

ECOLOGY AND DISTRIBUTION OF THE GENUS *EVOLVULUS* IN INDIA

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ABSTRACT

The genus *Evolvulus* is represented by about 80 species in tropical regions of the world, the maximum number of species being recorded in Brazil. In India the genus is represented by two species, i.e. *Evolvulus alsinoides* Linn., and *Evolvulus nummularius* Linn.

Evolvulus alsinoides Linn. is recorded to extend throughout India in open and grassy lands, ascending to a height of 6000 ft. in the Himalayas. *Evolvulus nummularius* Linn. also grows throughout India in various habitats. However this species is not recorded in any of the earlier floras of India. Raizada (1936) while describing it says "this is a recently introduced species or otherwise imperfectly known plant from the Upper Gangetic plain". The study presented here supports the view of its recent introduction.

EVOLVULUS ALSINOIDES LINN.

It is a hairy perennial herb, with spreading prostrate branches arising from a small woody root stock through which the plant propagates. Leaves are variable between 0.7 to 1.3 cms. in length, sessile or nearly so, lanceolate to ovate, obtuse, mucronate, acute at the base, densely clothed with white silky hairs. Flowers blue to white, in 1-3 flowered filiform peduncles, bracts, small linear hirsute, persistent, pedicels filiform. Calyx densely silky, green, segment 0.4 cms. long lanceolate acute. Corolla subrotate, 0.5 cms. long capsule 0.3 to 0.4 cms. in diameter, 4 valved and usually 4 seeded.

It is seen to flower during the dry period of April to June and the growth becomes more pronounced if there is grazing and scraping of the fields. Frequency determination of this species in various localities reveals that this plant happens to flourish in those adverse circumstances where the others can not. The fields which are protected and not subjected to grazing and scraping show a frequency of 24% for the distribution of this species. In a moderately grazed field it had a frequency of 28%, but in a field subjected to grazing associated with recent scraping its incidence increased to 44% frequency.

The greater frequency value in intensely grazed and scraped fields can easily be explained on the basis that by grazing and scraping the area which gets exposed can easily be occupied by this plant and hence it becomes more luxuriant under those circumstances but a remarkable change in the plants growing under such circumstances is seen. They become more restricted in growth i.e. their branches do not extend and cover larger areas and the number of flowers produced per plant is greatly reduced.

The most interesting feature observed in this case is with regards to the variation in flower colour from blue to white. The various shades which are obtained may be present on the same plant even on the same branch clearly rules out the possibility of this being genetically controlled.

A water extract of the flower pigment on treatment with NaOH gives a deep blue colour and with HCl a red colour. Several intermediate shades of colour are obtained by subjecting this extract to various pH values. This associated with the microscopical observations clearly indicate that the pigment in question is Anthocyanin. The colour variation in flower can thus be either due to one of the following factors or a combined effect of more than one such factors :—

1. The nature and concentration of the pigments and other associated substrates.
2. The state of aggregation of the Anthocyanin determined in part by the pH of the cell sap.
3. The presence or absence of the protective Colloids, pentagons etc.
4. The presence or absence of the copigments i.e. tannin, flavone glucosides.
5. The nature and concentration of metallic salts with OH group.
6. The formation of anhydrates.

Apart from showing the colour variations this plant also shows variations in the size of internodes and the leaves depending upon the soil moisture conditions. At places like Sagar, Bhopal, Sanchi, Pachmarhi, Jabalpur and Sihora, the plant was found on sandy soils and even at the crevices of stones which have very scanty soil and moisture. These plants had very profuse growth with a very thick clothing of hairs.

Culture experiments reveal that there exists a direct relationship between leaf size, internode size, stomatal index and growth of hairs with moisture content and an inverse relationship with the number of flowers born on each plant. The field observations alongwith the culture experiments clearly show that the organic content and the texture of the soil are of no obvious advantage to the presence of this plant. Perhaps this is the reason that this plant shows its luxuriant growth during the months of April to June, even after the fields are scraped.

EVOLVULUS NUMMULARIUS LINN.

