



Short communication

Fruit morphology of the genus *Potamogeton* L. in Kashmir Himalaya and its utility in taxonomic delimitationAijaz Hassan Ganie^{a,*}, Zafar Ahmad Reshi^b, Bashir Ahmad Wafai^b, Anzar Ahmad Khuroo^c^a Department of Botany, University of Kashmir, Kargil Campus 194105, Jammu and Kashmir, India^b Department of Botany, University of Kashmir, Srinagar 190 006, Jammu and Kashmir, India^c Centre for Biodiversity & Taxonomy, University of Kashmir, Srinagar 190 006, Jammu and Kashmir, India

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ABSTRACT

The fruit morphology of eight species of the genus *Potamogeton* L. in Kashmir Himalaya was examined, using stereomicroscopy and scanning electron microscopy, in order to determine their utility in taxonomic delimitation. During the study, both macro- and micromorphological characters, including the fruit shape, size, color, and nature of the fruit beak, were investigated. The results reveal that the broad- and linear-leaved species have keeled fruits, whereas in filiform-leaved species the dorsal and lateral keels are either absent or obscure. The present study clearly shows the potential utility of fruit features as delimiting characters in order to distinguish different species of the genus *Potamogeton* in this Himalayan region.

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Introduction

The morphological feature of fruits and seeds are frequently used in plant taxonomy to delimit different taxa (Kaya et al 2011). The use of ultrastructural characters has increased significantly with the emergence of scanning electron microscopy (SEM) (Heywood 1971). Nowadays, SEM is widely used to analyze fruit and seed characters for taxonomic studies (Kaya et al 2011).

The genus *Potamogeton* (family Potamogetonaceae) is difficult to delimit taxonomically because of its highly plastic morphological characters (Kaplan and Stepanek 2003). However, until now the macro- and micromorphological characters of fruits have been little investigated for their possible role in the taxonomic delimitation.

In fact, the fruit morphology in *Potamogeton* is interesting; the fruit of the genus has remained a matter of debate for so long, and it has been variously described as drupe, drupelet, achene, nutlet, drupes, or achenes by different researchers (Reichenbach 1845; Morong 1893; Fryer and Bennet 1915; Arber 1920; Muenscher 1936; Lawrence 1915; Clapham et al 1962). The unique morphological and anatomical features of the fruit are the main reasons that it has been described differently by various authors. However,

although the fruit resembles an achene, Haynes (1974) did not consider it achene because the seed coat is not adnate to pericarp, and it is rarely dry under natural conditions. Aalto (1970) recognized the fruit of the genus as drupe, but later he himself argued that it cannot be considered as drupe because the dorsal area of the pericarp is open and covered by a lid. A ridge-like structure called “keel” is present at the juncture of the lateral wall and the lid (Spencer et al 1971). Haynes (1974) considered the fruit in the genus as “drupe-like,” which was later on retained by Hay et al (2008).

The distinctive morphological characters of fruit in *Potamogeton* are valuable for species delimitation (Preston 1995). However, to date no detailed study on the taxonomic utility of morphological features of fruits in the genus has been undertaken, in particular by using stereomicroscopy and SEM technique. Therefore, the present study was undertaken with the main aim of investigating the macro- and micromorphological characters of fruits of the genus *Potamogeton* in Kashmir Himalaya for their utility in species delimitation.

Materials and methods

In the present study, the plant material of different species of *Potamogeton* was collected from the three freshwater lakes of Kashmir Himalaya: Dal, Anchar, and Manasbal. The geographical coordinates of the selected sites and other details are given in Table 1.

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Table 1. Salient features of aquatic sites where *Potamogeton* species were sampled in Kashmir Himalaya, India.

	Salient features of the water body			Species samples (voucher specimens deposited at KASH)
	Altitude (m a.s.l.)	Latitude (North)	Longitude (East)	
Anchar lake (Srinagar)	1595	34° 10'55"	74° 48'10"	<i>Potamogeton lucens</i> (4113), <i>Potamogeton natans</i> (100511), <i>Potamogeton pusillus</i> (10096), <i>Potamogeton crispus</i> (10038), <i>Potamogeton pectinatus</i> (100791)
Dal lake (Srinagar)	1595	34° 08'48"	74° 52'51"	<i>P. lucens</i> (1048), <i>P. natans</i> (10055), <i>P. pusillus</i> (10092), <i>P. crispus</i> (10037), <i>P. pectinatus</i> (10077), <i>Potamogeton nodosus</i> , <i>P. wrightii</i> (100117)
Manasbal lake (Bandipora)	1590	34° 15'26"	74° 41'26"	<i>P. lucens</i> (10047), <i>P. crispus</i> (10036), <i>P. pusillus</i> (10095), <i>P. nodosus</i> (80101), <i>P. perfoliatus</i> (10079), <i>P. wrightii</i> (100115)

m a.s.l. = meters above sea level; KASH = University of Kashmir Herbarium.

