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STATUS OF TOTAL PHENOLICS IN THE HYPOCOTYLS OF TWO *RHIZOPHORA* SPECIES DURING VIVIPAROUS GERMINATION

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Total phenolics were estimated in the hypocotyls of *Rhizophora mucronata* and *Rhizophora apiculata* during various developmental stages. The level of phenolics was found to be higher than that of glycophytes. Among the two species studied, *R. mucronata* contained more phenobes than *R. apiculata*, however, they decreased rapidly with elongation of the hypocotyls and the pattern was similar in both the spceies. The changing pattern was also very much comparable to that of startified dormant seeds.

Keywords : *Rhizophora* sp.; Total phenolics; Hypocotyl.

Phytochemicals are very important for chemical synthesis, spatial orientation, growth, flowering and germination. Among these, phenolics play an important role in photosynthesis (Towers, 1984) and also known to act as germination inhibitors (Sreeramulu, 1974; Khan and Ungar, 1986). The dormancy of seeds is attributed to the presence of some phenolic acids which are absent in non- dormant seeds (Khan and Ungar, 1986). During dormancy breaking the level of phenolic content was found to decrease appreciably (Sharma and Rai, 1988). In general, the level of total phenol was found higher in halophytes than glycophytes (Khan *et al.*, 1976). Presence of more phenolics in mangrove tissues were also reported (Goodall and Stoddart, 1989). However, the information regarding non-dormant seeds like viviparous seed germination in relation to changes in phenolics level is scanty. Thus, an attempt has been made to study the phenolic content in various developmental stages of unique hypocotyls of *Rhizophora* species.

Seedlings of *Rhizophora mucronata* Lamk. and *Rhizophora apiculata* Bl. were collected from Pitchavaram mangrove forest (lat.11° 27' N; long. 89° 47', E), Tamilnadu, India, in air-tight polyethylene bags. The different developmental stages were catagorized on the basis of length and weight of the hypocotyls. The seedlings were washed with tap water and rinsed with distilled water. The total phenolic content was estimated (Swain and Hillis, 1959) by weighing one gram of fresh material homogenised with 5 ml of 2 N HCl and kept on a boiling water bath for 20 minutes and then filtered. The filtrate was centrifuged at 3000 rpm for 15 minutes, the resulting supernatant was extracted with diethyl ether with the help of separating funnel. After evaporated to dryness, the residue was dissolved in 3 ml of 95% ethanol, and this was used to estimate the total

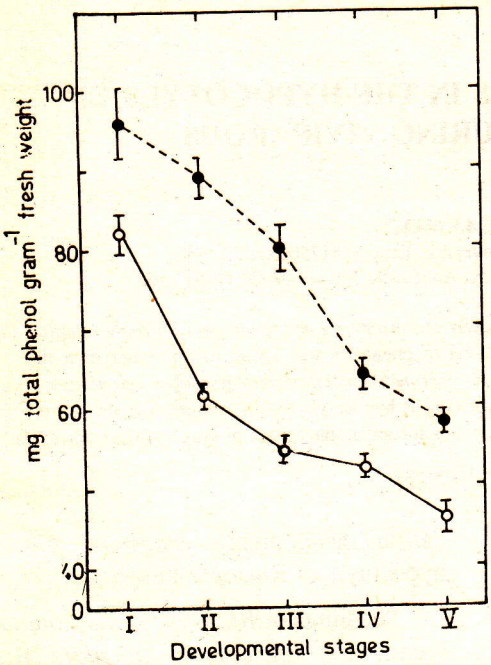

Fig.1. Total phenolic content quantified by extracting in diethyl ether and determined by Folin's reagent. Values of *R. mucronata* (●---●) and R. apiculata (0---0) are mean of three replicates and expressed in equivalents of mg coumarin. Vertical bars represent S.D.

phenolics with Folin's reagent. A standard curve was prepared by using known amounts of coumarin. Three replicates from different hypocotyls were used for every stage.

The results on the changes in total phenolic content in various developmental stages of the hypocotyls of *R. mucronata* and *R. apiculata* are graphically represented in Fig. 1. In general, the total phenolic content was found always higher in all stages of *R. mucronata* than *R. apiculata*. The total phenolics were recorded maximum at stage I of both the species studied. After that a steady decrease was observed from stage I to V of *R. mucronata* as well as in *R. apiculata*. The level of total phenolics was found less in stages V than other developmental stages. Though the percent decrease between the stage I and II of *R. apiculata* was 3 fold higher than that of *R. mucronata*, the difference between stages IV and V was found almost similar.

