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Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE)

A Peer Reviewed & Refereed, International Open Access Journal

www.jabe.in **Vol.1.Issue.2.2014 (Oct-Dec)** **E-ISSN:2394-2606**

ALLELOPATHIC STUDIES OF *DACTYLOCTENIUM AEGYPTIUM* (L.) BEAUV. COMPLEX

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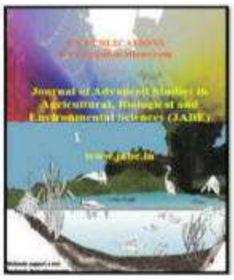

Article History

Received on:17-10-2014

Revised on:29-11-2014

Accepted on:30-12-2014

ABSTRACT

The common mode of speciation in cross fertilizing plants or animals involves gradual divergence of two or more population systems. The present study of the crowfoot grass *Dactyloctenium aegyptium*(L.) Beauv.was carried out in the university campus which showed morphological variability among its populations.As it is a prolific weed and not allowing other plants in its nearest vicinity it is quite interesting to study its phytosociological behaviour and its allelopathic qualities. The present study deals with its allelopathic behaviour of its different parts and the soilexudates collected around its roots.

INTRODUCTION

All members of a local populations share a single gene pool and any one of them has equal probability of mating with any other in producing offspring.(Mayor 1970). A common mode of speciation in cross fertilising plants or animals involves gradual divergence of two or more population systems. Hence the study of natural populations gained considerable importance in recent years and they are beeingrecognized as thefundamental units of a species. The present investigation was made from a single locality i.e., Nagarjuna University campus. Crowfoot grass (*Dactyloctenium aegyptium*(L.)Beuv.) is one of the dominant grass growing together with other grasses like *Cymbopogon,Heteropogon,Aristida,Chloris,Echinocloa,Eragrostis,Cyperus*, etc. The prevailing morphological and genetic variability is analysed and appraised through the observations on natural populations growing in Acharya Nagarjuna University campus (Mary and vijaya koteswari, 2003,2004).The present investigation with a general ecological slant was initiated with the objective of studyi ng morphological variability and some ecological differences in this grass complex. D. aegyptium occurred basically in eight morphologic forms which were grouped into two broad categories based mainly on the nature of the spikes i.e. compact (C1,C2,C3,C4,C5)and lax (L1,L2,L3) on spike structure (Mary and vijaya koteswari, 2003,2004).Other characters such as groeth habit, number of spikes, tillers, length of rachilla, etc.have been taken into consideration in distinguishing the above forms.

METHOD:

The telotoxic effects on four crops, viz.,rice (*Oryza sativa*), green gram (*Vigna radiata*), chillies (*Capsicum frutescence*), and the millet (*Eluesine coracana*) and two weed species viz., *Echinocloa colonum* and *Chloris barbata*, were studied.The plants of C4 at the flowering stage were collected from the local populations, washed in tap water , and the extracts were prepared seperately from roots, shoots and inflorescences. For 10% extracts 10grms of each of the above said parts were crushed in 100ml of distilled water. From this 5% extracts were prepared and stored in refrigerator at 10^0C . 10 seeds of each of the above crop plants and weeds were sown in soil filled petridishes. 10ml of 5% and 10% extracts were added to each dish.The number of germinated seeds, and the length and dry weight ofroot and shoot were noted.To make soil exudate, 1 kg of soil was collected fromnear the roots of the plants and it was added to about 2 liters of

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www.jabe.in **Vol.1.Issue.2.2014 (Oct-Dec)** **E-ISSN:2394-2606**

distilled water. It was mixed thoroughly and the filtrate was made upto 1i, which, for the present purpose, was considered to be 100%. From this,50% exudate was made. 25 seeds of each variety of crops and weeds were put in petridishes and 2ml of this soil exudate was added to each dish.Controls were maintained with distilled water. The number of germinated seeds were counted.

RESULTS:

a) Effect of soil exudate on germination and dry weight of seedlings of crop and weed plants:

The soil exudate of C4 inhibited the germination and seedling development in four crop plants viz., rice, millet,chillies and green gram, and two associated weeds, viz., *Chloris barbata* and *Echinocloa colonum*. Further the average dry weight of of the root and shoot of the seedlings of the above mentioned crops and weeds also decreased. The data on the germination of the treated seeds and the dry weight of seedlings are presented in the Tables 1 and 2 . The average length of root and shoot of seeedlings showed negative corrolation with the concentration of of soil exudate.

Table 1: The effect of soil exudate on germination and seedling growth of four crop plants.

contents	Rice					Millet					Green gram					Chillies				
	Number of germinated	Length of root(cm)	Length of shoot(cm)	Dry weight of root(mg)	Dry weight of shoot	Number of germinated	Length of root(cm)	Length of shoot(cm)	Dry weight of root(mg)	Dry weight of shoot	Number of germinated	Length of root(cm)	Length of shoot(cm)	Dry weight of root(mg)	Dry weight of shoot	Number of germinated	Length of root(cm)	Length of shoot(cm)	Dry weight of root(mg)	Dry weight of shoot
control	72	5.3	7.8	13	19	76	4	5.5	1	2	84	5.3	20	117	120	73	3.5	4	6.5	10.5
Soil xudate																				
50%	32	5	6.5	11.5	14.5	24	2.5	4	0.5	1	21	17.8	11	111	115	68	3	3.5	3	6
100%	28	4.3	4.5	11	13	16	1	2	0.5	1	17	17	9	103	101	20	2.3	2.8	1.5	2.5

b) Effect of extracts of root, shooot and inflorescence on germination and dry weight of seedlings of crop plants and weeds:

The aqueous extracts of roots, shoots and inflorescences of C4 brought about delayed and decreased germination and seedling development. The average dry weights of plumule and radicle were less than those of control. The elongation of radicle and plumule of seedlings also decreased in the treated cases. The data concerning the allelopathic effects of different parts of D.aegyptium on the four crops and two the weeds are given in the Tables 3 and 4 .

