

# Intergeneric Comparative Study of *Hydrobryopsis Sessilis* (Willis) Engler and *Zeylanidium Lichenoids* (Kurz) Engl. of the Family Podostemaceae

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## Abstract

Podostemaceae members show peculiar inter-generic similarities and intraspecific variations so that there is difference of opinion among taxonomists regarding their systematic position. *Hydrobryopsis sessilis* and *Zeylanidium lichenoides* are two members of this family which show many similarities and some differences. The present investigation analyses these similarities and differences in order to clarify the controversies regarding their taxonomic position.

**Keywords:** *Hydrobryopsis sessilis*, *Zeylanidium lichenoides*, inter-generic similarities, thallus, sessile flowers, spherical ovary.

## Introduction

Podostemaceae resemble lower plants like Algae or Bryophytes in their appearance. The plant body is thalloid in nature and grow on the rocks or submerged logs in fastly running rivers and streams of high altitude. In India the family represented by 11 genera and 28 species of 82 percent are endemic (Priyanka Khanduri et al., 2015). They are attached to substratum by means of adhesive hairs and/or finger-like anchoring organs, called 'holdfasts'. Adhesive hairs are reported to secrete 'super glue'. Moreover, sticky biofilms produced by cyanobacteria help to attach the roots to the rocky substrate. They survive as submerged haptophytes (and rheophytes) in these extreme habitats during the rainy season. At the end of the rainy season, the water level recedes and the plants emerge, with anthesis usually above the water level.

Intergeneric similarities and intraspecific variations in the family are so peculiar that there is difference of opinion among taxonomists regarding their systematic position. For e.g. Cusset (1973) sunk the genus *Griffithella* into *Cladopus*, which is not a justifiable step according to Cook (1996). According to Cusset (1992), the two Asian *Podostemum* spp (*P. subulatum* and *P. barberi*) are different from American *Podostemum* spp. which possess a median ligulate tepal in the fork of the andropodium. Such a median tepal does not occur in the Asian species. Thus she treated *P. subulatum* and *P. barberi* in the traditional Asian genus *Zeylanidium* as *Z. subulatum* and *Z. barberi*. Cook (1996) agrees with this decision of Cusset. Based on their observations, Mathew and Satheesh (1997) opined that more study was required to reach a final decision regarding this matter. Cusset (1992) also transferred *Farmeria indica* into a

newly created monotypic genus *Maferria* as *Maferria indica*, based on fruit character. Cook (1996) disagreed with this opinion.

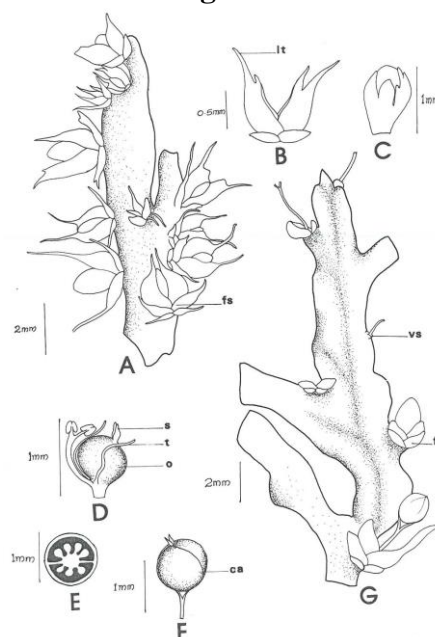
In 1902, Willis included *Hydrobryum sessile* and *Hydrobryum lichenoides* in the subgenus *Zeylanidium*. According to him, *Hydrobryum sessile* has sessile and smooth fruit, *H. lichenoides* has stalked and ribbed fruit. Cusset (1992) placed *Hydrobryum sessile* of Willis in the genus *Hydrobryopsis* as *H. sessilis*. *H. lichenoides* is included in the genus *Zeylanidium* as *Z. lichenoides*. The author tries to solve the issue of the ranking of these two taxon: *Hydrobryopsis sessilis* (Willis) Engler and *Zeylanidium lichenoids* (Kurz) Engl.

