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RECORDS OF HUMMINGBIRD POLLINATION IN THE WESTERN AMERICAN FLORA

II. ADDITIONAL CALIFORNIA RECORDS¹

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In the first paper of this series (*Aliso*, vol. 6, no. 2, 1966) we described the methods of field observation used in our studies of hummingbird pollination in western North America, and listed a number of pollination records in the California flora obtained by these field methods. The purpose of the present paper is to report several new records and to extend the list of known California hummingbird flowers.

HYDROPHYLLACEAE

1. PHACELIA MINOR

This annual herb occurs in dry places in coastal southern California and on the edge of the Colorado Desert. The flowers are violet and tubular-campanulate with exerted stamens and style which mature in protandrous order. In several populations in the Claremont area we have seen only bees, particularly *LasioGLOSSUM sisymbrii* and *Anthophora sp.* among native bees, visiting and pollinating the flowers. The flowers of a desert population near Palm Springs, however, were visited and pollinated by pseudomasarid wasps and by hummingbirds.

Palm Canyon, near Palm Springs, Riverside Co., March 9 and 30, 1966. There is much variation in flower size in this population, the corollas of different plants ranging from 1.2 to 2.8 cm in length. A male Anna hummingbird was observed to be feeding on the flowers and a male Costa was apparently feeding on them too (the latter was less clearly seen). The Anna hummingbird visited both large and small flowers, brushing against the exerted stamens in the process, and much white *Phacelia* pollen adhered to its face, where it would rub off on the exerted stigma.

LABIATAE

2. MONARDELLA MACRANTHA

This perennial herb grows in dry sandy or rocky soil in the yellow pine zone of the mountains from central California to northern Baja California. The flowers are red and trumpet-shaped with a tubular corolla usually about 3 cm long and well exerted stamens. Dr. Elizabeth Sprague has observed hummingbird visitations.

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Palomar Mt., San Diego Co. Hummingbirds were feeding regularly on the flowers in late spring according to Dr. Sprague (oral comm.). The visits of hummingbirds result in pollination in the case of plants grown in Rancho Santa Ana Botanic Garden, as we have observed, and pollination undoubtedly follows from bird visits in the wild plant populations as well.

3. TRICHOSTEMA LANATUM

In the preceding paper of this series (*Aliso*, 1966) we gave suggestive evidence for hummingbird pollination in this species and pointed out the need for confirmatory field observations. The latter have since been obtained.

Calf Canyon, near Santa Margarita, San Luis Obispo Co., May 18, 1966. The plants grow in washes and draws in the chamise-covered hills. A male Costa hummingbird was systematically visiting and pollinating the flowers. Another hummingbird, probably a male Anna, was also feeding on and pollinating the flowers. Incidental visitors were a bee fly and a bumblebee. The bee fly at least was not bringing about pollination.

SCROPHULARIACEAE

4. CASTILLEJA PAYNEAE

The low plants with their dull reddish flowers grow in the timberline and alpine zones of peaks in the southern Cascades.

Lassen Peak, Shasta Co., July 17-18, 1966. Calliope hummingbirds were systematically probing the flowers of a large population on bare rocky slopes near timberline (8500-9000 ft. elev.).

5. DIPLACUS AURANTIACUS

Previous pollination records for this species (cf. *Aliso*, 1966) involve Anna and unidentified hummingbirds on plant populations in central California. It is worthwhile to extend the picture to include visits of Allen hummingbirds in a northern population.

Shelter Cove, Humboldt Co., July 7, 1966. A scattered population inhabits coastal bluffs facing the sea. An Allen hummingbird, probably a female, was visiting and pollinating the flowers in one sub-population.

CAPRIFOLIACEAE

6. LONICERA INVOLUCRATA LEDEBOURII

The species as a whole is wide-ranging, its California representatives occurring mainly in the Sierra Nevada. We are concerned here with a coastal California race treated by Jepson as var. *ledebourii*. This race consists of tall shrubs with reddish instead of the usual yellow flowers. The pairs of flowers are subtended by large red bracts, and the corollas are tubular, 1.5 cm long, and bright yellow tinged heavily with red on the upper side. The anthers stand just below and the sticky green stigma just outside the orifice.

Pt. Buchon, San Luis Obispo Co., May 19, 1966. The shrubs grow in a willow thicket along a canyon bottom near the ocean. Allen hummingbirds were feeding regularly on the flowers. The pollen is probably carried on the birds' bills.

Strawberry Canyon, Alameda Co., April 16, 1949. Allen hummingbirds feeding on the flowers.

CAPPARIDACEAE

7. ISOMERIS ARBOREA

This common shrub of central and southern California produces its large yellow flowers throughout a long blooming season. The flowers have a full throat; the arched stamens and style are exerted on the lower side; and these organs mature in protandrous order.

The *Isomeris* flowers are best fitted for large bees. We have seen Carpenter bees (*Xylocopa brasiliatorum*) and other large bees regularly visiting and pollinating them in two desert localities. Hummingbirds also seek nectar in these flowers. In doing so they pick up and carry pollen on their bills, but only occasionally do the bills come into contact with the exerted stigmas. Therefore, while the hummingbirds bring about some pollination of *Isomeris*, the mechanism of these large-bee flowers is imprecise in relation to the hummingbird visits.

Andreas Canyon, near Palm Springs, Riverside Co., February 14, 1967. Costa and Anna hummingbirds were abundant and were feeding extensively on the *Isomeris* flowers. One male Rufous hummingbird was also observed.

San Gorgonio Pass, near Cabazon, Riverside Co., February 1, 1965. An unidentified female hummingbird was systematically feeding on the flowers.

ERICACEAE

8. ARCTOSTAPHYLOS PARRYANA PINETORUM

We discussed this species of manzanita briefly in our previous report (*Aliso*, 1966). Additional and more complete information is now available for a different population in the coniferous forest zone (5700 ft. elev.) in the San Gabriel Mts. Here the plants bloom in early spring, March and April.

The flowers are visited and pollinated by *Bombus*, *Osmia* and other bees on warm sunny days, but not during the frequent or prolonged periods of cold weather. Hummingbirds feed on the flowers on all but the coldest days following heavy snows. The birds are thus more regular flower visitors, but probably less effective pollinators, than the bees.

Glacier Campground, Mt. Baldy, San Gabriel Mts., San Bernardino Co., March 7 to April 7, 1967. Anna, Allen, and Rufous hummingbirds were feeding on the flowers almost daily as noted above. They probe for nectar on the wing, and this activity often brings their bill tip into contact with the pollen.

LILIACEAE

9. ALLIUM VALIDUM

This bulbous herb of wet meadows in the mountains of northern California has rose-colored flowers with exerted stamens and style. Hummingbird visits have been observed by Dr. Elizabeth Sprague.

Slate Creek Valley, near Tioga Pass, Sierra Nevada, Mono Co., August 27, 1956. According to Dr. Sprague (oral comm.) Rufous hummingbirds were feeding on the flowers and probably effecting some pollination.