



Notes on distribution of the genus *Alchemilla* (Rosaceae) in India with special reference to endemic species

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Abstract

The genus *Alchemilla* L., an inconspicuous and less known group of the family Rosaceae, is represented by 27 microspecies in India of which 21 are endemic to the country. Updated nomenclature, correct citation, diagnostic characters, phenological data, ecology and distribution of the species in India is provided in the present paper. Recommendation is suggested to conserve the neglected endemic members of the genus by *ex-situ* and *in-situ* method.

Keywords: *Alchemilla* L., diagnostic characters, distribution, endemic species, conservation, India

Introduction

The genus *Alchemilla* L., comprising of 100-1000 microspecies^[1], distribution of which is mostly Holarctic with Centre of species richness in Western Eurasia are extended from mountainous parts of Africa, Madagascar, Western Himalaya, South India, Sri Lanka, Java, China to Japan. The genus, represented in India by 27 microspecies^[2], is characterised by annual or perennial rhizomatous, woody herbaceous habit, lobed or deeply divided rosette or alternate radical and cauline leaves, clasping stipules with petioles, stems or inflorescences, much branched corymbose cymes or panicles, highly derived but inconspicuous or very small flowers, absence of petals and enclosed achenes

within membranous hypanthium. The genus *Alchemilla* L. with its numerous and variable forms was studied by different authors time to time^[3, 4, 5, 6, 7]. The systematics of the genus is poorly understood due to higher percentage of hybridization, polyploidization and apomictic nature^[8]. As far as the taxonomic study of the genus *Alchemilla* L. is concerned, it has been treated variously with different number of taxa and at different taxonomic rank time to time^[9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20] (Table 1) but a comprehensive monograph or revisionary study are yet to be done. The present paper has been attempted to briefly elucidate distribution of the genus *Alchemilla* L. with emphasis on endemic species component in India.

Table 1: Taxonomic treatment of the genus *Alchemilla* L. *s.l.* by different authors

Name of Author	Rank
Linnaeus (1753)	Genus
Scopoli (1772)	Genus
Persoon (1805)	Genus
De Candolle (1825)	Section
Focke (1888)	Section <i>EuAlchemilla</i>
Rydberg (1908)	Genus
Perry (1929)	Section (as <i>Alchemilla-Lachemilla</i> Gr. including 06 sections)
Rothmaler (1935)	Subgenus (including 07 sections)
Hauman & balle (1936)	Subgenus <i>EuAlchemilla</i>
Frohner (1969)	Genus (including 18 Sections)
Plocek (1982)	Genus (including 03 Sections)
Purohit & Panigrahi (1991)	Genus (including 02 Sections)
Notov & Kusnetzova (2004)	Genus (including 07 Sections)

Materials and methods

During working on the family Rosaceae under 'Flora of India' project of Botanical Survey of India, exhaustive literature survey was done supplemented with study of adequate herbarium specimens [deposited at CAL, BSD, DD, MH, BSIS, ASSAM, ARUN & BSA] and field observations. Nomenclature of the species has been updated following recent literature, plant name search engines such as Tropicos, IPNI, Kew Checklist, World Flora Online and Plant List. Current distribution of the members of the genus *Alchemilla* L. in India has been confirmed following authentic literature and herbarium data.

Enumeration

Genus: *Alchemilla* L.

1. *Alchemilla aksharmae* Panigrahi & K.M. Purohit in K.M. Purohit & Panigrahi, Fam. Rosac. India 1: 194. 1991.

Fl. & Fr.: July-September

Ecology & Distribution: Alpine regions. Jammu & Kashmir: Panchatarani, 34°11'24"N, 75°29'56"E, 3609m.

Endemic.

