

OBSERVATIONS ON THE DISTRIBUTION AND EFFECT OF SALINITY ON A
LITTLE KNOWN PLANT, *MIMULUS ORBICULARIS* WALL. EX BENTH.
(SCROPHULARIACEAE)

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A B S T R A C T

Mimulus orbicularis Wall. ex Benth., occasionally found in brackish water lakes, ditches, slacks and often in abandoned ricefields near estuaries and the coastal belt of Eastern India, is a rare aquatic plant. Very often the plants have been found to disappear from the habitat due to some ecological or anthropogenic factors. It is observed that the plant has very little potential for modulating its life cycle strategies in the same habitat. Though populations were recorded in three different localities in India, survival of this species in a permanent habitat is still a question due to its 'nomadic distribution'. On account of this population behaviour, the collection of this species by many workers in the past has been inadequate. Occurrence of this plant in new localities, extent of distribution and some changes in the morphological characteristics with the change of water salinity and some chemical components of water are discussed in this paper.

INTRODUCTION

The genus *Mimulus* L. has about 150 species (Grant, 1924; Mabberley, 1987) confined to America and a few in Australia. In India it is represented by 3 species (Hooker, 1884). Of these three, *M. nepalensis* Benth. and *M. strictus* Benth. are common whereas *M. orbicularis* Wallich ex Benth. is extremely rare and very sporadic in occurrence. Further, its distribution is restricted to coastal and estuarine regions. It was originally described by Benthham in 1835 based on Wallich's collection (*Wall. Num. List No. 3919*) from Rangoon in 1826. Later Benthham (1842) and Hooker (1884) simultaneously reported its further distribution

from Tavoy and Mergui based on the collections of Wallich and Griffith respectively. Gamble on a herbarium sheet of *D. Hooper* No. 39621 at CAL has remarked, "There are three specimens of this and no specimens at Kew so I have kept one in this Herbarium". He had sent two herbarium sheets from Kew Herbarium (Acc. No. 39621 at CAL) on 11.8.1913 out of three Indian representative gatherings collected by D. Hooper from Padikud, Chilka Lake, Ganjam. M. S. Ramaswami on D. Hooper's collection Nos. 39628 and 39621, has remarked, "a very interesting distribution, not previously recorded from this area". Grant (1924) in his monograph did not cite any of these specimens examined except the Type (*Wall. No. 3919*).

Benthham in DC. *Prodr.* (10:373.1842) has reported its distribution from India without

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mentioning its actual place of occurrence. In India this species was first collected by D. Hooper from Padikud, Chilka Lake, Ganjam in 1913. Haines (1922) and Gamble (1922) failed to re-collect this species from elsewhere in India and reported its distribution in the respective regional floras based on the Hooper's collections. In 1979 this species was collected after 66 years from Talchua, near the Dharma estuary, Cuttack district, Orissa (L. K. Banerjee 34561) and another population was recorded from West Bengal at Roydighi near the Moni river estuary, Sunderbans in 1985 (G. G. Maity 85). In 1982 the authors determined another unmounted specimen (Mofiz, s.n.) of this species collected from Chittagong coast in Bangladesh.

In view of the above, the present investigation on the distribution of this species, its description and some field observations on the effect of salinity would be interesting for this little known species hitherto reported only from Ganjam (Chilka Lake) and Burma.

Mimulus orbicularis Wall. ex Benth., Scroph. Ind. 29. 1835 & in DC. Prodr. 10 : 373. 1842; Hook. f., Fl. Brit. India 4 : 259. 1884; Haines, Bot. Bihar & Orissa Pt. 4 : 623. 1922; Gamble, Fl. Pres. Madras Pt. 5 : 947. 1922; Grant in Ann. Missouri Bot. Gard. 11(2 & 3) : 198. 1924.

