Reprinted from the
ANNALS OF THE ENTOMOLOGICAL SOCIETY OF AMERICA, VOL. 76, NO. 4, JULY 1983

Biological Studies of *Ceutorhynchus punctiger* (Coleoptera: Curculionidae) on Dandelion in Virginia[1]

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Ann. Entomol. Soc. Am. 76: 671–674 (1983)

ABSTRACT Development of *Ceutorhynchus punctiger* Gyllenhal, a weevil which feeds on dandelion seeds, was studied in relation to the phenology of dandelion in Virginia. Eggs were observed from when the flower bud rays were white (1st week of April) until the flower closed and the rays were dry and brown (2nd week of May). There were 3 instars; mean duration of the 1st, 2nd, and 3rd instars was 4.7, 3.7, and 29.2 days, respectively. First instars were initially detected when the bud's outer sepals were open (1st week of April), 2nd instars midway through the open flower stage (4th week of April), and 3rd instars at the beginning of the stage when the flower closed and rays were dry and brown (4th week of April). Pupation occurred in the soil; the pupal stage averaged 14.2 days. Seed consumption/larva was 19.0 ± 8.9 from a mean of 157.4 ± 40.1 seeds/dandelion flower. Adults fed on leaves and lived for an average of 96.5 weeks; there was no significant difference between sexes. Adult feeding had minimal impact on dandelion seed production.

Dandelion, *Taraxacum officinale* Weber (Compositae), is an ubiquitous weed in waste areas, lawns, overgrazed pastures, perennial cropland, and roadsides from sea level to 12,000 ft elevation. It is most notorious as a lawn pest because its seeds are frequently an impurity in Kentucky bluegrass and forage grass seeds.

Few reports exist on insects which attack dandelion. A weevil, *Ceutorhynchus punctiger* Gyllenhal, was reported in Europe feeding as adults on leaves and as larvae on developing seeds (Radde 1974). It is considered an immigrant species (D. R. Whitehead, personal communication), widely distributed in the northeastern part of the United States. Dillon and Dillon (1961) reported *C. punctiger* on flowers of dandelion, lettuce, and other composites in eastern North America. This weevil is grayish dark, 3.0–4.0 mm long, with a distinct white sutural spot behind the scutellum. We first noticed it attacking dandelion flower buds in 1974, and have since encountered it regularly in western Virginia. Although little published information is available on *C. punctiger*, members of the genus occur in Europe and North America. One species, *Ceutorhynchus rapae* Gyllenhal, is well known on cruciferous plants in the United States (Blatchley and Leng 1916). Because *C. punctiger* has consistently been found on dandelion in Virginia, we studied its life cycle in relation to host plant phenology and impact on dandelion, and present the results here.

Materials and Methods

Field samples were conducted weekly in 1979 and twice weekly in 1980–1982 from late March–May at the Prices Fork Research Center, three miles west of Blacksburg, Va. The sample area was an unmowed lawn (20 m x 20 m). The predominant vegetation was *Festuca arundinacea* Schreber. Ten samples were taken on each sample date. Each sample was taken by tossing a 0.25 m^2 frame without bias into the sample area. The number of dandelion plants within the frame and the growth stage of each were recorded to classify growth stages. Three buds or flowers representative of the dominant growth stages were removed from plants in each of the ten samples. These buds and flowers were dissected in the laboratory and the growth stage, number of puncture marks, *C. punctiger* eggs and larvae per bud were recorded.

To determine larval development rates, eggs collected from the buds were placed in clear plastic dishes (4.5 cm diam) with moistened cotton, between two pieces of filter paper. The eggs were maintained at a day–night temp of 21–10°C and 8L:16D. Three or five newly-hatched larvae were placed in a dandelion flower head and kept under the same temp and light regime in 0.45 liter clear plastic cages fitted with 25-mesh wire screen windows (5 cm diam). A dandelion stem was inserted through the lid and immersed in water. The inoculated heads were dissected daily; head capsule and body lengths of the surviving larvae were recorded before their reinoculation into fresh flower heads.

To determine the pupal duration and extent of larval seed consumption, closed flower heads with wilted and brown rays and containing full grown larvae were collected from the sample area. They were kept in the cages with the stalk immersed in water. The number of mature larvae crawling from the heads was recorded. Larvae were placed on moist peat moss and checked daily for cocoon formation or pupation. The start of the pupal stage was determined by the formation of the cocoon from silk and soil particles. Parasitism was monitored by checking for the emergence of parasitoids. Flowers containing 3rd instars were dissected to count the seeds eaten. Partially-eaten seeds were considered eaten when most of the seed was destroyed and failed to germinate. Uneaten seeds (996) collected during 1980 were checked for germination by placing them between 4–6 pieces of moist filter paper in a petri dish at 21°C. Newly-emerged adults were caged on bouquets of dandelion leaves and longevity recorded.

