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Bee visitation of *Phlox bryoides* (Polemoniaceae)

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BEE VISITATION OF *PHLOX BRYOIDES* (POLEMONIACEAE)

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Abstract.— Collections of diurnal insects from a population of *Phlox bryoides* on shortgrass prairie in southeastern Wyoming showed the flowers to be visited predominantly by *Synhalonia fulvitarsis*, a long-tongued bee. Analysis of pollen loads carried by captured bees revealed that almost all individuals were collecting *Phlox* pollen. *P. bryoides* may be an exception to the generalization that the genus *Phlox* is exclusively pollinated by Lepidoptera.

Entomophilous pollination in the genus *Phlox* is thought to be effected almost exclusively by Lepidoptera (Grant and Grant 1965). Species with corollas 1–2 cm long are exclusively pollinated by perching butterflies; those with corollas 3–4 cm long are pollinated by hawkmoths (Grant and Grant 1965). Based upon observations of three species (*P. caespitosa* Nutt., *P. diffusa* Benth., *P. multiflora* A. Nels.) plus a citation for *P. andicola* (Britt.) (Wherry 1955), it was concluded that all species of the Section Occidentales (=Section Microphlox of Wherry 1955), which "contains over 20 species of woody-based, needle-leaved, cespitose or cushion-like shrubs," were pollinated by Lepidoptera (Grant and Grant 1965). In particular, western cushion plants with erect 1-cm-long corolla tubes are pollinated by perching noctuid moths (Grant and Grant 1965). However, at least two species in the Section Occidentales possess corollas that are substantially shorter than 1 cm (*P. bryoides* Nutt., *P. hoodii* Rich., measurements from Wherry 1955) and could be pollinated by long-tongued bees or flies. Indeed, data reported here from a population of *P. bryoides*, a dense cushion plant common on shallow soils and rocky outcrops in southeastern Wyoming, suggest that the Grants' general conclusion (1965) may require modification. Individuals of the long-tongued eucerine bee species *Synhalonia fulvitarsis fulvitarsis* (Cresson) were common pollen collectors on the flowers and may be important pollinators.

Phlox bryoides blooms from the last half of May to late June/early July, with peak flowering during the first half of June. During this period in 1975 and 1976, weekly collections of flower-visiting bees were made during four hour-long periods, two each in morning and afternoon, on an 11000-m^2 plot in Albany Co., 8 km SSE of Laramie. About 30 percent of the plot was covered heavily by *P. bryoides*. Collections were not restricted to *P. bryoides*; rather, each floral species was censused in rough proportion to its percent of total floral abundance during each period. Thus the number of insects visiting *P. bryoides* was much larger than the relatively small numbers reported here.

Synhalonia fulvitarsis works the salverform flowers of *P. bryoides* very rapidly, visiting only a few of the many available in each cushion before moving to another cushion. In 1975, 11 females, 10 carrying pollen, were captured on the flowers of *P. bryoides*; in 1976 7 of 8 females captured had *Phlox* pollen loads. No diurnal pattern in foraging was evident except that females did not begin visiting flowers until after 1030 hours. Thereafter, activity was evenly spaced until collection ended, generally between 1530 and 1600 hours. Other bee species found on *Phlox* were represented by only 1 or 2 individuals each, and they did not carry pollen. Diurnal Lepidoptera were rare on the flowers.

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Most pollen loads examined from the 17 specimens (both years combined) contained more than 70 percent *Phlox* pollen (Fig. 1). Indeed, seven females carried loads that were almost pure (90 percent *Phlox* or higher), and the mean for all pollen loads was 64.5 percent *Phlox* (S. D. = 35.4, range 5.6–100.0).

Although Timberlake (1969) also reported S. *fulvitarsis* from the flowers of *Phlox*, this association does not appear to be obligatory. Rather S. *fulvitarsis* is probably polylectic, because it has been recorded from a large number of plant species (Timberlake 1969).

Effective cross-pollination in the Section Occidentales seems to require a nectar rather than pollen-collecting flower visitor because the anthers are situated above the stigma while the nectaries are located at the base of the corolla tube (Grant and Grant 1965). Thus, species that collect only pollen would not contact the stigma. In most species of *Phlox* the length of the corolla tube precludes nectar collection by all but long-tongued Lepidoptera. In *P. bryoides*, however, (and in *P. hoodii* as well) the corolla tube is relatively short (4–8 mm, Wherry 1955) and the nectaries are well within the reach of long-tongued bee species such as S. *fulvitarsis* (proboscis length measured from base of mentum through flabellum; $\bar{x} = 8.44$, s.d. = 0.465, N = 20 ♀ ♀). It is not unlikely that S. *fulvitarsis* collects nectar from *P. bryoides* at the same time pollen is collected, thereby achieving pollination. Whether *P. bryoides* is dependent upon long-tongued bees for pollination in any consistent way awaits the examinations of other populations.

Although bee pollination is prevalent in the family Polemoniaceae, it is regarded as the primitive condition from which all other pollination systems have been derived (Grant and Grant 1965). Moreover, the genus *Phlox* is regarded as an advanced member of the family, in part because of its pollination syndromes (Grant and Grant 1965). Wherry (1955) viewed Microphlox as an advanced section of the genus *Phlox* on morphological grounds and regarded the subsection Canescentes, of which *P. bryoides* and *hoodii* are members, as perhaps the most advanced group in the Microphlox. If both interpretations are correct, then bee pollination in the Canescentes represents reversion to the primitive condition in an advanced branch of the family.

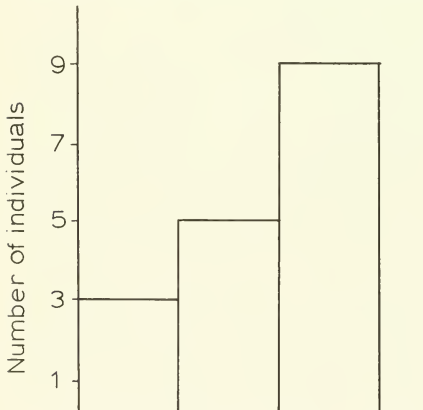

Fig. 1. Distribution of pollen loads carried by *Synhalonia fulvitarsis* by percent *Phlox bryoides*.

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