Glabrous, floating herbs, often rooting at the nodes. Leaves opposite; lamina 0.9-3.1 cm in diam., orbicular, entire, rounded at apex, attenuate at base; petioles 2-3 cm long, slender. Flowers bluish-white with yellow eye, bilabiate, 7-8 mm across, 12-13 mm long, 2-3 in each axil; pedicels 2-4 cm long, slender. Calyx campanulate, 3.5-4.5 mm long, almost truncate with 5 teeth. Corolla 8-9 mm long, slightly constricted towards throat, bilabiate, 5-lobed, imbricate, limb developing into 2 unequal inflated lips; posterior lip 2-lobed, longer and broader; anterior lip 3-lobed, smaller and narrower with crenate margin.

Stamens 4, didynamous, epipetalous; filaments 6-7 mm long; anthers distantly 2-loculed. Ovary ellipsoid, 3.3-2 × 1.2-1.5 mm, angular, glabrous. Style 4.5 mm long, slender. Stigma bilobed, 1-3 mm in diam. Capsules ellipsoid, 7-8 × 3-4 mm, partially angular with persistent 4-5 mm long style; seeds many.

Flowering & Fruiting : May to December.

Ecology : Occasional in shallow standing water in lakes, ditches, slacks and often in abandoned ricefields near estuarine and coastal regions.

Distribution : India : Orissa (Chilka Lake in Ganjam; Dhamra river mouth in Talchua); West Bengal (Roydighi in Sunderbans); Bangladesh (Chittagong) and Burma (Rangoon, Tavoy and Mergui).

Though the species was collected in the past from the Chilka Lake, Talchua and Roydighi in India after repeated searches in those places it is found to have disappeared at present from the localities so far collected.

Specimens examined (All at CAL) : INDIA : Ganjam, Padikud (Chilka Lake) 11.8.1913, D. Hooper 39621. Balasore, Rajbari 12.8.1913, D. Hooper 39628. Cuttack, Talchua (Dhamra river-mouth.) 7.6.1979, L. K. Banerjee 34561. 24-Parganas, Roydighi (Moni river-mouth.) 10.7.1985, G. G. Maity 85. BANGLADESH : Chittagong, Harbhang, 22.11.1979, Mofiz s.n. BURMA : Rangoon, August 1826, Wallich 3919. (Type) Mergui, Nov. 1900, S. Mokim 34. Tavoy, Dec. 1900, S. Mokim s.n.

EFFECT OF SALINITY

MATERIALS AND METHODS

Field survey was undertaken in Talchua near Dhamra river mouth in Orissa and in Roydighi near Moni river mouth in Sunderbans. Morphological characteristics such as length of floating plants, size of leaf-blades, number of branches and total number of