2. *Alchemilla brummittii* K.M. Purohit & Panigrahi, Fam. Rosac. India 1: 196. 1991.
Fl. & Fr.: August - October
Ecology & Distribution: Grows in between 2000-3500 m altitude. Jammu & Kashmir: Lidderwat, 34°09'34"N, 75°14'24"E, 8783M.
Endemic.
3. *Alchemilla ceciliae* Panigrahi & K.M. Purohit in K.M. Purohit & Panigrahi, Fam. Rosac. India 1: 197. 1991.
Fl. & Fr.: July-September
Ecology & Distribution: Grows at c. 4000 m altitude. Jammu & Kashmir: Muzaffarabad, Thilan, 34°21'30"N, 73°28'37"E, 719m.
Endemic.
4. *Alchemilla connivens* Buser, Bull. Herb. Boissier 2: 107. 1894.
Fl. & Fr.: May-June
Ecology & Distribution: Jammu & Kashmir
5. *Alchemilla chthamalea* Rothm., Bull. Misc. Inform. Kew Bot. 1938: 274. 1938.
Fl. & Fr.: June-August
Ecology & Distribution: Alpine forests, at 3000 m altitude. Jammu & Kashmir: Sambliali, Uttarakhand: 30°09'47"N, 79°58'14"E, 3214m., way to Pindari.
Endemic.
6. *Alchemilla duthieana* Panigrahi & K.M. Purohit, in K.M. Purohit & Panigrahi, Fam. Rosac. India 1: 200. 1991.
Fl. & Fr.: June-August
Ecology & Distribution: Alpine to subalpine forests, at 2500-2800 m altitude. Jammu & Kashmir: Type population near Gulmarg, 34°02'50"N, 74°22'46"E, 2715m.
7. *Alchemilla gilgitensis* K.M. Purohit & Panigrahi, Fam. Rosac. India 1: 202. 1991.
Fl. & Fr.: May-August
Ecology & Distribution: Jammu & Kashmir: Gilgit, 35°53'26"N, 74°28'02"E, 1500m.
8. *Alchemilla harae* K.M. Purohit & Panigrahi, Fam. Rosac. India 1: 229. 1991.
Fl. & Fr.: June-July
Ecology & Distribution: Dry and moist deciduous, semi evergreen and wet evergreen forests, evergreen shola forests, grasslands and swamps. Tamil Nadu: Nilgiri District: Bangi Tappal, 11°15'39"N, 76°30'33"E, 2580m.
Endemic.
9. *Alchemilla indica* Gardn., Calc. Journ. Nat. Hist. 8: 8. 1847. *Alchemilla vulgaris* Wight, Icon. Pl. Ind. Orient, f. 229. 1904. *Alchemilla vulgaris* var. *sarmentosa* Thwaites, Enum. Pl. Zeyl.: 102. 1859.
Fl. & Fr.: March-September
Ecology & Distribution: Open grass lands, dry and moist deciduous, semi evergreen and wet evergreen forests, evergreen sholas, marshy grounds, at 2000-2250 m altitude. Tamil Nadu: Nilgherries; Dodabetta, 11°24'01"N, 76°44'09"E, 2597m.; Ootacamund, 11°24'35"N, 76°41'43"E, 2250m.
Sri Lanka.
10. *Alchemilla kishangangensis* Panigrahi & K.M. Purohit in K.M. Purohit & Panigrahi, Fam. Rosac. India 1: 203. 1991.
Fl. & Fr.: June-August
Ecology & Distribution: Grows at 2700-3050 m altitude. Jammu & Kashmir: Kishan-Ganga valley, below Sonapind pass, 34°36'57"N, 73°37'03"E, 2938m.
Endemic.
11. *Alchemilla kungwatanensis* K.M. Purohit & Panigrahi, Fam. Rosac. India 1: 205. 1991.
Fl. & Fr.: June-August
Ecology & Distribution: Grows at 3000m altitude. Jammu & Kashmir: Kungwatan, near Aharbal waterfall, 33°38'56"N, 74°46'59"E, 2238m.
Endemic.
12. *Alchemilla madurensis* (Rothm.) Panigrahi & K.M. Purohit, Taxon 33: 504. 1984. *Alchemilla ceylanica* Moon ex Rothm. var. *madurensis* Rothm., Notizb. Bot. Gart. Berlin-Dahlem Bd. 12, No. 114: 487. 1935.
Fl. & Fr.: July-August
Ecology & Distribution: Dry and moist deciduous, semi evergreen and wet evergreen forests, shola forests, at 2150 m altitude. Tamil Nadu: Kodaikanal hill, 10°14'17"N, 77°29'20"E, 2082m.
Endemic.
13. *Alchemilla mantoniae* Panigrahi & K.M. Purohit in K.M. Purohit & Panigrahi, Fam. Rosac. India 1: 206. 1991, (as '*mantonii*').
Fl. & Fr.: August-September
Ecology & Distribution: Open alpine forest slopes, at 3000-3500 m altitude. Jammu & Kashmir: Ladakh, Zoji La, 34°16'45"N, 75°28'14"E, 3534m.
Endemic.
14. *Alchemilla nicolsonii* K.M. Purohit & Panigrahi, Fam. Rosac. India 1: 208. 1991.
Fl. & Fr.: September-October
Ecology & Distribution: Grasslands, scrub forests. Jammu & Kashmir: Jhelum Valley, Kajrag range, Hamal Basin, 34°30'13"N, 74°53'13"E, 3825m.
Endemic.
15. *Alchemilla niltarensis* K.M. Purohit & Panigrahi, Fam. Rosac. India 1: 209. 1991.
Fl. & Fr.: August-September
Ecology & Distribution: Alpine and sub-alpine forests. Jammu & Kashmir: Gilgit, Niltar Valley, 36°10'00"N, 74°10'42"E, 2898m.
Endemic.
16. *Alchemilla panigrahiana* K.M. Purohit, Fam. Rosac. India 1: 234. 1991.
Fl. & Fr.: June-August
Ecology & Distribution: Dry deciduous forests. Tamil Nadu: Kodaikanal, Palni, near Shathadikanal, 10°26'57"N, 77°30'55"E, 1450-2000 m.
Endemic.
17. *Alchemilla palii* Panigrahi & K.M. Purohit in K.M. Purohit & Panigrahi, Fam. Rosac. India 1: 211. 1991.
Fl. & Fr.: June-July
Ecology & Distribution: High altitude forest slopes, subalpine forests, at 1500-6000 m altitude. Uttarakhand: Rohini, Bugyals, 30°30'23"N, 79°11'11"E, 2600m.
Endemic.
18. *Alchemilla parijae* Panigrahi & K.M. Purohit in K.M. Purohit & Panigrahi, Fam. Rosac. India 1: 236. 1991.
Fl. & Fr.: May-June
Ecology & Distribution: Dry deciduous forests. Tamil Nadu: Way to Nilgiri peak, 11°23'57"N, 76°30'07"E, 2429m.

