

Honey bee foraging on dandelion and apple in apple orchards

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ABSTRACT

A four-year study was conducted to determine if honey bees foraging on dandelion switched to apple bloom when dandelion flowers closed in the afternoon. The number of honey bees foraging on dandelion decreased significantly in the afternoon with no significant increase of honey bee numbers on apple. Four thousand honey bees were marked while foraging on dandelion but only two were later observed working apple. Most honey bees foraging on dandelion for nectar do not switch to apple bloom after dandelions close.

Insecta, Honey bees, Pollinators, Dandelion, Apple

INTRODUCTION

'Delicious' apple requires cross-pollination and honey bees (*Apis mellifera* L.) are the primary pollinators (Mayer, et al. 1986). Dandelions (*Taraxacum officinale*) are frequently found on the orchard floor of apple orchards in the Pacific Northwest and British Columbia. Dandelions bloom at the same time as apples and may compete with apple flowers for the limited number of bees available for foraging. On warm sunny days dandelion flowers mostly close by 1330 and remain closed for the day. Even on cloudy days most dandelions close in the afternoon. Kremer (1950) suggested that since dandelions closed at midday there was no competition and bees deserting the closed dandelion foraged on apple. Percival (1955) studied pollen presentation of dandelion and apple and pointed out that dandelion may not lure bees from fruit trees. Filmer (1941) found about equal numbers of bees foraging on apple and dandelion and supposed that dandelion was a major competitor to fruit. Free (1968) using pollen traps and marked honey bee pollen collectors found a great percentage of the pollen collected by colonies placed in fruit orchards was dandelion and marked pollen collectors seldom changed from dandelion to fruit. He concluded that dandelion was a serious competitor for apple. However, he worked only with pollen collectors although he reported that most bees visit dandelion for nectar rather than pollen. The purpose of this study was to determine if honey bees foraging on dandelion for nectar switched to apple bloom when dandelion flowers close.

MATERIALS AND METHODS

A 'Bisbee' Delicious apple orchard planted near Prosser, WA in 1976 on a 10 x 18 ft spacing was used. Experiments were conducted during late April when the trees were at full open bloom in 1986, 1987, 1988 and 1989. A nearly solid cover crop of blooming dandelions occurred on the orchard floor every year. Each year 1,000 honey bees foraging on dandelion between 0930 and 1000, were marked with a small cheesecloth bag containing orange fluorescent powder. The cheesecloth bag was gently tapped on the upper abdomen of individual bees as they collected nectar from dandelion. The same 0.25 acre plot in the orchard was used every year. Each year the total number of honey bees and number of marked bees per apple tree per minute (20 replications) and per square meter of dandelions per 30 seconds (20 replications) were recorded at 0900, 1130 and 1430 on the same day the bees were marked and at 0900, 1130 and 1430 on the following day. The first count on the first day was prior to marking honey bees. In all years, all or nearly 100% of the dandelion flowers closed between 1200 and 1300 and remained closed for the day. Data were analyzed by ANOVA using Tukey's multiple mean comparison test (Steel and Torrie, 1980).

Table 1
Mean number of honey bees per apple tree per minute and per square meter of dandelion per 30 seconds. Prosser, WA.

Time	1986		1987		1988		1989	
	Apple	Dande- lion	Apple	Dande- lion	Apple	Dande- lion	Apple	Dande- lion
Day 1								
0900	4a	14a	5a	24a	4a	28a	15a	16a
1130	10b	21a	4a	30a	7a	35a	22a	20a
1430	12b	1b	4a	0b	6a	3b	17a	2b
Day 2								
0900	5a	16a	6a	7a	6a	29a	9a	7a
1130	12b	22a	8a	7a	5a	30a	13a	21b
1430	14b	0b	8a	1b	6a	7b	11a	1c

Means within a column and day followed by the same letter are not significantly different (Tukey's multiple mean comparison test, $P=0.5$).

Table 2
Mean percent of honey bees observed at each time period on apple bloom and dandelion flowers with orange fluorescent powder on their bodies. One-thousand honey bees foraging on dandelion were marked between 0930 and 1000 after taking the 0900 counts on day 1. Prosser, WA.

Time	1986		1987		1988		1989	
	Apple	Dande- lion	Apple	Dande- lion	Apple	Dande- lion	Apple	Dande- lion
Day 1								
0900	0	0	0	0	0	0	0	0
1130	0	48	0	53	0	46	0	35
1430	0	0	0	0	0	40	0.5	63
Day 2								
0900	0	28	0	10	0	27	0	33
1130	0	32	0	20	0	28	0	30
1430	0	0	0	0	0	21	0	23

RESULTS & DISCUSSION

As expected, honey bee foraging on dandelion decreased significantly in the afternoon when dandelion flowers closed (Table 1). However, there was no significant increase in honey bee foraging on apple flowers at 1430 when dandelion blooms were closed as compared to 1130 when they were open (Table 1). Higher numbers of honey bees foraging on apple after dandelion closed would indicate that bees foraging on dandelion did switch to apple. This was not the case in any of the four years. During 1986-1988, none of the 3,000 honey bees marked with orange powder while collecting nectar from dandelion was observed foraging on apple either on the day of marking or the following day (Table 2). In 1989, 2 bees out of the 1,000 marked were observed working apple at 1430 after dandelions closed (Table 2). Clearly, most honey bees do not switch to apple after dandelions close. Of the bees marked on dandelion at 0900, 35% to 63% were observed working dandelion at 1130 or 1430 on the day of marking and 10 to 33% on the next day (Table 2). The marking technique proved to be a good method for tracking individual bees. For example, at 1130 on day 1 in 1987, of 600 bees recorded on dandelion 318 were marked bees. Free (1970) suggested that an individual bee's foraging area is limited. We found that many marked bees continue foraging in our 0.25 acre test plot indicating that most

bees work a limited area. Honey bees foraging dandelion for nectar do not switch to apple bloom after dandelions close in the afternoon. Dandelions are beneficial to the bee colonies in providing pollen and nectar, but they appear to be a serious drain on the numbers of available pollinators for apple.

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Unseasonably low fall and winter temperatures affecting mountain pine beetle and pine engraver beetle populations and damage in the British Columbia Chilcotin Region

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ABSTRACT

Unseasonably low temperatures in the fall and winter of 1984 and the fall of 1985 resulted in the decline and termination by 1987 of a major mountain pine beetle infestation which had been in progress since the late 60's. Following the winter of 1984-85, brood survival on lodgepole pine trees in plots near Tsh Lake in the west-central Chilcotin area of British Columbia was restricted to the lower 0.5 m of infested boles, and the estimated average emergence of female beetles per tree was about 10% of the number required for replacement of the parent generation. Pine engraver beetle populations which built up during the mountain pine beetle epidemic killed many trees in 1985 and 1986, but collapsed by 1987, due mainly to tree resistance and other natural factors. The rise and fall of tree mortality from the pine engraver within the plots paralleled that in the rest of the central Chilcotin following the collapse of the mountain pine beetle outbreak.

INTRODUCTION

Mortality from cold is one of the major factors determining the distribution and abundance of the mountain pine beetle (*Dendroctonus ponderosae* Hopk.) (Safranyik 1978; Amman and Cole 1983). Mountain pine beetles normally overwinter as late-instar larvae, the stage at which they are the most cold-hardy (Safranyik 1978; Amman and Cole 1983). Cold-hardiness of mountain pine beetle increases with the accumulation of glycerol in body fluids in response to gradually decreasing temperatures in the fall and early winter