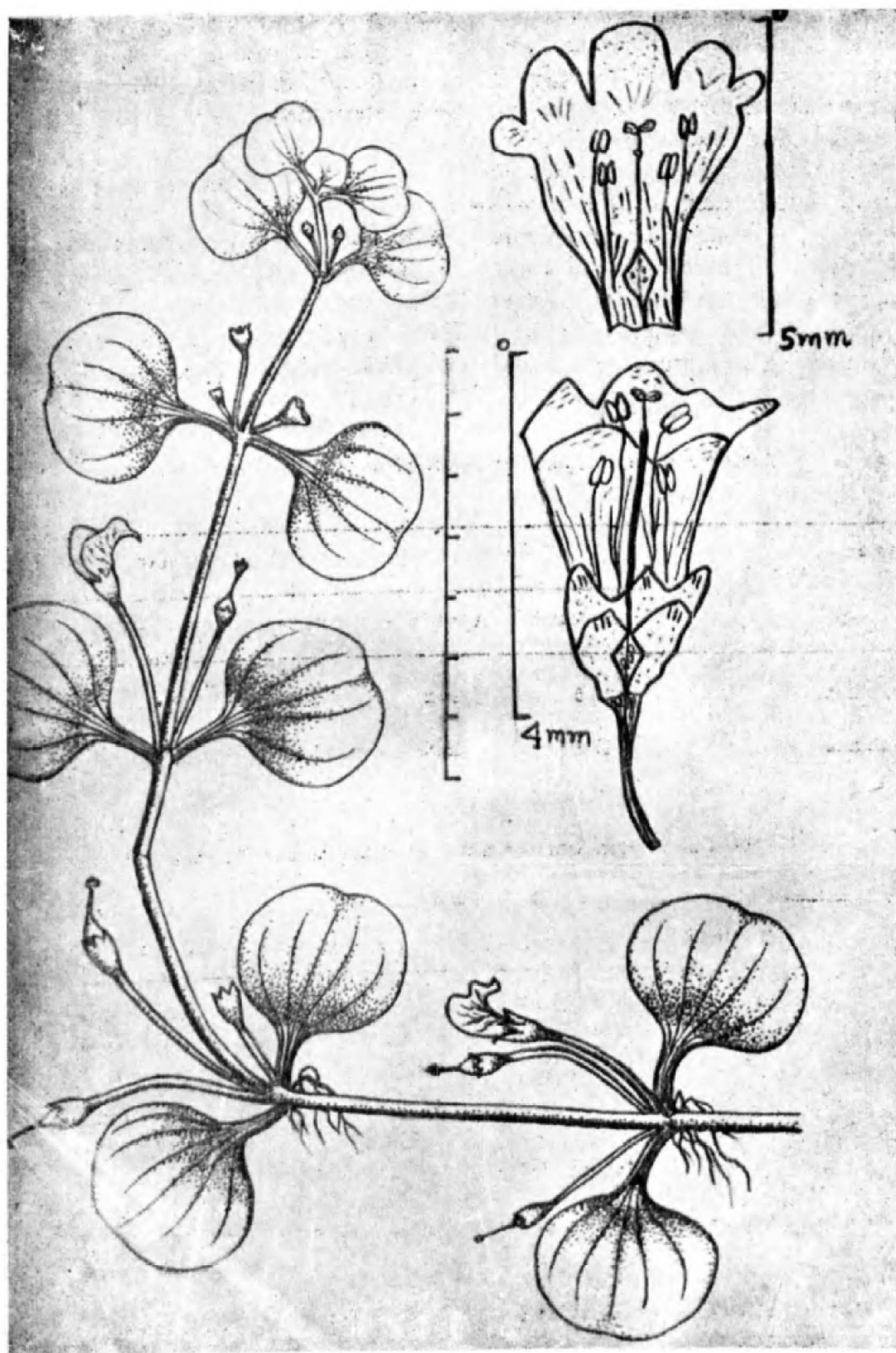


Fig. 1: Habit of *Mimulus orbicularis* Wall. ex Benth,

capsules per plant in relation to seasonal variation of water salinity and some chemical characteristics of water were analysed with a view to assessing the relationship if any, between the above mentioned variations and the morphological characteristics. For this purpose 10 sample plots were analysed in these areas. From each sample plot a minimum of 10 plants were randomly collected and details of morphological variations were noted for each plant. Three water samples from each sample plot were collected seasonally at a depth of 5 cm and

analysed following standard procedures (Jackson, 1958 ; Golterman, 1969). Based on these data seasonal morphological variations of the plants in relation to ecological stress were determined.

RESULTS

The data on water salinity and chemical characteristics which vary from season to season are summarised in Table 1 & 2. Table 3 gives data pertaining to various morphological characters of the plant in

Table 1 : Water salinity of Roydighi and Talchua habitats

Area	Salinity ECmmhos/cm Depth 0-5 cm.			
	Jan.-March	April-June	July-Sept.	Oct.-Dec.
Roydighi	18.5	16.2	8.5	17.9
Talchua	17.8	15.6	7.5	16.5