- Endemic.
19. *Alchemilla plocekii* K.M. Purohit & Panigrahi, Fam. Rosac. India 1: 212. 1991.
Fl. & Fr.: June-August
Ecology & Distribution: High altitude plant, growing at an altitude of 2100–2400 m altitude. Jammu & Kashmir: Yusmarg, Pahalgam, 34°00'57"N, 75°19'00"E, 2189m.
 Endemic.
20. *Alchemilla purohitii* Lakshmin., Bandyop. & Chand. Gupta, Havard Papers Bot. 23(1): 17-18. 2018. *Alchemilla sojakii* K.M. Purohit & Panigrahi, Fam. Rosac. India 1: 218. 1991.
Fl. & Fr.: July-August
Ecology & Distribution: Subalpine to lower alpine forests, 3500–4000 m altitude. Jammu & Kashmir: Single population on the way to Amarnath, 34°12'56"N, 75°30'14"E, 3908m.
21. *Alchemilla rothmaleri* Panigrahi & K.M. Purohit in K.M. Purohit & Panigrahi, Fam. Rosac. India 1: 214. 1991.
Fl. & Fr.: May-August
Ecology & Distribution: Alpine to subalpine forests. Jammu & Kashmir: Gulmarg Golf field, 34°03'26"N, 74°23'09"E, 2634m.
 Endemic.
22. *Alchemilla samantaraii* K.M. Purohit & Panigrahi, Fam. Rosac. India 1: 215. 1991.
Fl. & Fr.: June-August
Ecology & Distribution: Temperate forests. Jammu & Kashmir (few, scattered), 33°21'03"N, 75°20'04"E, 2865 m.
 Endemic
23. *Alchemilla sarojiniae* K.M. Purohit & Panigrahi in K.M. Purohit & Panigrahi, Fam. Rosac. India 1: 216. 1991.
Fl. & Fr.: July-September
Ecology & Distribution: Alpine meadows. Jammu & Kashmir (Kishanganga Valley), 34°40'08"N, 74°40'41"E, 2316m.
 Endemic.
24. *Alchemilla sibthorpioides* (Hook.f.) Panigrahi & K.M. Purohit, Taxon 33: 505. 1984.
Fl. & Fr.: March-April
Ecology & Distribution: Tamil Nadu: Nilgiris, Parson's Valley, Ooty, 11°23'59"N, 76°35'58"E, 2237m.
 Endemic.
25. *Alchemilla trollii* Rothm., Bull. Misc. Inform. Kew 1938: 272. 1938.
Fl. & Fr.: June-August
Ecology & Distribution: Subalpine to alpine forests. Jammu & Kashmir: Nanga Parbat, Gourikot-Alm, 35°16'46"N, 74°50'42"E, 2366m.
 Pakistan
26. *Alchemilla waltersii* K.M. Purohit & Panigrahi, Fam. Rosac. India 1: 219. 1991.
Fl. & Fr.: July-September
Ecology & Distribution: Temperate forests. Jammu & Kashmir: Kungwattan meadow, 33°36'03"N, 74°46'51"E, 2532 m.
 Endemic.
27. *Alchemilla ypsilotoma* Rothm., Bull. Roy. Bot. Gard. Kew No. 7: 273. 1938.
Fl. & Fr.: June-August