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Results and Discussion

During the study period, the density of dandelion rosettes averaged 13.8 ± 4.4 SD and had a range of 6.4–19.6 plants/m². No pattern of increase or decrease of rosette densities was evident during the sample periods. Very few dandelion seeds germinated after sampling began. The following twelve dandelion growth stages were established:

1	Rosette only, no bud.
2	Bud closed, rays white.
3	Bud closed, rays yellow.
4	Bud with outer sepals open, stem not elongated.
5	Stem elongated, flower not open.
6	Flower open.
7	Flower closed, rays wilted.
8	Flowers closed, rays dry and brown.
9	Flower closed, rays dropped off.
10	Seed head open, seeds exposed.
11	Seeds blown off.
12	Stalk fallen and deteriorated.

C. punctiger adults fed on the undersurface of dandelion leaves, causing a scarred area. Leaf damage, however, was minimal and adult feeding appeared to have little impact on dandelion seed production. Oviposition occurred in the early bud stages and appeared to be preceded by excavation of a small cavity which caused a necrotic puncture mark in the dandelion sepal. Of the 450 buds observed, 335 (74%) had at least one puncture mark, with a mean of 3.47 ± 4.04 puncture marks/bud. Eggs usually were found singly or in groups of up to nine in the sepal or petal ray, with a mean of 2.6 ± 1.2 eggs/puncture mark (n = 260 buds containing at least one egg). No eggs were found in 75 (22%) of the 335 buds having at least one puncture mark. Mean number of puncture marks per bud without eggs was 2.3 ± 1.7. The absence of eggs in 22% of the buds with puncture marks indicates that adult feeding occasionally is not accompanied by oviposition.

Eggs of *C. punctiger* were collected from April until the 2nd week of May with a maximum of 2.8 eggs/bud during the 4th week of April (Fig. 1). These were probably oviposited by overwintered adults. First instars, initially collected during the 1st week of April, increased to 0.7/bud by the 1st week of May. First instars found in buds during the 3rd week of May might not complete development because of starvation due to senescence of the flowers. During the 4th week of April, 2nd and 3rd instars were first detected. Increases in the number of 2nd and 3rd instars were similar, reaching 1.1 and 1.0/bud, respectively, in the 3rd week of May. No larvae were found in the flowers after the 3rd week of May. The dandelion plants had ceased blooming and producing new buds by this time. Although no pupae were observed in the field, pupation probably occurred 14 days after the 2nd and 3rd week of May, because the majority of 3rd instars was found during this period; larvae pupating in the laboratory on peat moss emerged as adults from late May–mid June. No bud development was observed throughout the summer and fall in the study area. However, along a building close to the study area, bud development and flowering did occur in a few plants during the 2nd and 3rd week of September. Thirteen flower heads were collected (23 Sept. 1981) and four 1st instars were dissected from one head. Thus, ovipositing females are active where bud development occurs in Sept., and a small second generation of the weevil can occur if there are sufficient degree days to complete larval development in the fall.

When *C. puntiger* developmental stages were plotted against the dandelion growth stages (Fig. 2), eggs were first detected at stage 2, increased to 5.8/bud by stage 5, but were not found after stage 8. Eggs began hatching at stage 4. The greatest number of 1st instars was at stage 7 (1.5/bud). First instars were collected until stage 9. Second instars began at growth stage 6 and increased to 1.8/bud by stage 8. Third instars were initially collected at growth stage 8 and increased to 1.2/bud at stage 9. Second and 3rd instars were not found in the flowers after stage 10. Laboratory and field observations indicated that fully-developed larvae dropped from the seed head when it opened (stage 10) and pupated on or immediately below the soil.

