

OBSERVATIONS ON PHYTOGEOGRAPHY AND ENDEMISM IN *CLEMATIS* DILL. EX LINN. (RANUNCULACEAE), WITH SPECIAL REFERENCE TO INDIAN TAXA

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ABSTRACT

Clematis Dill. ex Linn (Ranunculaceae) with 300-450 species, is essentially temperate but also found in elevated parts of the tropics. It is regarded to have originated around the eastern end of the Himalayas, and thence migrated to other parts of the world. The largest concentration is in South China (with 76% endemism). The distribution pattern in the world indicates a high degree of endemism in areas that are isolated or are distantly situated from the region of largest concentration. Thus in North America it is 91%, West Indies, 85%, New Zealand and neighbouring islands, 88%, Malagasy, 90%, West Africa, 75%, and so on. In Indian subcontinent the endemism is only 30%, the low figure is explained because of its contiguity and proximity with South China.

In India proper occur 33 species (42 taxa including subspp and vars.), of these 5 are endemic. Several Indian species are closely related to taxa occurring in neighbouring countries which when studied together might need merging or reduction in taxonomic status for want of clear-cut discontinuities. The distribution of interesting Indian species has been mapped

INTRODUCTION

Clematis Dill. ex Linn. (Ranunculaceae), according to Airy Shaw (1973), is cosmopolitan, though chiefly occurring in temperate regions. According to Good (1974), it is one of the "...large genera, which although essentially temperate in character, have nevertheless a notable distribution through the more elevated parts of the tropics," (the other examples, in Ranunculaceae, are *Anemone* Linn. and *Ranunculus* Linn.).

The genus, according to Airy Shaw (1973), comprises 250 species, whereas Tamura (1967) estimated 300 species. A conspectus prepared by Kaul (personal notes), based largely on collections deposited in the herbarium of the Royal Botanical Gardens, Kew, listed about 450 species, indicating distribution pattern of each as

per phytogeographic division of the world adopted at Kew Herbarium.

The reckoning of species in *Clematis* has been problematic. Kuntze (1885) accounted for 72 species, of which two belonged to *Naravelia* DC. and one to *Clematopsis* Bojer ex Hutchinson. But he included many as infraspecific taxa, particularly as subspecies, which were either earlier recognised as distinct species, or are nowadays again accepted so. For instance, *C. gouriana* Roxb. ex DC. and *C. grata* Wall. were reduced as subspecies of *C. vitalba* Linn.; *C. asplenifolia* Schrenk and *C. flammula* Linn. as subspecies of *C. recta* Linn., *C. munroiana* Wight and *C. andersonii* Cike. ex Ktze. as subspecies of *C. smilacifolia* Wall.; *C. graveolens* Lindley and *C. wightiana* Wall. as subspecies of *C. orientalis* Linn.; *C. connata* DC. and *C.*

grewiiflora DC. as subspecies of *C. buchananiana* DC. and *C. tortuosa* Wall. merged into the same; *C. sinchungica* Ktze. [now named *C. tongluensis* (Bruhl) Tamura] as subspecies of *C. montana* Buch.-Ham. ex DC.; *C. napaulensis* DC. as subspecies of *C. cirrhosa* Linn.; *C. puberula* Hk. f. et Thoms. as subspecies of *C. apiifolia* DC.; *C. meyeniana* Walp. as subspecies of *C. hedysarifolia* DC.; and *C. barbellata* Edgew., merged in *C. japonica* Thunb. The total number of specific and infraspecific taxa in Kuntze's monograph is about 450. This incidentally, reflects the importance of taking note of subspecific taxa also, while reckoning the total number of species in a genus like *Clematis*.

There being no recent world monograph of *Clematis* available and critical examination of each of the Kew specimens being by no means a practical possibility, we may for convenience, follow for the time being the Kaul's conspectus in presenting a tentative picture of the world distribution and endemism in the genus. The final word on this issue will have to necessarily await a taxonomic revision of the world *Clematis*.

World distribution of *Clematis* and endemism

The figure 1 and Table 1, based on Kaul's conspectus, provide an idea of the distribution of the *Clematis* species in 18 phytogeographical regions of the world, as adopted at Kew Herbarium. The encircled figures indicate the total number of species occurring in a region/subregion; the table gives, in addition, the total number and percentage of species restricted to a particular region, or in other words endemic to the area. A perusal of these shows that the greatest concentration of *Clematis* is in Sino-Japanese region where occur about 200 species; of these about 150 (76%) are endemic. Incidentally, the Kaul's conspectus reveals that the largest concentra-

tion of *Clematis* is in South China. The next in order of total number of species are the Indian subcontinent with about 53 species, of which 16(30%) are endemic; and the continent of North America with about 53 species, of which 48(91%) are endemic.

