

DISTRIBUTION PATTERN OF GENUS *RANUNCULUS* L. (RANUNCULACEAE) IN KASHMIR HIMALAYA AND ITS RELATIONSHIP AT WORLD LEVEL

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ABSTRACT

The Kashmir Himalaya, constituting a part of the Great Himalayan range, represents a repository of *Ranunculus*. During the course of present study 18 species were collected from different areas/localities of Kashmir Himalaya ranging from terrestrial to aquatic habitats and from low-altitudes to high-altitudes. The paper presents the distribution pattern of these taxa in the Kashmir Himalaya and its relationship at world level.

Key words: *Ranunculus*, Kashmir Himalaya, distribution pattern

INTRODUCTION

Ranunculus L. is a genus of herbaceous annuals and perennials belonging to family Ranunculaceae. It is the largest genus of the family, comprising ca. 600 species (Tamura, 1993, 1995) and numerous microspecies and apomictic races (Hörandl *et al.*, 2005). It is distributed almost worldwide, being concentrated in the temperate zones of Europe, Asia, North and South America, Australia, New Zealand, and in the alpine regions of New Guinea (Johansson, 1998). A small number of species occur in the tropical region, where they are restricted to

high mountain areas (Tamura, 1993, 1995).

Ranunculus species may be found in a variety of habitats such as forests, dry and damp meadows, marshes, puddles, streams, shallow and marshy banks of rivers and lakes, and alpine heaths. Most of the species appear to have great ecological amplitude; however, habitat-specific species are not uncommon.

The remarkable success of *Ranunculus* with respect to species diversity and distribution is believed to be multifactorial and mainly attributable to varied permutations and combinations of: 1) high morphological plasticity including genetic flexibility for rapid adaptation to new habitats, thus permitting development of various eco- and phenotypes; 2) hybridization and polyploidy for diversification, and 3) a broad range of reproductive systems including vegetative growth, autogamy, allogamy, apomixis and combinations thereof, enabling species to colonize various habitats, especially in regions with colder climates.

STUDY AREA

The Himalayan chain consists of the complex system of nearly parallel ranges of tertiary mountains, stretching over nearly

300 km, almost from the borders of Afghanistan in the west to the north of Myanmar in the east, approximately between 27° and 37°N latitudes and 72° and 91°E longitudes. The Himalayas are usually divided into three geographical divisions : 1) the Eastern Himalaya, 2) Central or Nepal Himalaya, and 3) the western Himalaya.

Himalaya

Kashmir Himalaya, constituting a part of the western Himalaya, represents a unique biospheric unit (Rodgers and Panwar, 1988). It is situated in the northern fringe of the Indian subcontinent between coordinates of 33° and 37° N latitudes and 72° 30' and 80° 30' E longitudes. The region consists of a deep elliptical bowl-shaped valley of Kashmir and the cold desert of Ladakh. Zojila (3,529 m) forms the lowest pass on the Greater Himalaya, connecting Kashmir Valley with Ladakh. The Pir Panjal Range bounds the Valley in the south and southwest while the Korakoram Range guards the Ladakh in the north.

The climate of the picturesque Kashmir Valley, often called the paradise on earth, is like that of mountains and continental parts of the temperate latitudes. The temperature ranges from an average daily maximum of 31°C and a minimum of 15°C during summer, to an average daily maximum of 4°C and a minimum of -4°C during winter months.

Ladakh or the 'little Tibet' encompasses a large tract of high mountains, comprising part of the Korakoram mountains to the north and west, and the western margin of the Tibetan Plateau. The region remains sheltered from precipitation almost

throughout its extensive relief and the temperature drops down much below 0°C during winter. Drass, which lies on the northeast of Zojila, is the second coldest place in the world, registering temperatures even below -40°C in winter.

MATERIAL AND METHODS

Collection and Preservation

The present investigation is based on field trips conducted between 2005 and 2009 across the Kashmir Himalaya. Depending on availability a random sample of 4 to 5 healthy specimens of each taxon from each population at the collection sites was collected and assigned a specific collection number. Complete field notes, recording details of the locality, habit, habitat, altitude, and diagnostic characters, were made of each specimen. The specimens were collected in floral and fruiting conditions and, after detailed study, sandwiched between newspaper sheets for pressing in the plant press. The papers were changed after every 24 hours until the specimens dried completely.

