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SALINITY-INDUCED CHANGES IN ISOPEROXIDASES IN TARO, *COLOCASIA ESCULENTA*

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Key Word Index—*Colocasia esculenta*; Araceae; taro; peroxidases; isozymes; salinity.

Abstract—The isoperoxidase patterns of two taro cultivars capable of growth at seawater dilutions of 25% or more were substantially altered when compared with freshwater grown plants. These alterations included the appearance of wholly new isozyme bands. Six other cultures were unable to grow in saline media.

INTRODUCTION

Elevated peroxidase activity is commonly associated with a variety of stresses in plants, including hypogravity, hypergravity, vibration, hypoxia, chilling, freezing, radiation and infection [1–3]. Indeed the variety is so great as to suggest that the peroxidase response is general and non-specific and hence should be increased by salt stress as well. That elevated peroxidase is a useful marker for salt stress in some plants at appropriate salinities is a matter of record [4, 5].

Experiments in this laboratory show, however, that cultivars of the same species may respond quite differently in their peroxidase activity–salt relations, and that salinity-induced elevations in enzyme activity seen when data are expressed on a fresh weight basis often become substantial decreases when those data are based on protein content [5, 6]. Although salinity-induced changes in total peroxidase activity remain of interest, the effects of saline growth media on isozyme patterns also might be expected to serve as sensitive markers, as they do for other physiological and environmental factors [7–10]. This has now been demonstrated in cultivars of taro, *Colocasia esculenta*.

RESULTS

Among taro plants screened for salt tolerance, the cultivars Vevela, Bunlong, Piko Ele-ele, Pololu, Kumu and Mana Lau Loa failed to grow in seawater diluted to 25% strength or higher. Two Samoan cultivars were grown in 25% seawater; however, they showed no consistent change in total peroxidase. In freshwater, Eot Lapar and A'ano Sama Sama Mumu root isoperoxidases were nearly identical but their leaf isozymes were not (Fig. 1).

Eot Lapar taro plants show dramatically altered isoperoxidase patterns when cultivated near their salinity limit of 25% seawater, i.e. 0.8% dissolved solids (Fig. 2). In addition to possible electrokinetic modifications in existing bands, these changes involve the appearance of new cathodic isoperoxidases in root and corm tissues, but not in leaves. In contrast A'ano Sama Sama Mumu taro can tolerate salinities as high as half-strength seawater, albeit with reduced growth (Fig. 3). Here, there is a remarkably regular succession of new isoperoxidase bands as salinity rises from 12.5% to 50% seawater. This involves the appearance of one new well-resolved anodic band and two new cathodic bands.

Isoperoxidase patterns frequently show striking chan-

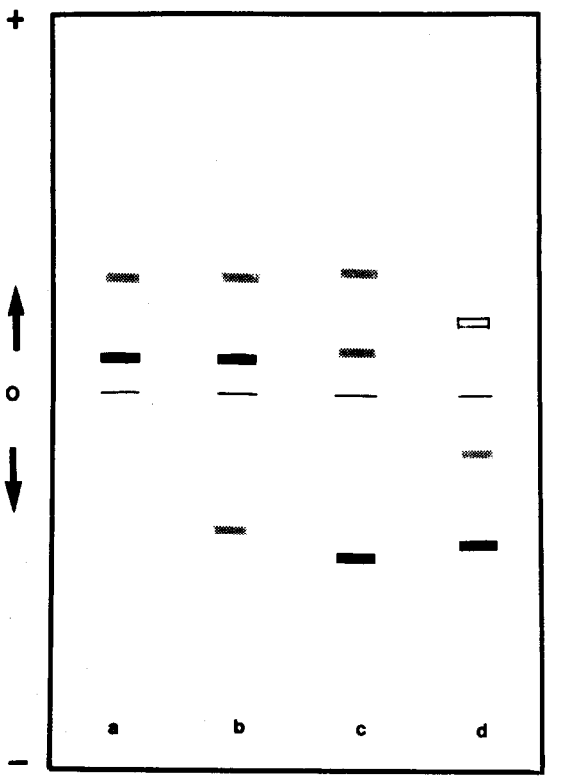

Fig. 1. Isoperoxidase in root and leaf tissue of two taro cultivars. Samples a and c are cultivar Eot Lapar; b and d, cv A'ano Sama Sama Mumu. Root tissues at a and b; leaf tissues at c and d. Rectangles represent isoenzyme bands; open, stippled, striped and solid areas indicate increasing stain intensities.