It is a prostrate herb; the stem branches rooting at the nodes. Leaves alternate, exstipulate, very shortly petioled almost orbicular, subcordate, glabrous 0.3 to 1.9 cms. long, rounded at the apex. Peduncles one flowered axillary much shorter than the leaves. Sepals 5 oblong or oblong ovate, obtuse about 0.25 cms. long not enlarged in fruit. Petals 5 angled or 5 lobed, pure white. Stamens 5, filaments filiform. Ovary entire, 2 celled, style 2, free to the base. Each deeply 2 cleft, stigma, linear filiform. Capsule globose 2-4 valved, 1-4 seeded, seeds glabrous. The plant shows the following variations in its morphological features. :—

1. Plants growing on footpaths or along the road sides are characterised with profused branching, small leaves and very small internodes thus forming a cushion.
2. Plants growing in grasslands in association with other species are bigger than those mentioned above and these grow more in the fields having sparse vegetation.
3. The plants growing in moist and shady situations have got much bigger leaves, bigger internodes and a large area than other forms mentioned above.

The leaf sizes were recorded in each of the three cases, which are as follows. :—

1. 0.35 × 0.3 cms. — 0.7 × 0.65 cms.
2. 0.4 × 0.3 cms. — 1.1 × 1.0 cms.
3. 0.6 × 0.6 cms. — 1.9 × 1.9 cms.

But the L/B ratio in case of the leaves is approximately the same in each case, i.e. nearly 1. Thus we can safely conclude that there is an overall change in the size of that leaf, and there is absolutely no variation in the shape or the form of the leaf. It is also quite obvious from the above given data that ranges found in each of the three groups are overlapping each other. This alongwith the transplant and reciprocal transplant experiments show that the new coming leaves in each case are identical in one pot. Showing thereby that these forms are only ecades and not ecotypes.

The observations of leaf size, internodal size and stomatal index with reference to the various moisture contents of the soil are as follows :—

Moisture Contents	Average internodal size of 5th internode	Average leaf size on 5th internode	Stomatal Index	
			Upper Surface	Lower Surface
11.87%	2.15 cms.	0.32 cms.	0.288	0.248
18.21%	2.88 cms.	0.8 cms.	0.266	0.200
19.05%	3.97 cms.	1.5 cms.	0.302	0.251

It is seen that the size of the internode and the size of the leaf are directly related with the moisture contents of the soil. But the stomatal index does not show such a sequence. Because the plant has got a prostrate habit, and the lower surface remains in contact with the soil surface, there are fewer stomata on the lower surface than on the upper. The higher stomatal index of the plant growing in a situation having minimum soil moisture may be due to the fact that at such situations this plant grows exclusively, thus the whole of water present in the soil is available for this plant only, while in other cases it is shared by other plants which remain in association with this. Even though the stomatal index is higher in this case, if we calculate the total number of stomata per plant, it will always be lower than that in other cases, as here the area is greatly reduced.

The plasticity with regards to the adaptation towards various moisture ranges endows this species to inhabit a very wide range of habitates. Therefore, it has acquired a great capacity to thrive at various situations with competence and enjoys a wider and prominent distribution than *E. alsinoides* Linn.

Looking to this fact it becomes quite evident that out of the two suggestions sponsored by Raizada (1936), the suggestion that this is a recently introduced species seems to be more plausible. Because endowed with the great plasticity and the amplitude, this species can spread rapidly and its present distribution and status could have been obtained soon after its introduction. In that event it should not have gone unnoticed. The great diversity between the two species with regards to their rooting habits and their other vegetative characters does not lend any possibility of confusion in keeping the two species together.

The argument that it might have missed the notice of the earlier systematists does not hold any water on the grounds, that *E. nummularius* is much more prominent than *E. alsinoides* and if the latter could have been noticed why not the former. Further it is possible that it might have escaped the notice of one worker but so many systematists like Hooker, Duthie, Haines, Cooke, etc. all have missed it does not seem to be possible.

In view of the above given facts we have no option but to believe that this is a recently introduced species in Indian flora on the basis of the occurrence of maximum number of species, Brazil seems to be the center of origin of this genus and from there the species would have migrated to inhabit the globe. *E. nummularius* would have come to India either as a result of normal distribution or through the human agencies. Investigations are in progress to determine the actual path, the genus has followed to attain the present distribution.

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