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THE PIERID FAUNA OF JEWEL FLOWER AT A MID-ELEVATION SIERRAN LOCALITY

Jewel flower (*Streptanthus tortuosus* Kell.) is one of the commonest, most widespread native Californian crucifers. Unlike many other *Streptanthus*, it occurs over a wide altitudinal range and on many different soils. Recent studies of endemic serpentine-barren *Streptanthus* in the North Coast Ranges have shown that 50% or more of the plants may receive pierid eggs, and larval damage may affect from 15% to 40%, depending on species, phenophase, and site (Shapiro, Amer. Nat., 117:276–294; Shapiro, unpublished). In these low-diversity communities three pierids (*Pieris sisymbrii* Bdv., *Anthocharis sara* Lucas, and *Euchloe hyantis* W. H. Edw.) feed more or less synchronously on two *Streptanthus (breweri* Gray, *glandulosus* Hook. vars.), which are both among the commonest herbaceous species. One larva of *P. sisymbrii*, surviving to pupation, can destroy the entire seed output of one medium-sized or several small *Streptanthus* plants.

At higher elevations the crucifer-feeding pierid fauna is more complex. On 25 June 1980 a census of pierid immatures was carried out on *S. tortuosus* along the Bowman Lake Road above Lang Crossing of the South Yuba River, Nevada Co., California, on the west slope of the Sierra (1400–1500 m). The site is a steep, xeric, sparsely vegetated slope (scattered montane chaparral on a quartz-muscovite-biotite-feldspathic schist). The aspect of the site is open and similar to a serpentine barren. *S. tortuosus* is an aspect dominant in the herb layer. The only other crucifers present are three species of *Arabis*, all rare (two known from one clump each on the slope), and the weed *Lepidium virginicum* var. *pubescens* (Greene) Thell. of which a few examples were found by the roadside. Most of the *Streptanthus* grow on ledges; their distribution is highly clumped. The crucifer-feeding pierid fauna of the general area includes nine species (four Euchloini, five Pierini); of these five are regular residents of the site (*Anthocharis sara*, *A. lanceolata* Lucas, *Euchloe hyantis*, *E. ausonides* Lucas, and *Pieris sisymbrii*) and a sixth (*Pieris rapae* L.) occurs as a stray.

One thousand, nine hundred and twenty-five *S. tortuosus* were examined. They had green fruit, and most still had a few flowers. Of the pierid species, *E. hyantis* (one seen) and *P. rapae* were still flying locally. Some 236 plants had been damaged in a characteristic pierid manner ("stemmed"): 43 larvae were found: 28 *E. hyantis* (2nd instar through prepupa), 7 *A. lanceolata* (2nd through 4th instars), 5 *A. sara* (3rd through 5th), 2 *P. sisymbrii* (one each, 4th and 5th), and 1 *P. rapae* (5th instar). All of these are obligate or preferential silique feeders, except *P. rapae*. No pierid eggs were found. Injury ranged from minor (by small larvae working the distal portions of single stems) to major and even complete (Fig. 1). Total plants damaged equaled 12.3%, with the average damage on these plants as of the sampling date being a 20% loss of siliques. Thus, by 25 June about 2½% of the reproductive potential of the plant population had been lost to pierid feeding. Shapiro (1975, Amer. Midl. Nat., 93: 424–431) estimated the seed loss of *Lepidium virginicum* to pierids at Donner Pass as about 1.4%. Both figures are substantially lower than on serpentine in the Coast Range. The extent of further depredation at Lang Crossing can be guessed at, noting that most of the small larvae of both *E. hyantis* and *A. lanceolata* collected June 25 were parasitized and were killed by an undetermined hymenopteran within four days from collection, with little further feeding. The bulk of the season's damage had presumably already been inflicted.

There is no general agreement among ecologists as to the criteria for recognizing either interspecific competition or food limitation on population growth in herbivorous insects, which rarely devastate their hosts in a state of nature. The leading authority on *Streptanthus*, A. R. Kruckeberg, writes (in litt.): "Having collected members of the genus ever since 1948, you should think I would have discovered instances of insect predation, yet I rarely do find them . . . in good years climatically, I can find an abundance of seed with inflorescences loaded with siliques up to the aborted terminal flowers of the raceme." Yet some of the serpentine *Streptanthus* appear to have evolved specific anti-herbivory mechanisms directed at pierids (Shapiro, Amer. Nat., *loc. cit.*).

