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Cover of Plants with Extrafloral Nectaries at Four Northern California Sites

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COVER OF PLANTS WITH EXTRAFLORAL NECTARIES AT FOUR NORTHERN CALIFORNIA SITES

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ABSTRACT

Percent cover of plants with extrafloral nectaries was investigated in three California habitats with the same physiognomy as habitats previously studied in Nebraska (perennial native grassland, riparian forest, deciduous forest). In contrast to Nebraska where cover of plants with extrafloral nectaries reached 14 percent, no plants with extrafloral nectaries were found in any California transect. Chaparral was also studied; no plants with extrafloral nectaries were found.

A number of plant species with extrafloral nectaries (EFNs) have been shown to be involved in a mutualism with ants (Bentley, 1977; Deuth, 1977; Tilman, 1978; Inouye and Taylor, 1979; Koptur, 1979; O'Dowd, 1979; Pickett and Clark, 1979; Keeler, 1980b). Extrafloral nectaries are glands on a plant that secrete a nectar rich in sugars and amino acids, but are not involved in pollination. For ecological studies, function rather than morphology is considered the crucial aspect of the definition of an EFN.

Little is known about the distribution of plants with EFNs. Bentley (1976) and Keeler (1979) found that 0–80 percent of the plants in tropical habitats (Costa Rica and Jamaica) had EFNs, and that this correlated with ant abundance. In Nebraska, Keeler (1980a) found 0–14 percent of the cover to have EFNs. The percent cover of plants with EFNs in Nebraska was correlated strongly with abundance of foraging ants and secondarily with plant species diversity (H'), but not with rainfall or frost-free season.

This study was undertaken to test for a relationship between biome and the abundance of plants with EFNs. Three California communities with plant associations similar to the Nebraska ecosystems previously studied (prairie, riparian forest, and deciduous forest) were analyzed. The similar habitats are probably the result of similar rainfall (40–80 cm/yr). Adjacent chaparral was also investigated.

METHODS

Vegetation analysis was carried out in natural habitats using a point-intercept method. Plants nearest to randomly chosen points along a transect were identified and scored for presence of EFNs. At each site, 500–1000 points were recorded on two transects. Simultaneously, abundance of ants was estimated using response of ants to karo syrup

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and tuna fish baits (about 1 ml of each at 25 spots 2 m apart). Number and species of ants on baits at 15, 30, 60, 120, and 180 min. were recorded; the number of baits found reflects forager density, and number of species per bait probably indicates the diversity of the ant community.

The California sites were as follows: 1) Native grassland. Bunchgrass prairie 6.5 km north of Stonyford, Colusa County, on the Lodoga Rd., 370 m. This was a *Stipa* prairie with abundant annual forbs. 2) Riparian forest understory. Two sites along the Sacramento River, off Route 45 south of Princeton, Colusa Co., were studied; opposite Road 64, and along Reservation Road, 25 m. The canopy was dominated by cottonwoods, the understory by *Vitis americana, Ribes* spp., and *Rhus diversiloba*. 3) Deciduous forest understory. The study area was in Mendocino National Forest, Colusa Co., near Deafy Glade, 1370 m. The canopy was dominated by deciduous oaks (*Quercus garryana, Q. kelloggii*); the understory contained a variety of forbs, especially *Lupinus* sp. 4) Also studied was a chaparral site at 610 m in Mendocino National Forest along road 18N01 east of the Mill Creek campsite.

All studies were carried out 10–30 May 1979. This time was chosen for maximal plant and animal activity. The season had been cool and wet through the previous week. The days on which the study was carried out were warm, clear, and windy. Annual forbs were still flowering at the prairie site and *Stipa* was in bud. While it is possible that some extrafloral nectaries function at other times, the availability of water and the peak animal (both ant and herbivore) activity suggest April–May as the likely time for greatest EFN activity.

Air temperature was noted for all experiments. It ranged from 16°C to 33°C for 0900–1200 hr PDST, when ant baiting was carried out.

Results

Not one plant with EFNs was found in any of the transects or observed at any of these sites (Table 1). Frequency of ants discovering baits was astonishingly low, in particular at the prairie site, where in one three-hour experiment, not one of 25 pairs of baits was found by ants. The California sites had significantly fewer ant species per bait as judged by the Wilcoxon two-sample test (n = 10,6; C = 53, $p < 0.01$; Sokal and Rohlf, 1969). Adding in the chaparral sites, there are still significantly fewer ants per bait at the northern California sites (n = 10,8; C = 9; $p < 0.001$) than at the Nebraska sites.

Discussion

No species with extrafloral nectaries were found at any of the California sites. No native plants with extrafloral nectaries are known from the California habitats studied (pers. obs.; H. G. Baker, pers.

TABLE 1. PERCENT COVER OF PLANTS WITH EXTRAFLORAL NECTARIES AND BAIT VISITATION BY ANTS FOR EIGHT TRANSECTS THROUGH FOUR VEGETATION TYPES IN NORTHERN CALIFORNIA.

Sites	Percent cover of EFN	# points sampled	% baits found in 180 min.	Mean ant spp/bait
Prairie	0	554	12	0.12
	0	865	0	0
Riparian forest understory	0	1064	33	0.43
	0	1045	55	0.55
Deciduous forest understory	0	659	87	1.61
	0	542	100	2.71
Chaparral	0	420	86	1.29
	0	544	86	1.52

comm., 1976). Some of northern California's introduced species do have EFNs, and have been shown to benefit by mutualism with ants (Koptur, 1979). Furthermore, *Helianthella californica* (Asteraceae), a forb of the Sierra Nevada, has EFNs and is found at the same latitudes as the sites studied. However, all Nebraska transects had plants with EFNs except tallgrass prairie. Even in tallgrass prairie, species with EFNs were noted outside the transect (Keeler, 1980a). This suggests that in reality, plants with EFNs are less abundant in northern California than they are in comparable habitats in Nebraska. Why this type of plant defense is not favored in these northern California habitats is not clear at this time.

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