Taxonomic Identification

The specimens were identified using the available literature on floristics such as Hooker and Thomson (1872), Stewart (1972), Kachroo *et al.* (1978), Sharma and Kachroo (1981), Polunin and Stanton (1984), Riedl and Nasir (1991), Rau (1993), Whittemore (1997) and Wang and Gilbert (2001).

The identifications were authenticated by matching the specimens with those deposited in the Kashmir University Herbarium (KASH). Some of the taxa were also checked by Dr. Elvira Hörandl,

Department of Systematic and Evolutionary Botany, University of Vienna, Austria.

RESULTS

During the present investigation, 18 species of *Ranunculus* were recorded as growing across the Kashmir Himalaya in diverse habitats, ranging from terrestrial to aquatic, and in a broad array of altitudes.

These taxa, on the basis of their habitat preferences and altitude, can be arranged into six groups as follows:

1. Terrestrial low-altitude species: *Ranunculus arvensis*, *R. laetus*, *R. muricatus*, and *R. trilobus*.
2. Terrestrial high-altitude species: *Ranunculus brotherusii*, *R.*

chaerophyllos, *R. hirtellus*, *R. membranaceus*, *R. munroanus*, *R. palmatifidus*, and *R. rubrocalyx*

3. Aquatic low altitude species: *R. lingua* and *R. trichophyllus*
4. Aquatic high altitude species: *R. natans* and *R. sarmentosus*
5. Amphibious low altitude species: *R. sceleratus*
6. Amphibious high altitude species: *R. pulchellus* var. *pulchellus*, *R. pulchellus* var. *longicaulis*, and *R. tricuspis* var. *lanceifolius*

The distribution of these taxa in the three geographic regions of the Kashmir Himalaya viz. Jammu, Kashmir and Ladakh is presented in Table 1.

Table 1. Distribution of Kashmir Himalayan *Ranunculus* species in Jammu, Kashmir and Ladakh regions [(+) = present; (-) = absent]

Taxon	Kashmir	Jammu	Ladakh
<i>R. laetus</i>	+	+	+
<i>R. arvensis</i>	+	+	-
<i>R. muricatus</i>	+	+	-
<i>R. trichophyllus</i>	+	+	-
<i>R. sceleratus</i>	+	+	-
<i>R. hirtellus</i>	+	-	+
<i>R. trilobus</i>	+	-	-
<i>R. palmatifidus</i>	+	-	-
<i>R. munroanus</i>	+	-	-
<i>R. rubrocalyx</i>	+	-	-
<i>R. lingua</i>	+	-	-
<i>R. membranaceus</i>	-	-	+
<i>R. pulchellus</i>	-	-	+
<i>R. natans</i>	-	-	+
<i>R. sarmentosus</i>	-	-	+
<i>R. tricuspis</i> var. <i>lanceifolius</i>	-	-	+
<i>R. chaerophyllos</i>	-	-	+

DISCUSSION

The genus *Ranunculus* L. has been divided into 7 subgenera by Tamura (1995). The distribution of these 7 subgenera across the world, as summarized in Table 2, reveals that the largest number of species occur in Europe, followed by Asia and North America, while the least number of species occur in Australia. The genus shows considerable diversity in the Mediterranean, with ca. 160 species, of which 78 are endemic to this region (Greuter et al., 1989).

China alone has 125 species of *Ranunculus*, of which 66 are endemic (Wang and Gilbert 2001). In Arctic, the genus is represented by 42 - 48 species and subspecies (Tolmachev, 1971). In India, 33 species of *Ranunculus* are reported, inhabiting temperate regions, including the Great Himalayan Range, and cold tropical mountains (Cook, 1966; Meikle, 1959 and Srivastava, 2010). Riedl and Nasir (1991) have reported 23 species of the genus from northwest Himalaya.