Table 2 : Chemical characteristics of water of Roydighi and Talchua habitats

	Roydighi				Talchua			
	Jan.-March	April-June	July-Sept.	Oct.-Dec.	Jan.-March	April-June	July-Sept.	Oct.-Dec.
pH	8.1	7.7	6.8	7.9	8.0	7.6	6.8	7.8
Ca ⁺⁺ (m. eq/lit.)	11.0	12.5	4.0	8.3	10.8	11.9	4.0	7.9
Mg ⁺⁺ (m. eq/lit.)	43.5	55.3	18.5	35.1	40.3	49.5	17.5	33.4
Na ⁺ (m. eq/lit.)	140.3	124.7	65.5	133.2	135.2	120.1	57.7	127.1
Cl ⁻	194.2	170.1	89.2	181.6	186.9	163.8	78.7	173.2

different seasons and in different areas. The overall range of variation of the plant's characteristics sampled from different seasons were : length 65-108 cm ; leaf width 0.9-3.1 cm ; number of branches per plant 3-12 and number of capsules per plant 10-19. It was found that the population density becomes maximum and plants show positive acceleration phase from the month of June to September with increased length of stem, larger leaf and lower reproductive capacity (capsules 9-10 per plant) when water salinity ranges from 7.9-8.6 ECmmhos/cm with pH towards neutral and lower Ca^{++} , Mg^{++} , Na^{+} and Cl^{-} . The population density becomes minimum and plants show negative acceleration phase from the month of October to January with shorter stem, smaller leaf, less number of branches and higher reproductive capacity (capsules 18-19 per plant) when water salinity ranges from 16.2-18.5 ECmmhos/cm with the pH towards alkaline and higher Ca^{++} , Mg^{++} , Na^{+} and Cl^{-} . A correlative assessment of data on the degree of accelera-

tion phase in the seasonal stresses and the plant responses bring out dynamic relationship in terms of development of different morphological variations by the plant. These are shown in Table 4. The plant is capable of developing maximum life cycle strategies with response to minimum stress during the rainy season when influence of fresh water flow makes the habitat less saline. During this time plants produce maximum number of branches, broader leaves and less reproductive structures. A difference in stress during winter brings about a striking variation in the morphological characters showing shorter stem, reduced leaf and more reproductive structures.

DISCUSSION

Present investigation indicates that *M. orbicularis* Wall. ex Benth. shows more vegetative growth in monsoon and reproductive efficiency in winter. It seems that changes in water salinity and some chemical

Table 3 : Morphological characteristics of *M. orbicularis* in different seasons occupying two different habitats.

Morphological characteristics	Habitat types							
	Roydighi				Talchua			
	Jan.	April	July	Oct.	Jan.	April	July	Oct.
Length of floating stem(cm)	65-72	75-86	101-108	70-73	63-69	72-81	98-103	66-69
Leaf width(cm)	1.6-1.9	1.3-1.8	2.1-3.1	0.9-2.0	1.5-1.8	1.3-1.7	2.2-2.9	1.0-1.8
Number of branches	3-4	4-6	7-12	3-4	3-5	4-7	8-12	3-4
Number of capsules per plant	15-20	13-16	10-12	16-19	14-18	12-14	9-11	15-18

components of water may have a significant effect in vegetative growth and flower induction of this species.

There are some other environmental and ecological factors controlling the life cycle pattern and reproductive biology of this plant such as : Changes in temperature and photoperiod from monsoon to winter might have a significant role in vegetative growth and

reproductive structure (Sculthorpe, 1967); further, increased number of capsules in winter might have a correlation with the life cycle of pollinating agents (Mabberley, 1987). Therefore effect of temperature, photoperiod, pollination ecology and other factors are to be investigated before arriving at a final conclusion on the life cycle pattern and reproductive biology of this species.

Table 4 : Nature of acceleration phase, stress and the strategies developed by *M. o. bicularis* in different seasons.

Degree of acceleration phase and stress	Seasons	Strategic response
High acceleration phase and no stress.	Rainy season	Long floating stems, wider leaves, greater number of branches and low reproductive capacity.
Low acceleration phase and high stress.	Winter season	Short stems, reduced leaves, less number of branches and high reproductive capacity.

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