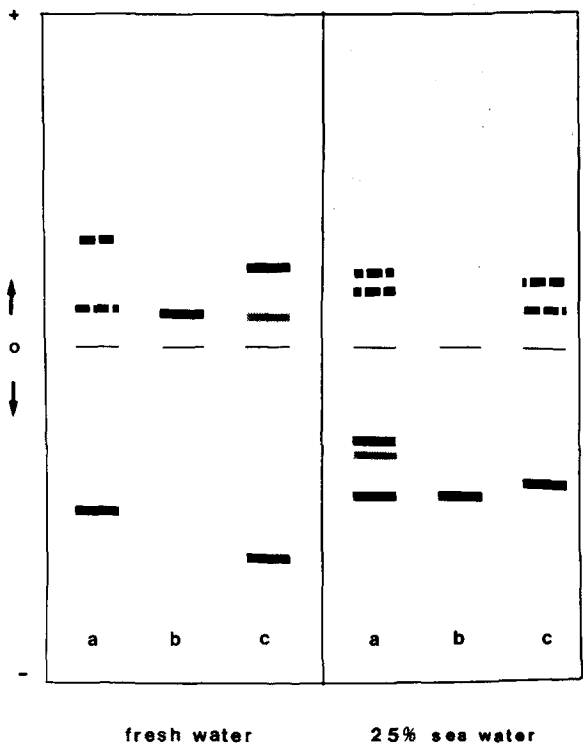

Fig. 2. Isoperoxidase of taro cultivar Eot Lapar grown in fresh water and 25% seawater. Samples a, b and c represent root, corn and leaf respectively within each set. The code for the intensity of band staining is as in Fig. 1.

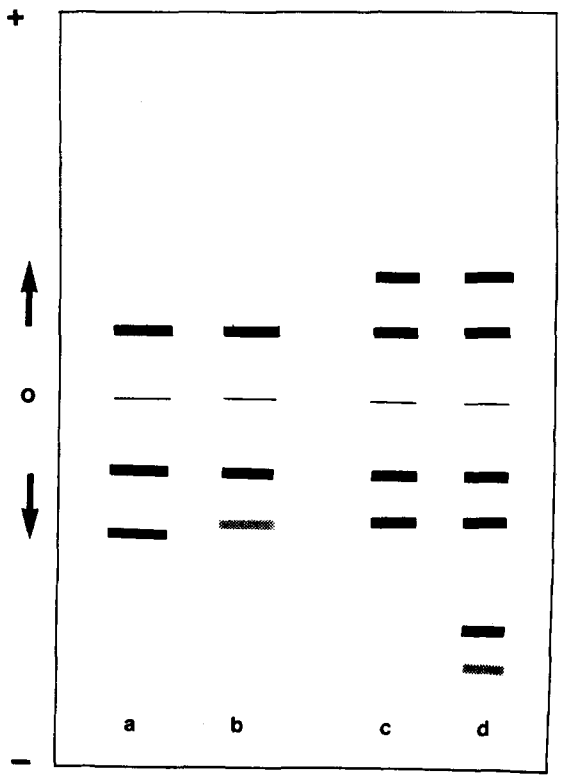

Fig. 3. Isoperoxidase in leaf tissue of taro cultivar A'ano Sama Sama Mumu grown at various salinities. Freshwater bands are at a; 12.5, 25 and 50% seawater respectively are at b, c and d. Stain code as in Fig. 1.

ges under hormonal or environmental influences. These data show that the growth of taro cultivars in saline waters is accompanied by the appearance of new isoperoxidases, with or without the disappearance of displacement of freshwater isozyme bands. Taros are commonly treated as glycophytes. It does not follow, however, that culture in salt water will constitute a stress. Experiments with papaya, also a glycophyte, show growth stimulation even at salinities approaching the 25% seawater level [11]. In the present case, whether or not the salinity-induced isoperoxidase changes are to be regarded as adaptive or injury responses remains to be determined.

EXPERIMENTAL

Plants. Cultivars of taro (*Colocasia esculenta*) were obtained from the University of Hawaii's Lyon Arboretum, Honolulu, or from local growers. 'Cuttings' consisted of shoots about 25 cm in height attached to corm pieces *ca* 4 cm in diameter. They were planted in 4-l. pots in a peat–vermiculite mixture and provided with fresh water for 14 days. Five replicate cuttings were then transferred to pots and provided with freshwater or seawater dilutions corresponding to 12.5, 25 or 50% of full strength. Plants were maintained at 24° under daylight fluorescent illumination at $265 \pm \mu$ Einsteins m^2 sec. After seven weeks, new growth was harvested for analysis. For electrophoresis, 10 mg fr, wt quantities of root, leaf or corm tissue were macerated on 9 × 5 mm Whatman No. 1 filter paper rectangles. The papers were positioned at the origin in 11 × 15 cm starch gels prepared with 14.7 g of hydrolysed starch (Connaught) per 150 ml of pH 9.0 borate buffer [9, 11]. Bridge buffer was prepared from 0.2 M H_2BO_3 + 0.5 M NaOH. Gels were run at 200 V, 15 mA (Beckman Duostat) for 4 hr at 24°. Peroxidase bands were developed using 4 mM guaiacol with 5 mM H_2O_2 in 0.2 M Sørensen phosphate buffer at pH 5.9.

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