Influence of Micronutrient Availability on Biomass Production in *Cineraria maritima*

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Cineraria maritima is an annual exotic medicinal herb. Aerial parts of the plants are commercially utilized for the preparation of homeopathic eye drops. Therefore the whole biomass of the aerial part is in much demand, commercially. The raw materials are of limited availability, and the indigenous requirement is met mostly, by import of the prepared drug formulation at higher cost. Concerted efforts are being made for the cultivation of this exotic medicinal plant. The effect of low to high supplies of micronutrients-Fe, Mn, B, and Zn on shoot biomass production, have been studied in *C. maritima* grown in sand culture. Higher doses of boron (at 1.0 mg/l) and zinc (at 0.1 mg/l) are observed to be beneficial for shoot biomass production, as compared to Iron (at 11.2 mg/l) and Manganese (at 1 mg/l). Low supplies of iron, manganese, zinc, and boron, however, uniformly decrease biomass production. This study shows that higher supplies of B and Zn are beneficial for higher biomass production in *C. maritima*.

Cineraria maritima L.(Syn. *Senecio bicolor*Wild) Tod. Spp *cineraria*, (syn *S. cineraria* DC) belonging to the Family Asteraceae, is an important annual exotic medicinal herb. The aerial parts of the plant (leaves and stem) are used in homeopathic preparations for ophthalmic uses in the treatment of corneal clouding, opacity, cataract, and conjunctivitis[1].

The raw materials are of limited availability, and the indigenous requirement is met largely by import of the prepared drug formulation, at higher cost. The Central Council of Research in Homeopathy is cultivating this exotic plant to a limited extent in Nilgiri hills[2] (Web site address: www.mohf.nic.in accessed on 31-3-2004 now renamed, and the current web site address: www.indianmedicine.nic.in and www.ccrhindia.org\survey_and_collection.htm accessed on 7-5-2005). Central Institute of Medicinal and Aromatic Plants (CIMAP) is making concerted efforts for its cultivation in Indo-gangetic plains. A complete package of agro-technological practice is essential for successful cultivation of this plant. Among the various factors, the micronutrient requirement and its availability, significantly affect biomass production. Integrated nutrient management and micronutrient disorders are now recognized as a major constraint in the production of many medicinally important crops in different agro climatic regions of the country[3], and the references therein.

Since the whole aerial biomass of *C. maritima* is utilized for drug preparation, understanding the influence of micronutrient availability on biomass production, is important. In the present paper, the effect of different doses of micronutrient supplies of (Fe, Mn, B and Zn) on shoot biomass production, have been studied on this plant grown in sand culture. Seedlings of *C. maritima* (CIMAP Gene Bank Accession No.4554) were raised in the nursery of the CIMAP farm, and were transplanted in 5L plastic pots filled with acid digested (17% HCl and 1% oxalic acid) silica sand[4]. Balanced Hoagland and Arnon's[5] nutrient solution was supplied to the plants. Salts used in

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TABLE 1: AFFECTS OF LOW AND HIGH LEVELS OF MICRONUTRIENT SUPPLIES OF Fe, Mn, B AND Zn ON GROWTH PARAMETERS OF *CINERARIA MARITIMA*

Nutrient supply (mg/l)	Shoot biomass (g f wt/plant)	Shoot biomass (g dry wt/plant)	Plant height (Cm)
Control*	7.74	2.20	39.23
Fe 0.56	2.49	1.30	35.40
Fe 11.2	4.64	2.41	35.90
Mn 0.05	2.14	1.24	36.20
Mn 1.0	5.93	3.15	36.80
B 0.05	3.70	1.80	36.00
B 1.0	17.14	7.32	39.86
Zn 0.005	1.93	0.50	35.46
Zn 0.1	12.12	3.45	39.76
CD 5%	0.46	0.40	4.8
1%	0.63	0.55	6.6

*The control micronutrient supply consisted of (mg/l), Fe-5.6, Mn-0.5, B-0.5, and Zn-0.05.

the preparation of nutrient stock solutions were purified by dithizone solution, for removal of Fe, Mn, and Zn, whereas for removal of B alcohol, recrystallization was utilized[4]. All stock solutions and subsequent dilutions were prepared in distilled water. Initial trials conducted, showed that micronutrient supply (mg/l) of Fe-5.6, Mn-0.5, B-0.5, and Zn-0.05, was sufficient for normal growth, and this treatment served as control. One experimental set received deficient (one tenth) of the control micronutrient supply (mg/l) Fe-0.56, Mn-0.05, B-0.05, and Zn-0.005; where as another set received higher supplies (twice the control supply) of Fe-11.2, Mn-1.0, B-1.0, and Zn-0.1.Each treatment was replicated three times (each replication being a pot with one plant). Observations on visual deficiency symptoms, plant height, and fresh and dry biomass, were recorded 4 months after transplanting. The mean data were statistically analyzed for test of significance. Plants receiving low levels of Fe, Mn, B and Zn exhibit significant visual deficiency symptoms. Fe deficiency was marked by typical chlorosis of young leaves, and of B, as stunted growth of young growing tips. Stunted growth and necrosis of growing tips has also been observed earlier in other medicinal plants such as *Artemisia annua*.[6] In opium poppy, complete absence of flowering tops was observed under low B availability, that drastically reduced its economic yield[7]. Higher supplies of B (at 1.0 mg/l) and Zn (at 0.1 mg/l) significantly enhanced fresh (17.14 and 12.12 g/plant, respectively) and dry biomass yield (7.32 and 3.45 g/plant respectively), as compared to Fe (where no significant increase in fresh and dry biomass were observed) and Mn (where increase in dry biomass was observed at 3.15 g/plant compared to control) (Table 1). Thus for high economic yields, particularly of biomass, which is basic raw material for the drug, higher supplies of B and Zn are beneficial for cultivation.

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