

A compendium of Brassicaceae in Indian subcontinent: Its distribution and endemism

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Abstract: A preliminary checklist of Brassicaceae Burnett (*nom. cons.*) or Cruciferae Adans (*nom. cons. et nom. alt.*) in Indian subcontinent has been prepared on the basis of primary observations of different taxa belonging to this family in wild habitats and on secondary observations based on examining herbarium specimens and taxonomic literature. On the Indian subcontinent (comprising Bangladesh, Bhutan, Myanmar, Nepal, Pakistan, Sri Lanka and India), the family Brassicaceae is poorly represented (8.88%). The present paper deals with distribution, phytoendemism, possible fossil ancestry, potential, survival threat on existing taxa etc. of Brassicaceae in Indian subcontinent. For better understanding of the species dynamics of Brassicaceae in Indian subcontinent, the present status of phytoendemism has been compared to the data of previous investigations done in nineteenth century.

Keywords: Brassicaceae, distribution, endemism, Indian subcontinent.

Introduction

A taxonomic review of the family: Brassicaceae Burnett (s.l.)

Almost all systems of classification of plants till 1850 were primarily concerned with the asexual plants (Cryptogams). It was HOFMEISTER (1851) explained the phenomenon "alternation of generation" first time, which helps to understand the relationships of flowerless plants themselves and flowering plants; his theory

suggested the key to conform natural system of classification. BENTHAM and HOOKER's (1862-1883) monumental work was published in *Genera Plantarum*, considered to be most popular one in eighties, based on natural system of classification of DE CANDOLLE's (1813) "*Theorie elementaire de la botanique*". BENTHAM and HOOKER (1862-1883) in their system of classification, put order Cruciferae and Capparideae under cohort Parietales. Later on ENGLER and PRANTL (1887-1915) in their widely accepted system of classification "Die naturlichen pflanzenfamilien", in which the families of angiosperms have been arranged in ascending series according to the increasing complexity of flower and they replaced the term "Natural Order" of BENTHAM and HOOKER (1862-83) by the term "family" and the "Class or Series" by "Order"; they placed family Capparidaceae and Cruciferae under suborder Capparidineae, order Rhoedales. HUTCHINSON (1926) proposed a new system of classification on apparently phylogenetic lines in "*The Families of Flowering Plants: Part 1 (Dicotyledons)*" and here he placed family Cruciferae under order Cruciales and the family Capparidaceae under order Capparidales and he put these two separate orders under the division Archichlamydeae and the difference between these two families are distinguished morphological characteristics e.g. Cruciferae could be distinguished from Capparaceae by having cruciform corolla, tetradynamous stamens, the absence of gynophore etc. There are difference of opinion between BENTHAM and HOOKER (1862-83) and HUTCHINSON (1926, 1967), as to whether Cruciferae has been derived from Papaverous ancestors or from Capparidaceous ancestors. The Capparadacian alliance is more tenable if morphological as well as anatomical characteristics of androecium and gynoecium are taken into consideration. Presence of cruciform corolla and tetradynamous stamens is characteristic features of Brassicaceae but there are some basal members of this family having floral features (presence of gynophore and lack of tetradynamous stamens) and woody habit make them more close to Capparaceae and these features have not satisfactorily resolved whether it is state of convergent evolution or state of divergence of ancestral features from common stock (AL-SHEHBAZ, 1973; CRONQUIST, 1981; ROLLINS, 1993). Shifting of few genera between the families Brassicaceae and Capparaceae have been done by different worker in different time [e.g. two genera: *Dipterygium* and *Puccinia*, previously belong to Brassicaceae (HUTCHINSON, 1967) moved to Capparaceae (PAX and HOFFMAN, 1936; HEDGE, KJAER and MALVER, 1980) under subf. Dipterigoideae, based on presence of methyl-glucosinolate, a compound derived from Capparaceae not Brassicaceae (LUNING, KERS and SEFFERS, 1992; Iltis, 1999)] which further reaffirm the common stock theory. Sometimes morphological characteristics are solely considered for taxonomic review of different plant groups, which might not sustain for long time but it is a proven fact that it might be considered as useful tool when phylogenetic analysis taken into consideration, e.g. the members of subf. Cleomoideae (having palmately compound leaves, fruit with no septum) could be easily distinguished from Brassicaceae (having simple leaves, capsule with false septum) and subf. Caparoideae (having simple leaves) has resemblance to Brassicaceae; the link

between divergence form of Subf. Cleomoideae and subf. Capparoideae is the genus *Crateva* (which has palmately compound leaves) though it belongs to subf. Capparoideae (HALL et al. 2002). Based on the consistency of different morphological characters two subfamilies belonging to Capparidaceae or Capparaceae, Cleomoideae (herbaceous, compound palmately leaves, fruit capsular) and Capparoideae (woody habit, simple leaves, fruit berry) have been raised to family status, viz. family: Capparaceae, with ca.25 genera and 440 species and family: Cleomaceae, with 8 genera and 275 species (AIRY SHAW, 1965; HUTCHINSON,1967). Brassicaceae is thought to be arisen from a common stock with Capparaceae subf. Clemoideae and supposed to be connected by tribe: Stanleyeae under Brassicaceae (AIRY SHAW, 1965; TAKHTAJAN, 1980) or by tribe: Thelypoideae, belonging to Brassicaceae (ILTIS, 1957, 1958, 1959; AL-SHEHBAZ, 1973). Based on morphological and phylogenetic analysis it is universally agreed that Capparaceae and Brassicaceae are closely related (ILTIS, 1957; AL-SHEHBAZ, 1973; DAHLGREN, 1975; TAKHTAJAN, 1980; CRONQUIST, 1981; RODDMAN et al, 1993, 1996; ROLLINS, 1993; KAROL et al., 1999; THRONE, 2000; THRONE and REVEAL, 2007). To elucidate the monophyly of Capparaceae, JUDE et al. (1994) carried out morphological cladistic analysis by using some Capparaceae and Brassicaceae sample and the result clearly show that subf. Capparoideae form a paraphyletic grade sister to monophyletic subf. Clemoideae and Brassicaceae. To further focus on the relationship between the family Brassicaceae and Capparidaceae HALL et al.(2002), in their cladistic analysis have done DNA sequencing of chloroplast regions from the members of Capparaceae and Brassicaceae and they found three main clads: Capparaceae subfamily (subf.) Capparoideae, subf. Cleomoideae and Brassicaceae. The phylogenetic analysis, based on morphological (like reduction in number of stamens, presence of dehiscent fruit, herbaceous habit) and molecular data further indicated that subf. Clemoideae is more closely related to Brassicaceae than subf. Capparoideae (JUDE et al. 1994, 1999; RODMAN et al., 1996, 1998). Based on the studies of polyploidy level in the families Brassicaceae and Cleomaceae, ECKHART (2006); SCHRANZ and MITCHELL-OLDS (2006) came in conclusion that divergence of Brassicaceae from Cleomaceae possibly occur between 15-86 million years ago. DOWELD (2007) has tried to split genus *Stixis* L. from Capparaceae and formed a new family: Stixaceae DOWELD (including the genus *Forchhammeria* Lieb.) but still it is considered under Brassicaceae *sensu lato*, excluding *Forchhammeria* as it is more closely related to Resedaceae than Brassicaceae (found in chloroplast DNA analysis by HALL et al.,2002), by APG¹. The recent phylogenetic analysis of Brassicaceae and Capparaceae by HALL et al., 2002, found that there is a close sister family relationship between these two families. Based on all of these phylogenetic analyses, APG (1998, 2003) merged the families: Capparaceae JUSS., Cleomaceae BERCHT & J. PRESL. and Brassicaceae BURNETT into Brassicaceae BURNETT *sensu lato* under order:

¹ Angiosperm Phylogeny Group.

Brassicales², under clad EurosidsII, under Rosid, under Core Eudicot, Eudicot, under Angiosperms in “*An Ordinal Classification for the Families of Flowering Plants*”.

Brassicaceae, with the members of herbs of ca.419 genera and ca.4130 species distributed mainly in temperate regions, except Antarctica regions (AL-SHEHBAZ et al.,1998; AL-SHEHBAZ 2000a; AL-SHEHBAZ and WARWICK, 2005, 2006; AL-SHEHBAZ et. al.,2002; APG,1998;2003; BACKER and BAKHUIZEN,1963; BAILEY et. al. 2006; DEBNATH et al., 1993; HEDGE,1976; HEYWOOD,1993; HUTCHINSON,1993; JONSELL, 1988; O’KANE and AL-SHEHBAZ, 2003; SCHULZ, 1919, 1924, 1926, 1936; WARWICK et.al., 2006a, 2006b; ZHOU et al, 2001) highly diverse in Irano-Turanian, Mediterranean and North America. Apart from economic and ethno botanical importance, the underexploited genetic resources belonging to this family deserve conservation on the verge of depletion of wild habitats. The lack of contemporary phytogeographical analysis of Brassicaceae in South Asian region , which is pre-requisite criteria to adopt conservation strategies on a national level as well as regional level, lead to undertake the present studies. The last phytogeographical review of this family on the Indian subcontinent was done in 1939-40 (CHATTERJEE, 1939).Thus an appraisal is necessary to monitor the species dynamics of Brassicaceae in the same geographical location after a period of time. Species dynamics is a key indicator in predicting whether a particular group of plants is in a mode of expansion or extinction. Apparently, it is an academic study where economic potential of an under-exploited group of plants is not taken into consideration. Hence, species dynamics should be considered as an important parameter in determining sustainable utilization pattern as well as planning of conservation strategies. For a developing country, underexploited plant resource should be considered as potential natural resource, which could play an important role in socio-economic development. But, most of the time it has been found the conservation initiative , strategies, ethics in developed countries is much more pro-active than developing countries, where underexploited plant is being considered as a potential resource, whereas it is just “weed-like plant” in other world.

Material and methods

To prepare a preliminary checklist of Brassicaceae in Indian subcontinent, available floristic works of Indian subcontinent and other major regions have been consulted, starting with Index Kewensis. The list of endemic taxa has been prepared from the literature and confirmed from herbaria, viz. BSD (Botanical Survey of India, Northern Circle, DehraDun), BSI (Botanical Survey of India, Western Circle, Pune), BSIS (Industrial Section of Indian Museum, Botanical Survey of India), CAL (Central National Herbarium, Botanical Survey of India), CDRI (Central Drug Research Institute, Lucknow), CIMAP (Central Institute of Medicinal and Aromatic Plants, Lucknow), DD (Forest Research Institute,

² To prioritise Brassicaceae over Capparaceae , the name of the order Brassicales has been picked instead of Capparales (JUDD et al,1994).

DehraDun), FRC (Herbarium, Divn. of Genetics and Tree Breeding, Institute of Forest Genetics and Tree Breeding, Coimbatore, Tamil Nadu), LWG (National Botanical Research Institute, Lucknow), MH (Herbarium of Botanical Survey of India, Southern Circle, Coimbatore), RBGT (Herbarium, Tropical Botanic Garden, Research Institute, Trivandrum, Kerala), RRCBL (Medicinal Plant Herbarium, Regional Research Laboratory, Bangalore), RBGT (Herbarium, Tropical Botanic Garden, Research Institute, Trivandrum, Kerala), RRLB (Regional Research Laboratory, Bhubaneswar) and K (Royal Bot. Gard., Kew). The microfiches of C. Linnaeus's collection from two European herbaria, have also been studied viz. Herbarium, London (LINN) and Herbarium, Stockholm (S). In search of endemic and threatened taxa, field surveys have been undertaken in North-Western and Western Himalayas and Western Ghat regions of India. The required data on threatened taxa of Brassicaceae were partially accumulated from World Conservation Monitoring Centre, Cambridge; U.K. The results on phyto-endemism are more useful for further analysis (from spatio-temporal perspective) and understanding of species dynamics, if floristic provinces are considered rather than political boundaries (MAJOR, 1990). Though assortment of endemic taxa belonging to Brassicaceae in Indian subcontinent has been done, under political boundaries, the same geographical location, where CHATTERJEE (1939) did his first phyto-endemic analysis of Indian Flora; the assortment of endemic taxa of Brassicaceae in different phytocorias³ in India has been made following the phytocorial classification of KUNDU (2001).

Results and discussion

Distribution of Brassicaceae in Indian subcontinent

In India the family is represented by ca.71 genera and ca.263 species (CHOWDHERY and RAO, 1985; DANIEL and SABINS, 1977; DEBNATH et al., 1993; HOOKER, 1862; HOOKER and THOMSON, 1872; KERS, 1999; NAQSHI and JAVEID, 1984; RAWAT, DANGWAL and GAUR, 1996). Present investigation reveals that number of taxa is ca.298 (comprising 266 species and 32 sub-species), under 78 genera belonging to Brassicaceae in India. The checklist of Brassicaceae in Indian subcontinent (AL-SHEHBAZ 2000b, 2000c, 2001, 2002a, 2002b, 2002c, 2003, 2004; DHAR, RAWAT and SAMANT, 1996; HARA, 1979a; JAFRI, 1973a, 1973b; GRIERSON, 1984a, 1984b; HARTMAN, 1984; HALIM, KHAN and HOSNE-ARA, 1992; JACOBS, 1964, 1965; SUNDARA RAGHAVAN, 1993; TRIMEN, 1885, 1974; VISWANATHAN, 2000; WHITMORE, 1979; ZHOU et al., 2001) is presented in Tab. 1.

³ TAKHTAJAN (1986).

