1-1981

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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 (pe­
renial 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 stud­
ies, 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 commu­
nities with plant associations similar to the Nebraska ecosystems pre­
viously studied (prairie, riparian forest, and deciduous forest) were
analyzed. The similar habitats are probably the result of similar rain­
fall (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 kar0 syrup
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.
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.

**Acknowledgments**

I thank the administrators of the Mendocino National Forest for their cooperation, Dr. and Mrs. H. G. Baker for their advice and assistance, and S. Cantwell for her help.

**Literature Cited**


(Received 8 Apr 1980; revision received and accepted 19 Sep 1980.)