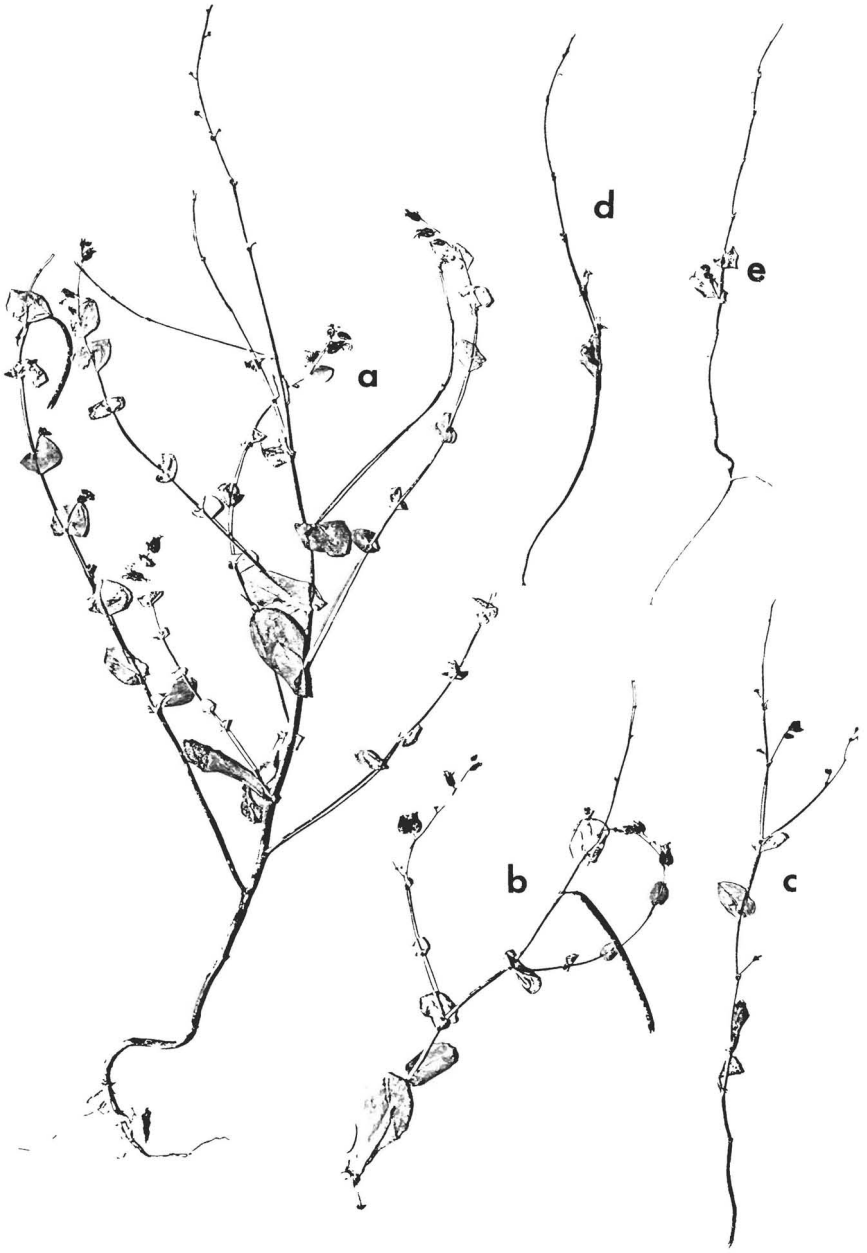

FIG. 1. *S. tortuosus* collected at Lang Crossing, vi.25.80, showing feeding damage inflicted by *Euchloe hyantis* (larvae collected from all specimens). **a:** destruction of almost all siliques by one mature larva. This large, vigorous plant had the potential to produce a second seed crop before the end of the growth season. **b:** medium-sized plant with most of inflorescence destroyed by a third-instar larva. **c:** small plant with all siliques destroyed by third-instar larva, but a few flower buds intact. **d, e:** small plants with all siliques destroyed; these individuals had no prospect of recovery.

The impact of pierid feeding must be assessed the level of the individual plant rather than the population as a whole; then it can be seen that a single oviposition can be effectively lethal. If larval survivorship is high, most plants that receive one pierid egg will fail to set seed. If it is lower, the losses will be less, but still may be substantial. In *S. tortuosus* at Lang as with other crucifers (Shapiro, loc. cit.) the brunt of injury is borne by peripheral and isolated individuals rather than those in large stands; pierids consistently disobey the "resource concentration hypothesis" (Root, 1973, Ecol. Monogr., 43: 95–124). Since other herbivores, including the flea beetles *Phyllotreta* (Chrysomelidae), are density-dependent, *Streptanthus* may be under conflicting selection pressures affecting spacing or seed dispersal. The relatively low overall impact of pierids on seed production at Lang may reflect the highly aggregated dispersion of the plants, since attack is so catastrophic to the victims.

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