Tab. 1. Checklist of Brassicaceae in Indian subcontinent and other places

	Name of the taxa	Place of occurrence
1.	<i>Alliaria petiolata</i> (M. Bieb.) Cavara & Grande in Bull. Orto. Bot. Regia Univ. Napoli 3: 418. 1913.	India, Pakistan, Nepal, China, Afghanistan, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Turkmenia, Uzbekistan, S. W. Asia, Europe, N-America.
2.	<i>Alyssum dasycarpum</i> Stapf. ex Willd. in Willd. Sp. Pl. iii. 469. 1800.	Pakistan, Iran, Afghanistan, China, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Turkmenia, Uzbekistan, S. W. Asia.
3.	<i>A. desertorum</i> Stapf in Denkschr. Akad. Wiss. Wien, Math. Nat. Kl. 51 : 302. 1886.	India, Pakistan, Afghanistan, China, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan, Turkmenia, Uzbekistan, S. W. Asia, N. America.
4.	<i>A. heterotrichum</i> Boiss., Diagn. Ser. L, 6: 15. 1845.	Pakistan, Iran, Turkmenia, Afghanistan.
5.	<i>A. homalocarpum</i> (Fisch. & May) Boiss, Fl. Or. 1: 285. 1867.	Pakistan, Iraq, Iran, Egypt, Arabia.
6.	<i>A. klimesii</i> Al-Shehbaz, Novon 12: 309.2002.	India, China.
7.	<i>A. lanceolatum</i> Baumg., Jahresber. Kais. – Franz-Jos-Oberreal-Schule Baden b. Wien. 48: 11. 1911.	Pakistan, Iran, Turkmenia, Afghanistan.
8.	<i>A. linifolium</i> Stapf. ex Willd., Sp. Pl. 3: 467. 1800.	Pakistan, Afghanistan, China, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Turkmenia, Uzbekistan, Australia, S.W.Asia, Europe.
9.	<i>A. marginatum</i> Steud ex Boiss in Ann. Sc. Nat. Ser. 2, 17: 157. 1842	Pakistan, Arabia (Eastward).
10.	<i>A. stapfii</i> Vierh. In Verh. Zool-Bot. Ges. Wien, 64: 261, t. 7. F. 1. 1914	Pakistan, Afghanistan, S. W. Asia.
11.	<i>A. szowitsianum</i> Fisch. & C. A. Mey in Ind. Sem. Hort. Petrop. 4: 31. 1937.	Pakistan, Iraq, Iran, Turkmenia, Turkey, Afghanistan
12.	<i>A. turkestanicum</i> Regel & Schmalh ex Regel. Pl. Nov. Fesch. 6. 1879.	Pakistan, Iran, Afghanistan, C. Asia.
13.	<i>Aphragmus hinkuensis</i> (Arai, Ohba & Al-Shehbaz) Al-Shehbaz & Warwick, Can. J. Bot. 84: 279. 2006.	Nepal, China.
14.	<i>A. hobsonii</i> (H. Pearson) Al-Shehbaz & Warwick, Can. J. Bot.84: 279.2006.	India, Nepal, Bhutan, China.
15.	<i>A. ladakiana</i> Al-Shehbaz, Novon 12: 310. 2002.	India.
16.	<i>A. nepalensis</i> (H.Hara) Al-Shehbaz, Harvard Pap. Bot. 112.2000.	Nepal.
17.	<i>A. obscurus</i> (Dunn) O.E.Schulz, Repert Sp.Nov. Regni Veg. 31:330.1933.	India, Nepal, Bhutan, China.
18.	<i>A. ohbana</i> (Al-Shehbaz & Arai) Al-Shehbaz & Warwick, Can. J. Bot.84: 279.2006.	Nepal, China.
19.	<i>A. oxycarpus</i> (Hook. f. & Thoms.) Jafri in Notes R. Bot. Gard. Edinb. 22: 96. 1956.	India, Pakistan, Nepal, Bhutan, China, Afghanistan, Tajikistan.
20.	<i>A. serpens</i> (W.W.Smith) Al-Shehbaz & Warwick, Can. J. Bot.84: 279.2006.	India, Nepal, Bhutan, China.

	Name of the taxa	Place of occurrence
21.	<i>Arabis amplexicaulis</i> Edgew., Trans. Linn. Soc. Lond. 20 : 31. 1846.	India, Pakistan, Nepal, Bhutan, Afghanistan, China.
22.	<i>A. axilliflora</i> (Jafri) Hara in J. Jap. Bot. 47: 107. 1972.	Bhutan, China.
23.	<i>A. bijuga</i> G. Watt, J. Linn. Soc., (Bot.) 18: 378. 1881.	India, Pakistan, China, Iran.
24.	<i>A. fruticulosa</i> C. A. Mey. in Ledeb., Fl. Alt. 3: 1831.	Pakistan, China, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan.
25.	<i>A. kashmiriaca</i> Naqshi, Singh & Koul, Journ. Econ. Tax. Bot 5. : 709, 1984.	India.
26.	<i>A. nova</i> Vill., Prosp. Pl. Dasuph. 3:319 1788.	India, Pakistan, Afghanistan, W. Asia, Mediterranean region, Europe.
27.	<i>A. pangiensis</i> G. Watt., J. Linn. Soc., (Bot.) 18: 378. T. 10. 1881.	India, Pakistan, Nepal.
28.	<i>A. paniculata</i> Franch. Pl. Delavay 57. 1889.	Nepal, China.
29.	<i>A. pterosperma</i> Edgew., Trans. Linn. Soc., Lond. 20: 33. 1846.	India, Pakistan, Nepal, Bhutan, China.
30.	<i>A. recta</i> Vill. Prosp. Pl. Dauph. 3: 319. 1788.	India, Europe.
31.	<i>A. saxicola</i> Edgew., Trans Linn. Soc., Lond. 20 : 32. 1846. var. <i>elatior</i> (O. Schulz) Jafri, Notes R. Bot. Gard. Edinburgh 22 (2): 100. 1956.	India, Pakistan.
32.	<i>A. saxicola</i> Edgew. var. <i>saxicola</i>	India, Pakistan, Afghanistan.
33.	<i>A. tenuirostris</i> O. Schulz. Notizbl. Bot. Gart. Berlin 9: 1066. 1927.	India, Pakistan.
34.	<i>A. tibetica</i> Hook. f. & Thoms., J. Linn. Soc., Bot. 5: 143. 1861.	India, Pakistan, China, Afghanistan, Kyrgyzstan, Tajikistan.
35.	<i>A. venusta</i> Hara in J. Jap Bot. 47: 108. 1972.	Bhutan.
36.	<i>Arabisopsis taraxacifolia</i> (T. Anderson) Jafri in Fl. W. Pakistan 55: 274, 1973.	India, Pakistan.
37.	<i>A. thaliana</i> Heynh. in Hioll & Heynh., Fl. Sachs. 1: 538. 1842.	India, Pakistan, Nepal, Bhutan, China, Kazakhstan, Mongolia, Russia, Tajikistan, Uzbekistan, Korea, Japan, S. W. Asia, Mediterranean region.
38.	<i>Arcyosperma primulifolium</i> (Thoms.) O. Schulz in Engler, Pflanzenr. 86: 182. 1924.	India, Pakistan, Nepal, Bhutan.
39.	<i>Atelanthera perpusilla</i> Hook. f. & Thoms in J. Linn. Soc., Bot. 5: 138. 1861.	India, Pakistan, Afghanistan, China, Tajikistan.
40.	<i>Barbarea intermedia</i> Boreau, Fl. Cent. France 2: 48. 1840.	India, Pakistan, Nepal, Bhutan, China, S.W. Asia, Europe.
41.	<i>B. plantaginea</i> DC., Syst. Nat. 2 : 208. 1821.	Pakistan, S. W. Asia, Afghanistan.
42.	<i>B. vulgaris</i> R. Br. in Aiton, Hort. Kew. ed. 2, 4: 109. 1812.	India, Pakistan, Sri Lanka, Kazakhstan, Russia, Mongolia, Tajikistan, Korea, Japan, Europe, Australia, Africa.
43.	<i>Brassica juncea</i> (L.) Czern. Consp. 8. 1859. var. <i>juncea</i>	India, China, C. & E Asia, Europe.

	Name of the taxa	Place of occurrence
44.	<i>B. napus</i> L., Sp. Pl. 666. 1753. ssp. <i>napobrassica</i> (L.) Jafri in Fl. W. Pakistan 55: 24. 1973	India.
45.	<i>B. napus</i> L., ssp. <i>napus</i> var. <i>quadrivalvis</i> (Hook. f. & Thoms.) O. Schulz in Engler. Pflanzenr 70: 42. 1919.	India, Nepal.
46.	<i>B. napus</i> L., ssp. <i>napus</i> var. <i>trilocularis</i> (Roxb.) O. Schulz in Engler, Pflanzenr 70:42. 1919.	India, throughout the temperate region of the World (Cultivated).
47.	<i>B. nigra</i> (L.) Koch in Roehling, Deutsch, Fl. ed. 3, 4: 713. 1833.	India, Pakistan, Nepal, China, Afghanistan, Vietnam, Kazakhstan, Russia, Europe, N. Africa, S. W. Asia (Cultivated).
48.	<i>B. oleracea</i> L., Sp. Pl. 667. 1753. var. <i>botrys</i> L., Sp. Pl. 667. 1753.	Naturalized and cultivated in India, China.
49.	<i>B. oleracea</i> L., var. <i>capitata</i> L., Sp. Pl. 667. 1753.	Naturalized and cultivated in India, China.
50.	<i>B. oleracea</i> L., var. <i>gemmifera</i> Zenker, Fl. Thuringen 15: 2. 1836.	Naturalised and cultivated in India, China.
51.	<i>B. oleracea</i> L., var. <i>gongylodes</i> L., ssp. Pl. 667. 1753.	Widely cultivated in India, China.
52.	<i>B. rapa</i> L., Sp. Pl. 666. 1753 var. <i>oleifera</i> Dc. Syst Nat. 2: 591. 1821.	Naturalized and cultivated in India, China, C. Asia, Europe.
53.	<i>B. rapa</i> L., var. <i>rapa</i>	Widely cultivated in India, China.
54.	<i>B. tournefortii</i> Gouan, Illus. Obs. Bot. 44. 1773.	Naturalized in India, native of Mediterranean region, Spain, Italy (widely cultivated).
55.	<i>Braya forrestii</i> W.W. Smith, Notes Roy. Bot. Gard. Edinburgh 8: 119. 1913.	Bhutan, China.
56.	<i>B. rosea</i> (Turcz.) Bunge in Del. Sem. Hort. Dorpat 7. 1839.	India, Pakistan, Nepal, Bhutan, China, Kyrgyzstan, Mongolia, Russia, Tajikistan.
57.	<i>B. thomsonii</i> Hook. f. in J. Linn. Soc., (Bot.) 5: 168. 1861.	India, China.
58.	<i>B. tibetica</i> Hook. f. & Thoms. in J. Linn. Soc., (Bot.) 5: 168. 1861.	India, China.
59.	<i>Cadaba farinosa</i> Forssk., Fl. Aegypt. Arab. 68. 1775. ssp. <i>farinosa</i>	India, Pakistan, Arabia, Egypt, Trop. Africa.
60.	<i>C. farinosa</i> Forssk. ssp. <i>rarifolia</i> Jafri in Fl. W. Pakistan (Karachi) 4: 41. 1972.	Pakistan.
61.	<i>C. fructicosa</i> (L.) Druce in Bot. Exch. Cl. Soc. Brit. Isles 3: 415. 1914.	India, Pakistan, Bangladesh, Myanmar, Sri Lanka, Africa, Arabia.
62.	<i>C. heterotricha</i> Stocks ex Hooker, IC. Pl. t. 839. 1852.	Pakistan, Arabia, Trop. Africa.
63.	<i>C. trifoliata</i> (Roxb.) Wight & Arn., Prodr. 1: 24. 1834.	India, Sri Lanka.
64.	<i>Capparis acutifolia</i> Sweet, Hort. Brit. ed. 2. 2: 585. 1830. ssp. <i>bodinieri</i> (A. Leveille) Jacobs in Blumea 12: 431. 1965.	India, Bhutan, Myanmar, China, Taiwan, Vietnam.
65.	<i>C. acutifolia</i> Sweet, ssp. <i>sabiaefolia</i> (Hook. f. & Thoms.) Jacobs in Blumea 12: 432. 1965.	India, Myanmar, China, Laos, Vietnam, Thailand.
66.	<i>C. acutifolia</i> Sweet, ssp. <i>viminea</i> Jacobs in Blumea 12: 429. 1965.	India, Bhutan, Myanmar, China, Laos, Vietnam, Thailand.