Ecology & Distribution: Alpine meadows. Jammu & Kashmir: Sonmarg, Musjid Valley, 34°18'10"N, 75°17'36"E, 2672m. Endemic.

Discussions and Conclusion

India, with wide range of climatic conditions, varied topography and habitats, ranks among the 17 mega biodiversity countries of the world and top ten species-rich nations, harbors c. 8% of globally known floral elements of which 28% taxa are endemic to the country. The current estimation reveals that floristic wealth of India comprising of a total of 55,048 plant taxa of which Angiosperms account for c. 21984 taxa, followed by fungi (15602 taxa), algae (9008 taxa), lichens (2989 taxa), Bryophytes (2800 taxa), Pteridophytes (1314 taxa) and Gymnosperms (82 taxa) [21]. While exhaustive floristic explorations throughout the country resulting discovery of a good number of species every year, on the other hands, diverse topographic conditions, ecological habitat, variable climate and increasing anthropogenic threats accelerating the process of active speciation and evolution of new species which contribute higher percentage of endemic elements to the world as well as Indian flora [22]. Analysis of the current estimation highlights the rise in alarming percentage of endemic taxa in India which is a matter of concern to the scientific fraternities. A thorough review of literature and consultation of herbarium specimens deposited in various National and International herbaria account for approx. 4381 species and infraspecific taxa under 1007 genera and 176 families of vascular plants as endemic to Indian territory of which angiosperms holds 4303 species and infraspecific taxa followed by Gymnosperms (12) and Pteridophytes (66) [23].

The genus *Alchemilla* L. (Rosaceae), comprising of 27 microspecies, was traditionally grouped into two aggregate species groups viz. *Alchemilla* agg. *villosa* Jungh. and *Alchemilla* agg. *vulgaris* L. However, due to predominance of interspecific hybridization, vegetative apomixis and agamospermy, delimitation of the microspecies into 02 aggregate groups of species are much difficult [19]. Of the Indian species of the genus *Alchemilla* L., 74% are endemic to Jammu & Kashmir followed by 22% to Tamil Nadu and 7.4% to Uttarakhand (Figure 1).

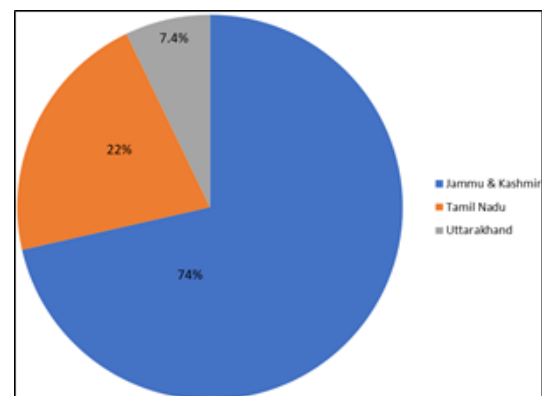


Fig 1: Distribution of endemic taxa of the genus *Alchemilla* in India

Jammu & Kashmir	74%
Tamil Nadu	22%
Uttarakhand	7.4%

The members of the genus grow in the temperate, alpine, subalpine regions, dry and moist deciduous, semi evergreen and wet evergreen forests, evergreen shola forests, open grasslands and swamps at a wide altitudinal range between

