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Atrazine effect on Photosynthesis of Pistria Stratiotes,L.

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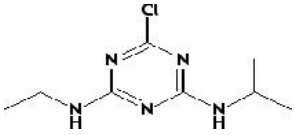
Abstract: In recent years the eradication of weeds has drawn the attention of scientists, agriculturalists and environmentalists. *P. Stratiotes*, L. is a highly noxious weed interface with agro – ecosystem of both coastal and inland hydroelectric projects and public health. It is understood that this weed has caused severe ecological damage and economic loss. In order to control the diversity of *P.Stratiotes* L, an attempt has been made in terms of chemical treatments. Different concentrations of atrazine have been applied in invitro condition enriched with NPK fertilizers for five consecutive days. The treated plants were analysed bio-chemically. The results indicate the two types of responses of atrazine in *P.Stratiotes*. The low concentration of atrazine ranging from 0.01 to 0.05 ppm is admissible for effective growth, whereas the higher concentrations have shown an adverse effect on the growth of *P.Stratiotes*, L. The impacts of different concentrations levels of atrazine in *P.Stratiotes* have been discussed in detail.
Keywords: Atrazine effect, Photosynthesis, *Pistria Stratiotes*,L.

Introduction

In recent years the problem of aquatic weeds have become very serious throughout the world. The aquatic weeds have caused ecological damage and economic loss due to their interface with agriculture, inland transport, inland fisheries, hydroelectric projects and public health. In our country large irrigation projects have become useless due to the blockage in canal by the aquatic blooms and reduced water flow by 80% [1]. Fisheries loss due to aquatic weeds is around one million kg fish annually [2]. Aquatic weeds harbour the plant pest and forming a breeding ground for mosquitoes an insect vector for human diseases encephalitis and rural filariasis [3].

The problems of control and eradication of weeds has drawn the attention of biologist, agriculturist and environmentalist in the recent years. Many methods have been adapted, among them application of chemicals has found to be successful. It is generally agreed that the success of controlling weeds lies with any approach which does not alter the environment and the desired biota. In this regard atrazine is widely used herbicide as it is known to affect the growth of selective broad leaved weeds.

Atrazine Chemical Structure



Atrazine is effective on both root and foliar application. Many attempt have been made to control aquatic weeds using herbicides. All these studies were concerned only with evaluating the effectiveness of herbicides in killing the plants and morphological changes of the plant. However, the study of atrazine (herbicide) on physiological metabolism of *P.Stratiotes*,L. is limited. So the present study is focused mainly on

the effects of different concentrations of atrazine on photosynthetic products of *P. Statiotes* and to assess the concentration used to eradicate the weed totally.

Materials and Methods

Pitia Stratiotes used for the present study and was collected from the pond and acclimatized in the growth medium consists of tap water supplemented with commercially available NPK (17:17:17). After acclimatization, plants of uniform sizes were transferred to plastic trough of 3 litres capacity containing various concentrations of atrazine and placed under glass house condition. After 2 days of treatment, plants were removed and washed with distilled water and used for analysis. Morphological observations were made and growth aspect was recorded on the basis of chlorophyll content [4] and starch [5] Total sugar content was determined by the method proposed by [6].

Results and Discussion

Morphological observation

Some of the morphological changes noted in the atrazine treated plants were burning, rolling of leaf margins, Chlorosis and necrosis. These effects were mainly dependent on concentration and duration of chemical treatment. At lower concentration (0.01 and 0.05 ppm) the plant was more vigorous than the control. Whereas at higher concentration such as 1 and 2 ppm the total eradication of weeds towards the last sampling period. The promoting effect on growth at subtoxic levels of atrazine as presented in present investigation as supported by [7] in bean and cotton established that the increase in growth was due to increased nitrogen absorption. The growth inhibition at higher concentration (1 and 2 ppm) could be due to the inhibition of Photosynthesis [8] [9]. The total chlorophyll data of present investigation (table.1) showed decrease in total chlorophyll supporting the ideas that higher concentrations of atrazine inhibited photosynthesis.

Physiological observations

Total chlorophyll

Table 1: Changes in total chloropyll content in P.Stratiotes treated with atrazine as mgg $^{-1}$ dry wt.

Days	Control	Concentrations of atrazine in ppm				
		0.01	0.05	0.1	1	2
2	17.82	21.00	25.9	19.7	12.66	9
4	18.9	26.32	26.5	17.2	12.00	8.8
6	19.38	27.01	26.9	17.7	8.4	nil

Application of Atrazine influenced the chlorophyll content in leaves of *P.Stratiotes*. In control series a gradual increase in the total chl. content is observed (Table 1). The treated plants at low concentrations also implies the gradual increase but the degree of increase in the concentrations of 0.01 and 0.05 ppm was more than the control. In control series, Chl. contents was in the range between 17.82 and 19.38 mgg^{-1} dry wt.