Development from egg hatch to adult emergence took ca. 52 days; the durations, head capsule measurements, body length of the larval stages, and the length of the pupa stage, are shown in Table 1. The mature larva spun a cocoon and remained quiescent for an average of 9.2 ± 1.0 days before molting to the pupa. No parasitoids emerged from the observed larvae, nor were any adult parasitoids detected on dandelion flowers in the field. Newly-emerged weevils caged and maintained on dandelion leaf bouquets in the laboratory survived for 96.5 ± 15.3 weeks (n = 38); two male adults collected in 1978 are still alive after 4 years. No significant differences in longevity were found between sexes (males 90.7 ± 20.4 weeks; females 101.4 ± 9.7 weeks). Only eight adults were found on dandelions, mostly in the

Table 1. Development of *C. punctiger* larva and pupa on dandelion flowers at 21–10°C, 8 h photophase

Stage	Duration (days)		Head capsule size (mm)		Body length (mm)	
	n	(mean ± SD)	n	(mean ± SD)	n	(mean ± SD)
1st instar	50	4.7 ± 0.9	54	0.35 ± 0.02	31	1.36 ± 0.24
2nd instar	35	3.7 ± 0.7	65	0.50 ± 0.03	65	2.08 ± 0.43
3rd instar	21	29.2 ± 3.6	46	0.66 ± 0.03	42	3.56 ± 0.72
Pupa	43	14.2 ± 1.6	—	—	—	—

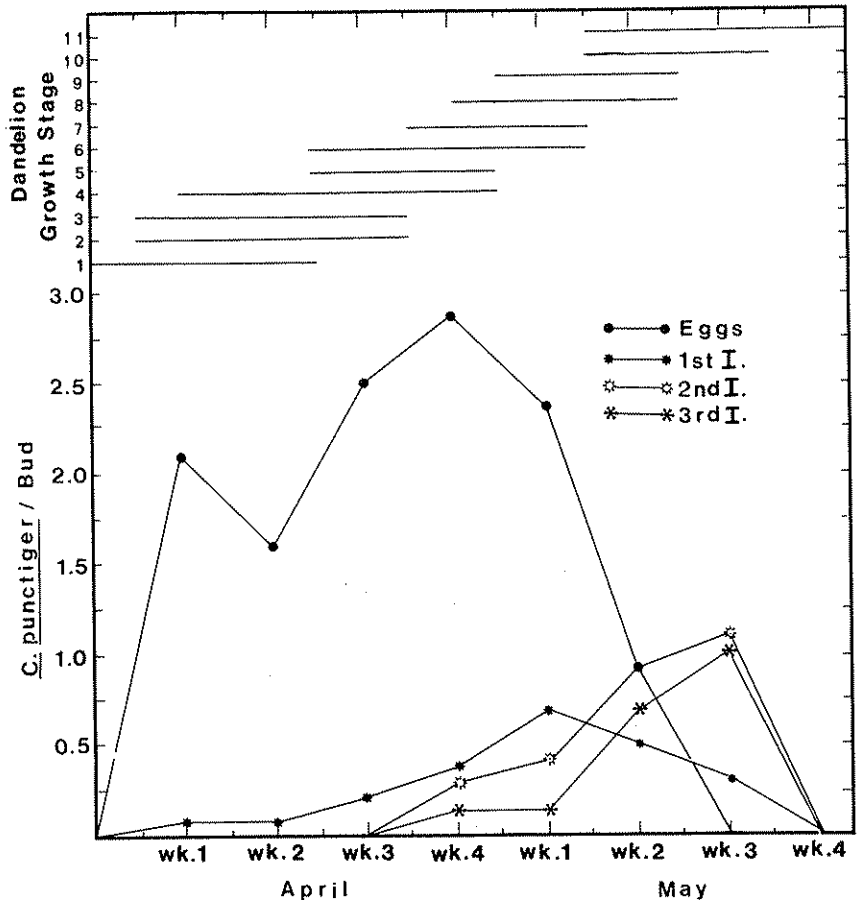

FIG. 1. Density of *C. punctiger* eggs and larvae on various dandelion growth stages from March–May 1979/1981. (See text for description of dandelion growth stages.)

center of the rosettes or under the sepals during the field studies. That so few were found was due probably to the thick vegetation surrounding the rosettes and to the gray color of the weevils (which blended in with its surroundings), and not to a low weevil population.

Larvae partly or almost completely consumed individual seeds; they averaged 19.0 seeds/larva (Table 2). Infestation averaged 3.75 larvae/bud and all seeds were eaten in 4% of the heads. Total seeds produced were reduced by 45.2% (from 157.4–86.2 seeds/bud). Each larva destroyed 12.1% of the seeds. Germination of uneaten seeds (993) was 76%.