Chatterjee (1939)—also quoted by Maheshwari *et al.*, 1965—estimated that *Clematis* in Indian subcontinent is represented by 76% of endemicelements. The present study has brought this figure down to 30%. The species endemic to Indian subcontinent are presented in Table 2 (5, marked with an asterisk are endemic to India proper). Chatterjee (1939) while discussing endemism in Indian Ranunculaceae observed that zygomorphic genera show a greater tendency to evolution of new species (or in other words show greater endemism) while the actinomorphic genera might be regarded as more stable (showing low endemism). *Clematis* being an actinomorphic genus, he "confessed that it is difficult to see why *Clematis* ... should show so high a percentage of endemics." The low figure of endemics as discovered in the present study vindicates Chatterjee's contentions about actinomorphic genera.

The extent of endemism in Indian subcontinent (30%) is quite low when compared with that of the North America (91%), although the total number of species occurring in each of the two regions are equal. This is easily understandable in view of the contiguity of the Indian subcontinent with the other regions of the continent of Eurasia; on the other hand, North America is geographically isolated and distantly situated vis-a-vis the zone of greatest concentration of *Clematis*.

The North and Central Asia & Tibet with about 30 species comes next. Here hardly 9 species (32%) are recorded to be endemic and this zone is again contiguous with that of the greatest concentration.

The percentage of endemism is very high in New Zealand and neighbouring islands (88%) as out of 17 species 15 are considered endemic; in the islands of the West Indies (85%) where out of 13, 11 are endemic; and in Malagasy (Madagascar) and other islands (90%), as out of 21, 19 are endemic. The criterion of geographical isolation is a pointing factor in all the three cases.

The percentage of endemism is high in West Africa and Southern South America (in both 75%); however, the total number of species recorded there is quite low (4 in West Africa and 8 in Southern South America).

Indonesian Islands, Central America and Western South America have a fair representation of *Clematis* where the number is 23, 18, and 19 respectively. Among these the percentage of endemism is highest in Central America (67%), followed successively by Western South America (63%) and Indonesia (57%). The endemism in Central Tropical Africa (55%), Ethiopia, Somaliland and Sudan (57%), Kenya and Tanganyika (69%), South Africa (63%) and Eastern South America (62%) is fairly high but in the Orient and North Africa it is quite low (25%). Europe and Orient have almost an equal number of species (16 each) but the percentage of endemism is relatively much higher in Europe (50%).

It may thus be inferred that like *Naravelia* (Kaul, 1968), the maximum development of *Clematis* is observed on the South East Asian Continental Shield. It seems to have originated and evolved in South China, migrating far and wide, being well adapted to wind dispersal, as most of the species possess achenes with elongated feathery styles. This region, in view of some phylogenists, forms a part of the land where angiosperms originated and evolved. Takhtajan (1969) says that the angiosperms originated, and for a rather long period evolved under montane tropical conditions.

He has considered S.E. Asia around the eastern end of the Himalayas to be the primary centre of origin for the temperate flora of the northern hemisphere. His reasoning is based on the fact that around the eastern end of the Himalayas, the huge and complicated systems of mountains has contributed excellent conditions for differentiation and migration of mountain plants. The early adaptive evolution and differentiation are believed to have been facilitated by the multitude of ecological niches co-existing in a mountain habitat and by their distribution in small and partly isolated populations, leading to genetic drift and adaptive radiation.

The general pattern of the distribution of *Clematis* indicates that farther the area of its distribution from that of the region of greatest concentration, (*i.e.*, South China) the higher the percentage of endemism. The highest specialisation in sex expression is also reflected in a similar pattern as dioecious habit or polygamous flowers are seen in a number of *Clematis* taxa occurring in North and South America, West Indies, Malagasy (Madagascar), Australia, Tasmania, New Zealand and neighbouring islands.

Indian *Clematis*: general taxonomic considerations and the world distribution

As a result of detailed study of the genus (Kapoor, 1962, 1965, 1966, 1969, 1983), 33 species (42 taxa when subspecies and varieties included), are recognised to be occurring in India proper; of these only 5 are endemic (15%).

Clematis, as reflected by its taxonomic account, is a highly variable group in India. A study of some of the specimens of same taxa occurring outside India as well as their close relatives occurring in neighbouring countries reveals that several of them could be linked up by a series of specimens so close that there are possibly no clear-cut discontinuities. There are others which though very close—as if woven together

in a common fabric of morphological characteristics—yet composed of populations that are seemingly distinct. There is no single character by which a taxon may be distinguished from all the rest. It is only a combination of characters that afford recognition of seemingly distinct entities, particularly among those taxa that are relatively closer together and are at times considered to represent a complex. Even in such cases also, one or more characters of a particular character-combination-set may find expression in another related taxon. This explains Kuntze's recognition of several taxa, that were originally described as species, to be only as subspecies under a broad species.

Such complicated complexes need to be thoroughly investigated. It is obvious that for a more meaningful appraisal the taxa need to be studied complex-wise or a wider area including the neighbouring regions may be taken up for the study, rather than an artificial area like political India. The biosystematics of some of such complexes may provide a better taxonomic arrangement, whereby the constituent units may then be accepted with certainty or at least with a better affirmation to be distinct species, or some would be relegated to infraspecific level again, or even merged into one.

