Phytochemistry, 1973, Vol. 12, pp. 1521 to 1522. Pergamon Press. Printed in England.

EFFECT OF BENZIMIDAZOLE AND NICKEL IONS IN THE CONTROL OF *ORYZA SATIVA* LEAF SENESCENCE BY RED AND FAR-RED LIGHT*

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(*Received* 1 *January* 1973. *Accepted* 8 *February* 1973)

Key Word Index—*Oryza sativa*; Gramineae; rice; senescence; red and far-red light; chlorophyll; protein; benzimidazole; nickel ion effect.

Abstract—Changes in the levels of chlorophyll and protein were determined in detached rice leaves floated on water, benzimidazole (mM) and nickel chloride (mM) under continuous dark, red (R) and far-red (FR) illumination. Senescence was enhanced under FR and retarded under R illumination as compared to the dark treatment for leaves floated both on water and benzimidazole solution. Benzimidazole and nickel ions also delayed the senescence of leaves still further, although only to a limited extent under FR illumination. Protein changes showed similar trends to chlorophyll during senescence.

BOTH benzimidazole and nickel ions delay the senescence of detached rice and wheat leaves[1-4] in dark. A recent report[5] emphasizes the enhancement of senescence by FR light in mature green tissue of intact thalli of *Marchantia polymorpha*. R light retarded and FR speeded senescence in tobacco leaf discs[6] but this has been questioned.[7]

In view of these reports an experiment was designed to study the effect of benzimidazole and nickel ions on the senescence of detached rice leaves in dark, R and FR light, and the results obtained are shown in Fig. 1. The initial values of the five apical leaf segments weighing *ca.* 200 mg for (a) chlorophyll: extracted in 80% EtOH (25 ml) averaged $A_{665\ nm} = 1{\cdot}4 \pm 0{\cdot}05$; (B) protein: 20·6 mg (bovine serum albumin equivalent). A study of the figure indicates the effect of benzimidazole and nickel ions under dark, R and FR illumination in retarding the senescence (as measured by chlorophyll loss) of leaves. The relative rates of chlorophyll and protein loss in water-floated (control) leaves decreased considerably with R, but FR illumination accelerated the rate of loss. Benzimidazole, which retards the loss of chlorophyll and protein in detached leaves under continuous dark,[2,3] was also effective in retarding the senescence under R or FR (Fig. 1). Nickel ions retarded senescence in the dark and under FR but had no effect in R light. The protein changes showed similar trends to chlorophyll changes under dark and R light.

* Part III of the series "Studies on Leaf Senescence". Listed as paper No. 4 of the Plant Biochemistry and Enzymology Laboratory of the Department of Botany, Utkal University.

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The most important outcome of this investigation is that FR light induces senescence whereas R light retards senescence for leaves floated on water which corroborates a recent report.[5]

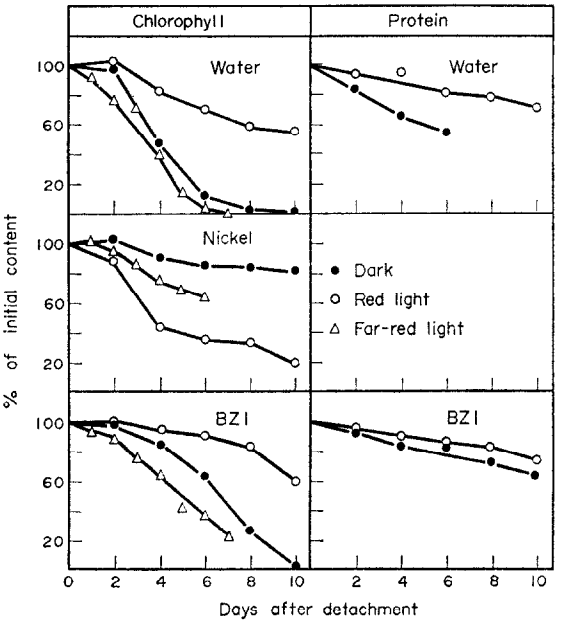

FIG. 1. CHANGE IN THE LEVELS OF CHLOROPHYLL AND PROTEIN OF DETACHED RICE LEAVES FLOATED ON WATER, BENZIMIDAZOLE (BZI) AND NICKEL CHLORIDE SOLUTION UNDER DARK, RED AND FAR-RED LIGHT.

EXPERIMENTAL

5 cm leaf tips from 7-week-old Rice (*Oryza sativa* var. BBS 873) plants were thoroughly washed in H_2O. Samples of 5 leaf tips (*ca.* 200 mg) were floated on 30 ml H_2O (control), benzimidazole (mM) or $NiCl_2$ (mM) in 10 cm Petri-dishes containing 20 μg chloramphenicol and 200 units penicillin. Neither penicillin nor chloramphenicol decreased the chlorophyll loss at the concentration used. The dishes were kept in the dark at 27° or under continuous R[8] (590–700 nm), FR[8] (700–735 nm) illumination at 32°. Samples were harvested at intervals for chlorophyll[9] and protein[10] estimations. All experiments were performed three times.

Acknowledgements—The authors are grateful to Prof. B. Padhi for providing the necessary facilities. This work was supported in part by a grant from the University Grants Commission and the Board of Scientific and Industrial Research, Government of Orissa to one of us (D. M).

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