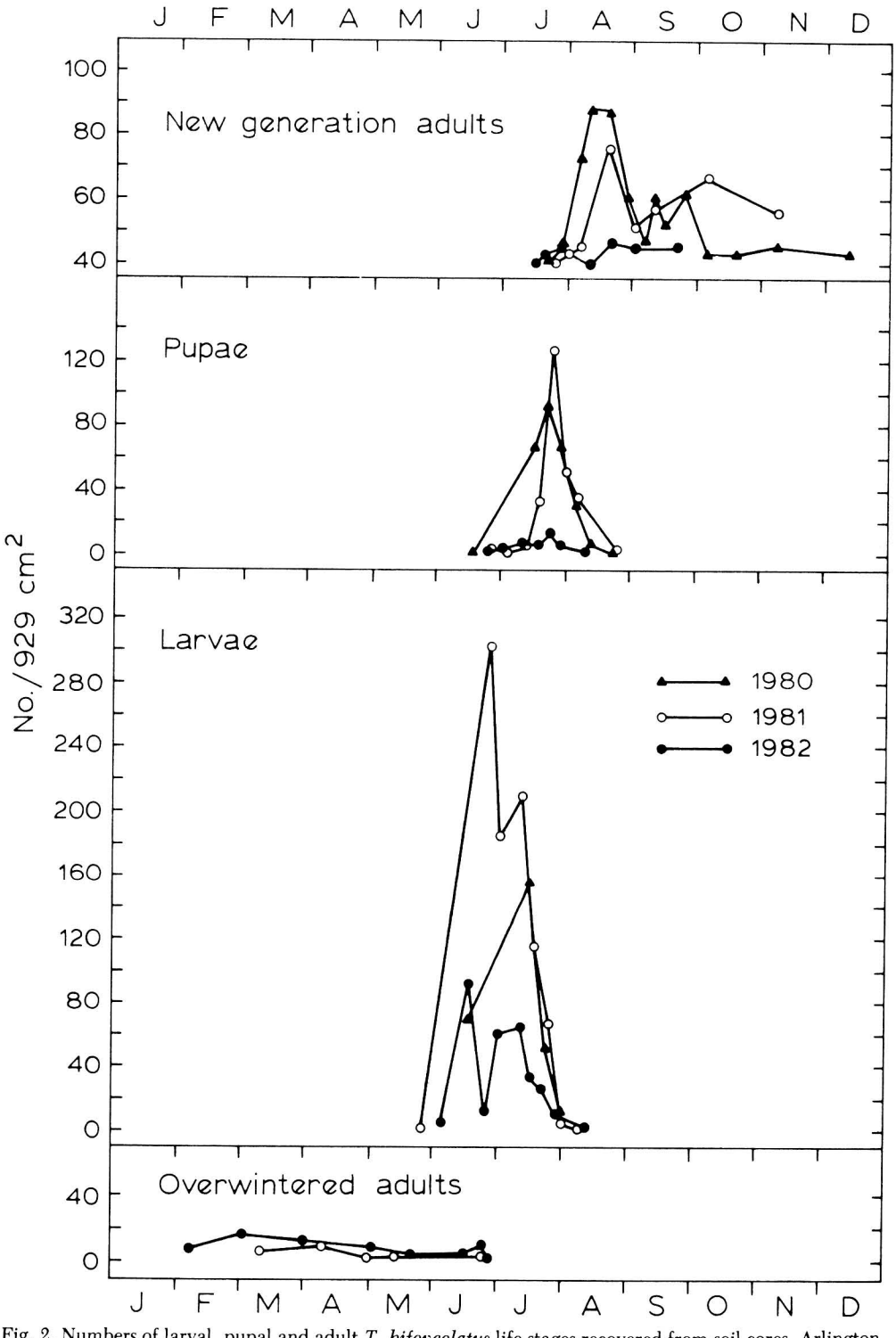

Fig. 2. Numbers of larval, pupal and adult *T. bifoveolatus* life stages recovered from soil cores. Arlington, WA.

the observed incidence of this disease was extremely low and did not adequately explain the decline in the beetle populations.

New generation adults stay in the field only a short time before they begin to migrate to overwintering sites. Migrations began in late August in 1980 and 1981. In 1982, adult populations were too low to detect a significant emigration from the field.