Kapoor (1983) pointed out that *C. acuminata* DC. can be connected on the one hand with South-East Asian, *C. lechnaultiana* DC. (Kuntze, 1885, united the two), and on the other, with closely related taxa occurring in South China. The controversy with regard to the taxonomic status of the DeCandollean taxa, *C. loasifolia*, *C. grewiiflora* and *C. buchana-niana* still remains unresolved, all the three being very closely related, and intermediate forms, when accounted for, exhibit a gradual merging. *C. barbellata* Edgew., at one time placed under *C. japonica* Thunb. has several intermediate forms to relate

them closely. *C. montana* complex has been split up following newer concepts, yet probably it needs to be thoroughly examined for all its counterparts as distributed throughout Western and Eastern Himalayas extending eastwards to China and Japan. *C. orientalis* Linn., being a highly variable species, is considered to be a complex of circumpolar distribution (Fig. 2). *C. gouriana* Roxb. ex DC. and *C. grata* Wall. have been considered by Kuntze (1885) to be subspecies of *C. vitalba* Linn., which is distributed in China and as far west as Europe, through North and Central Asia and all through Orient and North Africa (Fig. 3). Another very closely related taxon is *C. kerriana* Drumm. et Craib distributed in China and Indo-China. All these seem to be originating from the same Chinese stock and are indeed very close, and occasionally one is confronted with intermediate specimens which are difficult to be placed. And if related taxa of South-East Asia as well as those occurring in Europe are studied, the distinction between them may appear more and more tenuous.

This clearly illustrates, as stated above, that there are, in fact, populations which on the one hand appear sufficiently stabilised to be rated as distinct entities, while still appearing to be knitted together by a common fabric. Incidentally it is these which have been subjected to frequent merging or splitting in the past.

The Table 3 shows the distribution pattern of Indian species of *Clematis* in the various geographical divisions/subdivisions (based on Kaul, personal notes). It also includes some taxa that are not Indian, but have bearing on taxonomic or phyto-geographical aspects of the Indian species.

A perusal of the table shows that as many as 19 species are common to India and China. Some of the species occurring only in India, or India and China both, are widely distributed in Burma, Malaya, South

East Asia and neighbouring islands, Thailand to Vietnam, Tibet and North Central Asia, the Orient, Africa (Ethiopia, Somaliland & Sudan; Kenya & Tanganyika; Angola, Rhodesia & Mozambique) and Europe.

Among the species occurring in India, *C. gouriana* Roxb. ex DC., *C. grata* Wall., *C. orientalis* Linn., *C. alpina* (Linn.) Mill. and *C. smilacifolia* Wall. seem to have the widest distribution.

C. orientalis Linn. is distributed from China westwards to Himalayas and in the Orient, and towards north-west in North Central Asia and Tibet, and Europe. This again seems to be a Chinese Taxon. The closely related *C. graveolens* Lindl. has been recorded from India and Orient but not from China, whereas *C. vernayi* C.E.C. Fischer occurs in China and in Tibet. *C. alpina* (Linn.) Mill. which too is quite close in appearance grows in China extending south-westwards to India and westwards and north-westwards in North Central Asia, Tibet and Europe (Fig. 2).

C. wightiana would have been endemic to India if it had not been recorded from Kenya & Tanganyika (Fig. 2). If this record outside India is correct, then it is a case of discontinuous distribution representing remnants of the geologic times subservient to continental drift.

C. gouriana Roxb. ex DC. has been recorded from, besides India, as far east and south-east as Indonesia, New Guinea and Philippine Islands. *C. grata* Wall. has been recorded from Orient and Africa (Ethiopia, Somaliland & Sudan; Kenya & Tanganyika and Angola, Rhodesia & Mozambique) in the west of India and China in the north-east (Fig. 3).

C. smilacifolia Wall. has been recorded from China, southwest to India and towards south and south-east in Malaya Peninsula, Indo-China, Indonesia, Phillipine Islands and New Guinea. A closely related species, *C. fulvicoma* Rehd. et Wils. has been collected

in China, north-east region of India and Indo-China. Another related species, *C. loureiriana* DC. occurs in China, north-east fringes of the Indian subcontinent and in Philippines, but has not been collected in India proper. *C. andersonii* (Cl. ex Ktze.) Hj. Eichler is yet another closely related taxon (seemingly an offshoot of *C. loureiriana*-*C. smilacifolia* complex), distributed in Darjeeling, Sikkim and Burma. The examples of *C. smilacifolia* complex that are endemic to India proper are *C. theobromina* Dunn and *C. munroiana* R. Wight, the former in South India and the latter in South India and possibly (but doubtfully) in Sikkim. A variant of *C. smilacifolia* described by Kapoor (1965) as subsp. *andamanica*, was recorded endemic to Andaman & Nicobar Islands, the isolation of the taxon resulting in reduction in sterile part of the stamens accompanied with increase in the fertile part (the length of the thecae). Possibly the geographical isolation set off the process of variation. *C. bourdillonii* Dunn belonging to the same section (*viz.*, *Naraveliopsis* Hand.-Mzt.) is endemic to South India and *C. hedysarifolia* DC. (again of the same section) in West and South India. The distribution of these taxa is depicted in Figure 4.