	Name of the taxa	Place of occurrence
67.	<i>C. assamica</i> Hook. f. & Thoms. in Fl. Brit. India 1:177.1872.	India, Bhutan, Bangladesh, Myanmar, China, Laos, Thailand.
68.	<i>C. brevispina</i> DC., Prodr. 1: 246. 1824.	India, Sri Lanka.
69.	<i>C. cantoniensis</i> Lour., Fl. Cochinch. 331. 1790.	India, Bhutan, Myanmar, China, Vietnam, Laos, Malaysia, Thailand, Indonesia, Philippines.
70.	<i>C. cartilaginea</i> Decne. in Ann. Sc. Nat. Ser. II,3:273.1835.	Pakistan, N-tropical Africa, Arabia, Israel, Iraq. Iran.
71.	<i>C. cataphyllosa</i> Jacobs in Blumea 12:443.1965.	Myanmar.
72.	<i>C. cinerea</i> Jacobs in Blumea 12: 444.1965.	India.
73.	<i>C. cleghornii</i> Dunn. in Bull. Misc. Inf. Kew 1916.6l.1916.	India.
74.	<i>C. decidua</i> (Forsskal) Edgew in J. Linn. Soc. Lond., (Bot.) 6: 184. 1862.	India, Pakistan, Iran, Israel, Saudi Arabia, Egypt, Ethiopia, Sudan, West Asia.
75.	<i>C. divaricata</i> Lam., Encycl. reth. Bot. 1:606, 1785.	India, Sri Lanka.
76.	<i>C. diversifolia</i> Wight & Arn., Prodr. 1:27.1834.	India.
77.	<i>C. flavicans</i> Kurz in J. Asiat. Soc. Bengal 39(2): 62.1870.	India, Laos, Vietnam, Kampuchea, Thailand.
78.	<i>C. floribunda</i> Wight, Illus. 1: 33. 1840.	India, Sri Lanka, Myanmar, Thailand.
79.	<i>C. fusifera</i> Dunn. in Bull. Misc. Inf. Kew 1914:377.1914.	India.
80.	<i>C. grandiflora</i> Hook.f. & Thoms. in Fl. Brit. India 1:174.1872.	India.
81.	<i>C. grandis</i> L., Suppl. 263.1781.	India, Myanmar, Sri Lanka, Laos, Vietnam, Thailand.
82.	<i>C. micrantha</i> DC., Prodr. 1: 247. 1824.	India, Myanmar, China, Taiwan, Thailand, Philippines.
83.	<i>C. moonii</i> Wight, Illus.1: 35.1840.	India, Sri Lanka.
84.	<i>C. multiflora</i> Hook.f. & Thoms. in Fl. Brit. India. 1 : 178. 1872.	India, Nepal, Bhutan, Myanmar, China.
85.	<i>C. nilgiriensis</i> Subbarao, Kumari & Chandras. in J. Bombay Nat. Hist. Soc. 78:146.1981.	India.
86.	<i>C. olacifolia</i> Hook.f. & Thoms. in Fl. Brit. India 1:178.1872.	India, Nepal, Bhutan, Bangladesh, Myanmar.
87.	<i>C. pachyphylla</i> Jacobs in Blumea 12:476.1965.	India.
88.	<i>C. rheedei</i> DC., Prodr. 1:246.1824.	India
89.	<i>C. rotundifolia</i> Rottler, Neue. Schr. Ges. Naturf. Fr. Berl. 4:185.1803.	India, Sri Lanka.
90.	<i>C. roxburghii</i> DC., Prodr. 1: 247. 1824.	India, Sri Lanka.
91.	<i>C. rufidula</i> Jacobs in Blumea 12:487.1965.	Myanmar.
92.	<i>C. sepiaria</i> L., Syst. Nat.ed. 10.2: 1071.1759. var. <i>sepiaria</i>	India, Nepal, Bangladesh, Myanmar, Sri Lanka, Maldives, Africa, China, Vietnam, Malaysia, Thailand, Indonesia, Philippines, Australia.
93.	<i>C. shivaroyensis</i> Sund – Ragh.in Kew Bull.37: 72.1982.	India.
94.	<i>C. sikkimensis</i> Kurz in J. Asiat. Soc. Bengal 43(2): 181.1875. ssp. <i>sikkimensis</i>	India, Myanmar.

	Name of the taxa	Place of occurrence
95.	<i>C. sikkimensis</i> Kurz, ssp. <i>yunnanensis</i> (Craib & W.W. Smith) Jacobs, Blumea 12(3): 496.1965.	Myanmar, China, Vietnam, Thailand.
96.	<i>C. spinosa</i> L., Sp. Pl.503. 1753.var. <i>galeata</i> (Fresen) Hook.f. & Thoms. in Hook.f.Fl.Brit.India 1:173.1872.	India, Pakistan, Iran, Iraq, Israel, Trop. N. Africa.
97.	<i>C. spinosa</i> L. var. <i>himalayensis</i> (Jafri) Jacobs in Blumea 12 : 419. 1965.	India, Pakistan, Nepal.
98.	<i>C. spinosa</i> L., var. <i>spinosa</i>	India, Pakistan, Nepal, Bangladesh, China, Australia, Europe, N-America.
99.	<i>C. tenera</i> Dalz. in Hook. J. Bot. Kew. Gard. Misc. 2: 41. 1850.	India, Sri Lanka, Myanmar, Thailand, Trop. Africa.
100.	<i>C. zeylanica</i> L., Sp. Pl. L., Sp. Ed. 2. 720. 1762.	India, Nepal, Bangladesh, Myanmar, Sri Lanka, China, Vietnam, Malaysia, Thailand, Indonesia, Laos, Kampuchea, Philippines.
101.	<i>Camelina sativa</i> (L.) Crantz., Strip. Austr. 1: 17. 1762.	India, Pakistan, China, Kazakhstan, Mongolia, Russia, Tajikistan, Turkmenia, Korea, S. W. Asia, N. Africa, Europe, introduced in N. America.
102.	<i>Capsella bursa-pastoris</i> (L.) Medikus, Pflanzengatt. 1: 85. 1792.	India, China, Native to S.W.Asia and Europe, Cosmopolitan except tropics.
103.	<i>Cardamine africana</i> L. Sp. Pl. 655. 1753.	India, Sri Lanka, Indonesia, Trop & Subtrop. Africa.
104.	<i>C. calthifolia</i> H. Leveille, Bull. Acad. Int.Geogr. Bot. 24: 281.1914.	Myanmar, China.
105.	<i>C. circaeoides</i> Hook. f. & Thoms. & Thoms, J. Linn. Soc., (Bot.) 5: 144. 1861.	India, Bhutan, Myanmar, China, Vietnam, Taiwan, Laos, Thailand.
106.	<i>C. delavayi</i> Franchet, Bull.Soc.Bot. France 33:397.1886.	Bhutan, China.
107.	<i>C. elegantula</i> Hook. f. & Thomson, J. Linn-Soc. (Bot.) 5: 146. 1861.	India, Nepal, Bhutan.
108.	<i>C. flexuosa</i> Withering, Bot. Arr. Brit. Pl. ed. 3, 3 : 578. 1976.	India, Pakistan, Bhutan, Nepal, Myanmar, Bangladesh, China, Vietnam, Malaysia, Thailand, Philippines, Laos, Japan, Korea, Europe, Australia, Canada, S. America.
109.	<i>C. fragariifolia</i> O.E.Schulz, Bot.Jahrb.Syst.32:446.1903.	India, Bhutan, Myanmar, China.
110.	<i>C. gouldii</i> Al-Shehbaz, Novon 11(3): 289.2001.	Bhutan.
111.	<i>C. griffithii</i> Hook. f. & Thoms., J. Linn. Soc. (Bot.) 5: 146. 1861.	India, Nepal, Bhutan, China.
112.	<i>C. hirsuta</i> L., Sp. Pl. 655. 1753.	India, Pakistan, Sri Lanka, China, Vietnam, Thailand, Malaysia, Indonesia, Philippines, Laos, New Guinea, Turkmenia, Japan, S.W.Asia, Europe, S. Africa, N. & S. America, Australia.

	Name of the taxa	Place of occurrence
113.	<i>C. impatiens</i> L., Sp. Pl. 655. 1753.	India, Pakistan, Nepal, Bhutan, China, Afghanistan, Kazakstan, Kyrgyzstan, Russia, Tajikistan, Uzbekistan, Japan, S.W. Asia, Europe, S. Africa and N. America.
114.	<i>C. loxostemonoides</i> O. Schulz. Notizbl. Bot. Gart. Berlin 9: 1069. 1972.	India, Pakistan, Nepal, Bhutan, China.
115.	<i>C. macrophylla</i> Willd., Sp. Pl. 3 : 484. 1800.	India, Pakistan, Nepal, Bhutan, China, Korea, Kazakstan, Mongolia, Russia, Japan.
116.	<i>C. multijuga</i> Franchet in Bull. Soc. Bot. Fr. 3: 399. 1886.	Bhutan, China.
117.	<i>C. pulchella</i> (Hook. f. & Thoms.) Al-Shehbaz & G. Yang, Harvard Pap. Bot. 3(1): 77. 1998.	India, Nepal, Bhutan, China.
118.	<i>C. trichocarpa</i> Hochst. ex. A. Rich. Tent. Fl. Abyss. 1: 18. 1847.	India, Sri Lanka.
119.	<i>C. trifoliolata</i> Hook. f. & Thoms., J. Linn. Soc. Bot. 5: 145. 1861.	India, Nepal, Bhutan, China.
120.	<i>C. violaocea</i> (D. Don) Hook. f. & Thoms., J. Linn. Soc., (Bot). 5: 104. 1861.	India, Nepal, Bhutan, China.
121.	<i>C. yunnanensis</i> Franchet, Bull. Soc. Bot. Fr. 33: 398. 1886.	India, Nepal, Bhutan, China.
122.	<i>Cherianthus cheiri</i> L., Sp. Pl. 661. 1753.	India, native of Europe.
123.	<i>Chorispora bungeana</i> Fischer & Meyer in Shrenk, Enum. Pl. Nov. 1: 96. 1841.	India, Pakistan, Afghanistan, China, Kazakstan, Kyrgyzstan, Mongolia, Russia, Tajikistan, Uzbekistan.
124.	<i>C. macropoda</i> Trautv. In Bull. Soc. Nat. Mosc. 33: t. 109. 1860.	India, Pakistan, Afghanistan, China, Kazakhstan, Kyrgyzstan, Tajikistan.
125.	<i>C. sabulosa</i> Cambess. in Jacquem., Voy. Bot. 15, t. 15. 1844.	India, Pakistan, Kazakhstan, Tajikistan, Uzbekistan.
126.	<i>C. sibirica</i> (L.) DC. Syst. Nat. 2: 437. 1821.	India, Pakistan, China, Kazakhstan, Kyrgyzstan, Mongolia, Russia.
127.	<i>C. tenella</i> (Pallas) DC. Syst. Nat. 2: 435. 1821.	India, Pakistan, Afghanistan, China, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Turkmenia, Uzbekistan, Korea, S. W. Asia, Europe, America.
128.	<i>Christolea crassifolia</i> Cambess., Jacquem. Voy.4 (Bot.) 17: t.17. 1835.	India, Pakistan, Nepal, Afghanistan, China, Tajikistan.
129.	<i>C. parkeri</i> (O. Schulz) Jafri, Notes R. Bot. Gard. Edinb. 22: 52. 1955.	India, Pakistan, Nepal.
130.	<i>C. scaposa</i> Jafri, Notes R. Bot. Gard. Edinb. 22: 38, f. 2. 1955.	India.
131.	<i>Cleome angustifolia</i> Forsskal, Fl. Aegypt. Arab. 120.1775.	India, Sri Lanka, Arabia, Africa.
132.	<i>C. ariana</i> Hedge & Lammoud in Rech. f., Fl. Iran. 68:17.1970.	India, Pakistan, Afghanistan, Iran.
133.	<i>C. aspera</i> Koenig ex DC., Prodr. 1:1824.	India, Sri Lanka.
134.	<i>C. chelidonii</i> L. f., Suppl. Pl. 300. 1781.	India, Sri Lanka, Myanmar, Thailand, Malaysia, Indonesia.
135.	<i>C. felina</i> L. f., Suppl. Pl.300.1781.	India.
136.	<i>C. fimbriata</i> Vicary in J. Asiat. Soc. Bengal.16: 1158. 1847.	India, Pakistan, Afghanistan, Iraq, Iran, Turkmenia.

	Name of the taxa	Place of occurrence
137.	<i>C. gynandra</i> L., Sp. Pl. ed. 1: 671. 1753, var. <i>gynandra</i>	India, Pakistan, Nepal, Bhutan, Bangladesh, Myanmar, Sri Lanka, China, Vietnam, Malaysia, Thailand, Indonesia, Laos, Kampuchea, , Philippines, Pantropical.
138.	<i>C. gynandra</i> L., var. <i>nana</i> (Blatter & Hallberg), Bhandari in Bull. Bot. Surv. India 6: 327.1964.	India.
139.	<i>C. heratensis</i> Bunge & Bien. Ex. Boiss, ssp. <i>pakistanica</i> Jafri in Fl. W. Pakistan, 34: 25.1973.	Pakistan.
140.	<i>C. kollimalayana</i> M. B. Viswan., Kew Bull. 55: 245. 2000.	India.
141.	<i>C. monophylla</i> L., Sp. Pl. 672. 1753.	India, Sri Lanka. Trop, Asia.
142.	<i>C. rupicola</i> Vicary in Journ. Asiaf. Soc. Beng.16: 1158.1847.	Pakistan.
143.	<i>C. ruidosperma</i> DC., Prodr. I: 241. 1824. var. <i>ruidosperma</i> .	India, Bangladesh, Myanmar, Sri Lanka, Thailand, Malaysia, Philippines, Trop. America, Trop. Africa, Maldives.
144.	<i>C. ruidosperma</i> DC., var. <i>burmanii</i> (Wt. & Arn). M.O.Siddiqui & S. N. Dixit in Pl. Sci. (Lucknow) 6:68.1974.	India, Sri Lanka, Indonesia.
145.	<i>C. scaposa</i> DC., Prodr.1 : 239. 1824.	India, Pakistan, Sri Lanka, Indonesia.
146.	<i>C. simplicifolia</i> (Cambess) Hook. f & Thoms. in Fl. Brit. India 1: 169. 1872.	India.
147.	<i>C. speciosa</i> Raf., Fl. Ludovic 86. 1817.	India, Pakistan, Nepal, S.E.Asia, N & S.America, W.Indies.
148.	<i>C. spinosa</i> Jacq., Pl. Craib. 26. 1760.	India, China, West Indies, Native of S. America.
149.	<i>C. vahlina</i> Fresen. in Mus. Senck. 2: 110.1837.	India, Pakistan, Iran, Saudi Arabia, Afghanistan, Egypt, Trop. N. E. Africa.
150.	<i>C. viscosa</i> L., Sp. Pl. 672. 1753. var. <i>viscosa</i> .	India, Pakistan, China, Thailand, N. Africa, S. W. Asia, Australia, N. & S. America, Pantropical.
151.	<i>C. viscosa</i> L., var. <i>nagarjuna-kondensis</i> Sund-Ragh. in Bull. Bot. Surv. India, 28: 187. 1986.	India.
152.	<i>Cochlearia cochlearioides</i> (Roth) Santapau & Mahesghw. in J. Bombay Nat. Hist. Soc. 54: 804. 1957.	India.
153.	<i>Conringia planisiliqua</i> Fischer & Meyer in Sem. Hort. Petrop. 3: 32. 1837.	India, Pakistan, China, Iran, Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan, Turkmenia, Uzbekistan, S.W. Asia.
154.	<i>Crateva adansonii</i> DC. ssp <i>odora</i> (Bujch-Ham.) Jacobs in Blumea 12: 198. 1964.	India, Pakistan, Bangladesh, Myanmar, Sri Lanka, China, Taiwan, Malaysia, Thailand, Philippines, Tropical Africa.
155.	<i>C. magna</i> (Lour) DC., Prodr. 1: 243. 1824.	India, Bangladesh, Myanmar, Sri Lanka, China, Indonesia, Malaysia, Thailand.
156.	<i>C. nurvala</i> Buch.-Ham.Trans. Linn. Soc. London 15: 121.1872.	India, Bangladesh, Myanmar, China.

