SALT SECRETION IN RESPONSE TO β-ALANINE FOLIAR SPRAY IN *ACANTHUS ILICIFOLIUS* LINNAEUS

ABSTRACT

Seedlings of *A. ilicifolius* were planted under laboratory conditions and after stabilisation treated with increasing concentrations of NaCl from 0.0 to 0.3 M. Two sets were maintained and all plants were treated thrice a week, after their stabilisation to laboratory conditions. One set received only NaCl while second set received foliar spray of β-alanine in addition to NaCl. After 5 weeks plants were subjected to analysis. Upper surfaces of 3rd, 4th, 5th and 6th leaf were washed with distilled water and the washes were combined. Major inorganic constituents and chlorides were determined. It was observed that Na was more in NaCl treated set than β-alanine set, indicating less secretion of Na in latter case. Na/K ratio also showed lower secretion of K in β-alanine sprayed plants. Calcium secretion did not indicate any significant effect by β-alanine treatment, but values of Na/Ca ratio were more in second set. This would show that the relationship of Na and Ca got changed by β-alanine. Chlorides from secretion studies indicate retention of more chloride in the leaves sprayed with β-alanine. Present investigation relveals that β-alanine in mangroves has a protective role and acts through altering metabolic processes like ion regulation.

THE ABILITY of mangrove plants to adapt and survive in an environment of high salt stress places them into two categories, those that secrete salt and those that do not. Species that secrete salt regulate salt content in their tissues by having salt glands in the leaves, e.g., *Aegiceras*, *Avicennia* and *Acanthus*. In *Acanthus* salt glands are present

on both leaf surfaces, the upper or adaxial surface, however has more glands. In the present paper, attempt has been made to study secretion in this plant. Secretion is studied by testing the salt excreted from the leaves under different salt levels in the substratum. Physiological aspect of ion secretion has been discussed by many authors (Arisz *et al.*, 1955 ; Helder, 1956 ; Waisel, 1972 ; Thomson, 1975 ; Hill and Hill, 1976). In the present study, attempt also is made to study the role of β-alanine in *Acanthus ilicifolius* and salt secretion is investigated.

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Material and methods

The seedlings of *Acanthus ilicifolius* were collected from Ratnagiri and grown in tap water in cement pots. After stabilization of seedlings in the soil, they were treated with different concentrations of NaCl (0.00, 0.05, 0.1, 0.2 and 0.3 M). For each treatment three replicates were considered. There were two sets and plants were treated thrice a week with different concentrations of NaCl, while second set received foliar spray of β-alanine in addition to NaCl. After 16th treatments plants were subjected to the study of secretion. The upper surface of 3rd, 4th, 5th and 6th leaves was washed and washes were collected together treatment wise. Inorganic constituents were estimated from the washes where Na, K, Ca were determined flamephotometrically and Cl was found out by titrating against 0.1 N $AgNO_3$.

Results and discussion

The responses of plants of excessive salt, though controlled by genes, are reflected at morphological, physiological and biochemical levels. Salt compartmentation and secretion forms an integral part of salt tolerance mechanism. It has been suggested that in *Acanthus* the transport of salt from the vascular system to the leaf tissue and gland complex is by way of the symplast involving a system of vesicle formation and movement (Wong Chee Hong and Ong Jin Eong, 1984). In *Rhizophora* salt exclusion is by ultrafiltration (Scholander, 1968). It would seem that mangrove with salt glands (e. g. *Acanthus, Avicennia*) may need energy to excrete salt where as mangrove without salt-gland may be more efficient, requiring less energy to exclude salt. In the present work secretion study is limited to the exudate composition.

The salt secreted after 16th treatment from leaves of *A. ilicifolius* is shown in Table 1. Na secreted per plant ranges from 375-457 μg in NaCl treated set and 365 to 435 μg per plant in NaCl along with β-alanine treated set, indicating little less secretion of Na. K secretion increases slowely with the concentration and finally it becomes 102μg per plant, at 0.3 M NaCl treatment. In case of β-alanine sprayed plants, it ranges from 62 to 92 μg per plant. The Na/K ratio in NaCl treated plants is lower than the other set indicating comparatively less secretion of K in β-alanine sprayed plants. Kulkarni (1983) reported similar range of Na secretion, but values for K-secretion were quite low. However her study was conducted after three treatments.

Ca secretion in the present work does not indicate any significant effect of β-alanine treatment, but the values of Na/Ca ratio are slightly more in the second set which is due to amount of Na secreted.

The chlorides from secretion ranges from 0.937 to 13.530 mg/plant in the NaCl treated set and 1.400 to 13.071 in second set. This may indicate retention of more Cl in the leaves after β-alanine spray. Many investigators have shown that secretion of chloride

TABLE 1. *Salt secretion from the leaves of* A. ilicifolius *after sixteen treatments*

Treatment	Na	K	Ca	Cl	Na/K	Na/Ca
Control (NaCl)	0.375	0.075	0.623	0.937	5.00	0.60
0.05 M	0.397	0.078	0.937	6.535	5.08	0.42
0.1 M	0.435	0.088	1.125	12.604	4.95	0.38
0.2 M	0.457	0.095	1.250	10.270	4.81	0.36
0.3 M	0.457	0.102	1.430	13.530	4.48	0.31
Control (alanine)	0.365	0.067	0.687	1.400	5.39	0.53
0.05 M	0.385	0.071	0.750	3.734	5.38	0.51
0.1 M	0.410	0.079	0.875	6.068	5.16	0.46
0.2 M	0.427	0.085	1.125	7.002	4.98	0.37
0.3 M	0.435	0.092	1.312	13.071	4.69	0.33

Values expressed as mg/plant.

is an active process which takes place against concentration gradient. It seems that secretion of Cl depends upon the level of chloride present in plant tissue. It is seen from the present investigation that β-alanine affects the ion-secretion through salt glands of *A. ilicifolius*. It helps to tolerate higher levels of ions in the metabolic environment hence less secretion is observed on the surface.

Department of Botany,
Shivaji University, Kolapur 416 004.

N. G. MULIK

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