

Haberlandt,¹ in the petiole of Sunflower every vascular bundle is subtended by crescentic group of oil passages, both on its inner and on its outer side. In the present case some of the vascular bundles of the outer arc only are subtended by resin ducts on their outer side only. Structurally the resin ducts consist of seven to eleven secretory cells and one sheathing layer. The number of resin ducts vary from 13 to 19. There is no visible endodermis and pericycle.

There is the usual arc of collateral bundles. Some of them have internal bundles of various ages and sizes. The number of the internal bundles, in association with a normal bundle, may be more than one in some cases. The internal bundles arise from pith cells situated opposite to the protoxylem of the normal bundles and develop into reversed collateral bundles, quite independent of the outer normal bundles. They appear to develop after the normal bundles. They sometimes arise opposite to the medullary rays, or in the medullary rays of the normal arc. In the medullary bundles the position of the xylem and phloem is not changed as in the internal bundle. These internal bundles are also collateral and show inverse orientation of the xylem and phloem but some are composed of phloem or xylem only. The direction in which the protoxylem elements point and the amount of xylem and phloem formed, vary in different internal bundles. Occasionally two bundles are found touching each other by their xylem or phloem faces. This gives an impression of a normal bundle with an inversely oriented internal bundle. This may be due to branching of individual bundles and to anastomoses taking place between bundles. The single bundle gradually divides itself into two which then rotate in such a way as to lie opposite to each other and for a short distance touch by their xylem or phloem faces before becoming entirely separated.

Two types of anomaly in the structure of petiole in general are recorded by Solereder.² The occurrence of "rayed bundles" is one; while the other is "true concentric or hemiconcentric bundles". The Compositæ represent one of the natural orders, many members of which exhibit internal or medullary phloem in their stems. Worsdell³ in his study of origin and meaning of medullary (intra-xylary) phloem in stems of dicotyledons has investigated many Compositæ plants. He found complete absence of medullary strands in the petiole of seven species of Rudbeckia and of Dahlia. Of the tribe Helianthoideæ only in the petiole of *Echinacea purpurea* Moench., he observed the scattered disposition of the bundles. According to Thoday,⁴ "in the petiole of a large leaf of Sunflower, there are a number of small bundles, besides the three principal ones. These small bundles appear to anastomose in rather intricate fashion and one or two large ones unite with two lateral bundles. In the base the remainder cluster round the principal bundles as they diverge. Many of the smallest bundles consist, even in the case of a matured leaf, of phloem only and in others the xylem dies out in the normal region."

The phylogenetic or physiological significance of the internal bundles has been discussed by several authors as Worsdell,³ Maheshwari and

Singh,⁵ Wurke,⁶ Alexandrov and Alexandrova,⁷ and Hartwich.⁸ According to Worsdell³ they represent a vestigial structure, the remnant of a former system. Maheshwari and Singh⁵ and Wurke⁶ are of opinion that they are of an advanced character, the species with higher chromosomes being generally found to possess them and those with the lower numbers lacking them. Alexandrov and Alexandrova⁷ and Hartwich⁸ also regard them as derived. It may be quite possible that the extra bundles are developed in response to nutritive demand.

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A PODOSTEMAD FROM KUMAON (CENTRAL HIMALAYAS)

MEMBERS of the family Podostemonaceæ have been recorded in this country from South India, Assam, Eastern Himalayas (cf. Hooker¹ and Willis²) and recently Haines³ has described one species (*Lawia zeylanica*) from Orissa. In the Himalayas, there are no records of Podostemonaceæ west of Darjeeling. The collection of a podostemad from Kumaon is thus of interest in connection with the geographical distribution of the family.

The plant was found growing closely attached to large stones in the bed of the Kosi river at Chananda (29.46 N. and 79.38 E.), about 16 miles from Almora and 4,500 feet above the sea-level, in the months of August and September. The exact spot can be located by its situation opposite to the Gandhi Ashram of Chananda. On comparison with the other members of the family, it is seen that this podostemad belongs to the genus *Zeylanidium* Tul., described as a subgenus of *Hydrobryum* Endl. by Willis² in his account of the Podostemonaceæ of India and Ceylon. The genus *Zeylanidium* at present includes three species, *Z. olivaceum* (Gardn.) Engl., *Z. lichenoides* (Kurz) Engl. and *Z. Johnsonii* (Wight) Engl. The present material from Kumaon does not appear to agree with any one of these and is to be regarded as a new species.

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