C. connata DC., regarded most primitive (except Sect. *Archiclematis*) among all *Clematis*, is recorded from India, China and Central Asia. The related taxa *C. tortuosa* (Wall. ex Hk. f. et Thoms.) C.E.C. Fischer, *C. b Buchananiana* DC. and *C. grewiiflora* DC. remained confined to China and India. A variant, *C. loasifolia* DC. (if considered distinct from *C. grewiiflora* DC. with which it is very close), occurs in Nepal and Sikkim and needs to be watched for solving the confusion regarding its taxonomic status. *C. watii* Drummond et Craib, close to this group occurs mainly in China and extends southwards to Indo-China and south-eastwards to Burma and Manipur. Dhar & Kachroo (1983) observed

that none of the species of *Clematis* is endemic to Kashmir Himalaya. In fact all the species recorded in Kashmir have been recorded from China also.

There are ten more species that are common to China and India. These are : *C. acuminata* DC., *C. roylei* Rehder, *C. puberula* Hk. f. et Thoms., *C. acutangula* Hk. f. et Thoms., *C. barbellata* Edgew., *C. japonica* Thunb., *C. montana* Buch.-Ham. ex DC., *C. napaulensis* DC. and *C. cadmia* Buch.-Ham. ex Hk. f. et Thoms. Among these, *C. montana* is one of those which "are widespread, or at least their original homes cannot now be more accurately determined" (Good, 1974).

From the above it may be concluded that Indian *Clematis* has close Chinese affinities. It may also be recapitulated that for a meaningful investigation of the phyto-geographical aspects and endemism in *Clematis* the area for taxonomic study should be wider to cover the closely related taxa occurring in neighbouring regions, or alternatively, the taxa may be studied complex-wise.

Distribution of *Clematis* in India

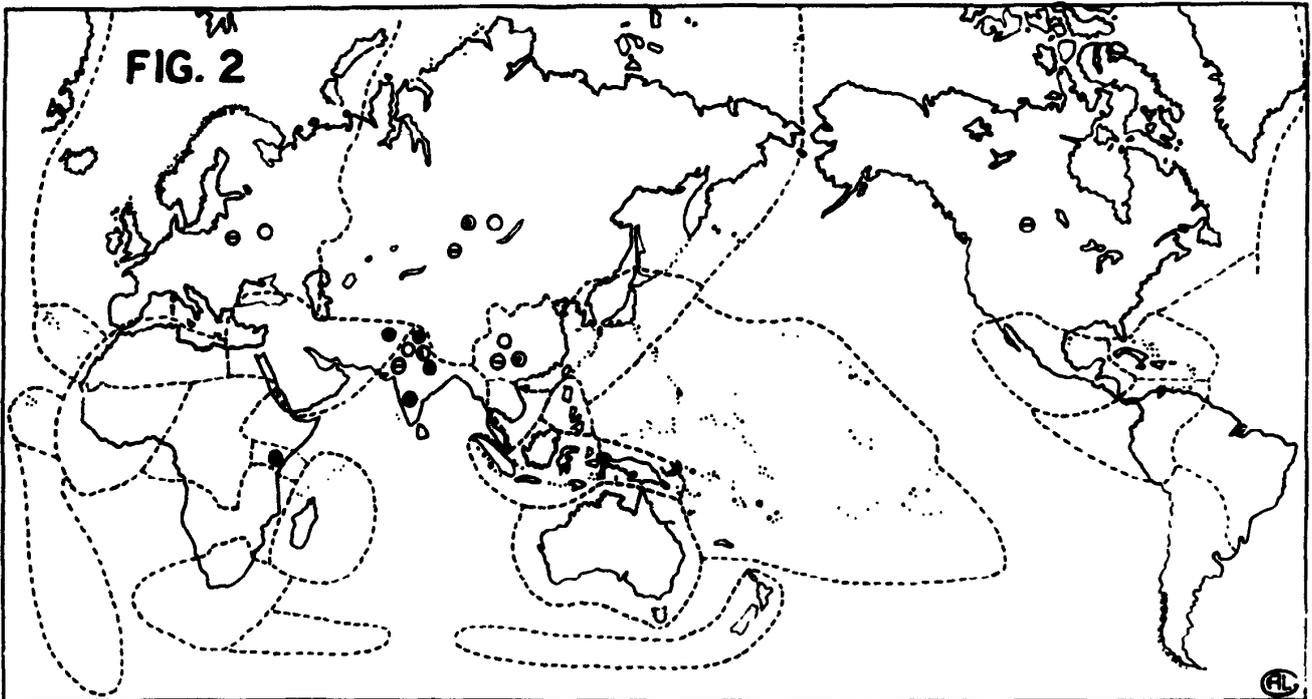
The distribution of *Clematis* in India proper is presented in Table 4, in order to facilitate a visual comparison. About the arrangement of the species in the table; it may be noted that there are differences of opinion concerning infrageneric classification of *Clematis*. Tamura (1956) divided the genus into sections subsections and series after studying particularly the East Asian *Clematis*. Keener & Dennis (1982), however, opined that until a world-wide monographic treatment is available, we can at best recognise only 4 subgenera in the genus. The species presented in table 4 could, to avoid controversy, be arranged in alphabetical order but that would not show which species are more closely related. I have, therefore, opted for arranging the taxa into groups numbered I to

