

Distribution of Alkaloides and Allelopathism of Selected Weeds from a Post Harvest Crop Field

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ABSTRACT: Though beneficial the weeds always pose an important biological constraint to crop productivity. The economic losses that are caused by these weeds globally costs billions of rupees every year. Allelopathic potentialities of plants are considered as an alternative natural way of weed management strategy for crop production as well as environmental benefits. Although the plants like the weeds are the great reservoirs of many new & potential phytochemicals, majority of them still remains unexplored either due to restricted habitat or because of being wild in nature. Hence the present survey was carried out taking ten (10) selected weeds of various stages of development from post harvest crop fields of Rice and Mustard in the OUAT Farm campus which have been left open for around two months. The Botanical authentication of the weeds were done by following the Taxonomic literatures. They are *Cardus nutans* L., *Cerastium fontanum* Baumg., *Cleome viscosa* L., *Euphorbia maculata* L., *Helianthus tuberosus* L., *Lactuca serriola* L., *Phyllanthus niruri* L., *Sinapsis arvensis* L., *Vernonia cinerea* Scherb., *Veronica arvensis* L. Weeds were collected between January and February 2014. Their crude alkaloidal contents were extracted and estimated from the dried powder of the whole plant following the standard methods (Harborne et al 1992). All plant samples indicate the presence of good amount of Alkaloid, highest being in *Veronica persica* Poiret. (17.35%) and lowest in *Cardus nutans* (3.07%). Variation of alkaloidal contents with variation in stage of development maximum reaching at the flowering stage, was indicated within the individuals of the same family. The quantity of the alkaloid was species specific. The allelopathic effect of the crude alkaloidal extract tested against the seed germination of Rice, Mung (Green gram) and Mustard, indicates that the alkaloids are not so effective towards the growth of Rice but quite inhibitory towards the growth of Mung. This result is interpreted basing upon their chi-square values.

KEY WORDS: Weeds, Postharvest cropfield, phytochemicals, alkaloids, Allelopathy, chi-square value.

I. INTRODUCTION

The progress of human beings has been associated with the best use of plant resources for their livelihood. The weeds are the unwanted plant growth competing with other targeted plant with short vegetative phase and high reproductive potential. They grow mainly in the crop fields (On or before cropping) due to accumulation of residual materials left after human action which provide better nourishment to their growth [10]. Though beneficial the weeds always pose an important biological constraint to crop productivity. The economic losses that are caused by these weeds globally costs billions of rupees every year [9]. From the point of view of both Food and Health security, allelopathic potentialities of plants are considered as an alternative natural way of weed management strategy for crop production as well as environmental benefits [2].

Ancient Indian literature observed that every plant on this planet is useful in industry, Medicine and Allelopathy. The phytochemicals harbored by the plants are the great reservoirs of many new and potential bioactive compounds which could become new leads to the discovery of noble drugs [12]. Although the plants like the weeds are the great reservoirs of many new & potential phytochemicals, majority of them still remains unexplored either due to restricted habitat or because of being wild in nature [10 & 12]. Among the phytochemicals the alkaloids constitute one of the major group of naturally occurring nitrogen-containing pharmacologically active organic compounds that has had a major

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impact throughout history on the economic, medical, political and social affairs of humans [11]. Hence the present survey was carried out taking ten (10) selected weeds of various stages of development from post harvest crop fields of Rice and Mustard within the OUAT Farm campus, left open for around two months to substantiate their potency.

II. MATERIALS AND METHODS

Weeds were collected between January and February 2014. The Botanical authentication of the weeds were done by following the Texonomic literatures of “The Botany of Bihar and Orissa” by H.H. Haines and “Weed Identification Guide” [5 & 14]. They are *Cardus nutans* L., *Cerastium fontanum* Baumg., *Cleome viscosa* L., *Euphorbia maculata* L., *Helianthus tuberosus* L., *Lactuca serriola* L., *Phyllanthus niruri* L., *Sinapsis arvensis* L., *Vernonia cinerea* Scherb., *Veronica arvensis* L. [Fig.1.(a) to (j)]. The growth status and fresh weight of the whole plant of each sample was taken and recorded [Table]. The whole plant materials were oven dried between 40°C to 50°C. Their crude alkaloidal contents were extracted and estimated from the dried course powder of the whole plant following the standard methods [6] and recorded in the Table.