## Results

### *Hydrobryopsis sessilis* (Willis) Engler

Submerged rheophytes with ribbon - like thallus (Fig. 1A, G), 1-5mm broad, green in colour, branched and attached to rocks by haptera on the underside of the thallus (Fig. 2B). Vegetative shoots are borne at the margin, in the axils of the branches as well as on their surface (Fig. 1A, G). Most of the vegetative shoots are transformed into floriferous shoots. Leaves 4-6, distichous with sheathing bases. The sheathing bases later function as the bracts of the flowers (Fig. 1A, B). The leaf tips persistent (Fig. 1B) or caducous (Fig. 1G). The lower bracts are smaller. The flowers are protected by membranous spathellae, 1-1.25mm long, boat-shaped with lobes (Fig 1C) or without lobes at the base of the split (Fig. 2 A). Flowers sessile, solitary. Stamens 2, borne on an andropodium, 1-2mm long, elongate after anthesis (Fig. 1D; 2C). Tepals 2, equal to the ovary (Fig. 2C) or longer than the ovary (Fig. 1D), dark-coloured and each on either side of the andropodium. Ovary globose, 0.75-1.5mm in diameter, smooth, eccentric (Fig 1D), bicarpellary, syncarpous, anisolobous with numerous ovules on swollen axile placenta (Fig. 1E). Stigma bilobed, each lobe less than 0.25-1mm long, conical in shape, eccentric in position (Fig. 1D). Fruit is dry dehiscent capsule with a short pedicel, less than 1-3mm long. Capsule globose, smooth, anisolobous, 1-1.5mm in diameter (Fig. 1F).

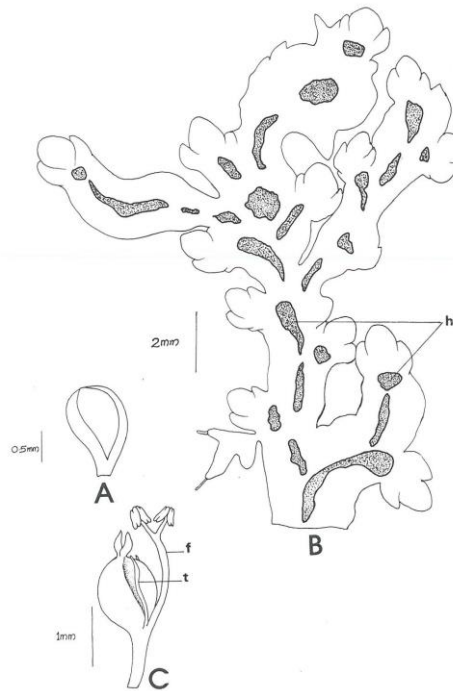
**Figure 1**



A Thallus showing marginal and submarginl floral shoots. B Two pairs of bracts. Note the persisting leaf tips on the upper bracts. C Spathella D. Flower after removal of spathella. E Cross-section of an

anisolobous ovary showing axile placentation .F Fruit note the eccentric position of the persistent stigma  
G Thallus showing marginal vegetative and floral shoots. (Ca, capsule; fs, floral shott; It, leaf tip; o, ovary; s, stigma; t, tepal; vs-vegetative shoot)

**Figure 2**



A Spathella without lobe at the base B Thallus (lowside) showing haptera C Mature flower after removal of sphthella (F, filament; h, haptera; t, tepal)

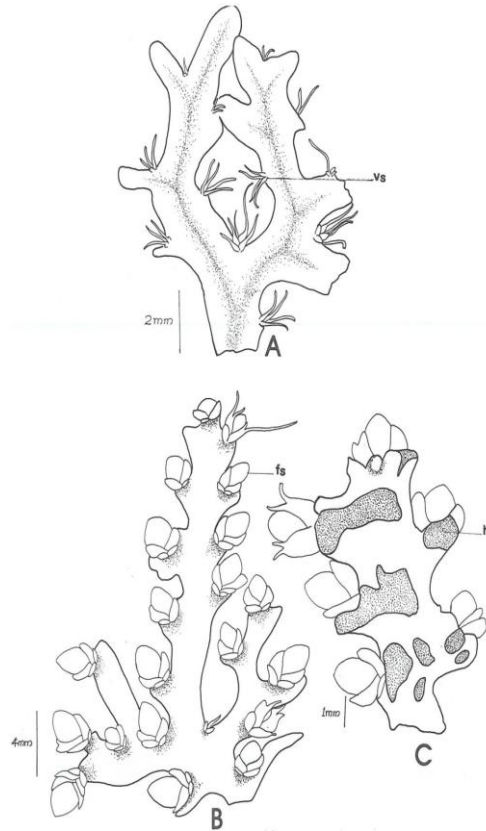
***Zeylanidium lichenoids* (Kurz) Engl.**