Table 2. Status of the Kashmir Himalayan *Ranunculus* species at world level.* [(+) = present, (-) = absent]

Species in Kashmir Himalaya	Species shared with various continents					
	Asia	Europe	North America	Africa	South America	Australia
<i>R. arvensis</i>	+	+	+	-	+	+
<i>R. muricatus</i>	+	+	+	-	+	+
<i>R. sceleratus</i>	+	+	+	+	-	-
<i>R. trichophyllus</i>	+	+	+	+	-	-
<i>R. chaerophyllos</i>	+	+	-	+	-	-
<i>R. trilobus</i>	+	+	+	-	-	-
<i>R. sarmentosus</i>	+	+	+	-	-	-
<i>R. lingua</i>	+	+	-	-	-	-
<i>R. laetus</i>	+	-	-	-	-	-
<i>R. brotherusii</i>	+	-	-	-	-	-
<i>R. hirtellus</i>	+	-	-	-	-	-
<i>R. membranaceus</i>	+	-	-	-	-	-
<i>R. munroanus</i>	+	-	-	-	-	-
<i>R. palmatifidus</i>	+	-	-	-	-	-
<i>R. rubrocalyx</i>	+	-	-	-	-	-
<i>R. natans</i>	+	-	-	-	-	-
<i>R. pulchellus</i>	+	-	-	-	-	-

*Compiled from Hooker's Flora of British India, BSI's Flora of India, Ali and Nasir's Flora of Pakistan, Flora of China and Flora of America

The distribution of the presently studied species of *Ranunculus* L. in Kashmir, Jammu and Ladakh regions, as summarized in Table 1, reveals that only one species, viz. *R. laetus* extends from the warm low-altitude regions of Jammu to the alpine cold deserts of Ladakh, although only a small population of the species was found at Thrungus, Dras. It is pertinent to mention that the species has not been reported from Zojila ever before, which otherwise could have acted as a seed bank for its dispersal to nearby areas of Ladakh region. However, anthropogenic role in the seed dispersal of the species cannot be ruled out, as the population under question is situated along Srinagar-Kargil National Highway. The distribution and subsequent acclimatization of the species in such a region which registers very low temperatures (up to -40°C) speaks of its potential to grow even

under hostile conditions. So, the restricted distribution of this species in Kashmir Valley and Jammu could only be attributed to geographical barriers.

The distribution of the presently investigated species of Kashmir Himalayan *Ranunculus* at world level, as summarized in Table 2 reveals that 8 out of the 18 species are shared with Europe, only 2 are shared with Australia, while 9 (*R. laetus*, *R. brotherusii*, *R. hirtellus*, *R. membranaceus*, *R. munroanus*, *R. palmatifidus*, *R. pulchellus*, *R. rubrocalyx*, and *R. natans*) are restricted to Asia only. In Asia the distribution of the genus in the neighbouring countries of India, as presented in Table 3, reveals that *R. natans*, *R. pulchellus* and *R. sceleratus* are present in most of the countries while *R. palmatifidus* is restricted to NW Himalaya.

Table 3. Status of the Kashmir Himalayan *Ranunculus* species in neighbouring countries [(+) = present, (-) = absent]

Species in Kashmir Himalaya	Species shared with neighbouring countries							
	China	Pakistan	Nepal	Russia	Afghanistan	Kazakistan	Mongolia	Other Asiatic countries
<i>R. natans</i>	+	+	+	+	+	+	+	
<i>R. pulchellus</i>	+	+	+	+	+	+	+	iran
<i>R. sceleratus</i>	+	+	+	+	+	+	-	Japan, Myanmar, Bhutan, Korea, Thailand, Egypt, Syria
<i>R. laetus</i>	+	+	+	-	+	-	-	
<i>R. hirtellus</i>	+	+	+	-	+	-	-	
<i>R. arvensis</i>	+	+	-	+	+	-	-	
<i>R. rubrocalyx</i>	+	+	-	-	+	+	-	Tajikistan
<i>R. brotherusii</i>	+	-	+	+	-	+	-	
<i>R. muricatus</i>	+	+	-	+	-	-	-	Iran
<i>R. membranceus</i>	+	+	+	-	-	-	-	
<i>R. munroanus</i>	+	+	+	-	-	-	-	
<i>R. trichophyllus</i>	+	+	+	-	-	-	-	
<i>R. lingua</i>	+	-	-	+	-	+	-	
<i>R. sarmentosus</i>	+	-	-	-	-	-	-	
<i>R. trilobus</i>	-	-	-	-	-	-	-	
<i>R. chaerophyllos</i>	-	-	-	-	-	-	-	Taiwan
<i>R. palmatifidus</i>	-	+	-	-	-	-	-	

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