	Name of the taxa	Place of occurrence
157.	<i>C. religiosa</i> Forster f., Pl. Escul. Ins. Occ. Austral.45.1786.	India, Nepal, Bhutan, Bangladesh, Myanmar, Sri Lanka, Malaysia, Thailand, Indonesia, Philippines, China, Vietnam, Japan, Australia.
158.	<i>C. unilocularis</i> Buch-Ham.in Trans. Linn. Soc.15: 121.1827.	India, Nepal, Bhutan, Bangladesh, Myanmar, Sri Lanka, China, Vietnam
159.	<i>Crucihimalaya axillaries</i> (Hook.f. & Thoms.) Al-Shehbaz et. Al. , Novon 9:301.1999.	India, Nepal, Bhutan, China.
160.	<i>C. himalaica</i> (Edgew.) O. Schulz in Engher, Pflanzenr. 86: 283. 1924.	India, Pakistan, Nepal, Bhutan, Afghanistan, China.
161.	<i>C. lasiocarpa</i> O. Schulz in Engler, Pflanzenr. 86: 282. 1924.	India, Pakistan, Nepal, Bhutan, China.
162.	<i>C. mollissima</i> (C. A. Meyer) Al-Shehbaz et al., Novon 9:299.1999.	India, Pakistan, Nepal, Bhutan, Afghanistan, China, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan.
163.	<i>C. stricta</i> (Cambess.) N. Busch, Fl. Cauc. Crite. 3, 4: 457. 1909.	India, Pakistan, Nepal, Afghanistan, China.
164.	<i>C. wallichii</i> (Hook. f. & Thoms.) N. Busch, Fl. Cauc. Crite. 3, 4: 457. 1909.	India, Pakistan, Nepal, Bhutan, Iran, Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenia, Uzbekistan, S.W. Asia.
165.	<i>Crambe kotschyana</i> Boiss. Diagn. Pl. Orient., Ser.1, 6:19.1845.	India, Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenia, Uzbekistan, S. W. Asia.
166.	<i>Descurainia sophia</i> (L.) Webb ex Promtl in Engler & Prantl, Pflanzenr. 3, 2: 192. 1891.	India, Pakistan, Nepal, Bhutan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan, Turkmenia, Uzbekistan, Korea, Japan, S.W. Asia, Europe.
167.	<i>Desideria himalayensis</i> (Cambess) Al-Shehbaz, Ann. Missouri Bot. Gard. 87: 555.2001.	India, Pakistan, Nepal, Bhutan, Afghanistan, China.
168.	<i>D. linearis</i> (N. Busch) Al-Shehbaz, Ann. Missouri Bot. Gard. 87: 556.2001.	Nepal, China, Tajikistan.
169.	<i>D. mirabilis</i> Pampanini, Boll. Soc. Bot. Ital. 1926:111.1926.	Pakistan, China, Tajikistan.
170.	<i>D. pumila</i> (Kurz.) Al-Shehbaz, Ann. Missouri Bot. Gard. 87: 560.2001.	India, Pakistan, China.
171.	<i>D. stewartii</i> (T. Anderson) Al-Shehbaz, Ann. Missouri Bot. Gard. 87: 556.2001.	India, China.
172.	<i>Dilophilla salsa</i> Thoms. in Hooker's J. Bot. Kew Gard. Misc. 4, 5: 20. 1853.	India, Pakistan, Nepal, Bhutan, China, Kyrgyzstan, Tajikistan.
173.	<i>Dipterygium glaucum</i> Decsne in Ann. Sci. Nat. Ser. 2, 4:66.1835.	India, Pakistan, Middle East, Egypt, Sudan, Arabia.
174.	<i>Diptychocarpus strictus</i> (Fischer ex Marschallvon Bieberstein)Trautvetter, Bull. Soc. Imp. Naturalistes Moscou 33(1):108.1860.	Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Turkmenia, Uzbekistan, S. W. Asia, S.E. Europe.
175.	<i>Diplotaxis griffithii</i> (Hook. f. & Thoms) Boiss., Fl. Orient. 1: 388. 1867.	India, Pakistan, Bangladesh, Afghanistan.
176.	<i>Dontostemon glandulosus</i> (Karelin & Kir.) O. Schulz, Notizbt. Bot. Ganf. Berlin 10: 554. 1929.	India, Pakistan, Bhutan, China, Kazakhstan, Russia, Tajikistan.

	Name of the taxa	Place of occurrence
177.	<i>D. pectinatus</i> (DC.) Ledeb., Fl. Ross 1: 175. 1841.	India, Pakistan, Nepal, China, Russia, Mongolia.
178.	<i>D. pinnatifidus</i> (Willdenow) Al-Shehbaz & H. Ohba Novon 10:96.2000. ssp. <i>pinnatifidus</i>	India, Nepal, China, Mongolia, Russia.
179.	<i>Draba affghanica</i> Boiss., Fl. Orient. Suppl. 55. 1888.	India, Pakistan, Nepal, Afghanistan, Iran.
180.	<i>D. altaica</i> (C. Meyer) Bunge in Delect. Sem. Hort. Dorpat. 8. 1841.	India, Pakistan, Nepal, Bhutan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan.
181.	<i>D. amoena</i> O. Schulz in Engler, Pflanzewr. 89: 188. 1927.	India, Nepal, China.
182.	<i>D. aubrietoides</i> Jafri in Notes R. Bot. Gard Edinburgh 22 : 106. 1956.	India.
183.	<i>D. bagmatiensis</i> Al-Shehbaz, Novon 12(3): 317. 2002.	India, Nepal.
184.	<i>D. bhutanica</i> Hara in J. Jap. Bot. 49: 131. 1974.	Bhutan.
185.	<i>D. cachemirica</i> Gandoger in Bull. Soc. Bot. France 46: 418. 1889.	India, China.
186.	<i>D. cholaensis</i> W. Smith in Rec. Bot. Surv. India 4: 352. 1913.	India, Nepal, Bhutan.
187.	<i>D. dasyastra</i> O. Schulz in Engler, Pflanzenr. 89: 265. 1927.	India, China.
188.	<i>D. draboides</i> (Maxim.) Al-Shehbaz, in Novon 14(2): 154.2004.	India, Nepal, Bhutan, China, Mongolia, Russia.
189.	<i>D. elata</i> Hook. f. & Thoms. in J. Linn. Soc., (Bot.) 5: 150. 1861.	India, Nepal, Bhutan, China.
190.	<i>D. ellipsoidea</i> Hook. f. & Thoms. in J. Linn. Soc., (Bot.) 5: 153. 1861.	India, Nepal, China.
191.	<i>D. eriopoda</i> Turcz. in Bull. Soc. Nat. Mosc. 15: 260. 1842.	India, Nepal, Bhutan, China, Mongolia, Russia.
192.	<i>D. falconeri</i> O. Schulz in Engl., Pflanzenr. 89: 300. 1927.	India, Pakistan.
193.	<i>D. glomerata</i> Royle, Illus. Bot. Himal. 1: 71. 1834.	India, Pakistan, Nepal, China.
194.	<i>D. gracillima</i> Hook. f. & Thoms. In J. Linn. Soc., (Bot.) 5: 153. 1861.	India, Pakistan, Nepal, Bhutan, China.
195.	<i>D. hicksii</i> A. J. C. Grierson in Notes Roy. Bot. Gard. Edinburgh. 42: 107. 1984.	Bhutan.
196.	<i>D. himachalensis</i> Al-Shehbaz, Novon 12(3): 317. 2002.	India.
197.	<i>D. humillima</i> O. Schulz in Engler, Pflanzenr. 89: 114. 1927.	India, China.
198.	<i>D. korschinskyi</i> (O. Fedtsch.) Pohle in Act. Hort. Petrop. 31: 484. 1914.	India, Pakistan, Nepal, China, Afghanistan, Tajikistan.
199.	<i>D. lanceolata</i> Royle, Illus. Bot. Himal. 1: 72. 1834.	India, Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Turkmenia, Uzbekistan.
200.	<i>D. lasiophylla</i> Royle, Illus. Bot. Himal. 1: 71. 1834.	India, Nepal, Bhutan, China, Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan.
201.	<i>D. lichiangensis</i> W.W. Smith, Notes. Roy. Bot. Gard. Edinburgh 11: 208. 1919.	Nepal, Bhutan, China.

	Name of the taxa	Place of occurrence
202.	<i>D. ludlowiana</i> Jafri in Notes R. Bot. Gard. Edinb. 22: 105. 1956.	India.
203.	<i>D. macbeathiana</i> Al-Shehbaz, Novon 12(3): 315.2002.	Nepal.
204.	<i>D. melanopus</i> Komarov in Trav. Soc. Nat. Petersb. Bot. 26: 102 1896.	India, Pakistan, China, Afghanistan, Iran, Kazakhstan, Kyrgyzstan, Tajikistan.
205.	<i>D. nemorosa</i> L., Sp. Pl. 643. 1753.	India, Iran, Turkey, China, Japan, Pakistan, Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan, Turkmenia, Uzbekistan, Europe, N-America.
206.	<i>D. oariocarpa</i> O. Schulz in Engler, Pflanzenr. 89: 279. 1927.	India, Bhutan.
207.	<i>D. olgae</i> Regel & Schmalh in Regel, Descr. Pl. Nov. in Fedstch., Reise Nach Turkest. Lief. 18: 8. 1882.	India, Pakistan, China, Kyrgyzstan, Tajikistan.
208.	<i>D. oreades</i> Schrenk in Fischer & Meyer, Enum. Pl. Nov. 2: 56. 1842.	India, Pakistan, Nepal, Bhutan, China, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan.
209.	<i>D. pakistanica</i> Jafri in Fl. W. Pakistan, 55: 133. 1973.	Pakistan.
210.	<i>D. polyphylla</i> O. Schulz in Engler, Pflanzenr. 89: 1927.	India, Nepal, Bhutan, China.
211.	<i>D. radicans</i> Royle, Illus. Bot. Himal. 1: 71. 1834.	India, Nepal.
212.	<i>D. setosa</i> Royle, Illus. Bot. Himal. 1:71. 1884.	India, Pakistan, China.
213.	<i>D. sherriffii</i> A. J. C. Ryerson in Notes Roy. Bot. Grad. Edinburgh, 42 : 108. 1984.	Bhutan.
214.	<i>D. sikkimensis</i> (Hook. f. & Thoms.) Pohle in Fedde, Report. Spec. Nov. 32: 144. 1925.	India, Nepal, Bhutan.
215.	<i>D. stenobotrys</i> Gilg & O. Schulz in Engler, Pflanzenr. 89: 291. 1927.	India.
216.	<i>D. stenocarpa</i> Hook. f. & Thoms. in J. Linn. Soc., Bot. 5: 183. 1861.	India, Pakistan, Afghanistan, China, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenia, Uzbekistan.
217.	<i>D. tenerrima</i> O. Schulz in Notizbl. Bot. Cart. Berlin 9: 640. 1932.	India.
218.	<i>D. tibetica</i> Hook. f. & Thoms. in J. Linn. Soc. 5: 152. 1861.	India, Pakistan, Nepal, China, Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan.
219.	<i>D. trinervis</i> O. Schulz in Engler, Pflanzenr. 89: 131. 1927.	India, Pakistan, Afghanistan.
220..	<i>D. williamsii</i> H. Hara in J. Jap. Bot. 52. 353. 197.	Nepal, Bhutan.
221.	<i>D. winterbottomii</i> (Hook. f. & Thoms.) Pohle in Fedde, Report. Spec. Nov. Beih. 32: 138. 1925.	India, Pakistan, China.
222.	<i>Drabopsis nuda</i> (Belanger) Stapf. Denkschr. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl. 51:298.1886.	India, Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenia, Uzbekistan, Turkey, S.W. Asia, S.E.Europe.

