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Chlorpyrifos Induced Alterations in Biochemical Responses in Ashwagandha [*Withania somnifera* (L.)]

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INTRODUCTION

The use of synthetic pesticides as crop protection chemicals has become the most accepted ecological weapon for assured crop production. Chlorpyrifos [*O,O* diethyl *O*-(3,5,6-trichloro-2-pyridyl) phosphorothioate] is a broad-spectrum organophosphate insecticide being used for more than a decade to control foliar insects that affect agricultural crops, to reduce pod damage[5], and subterranean termites[8]. Chlorpyrifos produces hazardous effects on the environment when it is applied directly on plants or mixed with soil[2]. Plant damage can also be caused by the solvents in a formulation, impurities in spray water, using more pesticide than listed on the label, or poorly mixing the spray solutions. Condition of the plant at the time of treatment can affect phytotoxicity, stressed plants may be more susceptible. Environmental conditions such as the temperature, humidity and light can influence phytotoxicity.

Ashwagandha [*Withania somnifera* (L.)] known commonly as Indian ginseng, poison gooseberry or winter cherry is a plant belong to family solanaceae or nightshade family. It is used as a herb in ayurvedic medicine. The roots of the plant are categorised as rasayanas, which are reputed to promote health and longevity by augmenting defence against disease, arresting the ageing process, revitalising the body in debilitated conditions, increasing the capability of the individual to resist adverse environmental factors and by creating a sense of mental wellbeing. Ashwagandha is third important prioritized medicinal plant listed by National Medicinal Plant Board (NMPB).Since use of pesticides in medicinal plants are undertaken by some farmers therefore present study was chalked to find out the effect of varying levels of chlorpyrifos in the secondary metabolites content of ashwagandha.

A pot experiment on ashwagandha crop was laid out in net house condition at Indian Institute of Soil Science, Bhopal, Madhya Pradesh, during winter season of the year 2015-16 to study the effect of chlorpyrifos level on ortho-dihydric phenol and alkaloid content of ashwagandha plant.

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In this experiment four treatment were taken *i.e.*, no spray of chlorpyrifos (T_1), foliar application of chlorpyrifos below normal (Low)-0.25% (T_2), foliar application of chlorpyrifos recommended dose (Medium)-0.75% (T_3) and foliar application of supra-optimal dose of chlorpyrifos (High)-1.25% (T_4). Experiment was laid out in Completely Randomized Block Design and further analysis of plant tissues were done for different biochemical parameters. Ortho-dihydric Phenol Contents (µg g^{-1} fw) was determined by method suggested by Johnson and Schall[4]. Estimation of Total Alkaloids (mg g^{-1} fw) content was determined by the method as outlined by Shamsa *et al.*[7]. The data were subjected to statistical analysis by the method described by Panse and Sukhatme[6].

The results presented in table 1 revealed that maximum ortho-dihydric phenol content at 30, 45 and 60 days after transplanting were reported in treatment T_1 (0.032 µg g^{-1} fw), T_1 (0.029 µg g^{-1} fw) and T_2 (0.041 µg g^{-1} fw) respectively. The results of present investigation suggest that decreased in ortho-dihydric phenol by increase concentration of pesticide doses. Chauhan *et al.*[1], also reported high decrease in the total dihydroxy phenols in imidacloprid residue containing potato samples by 49.93% as compared to untreated samples.

Data from table 1 showed that maximum alkaloid content at 30, 45 and 60 days after transplanting were noticed in treatment T_2 (0.110 mg g^{-1} fw), T_1 (0.051 mg g^{-1} fw) and T_2 (0.087 mg g^{-1} fw) respectively. This might be due to morphological and physiological changes associated with insecticide treatment in plants which includes the inhibition of plant growth and increase in alkaloid production at lower levels of insecticidal spray. Similar results were observed by Jaleel *et al.*[3], in triazole insecticide treated white yam with increased antioxidant potentials and enhancement in alkaloid production. From the present experiment it can be concluded that low chlorpyrifos level showed comparatively high ortho-dihydric phenol and alkaloid content as compare to medium chlorpyrifos level and high chlorpyrifos level treatment.

Table 1. Impact of pesticide on total alkaloid content (mg g^{-1}fw) and ortho-dihydric phenol (µg g^{-1} fw) of ashwagandha at various growth stages at 30, 45 and 60 days after transplanting (DAT)

Level of chlorpyrifos	Ortho-dihydric phenol (µg g^{-1} fw)					Total alkaloide content (mg g^{-1} fw)				
	DAT 30	DAT 45	DAT 60	Total	Mean	DAT 30	DAT 45	DAT 60	Total	Mean
T_1- Control (No chlorpyrifos)	0.032	0.029	0.019	0.08	0.027	0.098	0.051	0.076	0.225	0.075
T_2- 0.25% (Low)	0.022	0.023	0.041	0.086	0.029	0.110	0.050	0.087	0.247	0.082
T_3- 0.75% (Medium)	0.023	0.018	0.029	0.070	0.023	0.091	0.047	0.081	0.219	0.073
T_4- 1.25% (High)	0.030	0.026	0.036	0.092	0.031	0.109	0.047	0.073	0.229	0.076
Mean	0.027	0.024	0.031			0.102	0.049	0.079		
CD(P=0.05)	0.005	0.002	0.006			0.007	0.002	0.009		
CD(P=0.01)	0.001	0.009	0.001			NS	0.008	NS		
SE(m±)	0.001	0.001	0.001			0.002	0.001	0.002		
C.V.	6.639	3.646	6.376			2.429	1.259	4.181		

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