J. Phytol. Res. (2), (1989)

HISTOCHEMICAL CHANGES IN *EICHHORNIA CRASSIPES* (MART.) SOLMS. INDUCED BY ATRAZINE

S.S. SREENIVAS and B.C. RANA
Department of Biosciences, Sardar Patel University, Vallabh Vidyanagar-388 120, India.

Atrazine (2-chloro-4-ethylamino-6-iso propyl amino-S-traizine), a triazine compound was tried on *Eichhornia crassipes*, an aquatic weed. Some histochemical observations, like starch, lipids, proteins and enzyme peroxidase, were made to know the possible mode of action and biochemical changes. Two concentrations viz 0.2 ppm and 0 8 ppm were used to know the toxic level of herbicide. The suitability of Atrazine as weed control was discussed.

Keywords : Atrazine; Water-hyacinth; Histochemistry.

Introduction

The potential threat to our inland waters is coming from increased weed infestation resulted out of eutrophication of water bodies. Out of all the weeds water-hyacinth, *E. crassipes* is a worst menace. It blocks inland water ways and irrigation system, also invades fish culture ponds. Several workers have contributed to the control of this weed through both chemical usage (Joshi, 1969) and biological methods (Jayanath, 1988). The most commonly used chemical being 2, 4-D (Bajpai *et al.*, 1973). The present investigation was carried out with Atrazine, a photosynthesis barrier (Moreland *et al.*, 1958; Ashton *et al.*, 1960; Zweig and Ashton, 1962) on water-hyacinth. In the present study some preliminary observation were made on the histochemical changes occurring after the treatment as they precede biochemical changes (Cutter, 1978).

Material and Methods

Water-hyacinth plants were collected from local Anand pond and acclamatized to garden conditions by growing them in artificial tanks. One lower concentration (0.2 ppm) and a higher concentration (0 8 ppm) of the herbicide were given by mixing them in water. After third day of the treatment fresh leaf material was collected from different concentrations to study the histochemical and histo-enzymatic changes. They include starch (Johansen, 1940); lipids (Werker and Fahn, 1969,

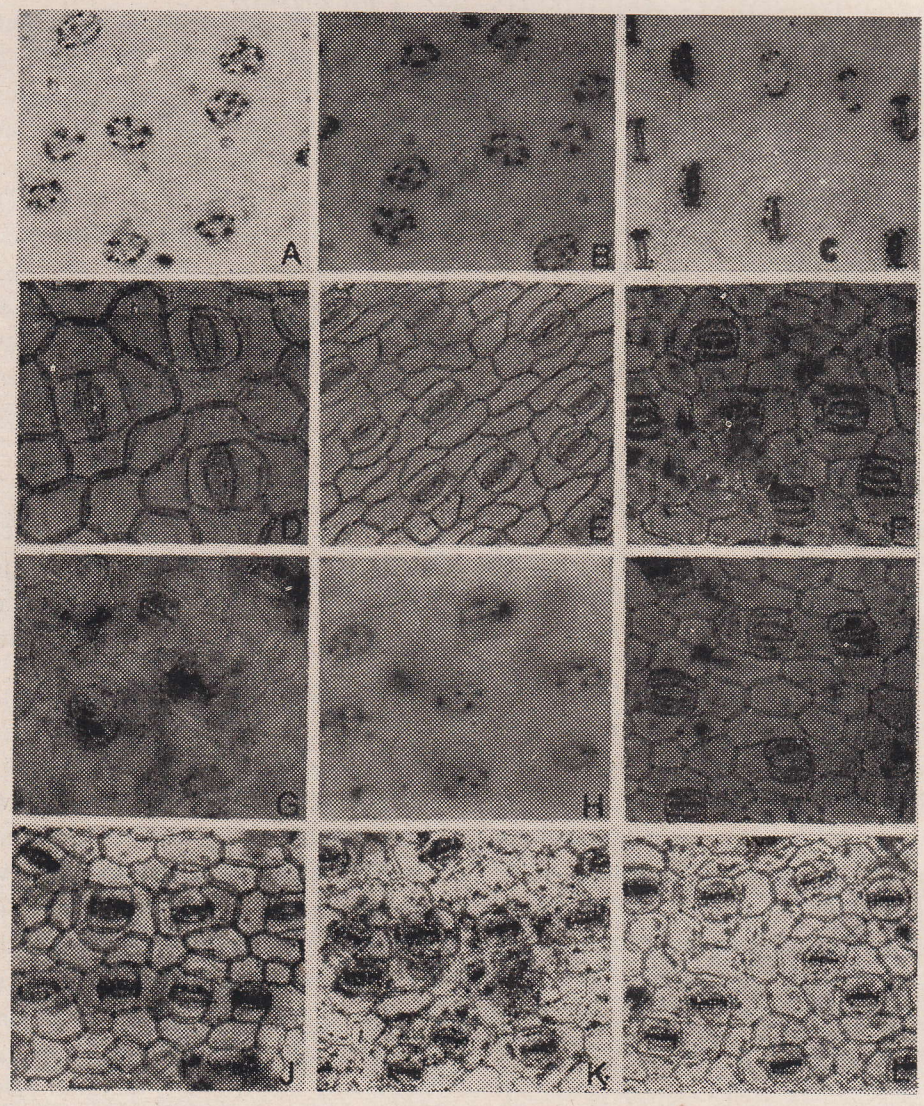

Fig. 1 Epidermal peeligs of control (A, D, G, J), 0.2 ppm atrazine treated (B, E. H, L,) and 0 8 ppm atrazine treated (C, F, I, K) showing starch, lipids, proteins and peroxidase activity respectively.
(A,B, C,H-65 x ; D, E, F, I—190 x and G, J, K, L—125 x)

proteins (Pearse, 1968) and enzyme peroxidase (Graham *et al.*, 1966).

