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MORPHOLOGY AND ANATOMY OF POLYGONUM VIVIPARUM

by

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A THESIS

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MORPHOLOGY AND ANATOMY OF POLYGONUM VIVIPARUM*

Polygonum viviparum L. is of interest because it reproduces vegetatively by means of bulbils appearing on the floral axis (fig. 14). This investigation is concerned primarily with determination of the nature of the flower, the bulbil, the peduncle, and the rhizome. The structure of the leaves and roots is also considered. The anatomy of the seedling is not described, for seedlings were not found in nature and could not be produced from the achenes that were collected late in the growing season.

Modification of the inflorescence for vegetative reproduction occurs in many groups of Angiosperms. Polygonum viviparum is the only species in the Polygonaceae known to reproduce in this manner. There are several other species in the family, however, that multiply by other vegetative methods. According to Schroeter (1908) Polygonum bistorta sends out small side branches from the fleshy, crooked rhizome. At the ends of these branches new plants arise. According to Hagi (1907-1931) Polygonum mite has creeping stems that produce roots and shoots at the nodes. Bailey and Bailey (1941) state that asexual reproduction can be brought about by horticultural methods in Atraphaxis, Cocco-lobis, Muehlenbeckia, and Rheum rhaponticum. The foregoing

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examples do not constitute a complete list of all polygonaceous plants known to reproduce vegetatively.

Polygonum viviparum is a widely distributed alpine species. Hagi (1907-1931) states that the plant occurs generally throughout the high mountains and arctic regions of Europe and Asia, including the Pyrenees, the Alps, the Juras, the mountains of Scandinavia, North England, and Scotland. Weaver and Clements (1938) report that the plant is one of the chief species of the summer aspect of the petran tundra of North America. Small (1895) records specimens from the summits of the White Mountains.

This species is found in abundance in the vicinity of Windy Point on the Cog Railroad on the southeast slope of Pikes Peak in Teller County, Colorado. It grows from an approximate altitude of 11,000 to 12,000 feet. This includes the lower alpine and upper subalpine zones. From twenty-five to one hundred twenty plants were found per square meter. The greater number occurred in those areas that had been disturbed by animals or by the development of experimental gardens.

MATERIALS AND METHODS

The material used in this study was collected in June, July, August, and early September in the area of the Windy Point station on Pikes Peak in Colorado. Most of the material was fixed in formalin-acetic-alcohol solution, and the remainder in Navashin's and Craf's solutions. When the equipment was available, air was removed from the tissues

before fixation. The material was sectioned at thicknesses varying from 8 to 25 microns. Wherever practicable free-hand sections were made. Gross observations were made with the aid of a binocular dissecting microscope.

Differential staining was applied according to the kind of tissue. The procedures used were Heidenhain's iron-haematoxylin and Orange G (Chamberlain, 1932); lacto-phenol (Maneval, 1936); tannic acid and iron chloride (Foster, 1934); Fleming's triple (Chamberlain, 1932); and Conant's quadruple (Johansen, 1940). In addition to the above methods a double stain of safranin O and fast green and safranin alone were employed. The sections were mounted in Canada balsam and in isobutyl methacrylate.

Unsuccessful efforts were made to promote normal growth of the rhizome and bulbils in the greenhouse and laboratory at Lincoln, Nebraska. These were planted in ordinary sand, quartz sand, loam, and native tundra soil. During a period of eight months the rhizomes produced a maximum of three leaves, after which growth was retarded. Bulbils, under similar conditions, started growth within a period of ten days. They grew for a short period but died after producing a maximum of three leaves.

Futile attempts were made to induce proliferation by cutting the rhizomes, the bulbils, the leaves, and the peduncle. Attempts were also made to germinate achenes taken from the most mature flowers available in late August and early September. These flowers had not yet fallen from