

Notes on the hemiparasite, *Bartsia alpina* (Scrophulariaceae)

LYTTON J. MUSSELMAN and STEVEN D. RICH

Department of Biological Sciences, Old Dominion University
Norfolk, Virginia 23508, U.S.A.

ABSTRACT: *Bartsia alpina* in Iceland parasitizes *Carex* sp., *Bistorta vivipara*, and *Empetrum eamesii* and almost certainly numerous other vascular plants. Haustoria are small in diameter (0.1 to 1.0 mm), have a reduced vascular core, and few (to 10) axial strands. Root hairs and a root cap are present on roots.

Bartsia alpina L. (Lokasjóðsbróðir) is one of five genera of parasite Scrophulariaceae occurring in Iceland. Like its relatives, *Bartsia* is a hemiparasite, that is, a chlorophyll containing plant apparently capable of normal photosynthesis which forms attachments to neighboring roots via modified lateral roots termed haustoria. Very simply, haustoria of parasitic Scrophulariaceae consist of three regions: (1) the vascular core, a mass of small vessel elements which abuts on the xylem of the parent root; (2) the axial strands, single strands of vessel elements which form a xylem continuity from host to parasite by passing through (3) the central parenchymatous core which forms the bulk of the haustorium between the vascular core and the host root.

Despite the fact that *Bartsia* occurs over much of northern Europe (FITTER *et al.*, 1974) very little is known regarding its host range or haustorial architecture (KUIJT 1969). Accordingly, the purpose of this paper is to record data from our observations.

MATERIALS AND METHODS

Material was collected in a grazed area along the Kaldidalur just west of Þórisjökull in August 1975 under permit R-203/5311 of the National Research Council as a part of our study on the autecology

and morphology of parasitic Scrophulariaceae. Nomenclature follows LÖVE (1970). Specimens put in liquid preservative were cleared in sodium hydroxide and stained in pararosaniline hydrochloride (MUSSELMAN & DICKISON 1975).

OBSERVATIONS AND DISCUSSION

In a little known publication HEINRICHER (1910) presented data on the life history of *Bartsia* based on his studies in nature and in cultivation. He noted that *Bartsia alpina* takes four to six years to mature from the time of sowing to flowering. The plants in culture were grown on two grass species as host, *Avena flavescens* and *Agrostis alba*. It is not known if *Bartsia* will grow without attachment to a host. However, in a discussion of host range in parasitic angiosperms as a whole, HEINRICHER (1910) states that parasites may attach to many different species. Our data shows this to be the case for *Bartsia* also.

We confirm the presence of *Bartsia* haustoria on the following: *Carex* sp., *Bistorta vivipara* (L.) S.F. Gray, and *Empetrum eamesii* Fern. & Wieg. The haustoria are small, ranging from 0.1 to 1.0mm in diameter, the latter being a large haustorium. The whitish haustoria were borne on fragile roots which readily broke when digging in the rocky soil. No doubt many more hosts could be found with further work. While tentative, our data would seem to indicate a broad host range for *Bartsia*.

The internal organization of the haustorium is similar to that of other parasitic Scrophulariaceae (MUSSELMAN and DICKISON 1975). The vascular core resembles that of the related genera *Melampyrum* and *Euphrasia* in being only moderately developed. Like the vascular core elements of other parasites, the vessel elements are irregularly shaped with scalariform thickenings and lateral perforation plates. The axial strands are each composed of a single strand of vessel elements, which are different in morphology from the vessel elements of the vascular core. The axial strands in the *Bartsia* haustorium are bowed similar to those of the *Aureolaria* type of haustorium (MUSSELMAN and DICKISON 1975).

Bartsia alpina is perennial from a slender rhizome. The portions of the rhizome near the soil surface have thick scales, with a distinctive, waxy cuticle. The somewhat fleshy nature of these scales invites comparison with the peculiar subterranean leaves of the related genus *Tozzia*. However, the scales of *Bartsia* lack the succulence and internal trichomes of *Tozzia*.

Although the scales lack trichomes, the remainder of the plant is covered with simple, uniseriate trichomes some of which are glandular. An examination of the stem apex indicates that all trichomes are probably gland tipped when young and that the other trichomes arise by a loss of the glandular heads. The various stages in the shedding of the glands and the resultant elongation of the stalk cell are clearly evident near the stem apex. Trichomes are present on younger portions of rhizomes.

Adventitious roots were commonly observed arising from the rhizomes. Root hairs, although sparse, and root caps were both present. Developing haustoria were present on those adventitious roots in contact with neighboring roots. Perhaps the production

of adventitious roots insures a continual supply of haustorial contacts. It is not clear how long the haustoria survive; no haustoria examined in this study appeared to be over one year in age. More critical data is needed to determine the functional longevity of haustoria.

REFERENCES

- FITTER, R., A. FITTER & M. BLAMEY. 1974. The wild flowers of Britain and Northern Europe. C. Scribner's Sons, New York. 336 pp.
- HEINRICHER, E. 1910. Die Aufzucht und Kultur der parasitischen Samenpflanzen. G. Fischer, Jena. 53 pp.
- KUIJT, J. 1969. The biology of parasitic flowering plants. Univ. of California Press, Berkeley. 246 pp.
- LÖVE, Á. 1970. Íslensk ferðaflóra. Almenna Bókafélagið, Reykjavík. 428 pp.
- MUSSELMAN, L.J. & W.C. DICKISON. 1975. The structure and development of the haustorium in parasitic Scrophulariaceae. Bot. Jour. Linn. Soc. 70: 183-212.

Received February 1976