VIII, each group named following Tamura's nomenclature.

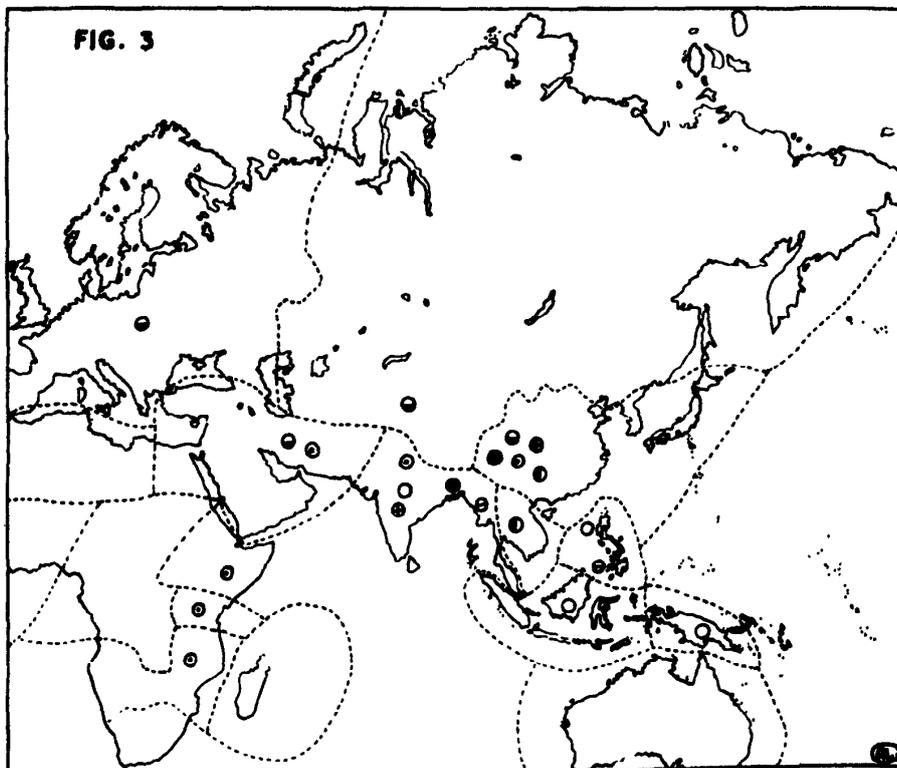
The phytogeographic divisions of the country and their sequence is according to Chatterjee (1939, 1962).

As is evident from the table, the areas poorly represented in *Clematis* are the Andaman & Nicobar Islands, Western Dry Region and the Gangetic Plain. The Western Ghats have a fair representation. The largest number of taxa are, however, recorded from Western and Eastern Himalayas, and Eastern India. In Deccan Plateau occur only 5 taxa (belonging to 4 species), viz., *C. roylei* Rehd. var. *roylei* and var. *patens* (Haines) Kapoor, *C. triloba* Heyne, *C. gouriana* Roxb. ex DC. and *C. smilacifolia* Wall. subsp. *smilacifolia*; all of these belong to different sections of the genus. Among these, *C. gouriana* Roxb. ex DC. is most widely distributed, almost throughout the country; *C. roylei* Rehder is a highly variable species, the variants, however, do not exhibit clear-cut discontinuity, except for the entity described as var. *patens*. *C. cadmia* Buch.-Ham. ex Hk. f. et T. has so far been collected in the region of Upper Gangetic Plain only, proximal to Nepal tarai, and it is incidentally the only species occurring in India that has beaked achenes (devoid of feathery styles).

The species that are common to Western and Eastern Himalayas and Eastern India are *C. tortuosa* (Wall. ex Hk. f. & Thoms.) Fischer, *C. bucharaniana* DC., *C. grewiiflora* DC. (all belonging to Sect. *Viorna* subsect. *Connatae*), excluding those whose occurrence in at least one of these regions be regarded as doubtful. *C. montana* Buch.-Ham. ex DC. is represented in Western and Eastern Himalayas by its three infraspecific constituents. *C. alpina* (Linn.) Miller (Sect. *Atragene*), *C. orientalis* Linn., *C. graveolens* Lindl. (Sect. *Meclatis*), *C. barbellata* Edgew. (Sect. *Bebaenthera*) and *C. asplenifolia* Schrenk and *C. grata* Wall.