The present result clearly indicates that the total phenolic content was higher in both the species of *Rhizophora*, than the perivious work carried out in the leaves of *Pterocarpus santalinus* L. (Venkataramaiah *et al.*, 1980) and in germinating seeds of *Rosa macrophylla* (Sharma and Rai, 1988), a known glycophytes. This is in accordance with the earlier reports of Khan *et al.*, (1976) and Goodall and Stoddart (1989). Higher phenolics in mangroves, as they are living in adverse condition, may be an adaptative mechanism to overcome the disease infection and grazing by distaste caused by phenolics. Development of disease resistance and immunity through phenols (Uritani, 1961; Kuc, 1964) are well documented.

Changing pattern of phenolic content during development was also very much similar to that of the earlier work done in startified dormant seeds (Sharma and Rai, 1988). The lowering amount of phenolic content may be due to shunting of acetyl CoA to the TCA cycle, which results in an inadequate pool of acetyl CoA which is essential

for the synthesis of complex phenols (Hanson *et al.*, 1967). This view is directly supporting our present finding that the respiration rate (Kothandaraman, 1984) upto stage III was increased in both *Rhizophora* species during growth and development of the hypocotyls. However, contradictory results were also reported in suspension culture of *Acer pseudoplatanus* (Henshaw and Pearce, 1969) and in Paul's scarlet rose cells grown in tissue culture (Amorim *et al.*, 1977). They suggested that the cells produced phenols during all phases of growth, but at stationary phase, the production was greatest. The result may probably due to their nature of materials selected for the study. Furthermore, the low content of phenol in stages V may plays a significant role to produce easy rooting during establishment of the seedling, after getting detached from the mother plants, because high concentrations of phenolic compounds are catagorised as growth inhibitors (Sreeramula, 1974) and also responsible for the slow growth of a plant (Venkataramaiah *et al.*, 1980).

Hence, with the available literature, our report concluded that (1) hypocotyls of Rhizophora sps. contain more phenolics than glycophytes reported by earlier workers, as an adaptative mechanism. (2) Dormancy may be determined by the presence of phenolic acids, but once dormancy breaking occurs, both dormant and non-dormant seeds behave alike, (3) increasing respiration rate may result in the fall of total phenolic content, (4) lowering level of phenolics in the last stages (V) may prepare the hypocotyls to get better rooting during establishment or get contact with soil.

References

Amorim H V Dougall D K and Sharp W R 1977, *Physiol. Plant.*, **39** 91

Goodall J A and Stoddart A 1989, *Aquat. Bot.*, **35** 197

Hanson K R, Zucker M and Sonderheimer E 1967, *Phenolic compounds and metabolic regulation* Appleton-Century-Crafts, New York, 68 pp.

Henshaw G G and Pearce R S 1969, *The relationship between growth and the synthesis of phenolics in suspension cultures of Acer pseudoplatanus* X-International Bot. Cong., Seattle, Washington, USA.

Khan A M and Ungar I A 1986, *Bot. Gaz.*, **147** 148

Khan M I, Khan M A, Khizar T and Nasir P 1976, *Plant production under saline conditions* Cento Symposium, Adana, Turkey, 140 pp.

Kothandaraman K R 1984, *Physiological* and *biochemical studies in the viviparous seedlings of two mangrove sps. of Pitchavaram* Ph.D. thesis, Annamalai University, Tamilnadu, India.

Kuc' J 1964, *Phenols in normal and diseased fruits and vegetables* Proceedings Appleton-Century-Crafts, New York, 63 pp.

Sharma S and Rai V K 1988, *Curr. Sci.*, **57** 275

Sreeramulu N 1974, *Z.Pflanzenphysiol.*, **71** 101

Swain T and Hillis W E 1959, *J. Sci. Food Agr.*, **10** 63

Towers C H N 1984, *Can. J. Bot.*, **62** 2900

Uritani I 1961, *Symposium on biochemistry of plant phenolics substances*, Colorado State University, Fort Collins, 98 pp.

Venkataramaiah V, Prasad S V, Rao G R and Swamy P M 1980, *Ind. J. Exp. Biol.*, **18** 887