2000-6500m altitudes. Distribution of the species is restricted exclusively in three states of India viz. Jammu & Kashmir, Tamil Nadu and Uttarakhand and strictly confined in Western Himalayas and Western Ghats (Table 2).

Table 2: Distribution of the genus *Alchemilla* L. in India

Name of species	Jammu & Kashmir	Tamil Nadu	Uttarakhand
<i>Alchemilla aksharmae</i> Panigrahi & K.M. Purohit	+	-	-
<i>A. brummittii</i> K.M. Purohit & Panigrahi	+	-	-
<i>A. ceciliae</i> Panigrahi & K.M. Purohit	+	-	-
<i>A. chthamalea</i> Rothm.	+	-	+
<i>A. connivens</i> Buser	+	-	-
<i>A. duthieana</i> Panigrahi & K.M. Purohit	+	-	-
<i>A. gillgitensis</i> K.M. Purohit & Panigrahi	+	-	-
<i>A. harae</i> K.M. Purohit & Panigrahi	-	+	-
<i>A. indica</i> Gardn.	-	+	-
<i>A. kishangangensis</i> Panigrahi & K.M. Purohit	+	-	-
<i>A. kungwatanensis</i> K.M. Purohit & Panigrahi	+	-	-
<i>A. madurensis</i> (Rothm.) Panigrahi & K.M. Purohit	-	+	-
<i>A. mantoniae</i> Panigrahi & K.M. Purohit	+	-	-
<i>A. nicolsonii</i> K.M. Purohit & Panigrahi	+	-	-
<i>A. niltarensis</i> K.M. Purohit & Panigrahi	+	-	-
<i>A. panigrahiana</i> K.M. Purohit	-	+	-
<i>A. palii</i> Panigrahi & K.M. Purohit	-	-	+
<i>A. parijae</i> Panigrahi & K.M. Purohit	-	+	-
<i>A. plocekii</i> K.M. Purohit & Panigrahi	+	-	-
<i>A. purohitii</i> Lakshmin., Bandyop. & Chand. Gupta	+	-	-
<i>A. rothmaleri</i> Panigrahi & K.M. Purohit	+	-	-
<i>A. samantaraii</i> K.M. Purohit & Panigrahi	+	-	-
<i>A. sarojinia</i> K.M. Purohit & Panigrahi	+	-	-
<i>A. sibthorpioides</i> (Hook.f.) Panigrahi & K.M. Purohit	-	+	-
<i>A. trollii</i> Rothm.	+	-	-
<i>A. waltersii</i> K.M. Purohit & Panigrahi	+	-	-
<i>A. ypsilotoma</i> Rothm.	+	-	-

Interestingly the members of the genus have not been reported from eastern Himalayas so far which may be explained by higher rainfall, temperature and humidity. However, extended distribution of *A. indica* Gardn. and *A. sibthorpioides* (J. D. Hooker) Panigrahi & Purohit to Sri Lanka with similar climatic conditions as in eastern Himalayas hardly justify the absence of the members of the genus *Alchemilla* L. in eastern Himalaya due to climatic factors.

Though most of the species of the genus *Alchemilla* are confined to a very narrow range of North-Western Himalaya and Western Ghats, conservation status of none or very few have been assessed by IUCN till now. The endemic species, especially narrow or paleo endemics occurring in geographically isolated habitats, are more vulnerable and prone to get extinct in near future due to genetic or ecological barriers [24, 25, 26]. The endemic species of this genus, restricted to a particular ecological niche, should be conserved on priority basis because loss of population of a narrow endemic may result loss of the species forever. As population of most of the endemic species is fragmented, continuous monitoring of fragmented population is required for better conservation management. *Ex-situ* conservation drive through micropropagation, gene banks and seed banks may be established for extension of the members beyond its present restricted population.

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