

**STUDIES ON THREE SPECIES OF PODOSTEMACEAE
WITH REFERENCE TO MORPHOLOGY,
REPRODUCTIVE BIOLOGY, *IN-VITRO* SEED
GERMINATION AND ECOLOGY**

ABSTRACT

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ABSTRACT

Podostemaceae are different from typical angiosperms in morphological, anatomical, embryological and developmental features. The members carry out their life-cycle tenaciously attached to the rocks in torrential currents of river rapids, streams and waterfalls. Their plant morphology deviates so markedly from the conventional root-shoot (CRS) model, typical of angiosperms, that morphological connotations such as stem root and leaf cannot be precisely applied.

The present work deals with the morphology-anatomy, *in-vitro* seed germination, some aspects of reproductive biology and ecology of three aquatic plants – *Polypleurum stylosum* var *laciniata* (Wright) J. B. Hall, *Zeylanidium lichenoides* (S. Kurz) Engler and *Willisia selaginoides* (Bedd.) Warming ex Willis, of the family Podostemaceae.

Water quality of rivers is determined by a diverse range of catchment variables and by local environmental conditions near sampling point. Washing of clothes, bathing and washing of vehicles are observed at the collection sites which may disturb the habitats of podostemads. Quantitative studies of water show that the podostemads grow in well oxygenated, non-pollutant and nutrient poor habitats. Some algae belonging to families of Cyanophyceae, Chlorophyceae and Bacillariophyceae were found growing with the podostemads. Some water animals/insects were also found with these plants which may help in their pollination.

The thalli of the podostemads studied here are made up of parenchymatous ground tissue surrounded by an epidermal covering. The clear differentiation of xylem and phloem, cambium and aerenchyma (commonly found in hydrophytes) are altogether absent. The leaves lack petiole, mesophyll tissue, aerenchyma, venation and stomata.

In *in-vitro* seed germination, the cells of the primary axis just below the cotyledons i.e the hypocotyl region in *Polypleurum*, become meristematic and initiate the development of thallus in the 22 days old seedling. In *Zeylanidium*, the mid region of the hypocotyl swells up because of the meristematic activity towards horizontal direction and form a lateral bulge in the 24 days old seedling. In *Willisia*, the radicular

base of the hypocotyl expands horizontally and gives rise to a thalloid plant body after about 28 days of seed cultured.

Flowers of all the three studied species are zygomorphic, lack sepals, petals, bear only the essential organs and are covered by a spathella. Spathella is made up of 3-4 layers of cells. The pollen:ovule ratio in *Polypleurum* is found to be 20:1 with an ovule:seed ratio of 8:5, pollen:ovule ratio in *Zeylanidium* is 63:1 with an ovule:seed ratio of 6:5 and pollen:ovule ratio in *Willisia* is found to be 32:1 with an ovule:seed ratio of 8:5. This relatively low Pollen: Ovule ratio in the studied plants and high seed set suggests the possibility of self pollination.

Unlike in the majority of the angiosperms, the embryo sac is of 4-nucleate cells. There is no double fertilization and no endosperm. Antipodal cells are absent. The development and organization of the embryo sac follows different patterns in different species. *Polypleurum* corresponds to the *Polypleurum* type, *Zeylanidium* corresponds to the *Apinagia* type and the *Podostemum* type is found in *Willisia*. The presence of pseudo-embryo sac/nucellar plasmodium is the characteristic feature of all Podostemaceae so far investigated.

Study of ENM has provided a predicted suitable habitat in India for *Polypleurum stylosum* var *laciniata* in Western Ghats whereas for *Willisia selaginoides*, it is in Kerala, Tamil Nadu and Karnataka. It is predicted that wider part of Kerala and southern part of Karnataka show the most suitable habitat for *Zeylanidium lichenoides*.