But in 0.01 ppm it range between 21 and 27-01mgg^{-1} dry wt, whereas in 0.05 ppm it varies between 23.9 and 26.9 mgg^{-1} dry wt (Table.1). The accumulation of total chl. in the present study may be attributed to the increase in synthesis of phospholipid content in thylakoid membrane of atrazine treated maize [10]. According to [11] the increase in total chlorophyll content in atrazine treated *Hordeum vulgare* is due to stimulatory effect of herbicide on enzyme involved for biosynthesis of chlorophyll.

The toxic effect of atrazine at higher conc. (0.1, 0.5, & 1 & 2 ppm) on chlorophyll synthesis is in accordance with earlier reports [12]. It was proposed that one of the fundamental phytotoxicity of atrazine treated plants is the peroxidative break down of polyunsaturated chloroplast membrane lipids leading to distribution of pigments and accumalation of toxic organic compounds [13].

Starch

Starch is the important photosynthetic product of any plans. It serves as the chief source of energy in plants and any disturbance either in its synthesis or utilization disturb the whole metabolic activities of plants.

In the present study the Starch content shows two types of responses to atrazine treatment. The control series maintained a steady level of starch throughout the study period. The results of the starch content is given in table 2.

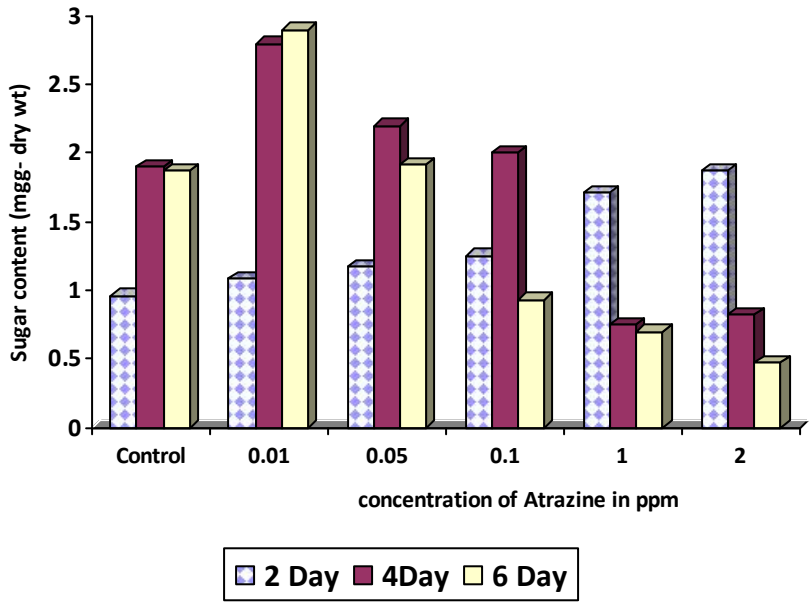
Table 2 : Changes in starch content of Pistia Stratiotes treated with atrazine as mgg- dry weight

Days	Control	Concentrations of atrazine in ppm				
		0.01	0.05	0.1	1	2
2	9.76	10.0	10.5	10.1	3.72	3.01
4	10.24	11.6	13.9	10.0	2.68	2.5
6	10.74	12.0	14.3	6.06	0.88	0.60

The present study revealed that lower concentrations of atrazine (0.01 & 0.05 ppm) significantly promoted starch content. Higher rate of photosynthesis was reported by [14] in atrazine treated algae. [15] found that the decreased rate of respiration in atrazine treated Maize. Thus increase in starch at lower level of atrazine in *P. Stratiotes* may be due to higher rate of photosynthesis and low rate of respiration. The drop in starch level at high concentration of atrazine is in accordance with previous reports of [16] [17] [18]. The partial inhibition of photosynthesis [19] and partial closure of stomata and restriction of Co_2 exchange [20] are the cause for decrease in starch level in Beans and some weeds repectively. The data presented here, the chlorophyll content support that a drop in photosynthesis is one of the reasons for reduction in starch at higher concentrations of atrazine.

The decrease in starch synthesis at higher concentration could possible be due to hydrolysis and it is in coincidence with higher amount of total soluble sugars noted in the present study (Figure 1).

Figure 1 : Changes in the sugar content of atrazine treated P.Stratiotes as mgg-1 dry wt.



The raise in hydrolytic activity over synthesis activity was in conformity with the earlier reports [21]. As atrazine is selective in action and less persistant in the medium, it causes less growth hazards to the environment. Eventhough biological method of control is less harmful, it is slow process to control the fast growing weeds. Atrazine at 1ppm concentration could be used as a very effective weed controlling agent.

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