The decline in adult numbers in the field after mid-August is associated with the start of the migration process. Seasonal migration activity as monitored at the aluminum building is depicted in Fig. 3. Migrating adults of the new generation started to accumulate on the concrete foundation of the overwintering site in late August each year. The weevils first congregated on the outside along the bottom of the quonset and on the concrete slab that supported the building. They were also found in the small crevices where aluminum sections of the building overlapped. Eventually, the weevils disappeared from these areas as they slowly found their way into the building. Ultimately, the adults were found only inside the aluminum quonset and other buildings at the study site.

Migration activity peaked in late September-early October and declined gradually thereafter. A few adults were still active into November and December. Emergence from the overwintering site commenced the following March, peaked in April-early May and declined to negligible levels towards the end of June in all years. It is during these migration periods that adult *T. bifoveolatus* become nuisances around and in residences and other buildings.

It is unclear exactly what role the fall and spring adult movements serve in the biology of *T. bifoveolatus*. It is common for the adults of many

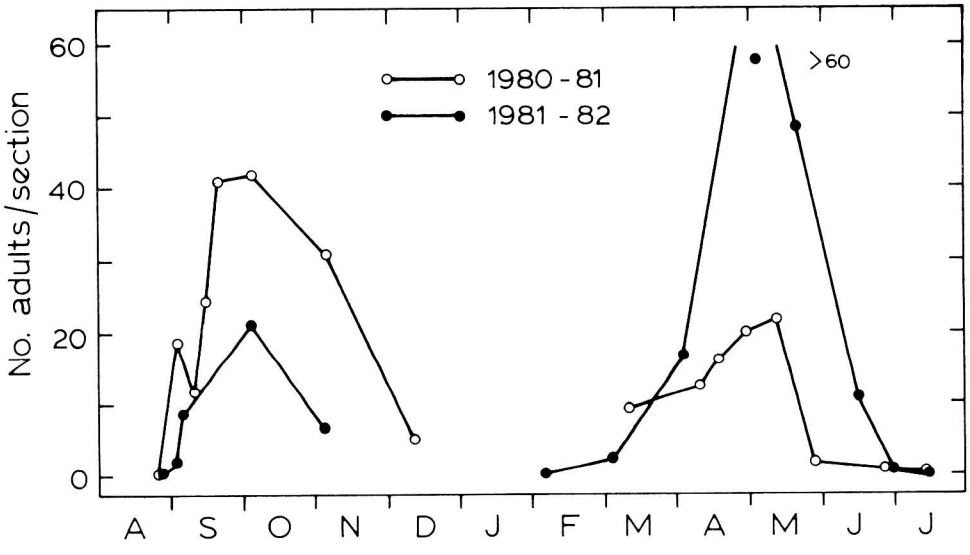

Fig. 3. Mean number of *T. bifoveolatus* adults aggregating at overwintering site. Arlington, WA.

species of Curculionidae to migrate in the fall to protected hibernation sites and to return to the breeding sites the following spring. The fall emigration accounted for much of the decline in the grassland population of new gray grass weevil adults during September. However, in the two years that overwintering populations in soil cores were monitored (Fig. 1) no significant increase in adult field populations accompanied the spring exit of the adults from the protected overwintering site. Furthermore, soil cores contained a residual population of adults throughout the winter. For these reasons, and because each year larvae were rather evenly distributed throughout the grassland study site regardless of the distance from any identifiable overwintering sites (one SE averaged ± 33% of the 7-core $\bar{x}$), we suspect that the residual adults which remain in the field over winter are the primary source of the new generation. Overwintered adults may have aggregated in suitable breeding sites in close proximity to the overwintering site. However, examination of soil cores taken from this area indicated this was not so.

Sleeper (1955) noted that *T. bifoveolatus* can be found under rocks in open meadows. Though there were no rocks or similar objects in our study area, there were some at the field's north and south boundaries. Searching beneath them only rarely revealed an adult weevil.

Trachyphloeus bifoveolatus is univoltine in western Washington. The adult is the predominant life stage, being present every month of the year ex-

cept for part of July. Females reproduce parthenogenetically. There are no males in populations of this insect in western Washington. Though their numbers can be impressive (100-300 + larvae/-929 cm^2 in the field), they do no apparent economic damage and go unnoticed until the adults are in their migratory phase.

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