	Name of the taxa	Place of occurrence
223.	<i>Erophila verna</i> (L.) Beser, Enum. Pl. Volyhym 22. 1822.	India, Pakistan, Afghanistan, Iran, C & W Asia, Europe. N-Africa, N. E. America.
224.	<i>Eruca vesicaria</i> (L.) Cavanilles ssp. <i>sativa</i> (Miller) Thellung in Hegi, Ill. Fl. Mitt.Eur.4 (1): 201.1918.	India, Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan, Turkmenia, Uzbekistan, S. W. Asia, Europe, N-Africa.
225.	<i>Erysimum aitchisonii</i> O. Schulz in notizbl. Bot. cart. Berlin 9: 1080. 1927.	India, Afghanistan.
226.	<i>E. alticum</i> C. Meyer in Ledeb., Fl. Alt. 3 : 153. 1831.	India, Pakistan, Afghanistan, C-Asia.
227.	<i>E. benthamii</i> Monnet, Notul. Sysy. (Paris) 2: 242.1912.	India, Nepal, Bhutan, China.
228.	<i>E. cachemicum</i> O. Schulz in Notizbl. Bot. Cart. Berlin 9: 1080. 1927.	India.
229.	<i>E. deflexum</i> Hook. f. & Thoms. in J. Linn. Soc., (Bot.) 5: 165. 1861.	India, Bhutan, China.
230.	<i>E. dolponese</i> Hara in J. Jap. Bot. 50: 265. 1975.	Nepal.
231.	<i>E. flavum</i> (Georgi) Bobrov, Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk SSSR. 20: 15.1960. ssp. <i>altaicum</i> (C.A.Meyer) Polozhij Sist. Zamteki Mater. Gerb. Krylova Tomsk. Gosud. Univ. Kuybysheva 86:3.1979.	Pakistan, China, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan.
232.	<i>E. funiculosum</i> Hook. f. & Thoms in J. Linn. Soc., (Bot.) 5: 165. 1861.	India, China.
233.	<i>E. hieraciifolium</i> L., Cent. Pl. I, 18, 1755.	Pakistan, China, Kazakhstan, Mongolia, Russia, Tajikistan, Uzbekistan, Europe, N. America.
234.	<i>E. longisiliquum</i> Hook. f. & Thoms. in J. Linn. Soc. (Bot.) 5: 166. 1861.	India, Bhutan.
235.	<i>E. melicentae</i> Dunn in Bull. Misc. Inf. Kew 1920: 366. 1920.	India, Pakistan, Nepal, China.
236.	<i>E. pachycarpum</i> Hook. f. & Thoms. in J. Linn. Soc., (Bot.) 5: 167. 1861.	India, Nepal, Bhutan.
237.	<i>E. repandum</i> L., Demonstr. Pl. 17 1753.	India, Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Uzbekistan, Europe, N-Africa, S. W. Asia.
238.	<i>E. schlagintweitianum</i> O.E.Schulz, Notizbl. Bot. Gart. Berlin-Dahlem 11: 227. 1931.	Pakistan, China.
239.	<i>E. thomsonii</i> Hook. f. in J. Linn. Soc., (Bot.) 5: 165.1861.	India, Afghanistan, China.
240.	<i>Euclidium syriacum</i> (L.) R. Br. in Aitan. Hort. Kew., ed. 2, 4: 74. 1812.	India, Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Turkmenia, Uzbekistan, N. Africa, S.W. Asia.
241.	<i>E. tenuissimum</i> (Pallas) O. Fedtsch. in Bull. Herb. Boiss. 2: 915. 1904.	India, C & S. Asia, Europe.
242.	<i>Eurycarpus lanuginosus</i> (Hook. f. & Thoms.) Botschantzev, Bot. Mater. Gerb. Bot. Inst. Komarova Akad Nauk. SSSR 17:172.1955.	India, Pakistan, China.

	Name of the taxa	Place of occurrence
243.	<i>Eutrema deltoideum</i> (Hook.f. & Thoms.) O. E. Schulz in Engler, Plafenzenr. 86 (iv.105): 35. 1924.	India, Bhutan, China.
244.	<i>E. heterophyllum</i> (W.W.Smith) H.Hara, J.Japan Bot. 48.97.1973.	Bhutan, Nepal, China, Kazakhstan, Kyrgyzstan, Tajikistan.
245.	<i>E. himalaicum</i> Hook.f. & Thoms. J. Proc. Linn. Soc., Bot. 5: 164.1861.	India, Bhutan, China.
246.	<i>E. hookeri</i> Al-Shehbaz & Warwick, Harvard Pap. Bot. 10(2): 133.2005.	India, Nepal, Bhutan, China.
247.	<i>E. lowndesii</i> (Hara) Al-Shehbaz & Warwick, Harvard Pap. Bot. 10(2): 133.2005.	Nepal, China.
248.	<i>Farsetia hamiltonii</i> Royle, Illus. Bot. Himal. 1: 71. 1834.	India, Pakistan.
249.	<i>F. heliophila</i> Bunge ex. Cosson, Camp. Fl. Alt. 2: 227. 1884.	India, Pakistan, Iran.
250.	<i>F. jacquemontii</i> Hook. f. & Thoms. J. Linn. Soc., Bot. 5: 148. 1861, ssp. <i>jacquemontii</i>	India, Pakistan, Afghanistan, Iran.
251.	<i>F. jacquemontii</i> Hook. f. & Thoms. ssp. <i>macrantha</i> (Blatt. et. Hallb.) Bhandari, J. Econ. Tax. Bot. 5: 1087. 1989.	India.
252.	<i>F. jacquemontii</i> Hook. f. & Thoms., ssp. <i>edgeworthii</i> (Hook. f. & Thoms.) Jafri, Notes R. Bot. Gard. Edinburgh 22: 213. 1957.	India, Pakistan, Afghanistan.
253.	<i>F. ramosissima</i> Hochst. ex. Boiss., Fl. Or., Suppl. 30. 1888.	Pakistan, Egypt.
254.	<i>Goldbachia laevigata</i> (M. Beb.) DC. syst. Nat. 2: 577. 1821.	India, Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Russia, Mongolia, Tajikistan, Turkmenia, Uzbekistan, S. W. Asia.
255.	<i>Guillenia axillare</i> (Hook. f. & Thoms.) Bennet in J. Econ. Tax. Bot. 4 (2): 593. 1983.	India, Nepal, Bhutan.
256.	<i>G. duthiei</i> (O. Schulz) Bennet in J. Econ. Tax. Bot. 4: 593. 1983.	India.
257.	<i>G. flaccidum</i> (O. Schulz) Bennet in J. Econ. Tax. Bot. 4: 593. 1983.	India, Pakistan.
258.	<i>G. minuiflorum</i> (Hook. f. & Thoms.) Bennet in J. Econ. Tax. Bot. 4: 593. 1983.	India, Pakistan, Afghanistan, China.
259.	<i>Hornungia procumbens</i> (L.) Hayek, Repert. Spec. Nov. Regni Veg. Beih.30:480.1925.	India, Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Turkmenia, Uzbekistan, S.W. Asia, Europe, N.America.
260.	<i>Hymenolobus procumbens</i> (L.) Nutt. ex Torrey & Gray, Fl. N. America 1: 117.1838.	India, Mostly in N-temperate region.
261.	<i>Ianhedghea minutiflora</i> (Hook. f. & Thoms.) Al-Shehbaz & O'Kane, Edinburgh J.Bot. 56:322.1999.	India, Pakistan, China, Afghanistan, Tajikistan, Turkmenia, Uzbekistan.
262.	<i>Iberis amara</i> L., Sp. Pl. 649. 1753.	India, Native of Europe.
263.	<i>I. odorata</i> L., Sp. Pl. 649. 1753.	India, E. Mediferranean region, S. W. Asian region.
264.	<i>I. sempervrens</i> L., Sp. Pl. 648. 1753.	India, S-Europe (Cultivate).
265.	<i>I. umbellata</i> L., Sp. Pl. 649. 1753.	India, Pantropical.

	Name of the taxa	Place of occurrence
266.	<i>Isatis costata</i> C. Meyer in Ledeb., Fl. Alt. 3: 204. 1831.	India, Pakistan, China, Kazakstan, Mongolia, Russia, Tajikistan, S. W. Asia.
267.	<i>I. minima</i> Bunge, Delect. Seminum Hort. Bot. Dorpat. 1843: 7.1843.	Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenia, Uzbekistan, S.W. Asia.
268.	<i>I. tinctoria</i> L., Sp. Pl. 670. 1753.	India, Pakistan, China, Afghanistan, Kazakhstan, Mongolia, Russia, Tajikistan, Uzbekistan, S.W. Asia, Naturalized in Europe.
269.	<i>I. violascens</i> Bunge, Arbeiten Naturf. Vereins Riga 1: 166.1847.	Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenia, Uzbekistan, S.W. Asia.
270.	<i>Lepidium africanum</i> (Burm. f.) DC., Syst. Nat. 2: 252. 1821.	India, S-Africa, Australia.
271.	<i>L. apetalum</i> Willd., Sp. Pl. 3. 349. 1800.	India, Pakistan, Nepal, China, Kazakhstan, Korea, Mongolia, Japan, S. W. Asia.
272.	<i>L. appelianum</i> Al-Shehbaz, Novon, 12(1): 7.2002.	Pakistan, China, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Turkmenia, Uzbekistan, Naturalized in N. and S. America.
273.	<i>L. capitatum</i> Hook. f. & Thoms. in J. Linn. Soc., (Bot.) 5: 175. 1861.	India, Nepal, Bhutan, China.
274.	<i>L. cartilagineum</i> (J.Mayer) Thellung, Vierteljahrsschr. Naturf. Ges. Zurich 51:173. 1906.	Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan, Turkmenia, Uzbekistan, S.W. Asia, C. and S. Europe.
275.	<i>L. didymus</i> L. Mant. Pl. 1767.	India, Native of South America W & Central Europe, Africa, Iran, Pakistan, Afghanistan.
276.	<i>L. draba</i> L. Sp.Pl. 2, 1753.	India, Pakistan, Afghanistan, China, Kazakhstan, Russia, Turkmenia, Uzbekistan, S.W.Asia, Europe, S.Africa, N. and S.America.
277.	<i>L. latifolium</i> L., Sp. Pl. 644. 1753.	India, Bhutan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan, Turkmenia, Uzbekistan, S.W. Asia, C. Europe, N-Africa, Australia.
278.	<i>L. obtusum</i> Bassiner in Bull. Cl. Phys. Math. Acad. Imp. Sci. St-Petersb. 2: 203. 1844.	India, China, Kazakhstan, Mongolia, Russia, Tajikistan, Uzbekistan, S. W. Asia, Europe, N-Africa.
279.	<i>L. perfoliatum</i> L., Sp. Pl. 643. 1753.	India, China, Afghanistan, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Turkmenia, Uzbekistan, Japan, S.W. Asia, Europe, N-Africa.
280.	<i>L. pinnatifidum</i> Ledeb., Fl. Ross. 1: 206. 1841.	India, C & S. W. Asia, Europe, Australia.

	Name of the taxa	Place of occurrence
281.	<i>L. ruderale</i> L., Sp. Pl. 645. 1753.	India, China, Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan, Turkmenia, Uzbekistan, S-W. Asia, Europe.
282.	<i>L. sativum</i> L., Sp. Pl. 644. 1753.	India, Pakistan, Nepal, Bhutan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Russia, Japan.
283.	<i>L. virginicum</i> L., Sp. Pl. 645. 1753.	India, Pakistan, Bhutan, China, Japan, Russia, Native to N-America.
284.	<i>Lepidostemon pedunculatus</i> Hook. f. & Thoms. J. Proc. Linn. Soc., Bot. 5: 156. 1861.	India, China.
285.	<i>Leptaleum filifolium</i> (Willd.)Dc., Mem. Mus. Hist. Nat. 7:239.1821.	Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Turkmenia, Uzbekistan, S. W. Asia.
286.	<i>Litwinowia tenuissima</i> (Pallas)Woronow ex Pavlov, Fl. Centr. Kazakh 2:302.1935.	India, Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Turkmenia, Uzbekistan, S.W. Asia.
287.	<i>Lobularia maritima</i> (L.) Desv., J. Bot. Appl. 3: 162. 1814.	India, China, Taiwan, Native of Mediterranean and Macronesian region, Cultivated for ornamental purpose.
288.	<i>Maerua apetala</i> (Roth.) Jacobs in Blumea 12 (2): 207. 1964.	India.
289.	<i>M. crassifolia</i> Forsskal, Fl.Aegypt. Arab. 113.1775.	Pakistan, Trop. Africa, Egypt, Sinai, Arabia, Palestine, Israel, Jordan, U.A.E., Saudi Arabia, Oman.
290.	<i>M. oblongifolia</i> (Forsskal) A.Rich.in Guill. & Pers., Fl.Seneg. Tent. 1:32.1847.	India, Pakistan, Sri Lanka, Thailand, Arabia, Middle East Asia, Africa.
291.	<i>Malcolmia africana</i> (L.) R. Br. in Aiton, Hort. Kew. ed. 2, 4: 121. 1812.	India, Pakistan, China, Afghanistan, Kazakhstan, Mongolia, Russia, Kyrgyzstan, Tajikistan, Turkmenia, Uzbekistan, S. W. Asia. S-Europe, N. Africa.
292.	<i>M. intermedia</i> C. A. Mey., Verz. Pfl. Cauc. 186. 1831.	India, Iran, Pakistan, Caspian region.
293.	<i>M.karelinii</i> Lipsky, Trudy Imp. S.-Peterburgsk Bot. Sada 23: 31.1904.	Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenia, Uzbekistan, S. W. Asia.
294.	<i>M. scorpioides</i> (Bunge) Boiss., Fl. Orient. 1: 225.1867.	Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenia, Uzbekistan, S. W. Asia.
295.	<i>M. strigosa</i> Boiss in Ann. Sci. bat. Ser. 2, 17: 70. 1842.	India, Pakistan, Afghanistan, Iran.
296.	<i>Matthiola chorassanica</i> Bunge ex Boiss., Fl. Orient. 1:151.1867.	Pakistan, Afghanistan, China, Tajikistan, Uzbekistan, S. W. Asia.
297.	<i>M. flavida</i> Boiss., Diagn. Pl. Nov. Or 1, 6: 9 1845.	India, S. W. Asia.
298.	<i>M. incana</i> (L.) R. Br. in Aiton, Hort. Kew. ed. 2, 4 120. 1812.	Widely cultivated in India, China.
299.	<i>Megacarpaea delavayi</i> Franchet, Bull.Soc.Bot. France 33:406.1886.	Myanmar, China.