(a)



(b)



(c)



(d)



(e)



(f)



(g)



(h)



(i)

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(j)

Figure.1. Photoplates of Weed samples : (a) *Cardus nutans* L. (Asteraceae), (b) *Cerastium fontanum* Baumg. (Caryophyllaceae), (c) *Celome viscosa* L. (Capparaceae), (d) *Euphorbia maculata* L. (Euphorbiaceae), (e) *Helianthus tuberosus* L.. (Asteraceae), (f) *Lactuca serriola* (Asteraceae) (g) *Phyllanthus niruri* L. (Euphorbiaceae), (h) *Sinapsis arvensis* L. (Brassicaceae), (i) *Vernonia cinerea* Schreb. (Asteraceae), (j) *Veronica arvensis* L.

To observe the allelopathism the method with slight modification from Rosario Garcia Mateos et al.[4] and Sangita Chandra et al.[3] were followed. Seeds of rice, mung (green gram) and mustard pre-soaked with the solution (36mg of alkaloidal scrapings from the filter paper dissolved in 10ml of distilled water) of each alkaloidal extract for 72 hours and then were allowed to germinate over the moist filter paper placed inside petri dishes with a diameter of 9cm at room temperature to observe the percentage of germination and then transferred to trays containing soil for their survivability [Fig.2. -(a) to (k)]. Results were statistically analysed by chisquare test with reference to the percentage of germination in the control set with distilled water and recorded in the table.



(a)



(b)



(c)



(d)



(e)



(f)



(g)



(h)

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(i)



(j)



(k)

Figure.2.[Effect of Alkaloidal extracts on seed germination and survivality]: (a) *Cardus nutans* L. extract, (b) *Cerastium fontanum* baung. Extract ,(c)*Celome viscosa* L. extract ,(d) *Euphorbia maculata* L. extract. (e) *Helianthus tuberosus* L. extract (f) *Lactuca serriola* L. extract (g) *Phyllanthus niruri* L. extract (h) *Sinapsis arvensis* L. extract. i): *Vernonia cinerea* scherb. Extract (j) : *Veronica arvensis* L. extract (k): Control(without extract).

TABLE

Sl.No.	Name of the weed samples	Growth status	Fresh wt. In gm	Dry wt. In gm	% of Total Alkaloid content	% of Seed Germination			χ^2 (Chi-square) values		
						Rice	Mung	Mustard	Rice	Mung	Mustard
1	<i>Cardus nutans</i> L.	Rosette stage	134.94	17.52	3.07	86	60	76.60	0.05	1.43	1.14
2	<i>Cerastium fontanum</i> Baung.	Vegetative	140.32	266.23	3.21	88	46	64.70	0.00	8.23	0.14
3	<i>Cleome viscosa</i> L.	Fruiting	130.46	24.15	3.37	82	30	80.50	0.41	22.86	2.38
4	<i>Euphorbia maculata</i> L.	Flowering	120.25	36.41	9.28	84	56	20.00	0.18	2.80	33.70
5	<i>Helianthus tuberosus</i> L.	Flowering	644.41	10.61	5.02	80	20	61.80	0.73	35.71	0.53
6	<i>Lactuca serriola</i> L.	Vegetative	75.81	12.644	3.51	78	30	71.90	1.14	22.86	0.25
7	<i>Phyllanthus niruri</i> L.	Fruiting	39.21	16.46	9.4	86	36	57.80	0.05	16.51	1.47
8	<i>Sinapsis arvensis</i> L.	Vegetative	104.52	21.14	3.32	88	72	26.60	0.00	0.06	25.04
9	<i>Vernonia cinerea</i> Scherb	Flowering	120.05	26.29	4.54	96	34	24.00	0.73	18.51	28.30
10	<i>Veronica arvensis</i> L.	Vegetative	130.16	44.19	17.35	88	40	68.30	0.00	12.86	0.003
Control set						88	70	67.80			
Total χ^2 (Chi-Square) Value									3.29	141.83	92.953