Observations

Histochemical changes observed in the laminar part include reduction in stored carbohydrate in the form of starch (Fig. 1 A, B, C) and lipids (Fig. 1. D, E, F) and an increas in the protein contenr (Fig. 1. G, H, I) in the treated plants compared to control. The important oxidizing enzyme peroxidase showed comparatively enhanced activity in treated plants (Fig. 1 J). The changes that are in plants treated with 0.8 ppm are more pronounced compared to control as well as to those of plants treated with 0.2 ppm of herbicde (Fig. 1 C, F, I, K). Herbicide concentration of 0.8 ppm was found to be toxic as it caused severe damage to the extetnal morphology after the third day of treatment. Further, the anatomical observation showed that there is a failure in stomatal opening and closing and partial closure of already opened stomata.

Discussion

A considerable amount of literature has been cited on the mode of action of these group of herbicides. This research indicated that their major action is to block photosynthesis. Davies (1959) and Sheets (1961) reported that simazine, another compound of S-triazine group of herbicides, was readily absorbed and translocated following root application. This resulted in acute symptoms in the laminar part.

The decreased level in the stored carbohydrate (Singh *et al.*, 1972) may be resulted out of increased consumption in the metabolic activity as the herbicide is a strong photosynthetic inhibitor. Several workers have reported that S-triazines increase the protein content in a number of plant sps. (Allinson and Peters, 1970; Fink and Flethchali, 1967; Cosgrove *et al.*, 1987). While casual relationship between NRase and the protein synthesis has been attributed to enhanced NRase activity. Ries *et al.* (1967), Singh and Salunkhe (1970) made some observations that increased protein content is due to increased rate of aminoacid formation resulting from higher rate NRase and trans-aminase activities. Thus the decrease in the level of starch concomitant increase in the starch degrading enzymes amylase and phosphorylase as reported by Gates and Sipson (1968) indicates greater utilization of carbohydrates for protein synthesis. The increased level of peroxidase enzyme came out of increased oxidative metabolism (Atkinson, 1965). Moreover this enzyme is also supposed to be associated with phenolic metabolism and an increased rate of respiration (De

Jong, 1965). The higher rate of respiration envisaged by Ries (1967) coupled with higher ATPase activity supports the contention that triazines stimulate the utilization of carbohydrates for the synthesis of proteins.

From the above observaitons it is concluded that atrazine at the rate of 0.8 ppm can be toxic to the weed causing sufficient damage, therefore suggested for further studies.

Acknowledgement

The financial assistance from C.S.I.R. is gratefully acknowledged. The authors are thankful to B.P. Mills Pvt. Ltd., Bombay for supplying the atrazine used in the study.

Accepted, October 1989

References

Allinson D W J and Peters R A 1970, *Agron. J.* **62** 426

Ashton F H, Zweig G and Mason G W 1960, *Weeds* **8** 448

Atkinson D E 1965, *Science* **150** 851

Bajpai R P and Chauhan D V S 1973, *Proc. 3rd all, India Weed Control Seminar*, Hau Hissar, p. 60

Cosgrove, Dennis R and Michael Barrett 1987, *Weed Sci.* **35** 564

Cutter B G 1978, *Plant Auatomy Part I* Edward Arnold, London.

Davies D E, Funderburk H H and Sansiny N G 1959, *Weeds* **7** 300

De Jong D W 1965, *Bot Gaz.* **127** .

Fink R J and Fletchall O H 1967, *Weed Sci.* **15** 306

Gates J W and Simpson C M 1968, *Can. J. Biochem.* **46** 1459

Graham R C Jr. and Karnovsky M J 1966, *J. Histochem. Cytochem.* **14** 291

Jayanth K P 1988, *Curr. Sci*, **57** 968

Johansen 1940, *Plant Microtechnique* McGraw Hill, New York

Joshi N C 1969, *Pesticides* **3** 27

Moreland D E, Gentner W A, Hilton J L, and Hill K L 1958, *Plant Physiol.* **34** 432

Pearse A G E 1958, *Histochemistry–theoritical and applied Vol. I* Edinburgh, Churchill, Liwingstone

Ries S K, Chmiel H, Dilley D R and Filner P 1967, *Proc. Natl. Acad, Sci*, (USA) **58** 526

Sheets T J 1961, *Weeds* **9** 1

Singh B and Salunkhe D K 1970, *Can. J Bot.* **48** 2213

Singh B, Salunkhe D K and Lipton S H 1972, *J. Hort. Sci*, **47** 441

Werker E and Fahn A 1969, *Bot. Linn. Soc.* **62** 379

Zweig G, Ashton F M 1962, *J. Exptl. Bot* **13** 5