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|-----------------|-------------------|-----------------|
| ○ C. ALPINA | ◐ C. ASPLENIFOLIA | ● C. GRAVEOLENS |
| ◑ C. ORIENTALIS | ⊕ C. WIGHTIANA | ⊙ C. VERNAYI |



- | | | |
|----------------|----------------|---------------|
| ● C. APICULATA | ○ C. GOURIANA | ⊙ C. GRATA |
| ◐ C. KERRIANA | ◑ C. MEYENIANA | ⊕ C. PUBERULA |
| ◑ C. VITALBA | | |

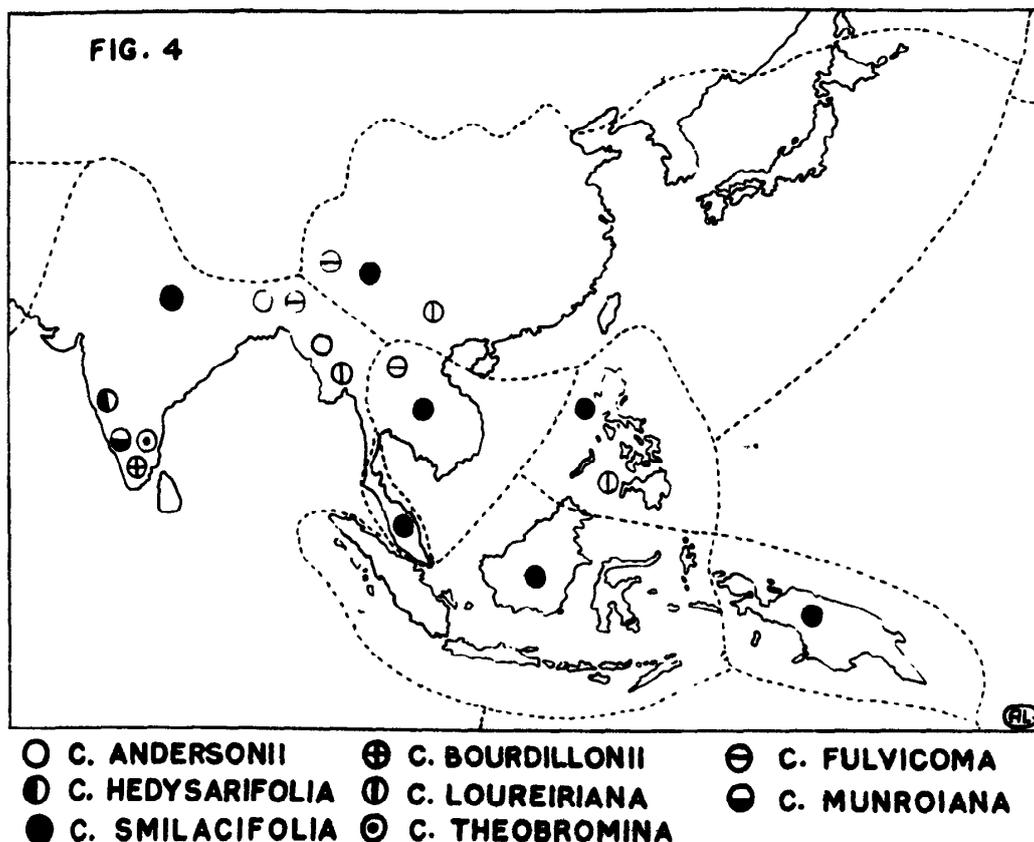


TABLE 1

Total number of *Clematis* ssp. represented in a particular phyto-geographical region/ subregion; and number of species restricted to each

No. of geographical div./ sub div	Name of geographical div./sub div.	Total No. of ssp. in the div./ sub div.	No. of species restricted to the geographical div./ sub div.	Percentage of elements restricted to the div./ sub div
1	2	3	4	5
1.	Europe	16	8	50%
2a.	Orient	16	4	25%
2b.	North Africa	4	1	25%
2c.	Canary, Madeira & Azores Islands	Nil	—	—
3.	North & Central Asia & Tibet	28	9	32%
4.	China & Japan	201	152	76%
5.	India, Pakistan, Burma & Sri Lanka	56	16	30%
6a.	Malaya Peninsula	3	1	33%
6b.	Indo-China	9	3	33%
6c.	Indonesia	23	13	57%
6d.	Philippine Islands	9	2	22%
6e.	New Guinea	11	5	45%
7.	Australia	8	2	25%
8.	New Zealand & other islands	17	15	88%
9.	Polynesia Islands	2	1	50%