The life cycle of *C. punctiger* is well synchronized with the phenology of dandelion in Virginia. The period of oviposition from April-mid-May matches bud formation of the dandelion plant, allowing for maximal survival of the larvae during bud development. By the time the flowers are closed and senescent, oviposition has ceased. With good synchronization of *C. punctiger* and host phenology, the impact on the dandelion plant population is primarily a function of larval density of the weevil. The highest mean number of 3rd instars per bud was 1.0 in the field survey, which included buds without 3rd instars, and 3.75 in the seed consumption study, in which all the field selected buds contained 3rd instars, with maximal infestation of 17 eggs and nine 3rd instars per bud. Because each larva destroys an average of 12.1% of the total seeds, the weevil could exert pressure on the plant by reducing the number of seeds via larval feeding.

Although larval feeding on hosts other than dandelion has not been documented, an estimate of the host range or host specificity of *C. punctiger* may be derived by considering other species of the same genus. Some members of the genus *Ceutorhynchus* attack weeds in Europe and North America and have been evaluated for their potential as biological control organisms. *Ceutorhynchus litura* (F.) has been released for the control of *Cirsium* thistles (Peschken and Beecher 1973); *Ceutorhynchus trimaculatus* F. was evaluated for its host specificity (Kok et al. 1979, 1982); and *Ceutorhynchus maculaalba* (Herbst) was found to be host specific to opium poppy and other poppies (Rizza et al. 1980). These species of *Ceutorhynchus* all have a sufficiently narrow host range for consideration as biological control agents. Their host specificity suggests that *C. punctiger* may also be host specific. Differences are more likely to be in behavioral patterns. Thus, although they are in

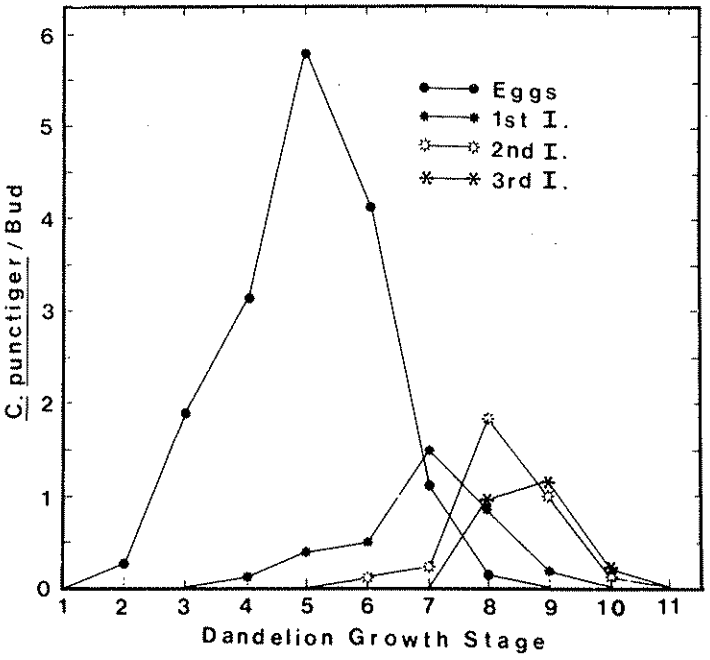

FIG. 2. Density of *C. punctiger* eggs and larvae in relation to phenology of dandelion in 1979/1981. (See text for description of dandelion growth stages.)

Table 2. Consumption of dandelion seeds by *C. punctiger*

Number of seeds[a]	mean ± SD	% of total seeds
Per bud	157.4 ± 40.1	100.0
Eaten/bud[b]	71.2 ± 43.0	45.2
Uneaten/bud	86.2 ± 58.1	54.8
Eaten/larva	19.0 ± 8.9	12.1

[a]Based on 66 flower heads.
[b]Mean number of larvae/bud = 3.75.

the same genus and adults are leaf-feeders (causing minimal damage), larval feeding behavior differs. *C. litura* and *C. trimaculatus* larvae feed in the root crown, while *C. punctiger* feeds in the bud on developing seeds, and *C. maculaalba* in the capsules and seeds of poppies.

Our data suggest that *C. punctiger* could be important in reducing the viable seed population of dandelions. However, the existing field population of the weevil is inadequate to inhibit or significantly reduce dandelion populations. For this weevil to have a greater impact on dandelions, manipulation or augmentation of the weevil would be necessary. Before any major efforts to enhance or increase its population are undertaken, detailed studies on the host specificity and key mortality factors of the weevil must first be conducted.

Acknowledgments

We thank the staff of the Systematic Entomology Laboratory, Agricultural Research Service, U.S. Dept. of Agriculture/SEA, Beltsville, Md, for identification of *C. punctiger* Gyll. This project was supported by state funds.

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