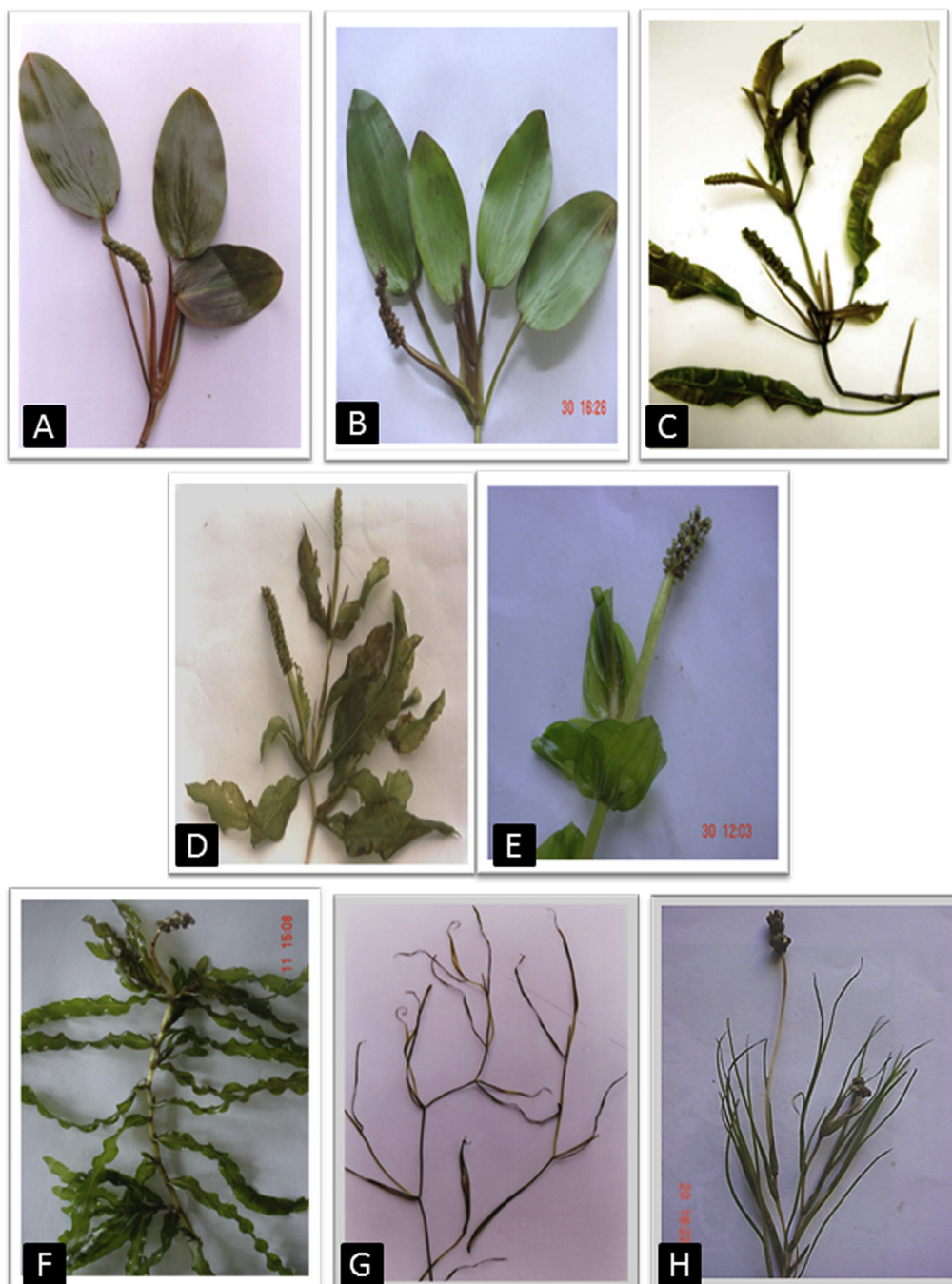


Figure 1. Species morphology: A–C, Floating broad-leaved species: A, *Potamogeton natans*. B, *Potamogeton nodosus*. C, *Potamogeton wrightii*. D–E, Submerged broad-leaved species: D, *Potamogeton lucens*. E, *Potamogeton perfoliatus*. F–H, Linear-filiform leaved species: F, *Potamogeton crispus*. G, *Potamogeton pusillus*. H, *Potamogeton pectinatus*.

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