Contd. Table 3

Name of species	Serial number of geographical div /sub div as adopted at Kew Herbarium															
	1	2	2	3	4	5	6	6	6	6	6	10	10	10	10	13
	a	b					a	b	c	d	e	b	c	d	e	
<i>C. alternata</i>						+										
<i>C. andersonii</i>						+										
<i>C. apiculata</i>						+										
<i>C. apifolia</i>					+											
<i>C. asplenifolia</i>		+				+										
<i>C. barbellata</i>					+	+										
<i>C. bourdillonii</i>						+										
<i>C. buchananiana</i>					+	+										
<i>C. burmanica</i>						+										
<i>C. cedmia</i>					+	+										
<i>C. connata</i>				+	+	+										
<i>C. fasciculiflora</i>					+											
<i>C. flammula</i>	+	+	+	+		Cult.										
<i>C. fulvicoma</i>					+	+	+									
<i>C. gouriana</i>						+			+	+	+					
<i>C. grata</i>		+			+	+							+	+	+	
<i>C. graveolens</i>		+				+										
<i>C. grewiiflora</i>					+	+										
<i>C. hedyarifolia</i>						+										
<i>C. japonica</i>					+	+										
<i>C. kerriana</i>						+		+								
<i>C. leschenaultiana</i>					+				+	+						
<i>C. lasifolia</i>						+										
<i>C. loureiriana</i>					+	+										
<i>C. meyeniana</i>					+	+				+						
<i>C. montana</i>					+	+										
<i>C. munroiana</i>						+										
<i>C. nepaulensis</i>					+	+										
<i>C. orientalis</i>	+	+		+	+	+										
<i>C. pavoliniana</i>					+											
<i>C. phlebantha</i>						+										
<i>C. puberula</i>					+	+										
<i>C. rehderiana</i>					+	+										
<i>C. robertsiana</i>		+														
<i>C. roylei</i>					+	+										
<i>C. smilacifolia</i>					+	+	+	+	+	+	+	+				
<i>C. theobromina</i>						+										
<i>C. tongluensis</i>						+										
<i>C. tortuosa</i>					+	+										
<i>C. triloba</i>						+										
<i>C. urophylla</i>				+	+											
<i>C. vernayi</i>				+	+	+										
<i>C. vitalba</i>		+	+	+	+	+			Cult.							
<i>C. wattii</i>					+	+			+							
<i>C. wightiana</i>						+							?	+		
<i>C. yunnanensis</i>					+											
<i>C. zemuensis</i>						+										
<i>Naravelia zeylanica</i>					+	+	+	+								

For names of the geographical divisions/subdivisions corresponding to serial numbers 1-6, 10 & 13, see Table-1.

TABLE 4

Distribution of *Clematis* spp. in India proper

Name of the Taxon	Name of the Phytogeographic Division										Remarks
	Deccan Plateau (including Eastern Ghats)	Western Ghats	Western Dry Region	Gangetic Plain (including Siwaliks & Sub-Himal. Tracts)	Eastern India (Assam of earlier phyto-geog.)	Eastern Himalaya	Western Himalaya	Andaman & Nicobar Islands	Altitude in metre		
1	2	3	4	5	6	7	8	9	10	11	
I. Section <i>Viorna</i> (Reichb.) Prantl subsect. <i>Connatae</i> Koehne											
1. <i>C. connata</i> DC.							+	+	1525-4300	Throughout the Himalayan range	
2. <i>C. acuminata</i> DC.							+	+	1800-2140	Not occurring east of Bhutan	
a. subsp. <i>acuminata</i>											
b. subsp. <i>sikkimensis</i> (Hk. f. et Thoms.) Brühl											
(i) var. <i>sikkimensis</i>							+	+	1067-2134	Simla (1500-2100 m) by Parker (1924) but no specimens seen in Indian herbaria from W. Himalayas	
(ii) var. <i>clarkei</i> (Ktze.) Brühl							+	+	300-700		

Contd. Table 4

1	2	3	4	5	6	7	8	9	10	11
3. <i>C. roylei</i> Rehd. (i) var. <i>roylei</i>	+			+			+		455-2140	Khasi & Jaintia Hills (1220 m) by Hook. f. & T. (1872) & Kanjilal <i>et al.</i> (1934) but no specimens seen in Indian herbaria.
(ii) var. <i>patens</i> (Haines) Kapoor	+								760	Singhbhum (Bihar)
4. <i>C. wattii</i> Drumm. et Craib					+				760-1800	Assam and Manipur
5. <i>C. tortuosa</i> (Wall. ex Hk. f. et Thoms.) Fischer					+	+	+		610-3965	Occurrence in Kashmir doubtful but in Chamba and Simla confirmed
6. <i>C. buchananiana</i> DC. (excl. var. <i>tortuosa</i> Hk. f. et Thoms.)					+	+	+		760-3050	
7. <i>C. grewiiflora</i> DC. var. <i>grewiiflora</i>					+	+	+		760-1830	Not occurring west of Kumaon
II. Section <i>Atragene</i> (Linn.) DC.										
8. <i>C. alpina</i> (Linn.) Miller							+		3350-3660	Kumaon and Garhwal
III. Section <i>Mecatis</i> (Spach) Tamura subsect. <i>Orientalis</i> Prantl										
9. <i>C. orientalis</i> Linn. (i) var. <i>longicaudata</i> (Ledeb.) Boiss.							+		1676-3658	Lahul and Spiti, Ladakh and other areas of Kashmir