	Name of the taxa	Place of occurrence
300.	<i>M. polyandra</i> Benth; in Hooker's J. Bot. Kew Garden Misc. 7: 356. 1855.	India, Pakistan, Nepal, China.
301.	<i>Myagrurn perfoliatum</i> L., Sp. Pl. 640. 1753.	India, C & S. Europe, C. & S. W. Asia.
302.	<i>Nasturtium microphyllum</i> Boern. ex. Reichb., Fl. Gen. Exc. 683. 1832.	India, Pakistan, Europe, W Asia, Africa, America.
303.	<i>N. officinale</i> R. Br. in Aiton, Hort. Kew. ed. 2, 4: 110. 1812.	India, Nepal, Sri Lanka, China, Taiwan, Native of S.W.Asia, widely naturalized in Europe.
304.	<i>Neotorularia brevipes</i> (Larelin & Kirilov) Hedge & J. Leonard, Bull. Jard. Bot. Belg. 56: 393. 1986.	Pakistan, China, Kazakhstan, Kyrgyzstan, Turkmenia.
305.	<i>N. humilis</i> (C. Meyer) Hedge & J. Leonard, Bull.Jard. Bot. Belg.56:394. 1986.	India, Pakistan, Nepal, Bhutan, Afghanistan, China, Kazakhstan, Russia, Tajikistan, Turkmenia, Uzbekistan, N-Africa, S.W. Asia, S.E.Europe.
306.	<i>N. torulosa</i> (Desfontaines) Hedge & J. Leonard, Bull. Jard. Bot. Belg. 56: 395. 1986.	Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan, Turkmenia, Uzbekistan, N. Africa, S.W. Asia, N.America.
307.	<i>Neslia apiculata</i> Fischer, C. Meyer & Are-Iall in Ind. Sem. Hort. Petrop. 8: 68. 1842.	India, C & S. W. Asia, S-Europe, N. W. Africa.
308.	<i>N.paniculata</i> (L.) Desvaux. J. Bot. Agric. 3: 162. 1815.	India, Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan, Turkmenia, Uzbekistan, N. Africa, S.W. Asia, N.America.
309.	<i>Noccaea andersonii</i> (Hook.f.& Thoms.) Al-Shehbaz, Adansonia 24(1): 91.2002.	India, Pakistan, Nepal, Bhutan, China.
310.	<i>N. cochlearioides</i> (Hook.f.& Thoms.) Al-Shehbaz, Adansonia 24(1): 91.2002.	India, Nepal, Bhutan.
311.	<i>N. nepalensis</i> Al-Shehbaz, Adansonia 24(1): 89.2002.	Nepal.
312.	<i>Notoceras bicornis</i> (Aiton) Amo, Fl. Iber. 6: 536. 1873.	India, Pakistan, S. W. Asia, Mediterranean region of Europe.
313.	<i>Olimarabidopsis pumila</i> (Stephan) Al-Shehbaz, Novon 9:303.1999.	India, Pakistan, Afghanistan, Kazakstan, Kyrgyzstan, Iran, Russia, Tajikistan, Uzbekistan, Turkmenia, S.W. Asia, E. Europe.
314.	<i>Pachypterygium brevipes</i> Bunge, Delect. Seminum Hort. Bot. Dorpat. 1843:8.1843.	Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenia, Uzbekistan, S.W. Asia.
315.	<i>P. multicaule</i> (Karelin & Kirilov) Bunge, Delect. Seminum Hort. Bot. Dorpat. 1843:8.1843.	Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenia, Uzbekistan, S.W. Asia.
316.	<i>Parrya chitralensis</i> Jafri in Notes R. Bot. Gard. Edinb. 22: 115. 1956.	India (P.O.K.), Pakistan.
317.	<i>P. exscapa</i> Ledeb., Icon. Pl. Ross. 1 : 21. T-86. 1829.	India, Pakistan, Afghanistan, C & N. Asia and Europe.
318.	<i>P. nudicaulis</i> (L.) Regel in Bull. Nat. Mosc. 34: 176. 1861.	India, Pakistan, Bhutan, China, Afghanistan, Russia, N. America.

	Name of the taxa	Place of occurrence
319.	<i>P. pinnatifida</i> Karelin & Kirilov Bull. Soc. Imp. Naturalistes Moscou 15: 147.1842.	India, Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan.
320.	<i>Pegaeophyton minutum</i> H. Hara, J.Jap.Bot. 47:270.1972.	India, Nepal, Bhutan, China.
321.	<i>P. nepalense</i> Al-Shehbaz et al., Novon 8:327.1998.	India, Nepal, Bhutan.
322.	<i>P. purii</i> (D.S.Rawat, L.R.Dangwal & R.D.Gaur) Al-Shehbaz, in Novon (14)2:157.2004.	India, Bhutan, China.
323.	<i>P. scapiflorum</i> (Hook. f. & Thoms.) Marquand & Shaw, J. Linn. Soc. (Bot.) 48: 229. 1929. ssp. <i>scapiflorum</i>	India, Pakistan, Nepal, Bhutan, Myanmar, China.
324.	<i>P. scapiflorum</i> (Hook. f. & Thoms.) Marquand & Shaw, ssp. <i>robustum</i> (O.E.Schulz) Al-Shehbaz et al. in Al-Shehbaz, Edinburgh J.Bot.57:164.2000.	Bhutan, China.
325.	<i>P. sulphureum</i> Al-Shehbaz, in Edinburgh J.Bot. 57(2): 169.2000.	Bhutan.
326.	<i>P. watsonii</i> Al-Shehbaz, in Edinburgh J.Bot. 57(2):168.2000.	India
327.	<i>Phaeonychium albiflorum</i> (T. Anderson) Jafri, Fl. W. Pakistan 55: 162. 1973.	India, Pakistan, Nepal, Bhutan, China.
328.	<i>P. parryoides</i> (Kurz ex Hook. f. & T. Anderson) O.E.Schulz Notizbl. Bot. gart. Berlin-Dahlem 9: 1092.1927.	India, Pakistan, Nepal, Bhutan, China.
329.	<i>P. jafrii</i> Al-shehbaz Nordic J.Bot.20:160.2000.	Nepal, Bhutan, china.
330.	<i>Ptilotrichum canescens</i> (DC.) Meyer in Ledeb, Fl. Alt. 3 : 66. 1831.	India, Pakistan, China.
331.	<i>Pycnoplithopsis bhutanica</i> Jafri , Pakistan J. Bot. 4: 74.1972.	India, Nepal, Bhutan, China.
332.	<i>Pycnoplithus uniflorus</i> (Hook. f. & Thoms) O. Schulz in Engler, Pflanzenr. 86 :199 1924.	India, Pakistan, China.
333.	<i>Raphanus raphanistrum</i> L., Sp. Pl. 669. 1753.	India, China, Taiwan, S. W. Asia, Europe, N-Africa.
334.	<i>R. sativus</i> L., Sp. Pl. 669. 1753. var. <i>caudatus</i> (L.) Hook. f. & T. Anderson in Fl. Brit. India 1: 166. 1872.	Cultivated in India.
335.	<i>R. sativus</i> L., var. <i>sativus</i> .	India, Pantropical(widely cultivated).
336.	<i>Rorippa benghalensis</i> (DC.) Hara, J. Jap. Bot. 49: 132. 1979.	India, Nepal, Bhutan, Bangladesh, Myanmar, China, Vietnam, Malaysia, Thailand, Laos, Kampuchea, Indonesia.
337.	<i>R. dubia</i> (Pers.) Hara, J. Jap. Bot. 30: 196. 1955.	India, Nepal, Bhutan, Bangladesh, Myanmar, China, Vietnam, Malaysia, Thailand, Japan, Indonesia, Laos.
338.	<i>R. elata</i> (Hook. f. & Thoms.) Handel- Mazzetti, Symb. Sin. 7:357.1931.	India, Bhutan, China.
339.	<i>R. indica</i> (L.) Hiern, Cat. Afr.Pl. Welw. 1: 26. Add. et. Corr. 1896 et. 2: 481, errata 1899.	India, Pakistan, Nepal, Bangladesh, Myanmar, Sri Lanka, China, Taiwan, Vietnam, Malaysia, Thailand, Laos, Indonesia, Philippines, N. and S. America.

	Name of the taxa	Place of occurrence
340.	<i>R. madagascariensis</i> (DC.) Hara, J. Jap. Bot. 30: 198. 1955.	India, Pakistan, Bhutan, Trop, Africa, Malagasy.
341.	<i>R. montana</i> (Hook. f. & Thoms.) Small, Fl. SE. United States, ed. 2: 1386. 1913.	India, Pakistan, Myanmar, Indonesia, China, E. Asia.
342.	<i>R. palustris</i> (L.) Besser, Enum. Pl. Volhyn. 27. 1822.	India, Pakistan, Nepal, Bhutan, China, Afghanistan, Kazakhstan, Mongolia, Russia, Tajikistan, Turkmenia, Uzbekistan, Japan, Korea, Europe, N.S. America, Australia.
343.	<i>R. sylvestris</i> (L.) Besser, Enum. Pl. Volhyn. 27. 1822.	India, Pakistan, Russia, Tajikistan, Uzbekistan, Japan, S.W. Asia, Europe.
344.	<i>Schouwia purpurea</i> (Forsskal) Schweinf. in Bull. Herb. Boissier 2: 486. 1896.	India, S. W. Asia, N. E. Trop. Africa.
345.	<i>Sinapis alba</i> L., Sp. Pl. 2: 668. 1753.	India, Pakistan, China, Vietnam, Tajikistan, Turkmenia, Russia, S. W. Asia, Europe, N-Africa.
345.	<i>S. arvensis</i> L., Sp. Pl. 2: 668. 1753.	Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan, Turkmenia, Uzbekistan, N. Africa, S.W. Asia, Europe.
346.	<i>Sisymbrium altissimum</i> L. Sp. Pl.2: 659. 1753.	India, Pakistan, Afghanistan, China, Kazakhstan, Kyrgyzstan, Russia, Turkmenia, Uzbekistan, Japan.
347.	<i>S. brassiciforme</i> C. Meyer in Ledeb., Fl. Alt. 3: 129. 1831.	India, Pakistan, Nepal, Afghanistan, China, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan, Turkmenia, Uzbekistan.
348.	<i>S. heteromallum</i> C. Meyer in Ledeb. Fl. Alt. 3: 132. 1831.	India, Pakistan, Nepal, China, Kazakhstan, Korea, Mongolia, Russia.
349.	<i>S. irio</i> L., Sp. Pl. 659. 1753.	India, Pakistan, Nepal, China, Taiwan, Afghanistan, Tajikistan, Turkmenia, Uzbekistan, W. Asia, Europe.
350.	<i>S. loeslii</i> L., Cent. Pl. 1: 18 no. 49. 1755.	India, Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan, Turkmenia, Uzbekistan, E. Europe, W. Asia.
351.	<i>S. officinale</i> (L.) Scop., Fl. Carn. 2: 26. 1772.	India, Pakistan, China, Kazakhstan, Russia, Japan, Europe, S.W. Asia.
352.	<i>S. orientale</i> L., Cent. Pl. 2: 24. 1756.	India, Pakistan, Russia, Japan, S. W. Asia, Europe.
353.	<i>Smelowskia flavissima</i> (Kar. & Kir.) Kar. & Kir. Bull. Soc. Imp. Naturalistes Moscou 15: 156. 1842.	Pakistan, Kazakhstan, Kyrgyzstan, Tajikistan.
354.	<i>S. calycina</i> (Stephan ex Willd.) C. Meyer in Ledeb. Fl. Alt. 3: 170. 1831.	India, Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan, Mongolia, Russia, N. America.
355.	<i>S. tibetica</i> (Thoms.) Ostenf. in S. Hedin, S. Tibet 6: 76. 1922.	India, Pakistan, Nepal, Bhutan, China, Tajikistan.
356.	<i>Solms-laubachia platycarpa</i> (Hook. f. & Thoms.) Botschantzev, Bot. Mater. Gerb. Bot. Inst. Komarova Akad Nauk SSSR 17:171.1955.	India, Bhutan, China.

Name of the taxa	Place of occurrence
357. <i>Spirorhynchus sabulosus</i> Karelin & Kirilov, Bull. Soc. Imp. Naturalistes Moscou 15:160.1842.	Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenia, Uzbekistan, N. Africa, S.W. Asia.
358. <i>Stixis scandens</i> Lour., Fl. Gochinch. 295.1790.	India, Myanmar, Malaysia, Thailand, Indonesia, Vietnam, Kampuchea, Laos, Philippines, Brunei, Singapore.
359. <i>S. suaveolens</i> (Roxb.) Pierre in Bull. Soc. Linn. Paris. 1:654.1887.	India, Nepal, Bhutan, Bangladesh, Myanmar, China, Thailand.
360. <i>Tausacheria lasiocarpa</i> Fischer ex. DC. Syst. Nat. 2: 563. 1821.	India, Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan, Turkmenia, Uzbekistan, N. Africa, S.W. Asia.
361. <i>Thlaspi arvense</i> L., Sp. Pl. 646. 1753.	India, Pakistan, Nepal, Bhutan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan, Turkmenia, Uzbekistan, Korea, Japan, S. W. Asia, Australia, Europe, N. and S. America.
362. <i>T. cochleariforme</i> Dc. Syst.nat.2:381.1821.	India, Pakistan, China, Kazakhstan, Mongolia, Russia, Tajikistan.
363. <i>T. kotschyianum</i> Boiss. & Hohen in Boiss., Diagn. Ser. 1, 8: 39. 1849.	India, C & S. W. Asia.
364. <i>T. montanum</i> L., Sp. Pl. 647. 1753.	India, S. W. Asia, Europe, America.
365. <i>T.perfoliatum</i> L.,Sp.Pl.646.1753.	Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Turkmenia, Uzbekistan Africa, S.W. Asia.
366. <i>T. septigerum</i> (Bunge) Jafri in Notes R. Bot. Gard. Edinb. 22: 119. 1956.	India, Pakistan, C-Asia.
367. <i>Turritis glabra</i> L., Sp. Pl. 666. 1753.	India, Pakistan, China, Afghanistan, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Tajikistan, Uzbekistan, Korea, Japan, N Africa, S.W. Asia, Australia, Europe.