Completely creeping herbaceous plants with ribbon-shaped thallus (Fig.3A, B), 1-4mm broad and few centimeters long, alternately branched and attached to rocks very firmly by haptera present all along the underside or by discontinuous patches of haptera along the underside (Fig. 3C). Sometimes the branches of the thallus overlap each other giving a crustaceous appearance(Fig.5A). Vegetative shoots are marginal, prostrate and consist of 4-8, rarely 9 leaves (Fig. 3 A). The leaves are distichous and linear with sheathing bases. The tips of the leaves are caducous and the sheathing bases become transformed to bracts (Figs.3B; 4 D-G); sometimes leaf tips are persistent

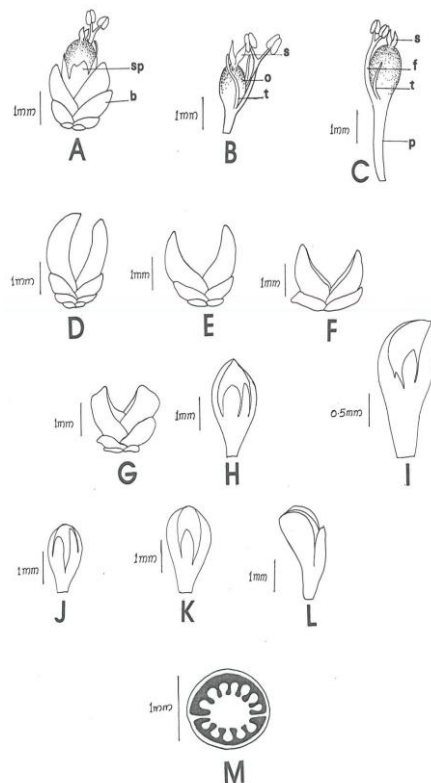
(Fig. 3B). Flowers are solitary and protected by membranous spathellae which are prostrate and boat-shaped after opening, with small lobe or lobes at the base of the split. Each spathella is 1.5-3 mm long (Fig 4 H-L). Pedicel of the flower 0.75-3 mm long, elongates after fertilization. Stamens 2 on an andropodium; 1.25 - 4mm long (Fig 4 A, B, C). Rarely 3 stamens occur; the filament of the third stamen is adnate to the andropodium showing separate vascular strand; filaments of the stamens elongate after anthesis (Fig.5 B). Tepals 2, present on either side of the andropodium, 0.75-2mm long, shorter than the ovary (Fig. 4 C), sometimes equal to (Fig 5 B) or longer than the ovary (Fig. 4 B). Ovary obovoid, smooth, 1-2mm long, black-coloured, rarely brown, anisolobous with numerous ovules on axile placenta (Fig 4 M). Stigma 0.25- 1mm long, bilobed, obcuneate (Fig 4 A-C) sometimes ovate with pointed tips, rarely

one of the lobes again forked (Fig. 5B). Fruit is a capsule which is 1-2 mm long, obovoid, anisolobous, 2-valved, each valve 3-ribbed (excluding dehiscence ribs), fruit-stalk 1.5 - 4.5 mm long (Fig.5 C, D).