Contd. Table 4

1	2	3	4	5	6	7	8	9	10	11
(ii) var. <i>obtusifolia</i> Hk. f. et Thoms.							+		2438-3353	Chamba and Bashahr
(iii) var. <i>latifolia</i> Hk. f. et Thoms.							+		3048	Kunawar (Bashahr), westwards to Afghanistan
10. <i>C. graveolens</i> Lindl.							+		900-3048	West and N.W. of higher regions of Jamuna Valley
11. <i>C. wightiana</i> Wall. ex Wt. et Arn.		+							1220-2440	Pune, Mahabaleshwar and southwards to Palni, Nilgiri, and other hills of Tamil Nadu and Kerala
IV. Section <i>Bebaeanthera</i> Edgew.										
12. <i>C. acutangula</i> Hk. f. et Thoms.					+				1200-2450	Naga and Khasi Hills
13. <i>C. japonica</i> Thunb.					+				1340	Khasi and Jaintia Hills
V. Section <i>Cheiroopsis</i> DC.										
14. <i>C. barbellata</i> Edgew.							+		2130-3660	Throughout W. Himal.
15. <i>C. nepalensis</i> Wall. ex DC						+	+		1220-2440	Not occurring west of Massoorie and Chakrata
16. <i>C. zemuensis</i> Smith						+			2744	So far known from Sikkim and Nepal only
17. <i>C. montana</i> Buch.-Ham. ex DC.										
a. subsp. <i>montana</i> (1) var. <i>montana</i>							+		1615-3810	Throughout W. Himal.

Contd. Table 4

1	2	3	4	5	6	7	8	9	10	11
(ii) var. <i>manipurensis</i> Brühl						+			2134-3048	Manipur and Nagaland, extending to Burma
b. subsp. <i>praecox</i> Ktze.						+			2743-4267	Sikkim and Darjeeling
18. <i>C. tongluensis</i> (Bruhl) Tamura										
(i) var. <i>tongluensis</i>						+			2285-3355	Sikkim and Darjeeling
(ii) var. <i>khasiana</i> (Brühl) Kapoor					+				1825	Khasi and Jaintia Hills
VI. Section <i>Clematis</i> subsect. <i>Pierotianae</i> (Tamura) Tamura										
19. <i>C. triloba</i> Heyne subsect. <i>Vitalbae</i> (Prantl) Tamura	+	+							up to 1000	Maharashtra and Madhya Pradesh
20. <i>C. puberula</i> Hk. f. et Thoms.					+		+		1220-2440	Garhwal and Kumaon to eastwards
21. <i>C. grata</i> Wall.							+		610-2750	Throughout W. Himal., extending westwards to Afghanistan
22. <i>C. gouriana</i> Roxb. ex DC.	+	+	+	+	+	+	+		305-2440	Most widely distributed in India
23. <i>C. apiculata</i> Hk. f. et Thoms. subsect. <i>Rectae</i> Prantl					+				910-1225	Khasi Hills and Manipur
24. <i>C. meyeriana</i> Walp.						+			1500	Aka Hills (Arunachal Pradesh)

Contd. Table 4

	1	2	3	4	5	6	7	8	9	10	11
25. <i>C. asplenifolia</i> Schrenk								+		2040-2600	Kashmir, westwards to Baluchistan
VII. Section <i>Naraveliopsis</i> Hand.-Mzt.											
26. <i>C. bourdillonii</i> Dunn			+							760	Merchiston Estate (Kerala)
27. <i>C. hedyсарifolia</i> DC.			+	+		?+				600-1000	One specimen seen from 'Mont. Khasia' (leg J.D. Hooker & T. Thomson)
28. <i>C. smilacifolia</i> Wall.											
a. subsp. <i>smilaci</i> <i>folia</i>	+		+		?+	+	+	+		300-1830	W. Himalaya Almora (Not occurring further westwards). Another widely distributed taxon
b. subsp. <i>andama-</i> <i>nica</i> Kapoor									+		
29. <i>C. fulvicoma</i> Rehd. et Wils.						+				300-2000	Khasi and Mikir Hills
30. <i>C. andersonii</i> (Cl. ex Ktze.) Hj. Eichler							+			915-1675	Sikkim and Darjeeling
31. <i>C. munroiana</i> Wt.			+							up to 2135	Mangalore, Coorg (Karna- taka), Anamalai and Palni Hills (Tamil Nadu)
32. <i>C. theobromina</i> Dunn			+							1820-2440	Nilgiri Hills only
VIII. Section <i>Viticella</i> DC. <i>emend.</i> Tamura subsect. <i>Viticella</i>											
33. <i>C. cadmia</i> Buch.- Ham. ex Hk. f. et Thoms.					+	+	+			90-915	Eastern Himal. Sikkim, Gangetic Plain : Gorakhpur only

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