Endemism of Brassicaceae in India

Analysis on species distribution of Brassicaceae revealed that 29 taxa are strictly confined and endemic to India (Tab. 2). Of the ca.29 taxa, 9 are confined in Northwestern Himalayas (P-1), 1 taxon is restricted in Western Himalayas (P-2), 2 are confined in Central Himalayas (P-3), 2 are restricted in Southern-Western Ghat (P-14), 3 taxa are confined in Central and Southern-Western Ghat (P-13, P-14), 1 each is spread-over entire western Ghat (P-12, P-13, P-14) and in Desert region-SemiArid Zone (P-6, P-7), respectively. Others are spatially distributed in Peninsular India. From the distributional pattern of 29 endemic taxa in India; it may be concluded that Northwestern Himalayas (P-1) is "endemic resort" for Brassicaceae in India, though concentration of endemic taxa in Western Ghat (P-14) regions is also noticeable. The species composition and representation of endemic taxa of Brassicaceae in India is presented in Tab. 3.

Tab. 2. Checklist of endemic taxa of Brassicaceae in India.

Name of taxa	Phytogeographic zones of India																	
	P-1	P-2	P-3	P-4	P-5	P-6	P-7	P-8	P-9	P-10	P-11	P-12	P-13	P-14	P-15	P-16	P-17	P-18
<i>Aphragmus ladakiana</i> Al-Shehbaz	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Arabis kashmiriaca</i> Naqshi, Singh & Koul.	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Brassica napus</i> L. ssp. <i>napobrassica</i> (L.) Jafri.	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Capparis cinerea</i> Jacobs	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Capparis cleghornii</i> Dunn.	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-
<i>Capparis diversifolia</i> Wight & Arn.	-	-	-	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-
<i>Capparis fusifera</i> Dunn.	-	-	-	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-
<i>Capparis grandiflora</i> Hook.f.&Thoms.	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-
<i>Capparis nilgiriensis</i> , Subbarao, Kumari & Chandras.	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
<i>Capparis pachyphylla</i> Jacobs	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Capparis rheedei</i> DC.	-	-	-	-	-	-	-	-	-	-	-	+	+	+	-	-	-	-
<i>Capparis shivaroyensis</i> Sund-Ragh.	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-
<i>Christolea scaposa</i> Jafri	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Cleome felina</i> L.f.	-	-	-	-	-	-	-	-	+	-	+	+	+	+	-	-	-	-
<i>Cleome gynandra</i> var. <i>nana</i> (Blatter & Hallberg) Bhandari	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
<i>Cleome kollimalayana</i> M. B. Viswan.	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
<i>Cleome simplicifolia</i> (Cambess) Hook.f.& Thoms.	-	-	-	-	-	+	+	+	+	-	+	+	-	-	-	-	-	-
<i>Cleome viscosa</i> var. <i>nagarjunakondensis</i> Sund-Ragh.	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
<i>Cochlearia cochlearioides</i> (Roth) Santapau & Maleshw.	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
<i>Draba aubriedoides</i> Jafri.	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Draba himachalensis</i> Al-Shehbaz	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Draba ludlowiana</i> Jafri	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Draba stenobotrys</i> Gilg. & O. Schulz.	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Draba tenerrima</i> O. Schulz	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Name of taxa	Phytogeographic zones of India																	
	P-1	P-2	P-3	P-4	P-5	P-6	P-7	P-8	P-9	P-10	P-11	P-12	P-13	P-14	P-15	P-16	P-17	P-18
<i>Erysimum cachemicum</i> O. Schulz.	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Farsetia jacquemontii</i> Hook.f. & Thoms.ssp. <i>macrantha</i> Blatter & Hallberg.	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
<i>Guillenia duthiei</i> (O.Schulz) Bennet.	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Maerua apetala</i> (Roth) Jacobs.	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-
<i>Pegaeophyton watsonii</i> Al-Shehbaz	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(+) = Presence, (-) = Absence

Phytocorial Divisions: North-West Himalayas (P – 1), Western Himalayas (P – 2), Central Himalayas (P – 3), Eastern Himalayas (P – 4), North East India (P – 5), Indian Desert (P - 6), Semi Arid Region (P – 7), Gangetic plain (P - 8), Central Deccan plateau (P - 9), Northern Eastern Ghat (P-10), Southern Eastern Ghat (P-11), North Western Ghat (P –12), Central Western Ghat (P – 13), Southern Western Ghat (P – 14), Coromandel Coast (P-15), Malabar Coast (P - 16), Andaman & Nicobar Islands (P – 17), Laccadive & Minicoy Islands (P-18). (KUNDU,2001).

Tab. 3. Species composition and representation of endemic taxa of Brassicaceae in India

Genera	Total taxa in India	Endemics		Total endemic taxa	%
		Species	Subspecies		
<i>Aphragmus</i>	5	1	-	1	20
<i>Arabis</i>	12	1	-	1	8.33
<i>Brassica</i>	11	0	1	1	9.09
<i>Capparis</i>	34	10	-	10	29.4
<i>Christolea</i>	3	1	0	1	33.3
<i>Cleome</i>	18	2	2	4	22.2
<i>Cochlearia</i>	1	1	0	1	100
<i>Draba</i>	37	5	0	5	13.5
<i>Erysimum</i>	11	1	0	1	9.09
<i>Farsetia</i>	5	0	1	1	20
<i>Guillenia</i>	4	1	0	1	25
<i>Maerua</i>	2	1	-	1	50
<i>Pegaeophyton</i>	5	1	0	1	20

Among ca.9 genera, *Capparis* is represented with highest number of endemic taxa: 10, followed by *Draba* is represented with 5 endemic taxa, followed by *Cleome* with 4 endemic taxa, followed by rest of the genera one taxon each. The percentage of endemism is tabulated in Tab. 3, which shows highest degree of endemism is shown by *Cochlearia*: 100%, followed by *Maerua*: 50%, *Christolea*: 33.3%, *Capparis*: 29.4%, *Guillenia*: 25% etc. From, ecological and phenological data of endemic taxa of Brassicaceae in India, it is found that : *Maerua* flowers between Jan-Apr., *Capparis* flowers during Feb-June, *Christolea*, *Brassica*, *Draba*, *Erysimum*, *Cochlearia*, *Guillenia*, flowers from May-Sept., *Cleome* flowers between June-Oct. and *Farsetia* flowers during August-December. Most of the endemic taxa occur in the high altitudes from 3000-5000 m. range in Himalayan regions and 500-1500m. range in Western Ghat regions.

Endemism of Brassicaceae in Indian subcontinent

In the Broader aspect, extent of endemism of Brassicaceae in Indian subcontinent is tabulated in Tab. 4. From Tab. 4, it has been found that – there are about 52 taxa (under 82 genera), restricted in distribution in Indian subcontinent. Out of ca.52 taxa ca.11 taxa are restricted in N.W. Himalayan region (Indo-Pakistan region), ca.2 taxa are extended over Indo-Pakistan-Nepal (N.W. and W. Himalayan) region; ca.8 taxa are confined in Western Himalayan region, particularly Indo-Nepal region; ca.8 taxa restricted in distribution in Indo-Nepal-Bhutan region (i.e. Western and Central Himalayas); ca.8 taxa are confined in Indo-Bhutan region (i.e. Central Himalayan region); ca.2 taxa are extended over Indo-Pak-Nepal-Bhutan region(i.e. N.W.-W.-Central Himalayas); 3 taxa are restricted in Indo-Myanmar (the gateway of S.E.Asian region) region and ca.8 taxa are confined in S.E. Asian region (Indo-Sri-Lanka region). These

52 taxa, restricted in Indian subcontinent, should be regarded as “Broad Range Endemics” or B.R.E.s (Kundu, 2005); on the contrary, ca.29 taxa which are strictly confined in India, should be regard as “Narrow Range Endemics” or N.R.E.s (Kundu, 2005). Comprising N.R.E.s and B.R.E.s altogether 81 taxa are Endemic in Indian subcontinent (E.I.S.). Apparently, it is very difficult to recognize any particular part of the Himalayan region as endemic resort. However, the distributional pattern of E.I.S. clearly indicates N. W. and W. Himalayan regions are ideal resort for endemic Brassicaceae in Indian subcontinent. The confinement of endemic taxa of Brassicaceae on physically alike “Island habitats” of Himalayan mountain ranges and Western Ghat mountain ranges make these taxa to be considered as “Island endemics” (Gentry,1986). Island endemism is a transitional form of endemism as it comprises of “relic” components as well “neo” endemics (for ecological barriers or new speciation); so pattern of endemism could be predicted after studying the fossil histories of this family. The distributional pattern of endemism of Brassicaceae in Indian subcontinent is presented in Fig. 1. The trend and extent of endemism of Brassicaceae in Indian subcontinent (whether in the mode of further dispersal or confinement) may be studied through the ratio of N.R.E. : B.R.E., which is presented in Tab. 5.

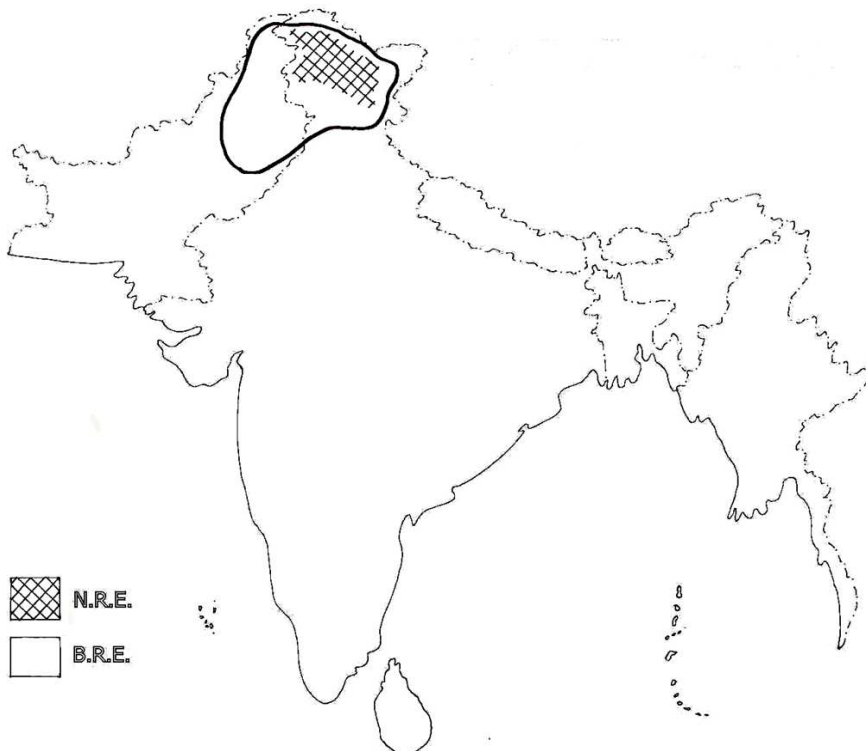


Fig. 1. An outline of endemism of Brassicaceae in Indian subcontinent
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Tab. 4. Checklist of endemic taxa of Brassicaceae in Indian subcontinent

Name of Taxa	India	Pakistan	Nepal	Bhutan	Bangladesh	Myanmar	Sri Lanka	Alt. (m)	Fl. Time
<i>Aphragmus nepalensis</i> (H.Hara) Al-Shehbaz	-	-	+	-	-	-	-	4800	#
<i>Arabidopsis lasiocarpa</i> O. Schulz	+	+	+	+	-	-	-	2400-2800	Apr.-June
<i>Arabidopsis taraxafolia</i> (J. Anderson) Jafri	+	+	-	-	-	-	-	#	Apr.-June
<i>Arabis pangiensis</i> G. Watt.	+	+	+	-	-	-	-	#	June-July
<i>Arabis saxicola</i> Edgew. var. <i>elatior</i> (O. Schulz) Jafri	+	+	-	-	-	-	-	#	May-July
<i>Arabis tenuirostris</i> O. Schulz.	+	+	-	-	-	-	-	#	June-July
<i>Arabis venusta</i> Hara	-	-	-	+	-	-	-	#	#
<i>Arcyosperma primulifolium</i> (Thoms.) O. Schulz	+	+	+	+	-	-	-	3100-4500	May-July
<i>Brassica napus</i> L. ssp. <i>napus</i> var. <i>quadrivalvis</i> (Hook. f. & Thoms.) O. Schulz.	+	-	+	-	-	-	-	3900-4900	May-Aug.
<i>Cadaba farinosa</i> Forssk. ssp. <i>rarifolia</i> Jafri	-	+	-	-	-	-	-	#	Feb.
<i>Cadaba trifoliata</i> (Roxb.) Wight & Arn.	+	-	-	-	-	-	+	#	Oct-Nov.
<i>Capparis brevispina</i> DC.	+	-	-	-	-	-	+	#	Feb, Apr, Oct, Nov.
<i>Capparis cataphyllosa</i> Jacobs.	-	-	-	-	-	+	-	550	#
<i>Capparis divaricata</i> Lam.	+	-	-	-	-	-	+	300-600	March, April
<i>Capparis moonii</i> Wight	+	-	-	-	-	-	+	1300	Oct, Dec, Feb, Apr
<i>Capparis olacifolia</i> Hook.f. & Thoms.	+	-	+	+	+	+	-	300 -1300	Feb, June.
<i>Capparis rotundifolia</i> Rottler	+	-	-	-	-	-	+	#	Oct, Nov, Jan, May
<i>Capparis roxburghii</i> DC.	+	-	-	-	-	-	+	600 m	Mar, May, July, Aug.
<i>Capparis rufidula</i> Jacobs.	-	-	-	-	-	-	+	#	#
<i>Capparis sikkimensis</i> Kurz ssp. <i>sikkimensis</i>	+	-	-	-	-	+	-	1200	Apr.-May.
<i>Capparis spinosa</i> L. var. <i>himalayensis</i> (Jafri) Jacobs.	+	+	+	-	-	-	-	1500-2000	May, Aug.
<i>Cardamine elegandula</i> Hook. f. & Thoms.	+	-	+	+	-	-	-	1000-3000	Apr.-May
<i>Cardamine gouldii</i> Al-Shehbaz	-	-	-	+	-	-	-	#	#
<i>Cardamine trichocarpa</i> Hochst. ex. A. Rich	+	-	-	-	-	-	+	#	July-Sept.