**FIGURE 3**



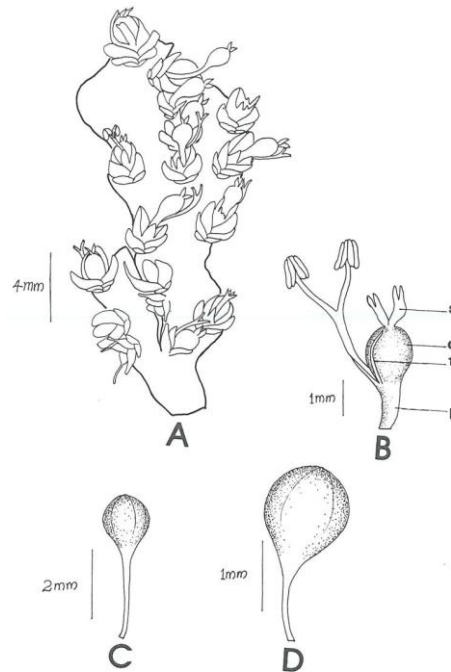
**FIGURE 4**



**FIGURE 3**A. Branched thallus with vegetative shoots. B Branched thallus with floral shoots C Thallus (lower side) showing haptera (Fs. Floral shoot; h, hapteron; vs, vegetative shoot)

**FIGURE 4** A Flower partly enclosed by spathella and bracts. B Young flower after removal of spathella. C Older flower after removal of spathella. G Bracts .H-L. Different types of spathellae .M Cross-section of an aniso lobous ovary showing axile placentation. (b. bract; f, filament; o, ovary; p, pedicel; s, stigma; sp, spathella; t, tepal.)

**FIGURE 5**



A Branched thallus with flowers. Note the crustaceous appearance due to the overlapping of branches. B Mature flower after removal of spathella. Note the forking of stigma lobes. C.D Fruits (o, ovary; p, pedicel; s, stigma; t, tepal)

### Discussion and conclusions

In 1902a, Willis included *Hydrobryum sessile* and *Hydrobryum lichenoides* in the subgenus *Zeylanidium*. According to him, *Hydrobryum sessile* has sessile and smooth fruit, *H. lichenoides* has stalked and ribbed fruit.

Cusset (1992) placed *Hydrobryum sessile* of Willis in the genus *Hydrobryopsis* as *H. sessilis*. *H. lichenoides* is included in the genus *Zeylanidium* as *Z. lichenoides*. The author has observed similarities between *Hydrobryopsis sessilis* and *Zeylanidium lichenoides* in the following characters:- ribbon-shaped creeping thallus with marginal secondary shoots, nature of bracts, boat-shaped spathella with lobe / lobes at the base of the split, bilobed and obtuse stigma, bicarpellary, syncarpous, anisolobous ovary with numerous ovules on axile placenta and the possession of dehiscent capsule with 2 unequal valves. Moreover, *H. sessilis* from many localities show shortly stalked, ribbed fruits. The typical sessile fruit and eccentric position of stigma is observed only in specimens collected from Begur.

*Hydrobryopsis sessilis* differs from *Zeylanidium lichenoides* in the following features:- sessile flowers, spherical ovary with an eccentric stigma, almost sessile fruit which is spherical, smooth. In *Zeylanidium lichenoides*, the flowers are pedicellate, sometimes the pedicel is very short. Ovary is generally obovoid

but sometimes it may be spherical or nearly spherical with ribs. The fruit is ribbed, rarely smooth. According to Jager-Zurn, 2000 *Zeylanidium* grow plagiotropously above the crust surface. Same is the case of *Hydrobryopsis sessilis* also.

The reproductive biology of *Hydrobryopsis sessilis* (Podostemaceae, subfamily Podostemoideae), a reduced, threatened, aquatic angiosperm endemic to the Western Ghats of India, was examined by Anitha Sehgal et al in 2009. In their article they considered the plant as *H. sessilis* belonging to the family Podostemaceae and subfamily Podostemoideae.

On the basis of the above findings, the author feels that a reconsideration regarding the position of *Hydrobryopsis sessilis* is worthwhile. It is possible that *H. sessilis* may be considered either as another species of *Zeylanidium* or as a variety of *Z. lichenoides*. However, more detailed investigation is required to arrive at a definite conclusion regarding the position of *Hydrobryopsis sessilis*.

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