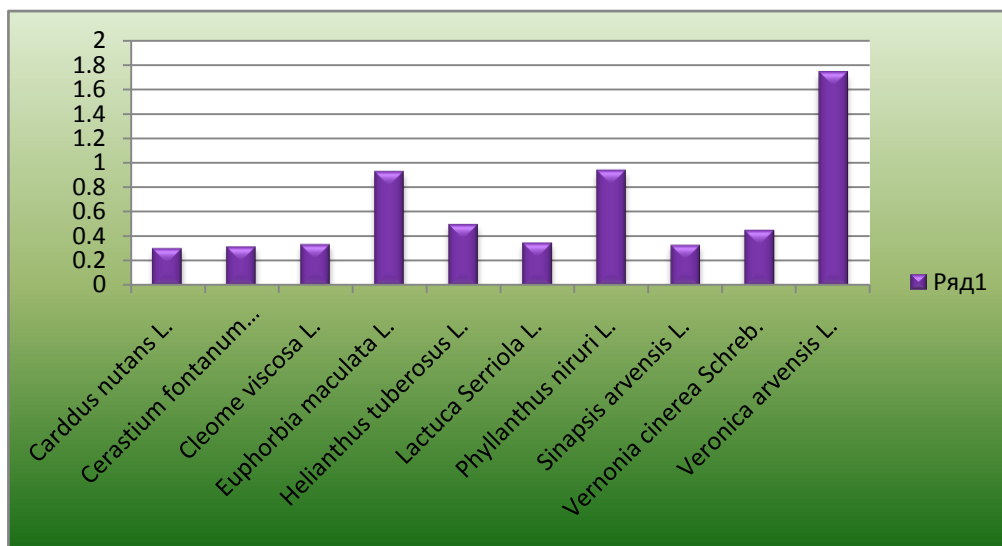
Table: Quantitative estimation of alkaloids from the weed samples and their effect on seed germination of rice,mung and mustard

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GRAPH



GRAPHICAL REPRESENTATION OF TOTAL ALKALOID
CONTENT OF SELECTED WEED SAMPLES

III. RESULT & DISCUSSION

Quantitative estimation of all weed samples indicate the presence of good amount of alkaloids distributed unevenly among the weeds highest being 17.35% in *Veronica arvensis* L. and lowest being 3.07% in *Cardus nutans* L.[Table].This is in agreement with the finding of Fazel et al.[11] where he estimated the alkaloidal contents of fourteen Iranian medicinal plants and found uneven distribution of alkaloids highest being 1688mg/100gDW in *Biebersteinia multifida* DC. Root and lowest being 7.90mg/gDW in *Scrophularia striata* Bioss. root.This variation in the alkaloidal composition of the weed samples may be correlated to their varying capacity of responses to the environment. Variation of alkaloidal contents with variation in stage of development maximum reaching at the flowering stage, was indicated within the individuals of the same family i.e. *Cardus nutans* L.,*Helianthus tuberosus* L.,*Lactuca serriola* L.,*Vernonia cinerea* Scherb. Of Asteraceae and *Euphorbia maculata* L. and *Phyllanthus niruri* L. of Euphorbiaceae. The quantity of the alkaloid was species specific.This is supported by the report of Srinivas Patnala et al. [8] who described that the factor that affect the content of active constituents in herbal plants include the age of the plants,temperature, daylight exposure,atmosphere,sampling method,the presence of toxic residues in soil,rainfall,altitude,soil composition and microbial contamination.G.S. Panwar et al. also proved that the production of secondary metabolites by plants depends greatly on the physiological and developmental stages of plants [7].The allelopathic effect of the crude alkaloidal extract tested against the seed germination of Rice,Mung(Green gram) and Mustard[Table] , shows that the chiscquare value of the differences between the percentage of germination in the control set and treated sets is significant in case of mung with a value of 141.82 and mustard with a value of 95.95 where as it was insignificant in case of rice with a value of 3.27 at all probability levels.This may be correlated to the fact that the rice seeds are not sensitive to the alkaloids but mustard and mung seeds shows sensitivity towards the alkaloidal extracts,mung seeds being more sensitive than mustard seeds. This is in agreement with the report of K.F. AI-Mutlaq et al. who mentioned the selective toxicity of alkaloids more sensitive being in the dicots than in the monocot plants[1 & 4].According to Kira Watkins[13] this is because the alkaloids interfere of with the intracellular calcium regulation.However result shown by the increase in the percentage of germination with alkaloidal extract of *Vernonia cinerea* Scherb.in rice(96%) only and that of *Sinapsis arvensis* L.in mung(72%) only and with extracts of

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Cardus nutans L., *Cleome viscosa* L. and *Lactuca serriola* L. in mustard showing the values of 76.6%, 80.5%, and 71.9% respectively, are not significant when compared with control.

IV. CONCLUSION

The weeds are proved to be potent for their alkaloidal contents but because of their negative effect (not promotive) on seed germination of crop samples, those can not be recommended for use as natural herbicides rather those can be referred for further research for new drug development.

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