	<i>Christolea parkeri</i> (O. Schutz) Jafri	+	-	+	-	-	-	-	#	June-July
	<i>Cleome aspera</i> Koenig ex DC.	+	-	-	-	-	-	+	400	Through-out the year
	<i>Cleome heratensis</i> Bunge & Bien.ex Boiss.ssp. <i>pakistanica</i> Jafri	-	+	-	-	-	-	-	#	Oct.
	<i>Cleome rupicola</i> Vicary.	-	+	-	-	-	-	-	#	#
	<i>Crateva adansonii</i> DC. ssp. <i>odora</i> (Buch.-Ham.) Jacobs.	+	+	-	-	-	+	+	750	Feb, Apr.
	<i>Draba bagmatiensis</i> Al-Shehbaz	+	-	+	-	-	-	-	4400	#
	<i>Draba bhutanica</i> Hara	-	-	-	+	-	-	-	#	#
	<i>Draba cholaensis</i> W. Smith	+	-	+	+	-	-	-	4300	July-Aug.
	<i>Draba falconeri</i> O. Schulz	+	+	-	-	-	-	-	#	July-Sept.
	<i>Draba hicksii</i> A.J.C. Grierson	-	-	-	+	-	-	-	#	#
	<i>Draba macbeathiana</i> Al-Shehbaz	-	-	+	-	-	-	-	5000	#
	<i>Draba oariocarpa</i> O. Schulz	+	-	-	+	-	-	-	4500-4700	June-Aug.
	<i>Draba pakistanica</i> Jafri	-	+	-	-	-	-	-	#	#
87	<i>Draba radicans</i> Royle	+	-	+	-	-	-	-	#	July-Aug.
	<i>Draba sherriffii</i> A.J.C. Grierson	-	-	-	+	-	-	-	#	#
	<i>Draba sikkimensis</i> (Hook. f. & Thoms.) Pohle	+	-	+	+	-	-	-	#	Aug.-Sept.
	<i>Draba williamsii</i> Hara	-	-	+	+	-	-	-	#	#
	<i>Erysimum dolponese</i> Hara	-	-	+	-	-	-	-	#	#
	<i>Erysimum longisiliquum</i> Hook. f. & Thoms.	+	-	-	+	-	-	-	3050-3950	May-June
	<i>Erysimum pachycarpum</i> Hook. f. & Thoms.	+	-	+	+	-	-	-	3000-4000	June-Aug.
	<i>Farsetia hamiltonii</i> Royle	+	+	-	-	-	-	-	#	Feb.-Nov.
	<i>Guillenia axillare</i> (Hook. f. & Thoms.) Bennet	+	-	+	+	-	-	-	2500-5000	Apr.-Aug.
	<i>Guillenia flaccidum</i> (O. Schulz) Beunet.	+	+	-	-	-	-	-	#	Apr.-June
	<i>Noccaea cochlearioides</i> (Hook. f. & Thoms.) Al-Shehbaz,	+	-	+	+	-	-	-	4200-4600	June-Aug.
	<i>Noccaea nepalensis</i> Al-Shehbaz,	-	-	+	-	-	-	-	3200	#
	<i>Parrya chitralensis</i> Jafri	+	+	-	-	-	-	-	#	#
	<i>Pegaeophyton nepalense</i> Al-Shehbaz et al.	+	-	+	+	-	-	-	#	June-July
	<i>Pegaeophyton sulphureum</i> Al-Shehbaz	-	-	-	+	-	-	-	#	#
	<i>Stixis scandens</i> Lour.	+	-	-	-	-	+	-	1650 m	Apr – Dec.

(+) Presence, (-) Absence, # Data is not available

Tab. 5. The ratio of N.R.E. : B.R.E. of Brassicaceae in Indian subcontinent

Genera	Narrow range endemic	Broad range endemic	Total
<i>Aphragmus</i>	1	1	2
<i>Arabidopsis</i>	-	2	2
<i>Arabis</i>	1	4	5
<i>Arcyosperma</i>	-	1	1
<i>Brassica</i>	1	1	2
<i>Cadaba</i>	-	2	2
<i>Capparis</i>	9	10	19
<i>Cardamine</i>	-	3	3
<i>Christolea</i>	1	1	2
<i>Cleome</i>	5	3	8
<i>Cochlearia</i>	1	-	1
<i>Crateva</i>	-	1	1
<i>Draba</i>	5	12	17
<i>Erysimum</i>	1	3	4
<i>Farsetia</i>	1	1	2
<i>Guillenia</i>	1	2	3
<i>Maerua</i>	1	-	1
<i>Noccaea</i>	-	2	2
<i>Parrya</i>	-	1	1
<i>Pegaephyton</i>	1	2	3
<i>Stixis</i>	-	1	1
	29	52	81

It has been found that the total number of taxa belonging to Brassicaceae on the Indian subcontinent is 367; whereas the total number of taxa in India is 298 (81.19%). The number of endemic taxa of Brassicaceae in Indian subcontinent is not so impressive: 81(22.07%). The number of narrow range endemics is 29 (7.90%) and the number of broad range endemics is 52 (14.16%). From the viewpoint of species dynamics, the percentage of endemism of Brassicaceae on Indian subcontinent in 1939-1940 (CHATTERJEE, 1939) was 55.17%, whereas in 2002-2004, it has become 22.07%. The negative index of phytoendemism in the same matrix in a time interval could be defined as either decreasing number of endemic taxa, invasion of pan-endemic taxa or endemic taxa in the mode of further expansion (i.e. shifting of mode of expansion from 'endemism" to 'pan-endemism") or combination of all factors.

Threatened taxa belonging to the family Brassicaceae in India

Species of Brassicaceae have huge economic potential as those are cultivated since inception of civilization. From the viewpoint of fiscal evaluation of natural resources, the increasing rate of phytoendemism is an important index for national economy of any developing state at the same time decreasing rate of endemism due to widespread dispersal of endemic elements (i.e. in the mode of pan endemism) and shifting of status from wild germplasm to cultivated crop is good for global community. Either in national level or global level (either in the

mode of endemism or pan-endemism) the germplasm has immense fiscal potential; so shrinkage of a particular germplasm due to habitat destruction and anthropogenic interference is a key negative gradient from conservation as well as economic viewpoint. If the potential resource is underexploited the loss is irreversible as the diminishing resource disappears forever with its unknown potential (e.g. unknown whether the depleting plant contains Glucosinolates or not) without further contributing to human being. The endemics of Brassicaceae and locally confined pan endemics with isolated small patches with less than minimal viable population size are the outfall of habitat disturbance and anthropogenic interference (e.g. ethno botanical utilization, conversion of wild habitat to cultivation field, urbanization etc.). It has been estimated that there are fourteen taxa of Brassicaceae (Tab. 6) facing survival threat; out of fourteen taxa, five taxa are belonging to the genus *Draba*. Apparently members of Brassicaceae are “weed like plants” so random weed clearings and rapid invasion of “exotic weeds” by these “weed like plants” make the population vulnerable to survive and makes it biologically incompatible to survive for a long period. These ca.28 taxa should be conserved properly. Besides, these 28 taxa, wild germplasm of Brassicaceae is enriched with ca.29 economically potential taxa which are either cultivated or exploited and consumed after collecting from natural habitat (e.g. vegetables, cattle feeds, condiments, oil seeds etc.) and there are ca.8 (e.g. *Alyssum* sp., *Capparis* sp.) horticultural potential taxa. Naturally, wild-germplasm of Brassicaceae in Indian subcontinent deserves conservation.

Tab. 6. Plants facing survival threat belonging to the family Brassicaceae in India

Name of taxa	Frequency Index	Biotic Pressure	Parts Used	Flowering Season
<i>Arabis tenuirostris</i> O. Schulz.	I.	I. S. P.	#	June-July
<i>Caparis cleghornii</i> Dunn.	I.	#	#	Feb - Apr
<i>Capparis rheedei</i> DC.	R.	I.S. P.	#	Feb – Jan
<i>Capparis cinerea</i> Jacobs.	Ex/E.	I. S. P.	#	May.
<i>Capparis diversifolia</i> Wight & Arn.	V.	I.S. P.	#	Sept.-Dec. Apr - July.
<i>Capparis flavicans</i> Kurz.	I.	Ec. (Condiments)	L.	Jan - Mar.
<i>Capparis fusifera</i> Dunn.	R.	#	#	Oct –Dec.
<i>Capparis mooni</i> Weight	I.	#	#	Feb – Apr.
<i>Capparis nilgiriensis</i> Subbarao, Kumari & Chandras.	I.	Hort./ I. S. P.	#	Mar – Apr
<i>Capparis pachypaylla</i> Jacobs	V.	I. S. P.	#	#
<i>Capparis rotundifolia</i> Rottler.	I.	#	#	Oct – Nov. Jan – May.
<i>Capparis roxburghii</i> DC.	I.	I.S. P.	#	Mar – May July – Aug.
<i>Capparis shevaroyensis</i> Sund. Ragh.	I.	I.S. P.	#	March

Name of taxa	Frequency Index	Biotic Pressure	Parts Used	Flowering Season
<i>Cardamine loxostemonoides</i> O. Schulz.	I.	Hort.	Fl	June-July
<i>Christohea stewartii</i> (T. Anderson) Jafri.	I.	I.S. P.	#	July-Aug.
<i>Cleome gynandra</i> var. <i>nana</i> (Blatter & Hallberg) Bhandari	I.	#	#	Nov.
<i>Cleome rutidosperma</i> DC. var. <i>burmanii</i> (Wt. & Arn). M. O. Siddiqui & S. N. Dixit.	I.	I. S. P.	#	May - June
<i>Draba amoena</i> O. Schlz.	I.	#	#	July-Sept.
<i>Draba aubrietooides</i> Jafri	I.	I.S.P.	#	June-July
<i>Draba dasyastra</i> O. Schulz.	I.	I.S. P.	#	July-Aug.
<i>Draba ludlowiana</i> Jafri	I.	I. S. P./ Ec.	Leaf	June-Aug.
<i>Draba tenerrima</i> O. Schulz	I.	I.S. P.	#	June-July
<i>Erysimum thomsonii</i> Hook. f. & Thoms.	I.	I. S. P.	#	#
<i>Farsetia jacquemontii</i> Hook.f. & Thoms. ssp. <i>macrantha</i> (Blatter & Hallberg) Bhandari.	I.	I. S. P./ Ec.	Seed	Aug.-Dec.
<i>Megacarpaea bifida</i> Benth.	E.	#	#	#
<i>Megacarpaea polyandra</i> Benth	I.	#	#	May-Aug.
<i>Parrya chitralensis</i> Jafri	I.	I.S. P.	#	#
<i>Thlaspi andersonii</i> (Hook. f. & Thoms.) O. Schulz.	I.	I.S. P./ Hort	Fl	March-July

#	:	Data is not available	I	:	Indeterminate
I. S. P.	:	Isolated Small Population	E	:	Endangered
Ec	:	Economic	Hort.	:	Horticultural (Ornamental)
Fl	:	Flower	V	:	Vulnerable
R	:	Rare	Ex	:	Extinct

Possible fossil evidence in relation to endemics of Brassicaceae in India

It is interesting to focus on phylogenetic relationship by studying the fossil remains of the ancestors of the modern taxa, which are referable to the endemic taxa of the family Brassicaceae now-a-days. But absence of fossilized form of a plant or its part raise question about its prehistoric ancestry and helps to predict about that group of plants as recently emerged group of plants on plant. However, lack of leaf impression or fossil woods of Brassicaceae from India has helped not to consider the endemic taxa of this family as "Palaeoendemics" (ENGLER, 1882) or "Holoendemics" (RICHARDSON, 1978) either. But collection of fossil pollens of Cruciferae from Haigam lake, Joshimaidan (VISHNUMITRE and SHARMA, 1966; SHARMA and VISHNUMITRE, 1969) of Kashmir and from

Otacamund (MENON, 1968), Tamil Nadu of Quaternary era (Postglacial), indicates its presence during this period and also indicates its affinity towards high altitudinal temperate region. The fossil pollen of *Capparis* sp. (CHANDA and MUKHERJEE, 1969) of late Quaternary from Calcutta, West Bengal has shown enough resemblance to the living taxa of the family Brassicaceae of now days. Though there is no endemic species reported from Gangetic plains so far but two endemic taxa of *Capparis* (*Capparis fusifera* and *C. diversifolia*) are reported from Deccan plateau, adjacent to Gangetic plain. Though a relation between fossil remnants and endemic living taxa of Brassicaceae of India, has yet to be established but recent phylogenetic analysis on Brassicaceae (BAILEY et al., 2006; O'KANE and AL-SHEHBAZ, 2003), speciation and dispersal pattern incites to consider the endemic taxa belonging to this category as "Neoendemics" (HERZOG, 1926).

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