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Table 2. The effect of soil exudate on germination and seedling growth of *Chloris barbata* and *Echinocloa colonum*.

	Chloris barbata					*Echinocloa colonum*				
content	Number of germinated seeds	Length of root(cm)	Length of shoot(cm)	Dry weight of root(mg)	Dry weight of shoot (mg)	Number of germinated seeds	Length of root(cm)	Length of shoot(cm)	Dry weight of root(mg)	Dry weight of shoot (mg)
control	56	2.5	5.0	2.0	4.0	64	1.0	2.0	7.5	10.5
Soil exudate										
50%	28	2.0	4.0	1.0	3.0	44	0.7	1.2	1.0	2.0
100%	16	1.0	3.0	0.5	2.0	32	0.4	0.8	1.0	2.0

Table 3: Effect of extracts of root, shoot and inflorescence on germination and seedling growth of crop plants.

contents		Rice					Millet					Green gram					Chillies				
		Number of germinated seeds	Length of root(cm)	Length of shoot(cm)	Dry weight of root(mg)	Dry weight of shoot (mg)	Number of germinated seeds	Length of root(cm)	Length of shoot(cm)	Dry weight of root(mg)	Dry weight of shoot (mg)	Number of germinated seeds	Length of root(cm)	Length of shoot(cm)	Dry weight of root(mg)	Dry weight of shoot (mg)	Number of germinated seeds	Length of root(cm)	Length of shoot(cm)	Dry weight of root(mg)	Dry weight of shoot (mg)
control		80.0	5.0	14.5	16.0	30.0	90.0	4.3	8.0	5.5	10.0	80.0	5.0	23.5	50.0	200.0	80.0	3.3	7.0	5.5	27.5
Root extract	5%	60.0	3.5	11.5	14.5	24.0	70.0	3.5	6.0	2.0	5.5	60.0	4.0	18.5	19.0	89.0	70.0	3.5	5.0	4.0	25.5
	10%	60.0	3.0	7.5	12.0	21.0	60.0	3.0	6.0	1.0	3.5	80.0	3.5	15.5	10.0	45.0	60.0	3.3	4.0	3.3	23.0
Shoot extract	5%	40.0	3.0	12.0	14.0	25.0	80.0	4.0	6.0	2.0	4.0	80.0	4.5	23.0	39.0	155.0	80.0	3.0	4.0	3.3	24.0
	10%	20.0	2.0	10.0	10.0	19.0	50.0	3.3	4.5	1.5	3.5	60.0	3.5	21.0	28.0	116.	80.0	2.3	3.0	2.8	21.0
Inflorescenc	5%	40.0	4.0	12.5	14.0	24.0	60.0	3.3	5.5	1.0	3.0	60.0	4.0	19.0	40.0	130.	80.0	3.0	4.3	4.0	21.0
	10%	20.0	3.0	11.5	13.0	19.0	50.0	3.0	5.0	1.0	2.0	30.0	4.0	21.5	29.0	118.	40.0	2.8	3.3	3.0	17.0

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www.jabe.in Vol.1.Issue.2.2014 (Oct-Dec) E-ISSN:2394-2606

Table4.Effect of extracts of root, shoot and inflorescence on germination and seedling growth of Chloris barbata and Echinocloa colonum.

		Chloris barbata					*Echinocloa colonum*				
content		Number of germinated seeds	Length of root(cm)	Length of shoot(cm)	Dry weight of root(mg)	Dry weight of shoot (mg)	Number of germinated seeds	Length of root(cm)	Length of shoot(cm)	Dry weight of root(mg)	Dry weight of shoot (mg)
control		3.0	2.0	5.0	4.0	8.0	4.5	2.5	6.0	4.0	9.0
Root extract	5%	2.0	1.0	2.0	2.5	5.0	3.5	2.0	4.0	3.0	8.0
	10%	1.0	0.5	1.0	1.0	3.0	3.0	1.0	2.0	2.0	6.0
Stem extract	5%	1.5	0.3	0.7	1.0	3.0	3.0	3.0	4.0	3.0	8.0
	10%	0.5	0.2	0.5	0.5	2.0	2.0	1.0	2.0	2.0	6.0
Inflorescence extract	5%	1.0	0.1	0.2	1.0	2.0	3.5	3.0	3.5	3.5	6.0
	10%	0.5	0.1	0.1	1.0	1.0	2.5	2.0	3.0	2.5	4.5

DISCUSSION:

Ecologists consider allelopathy as an important ecological phenomenon. Molisch(1937)coined this term to refer tobiochemical interactions between all types of plants inclding microorganisms,covering both detrimental and beneficial interactions. According to Rice(1974), allelopathy is due to any direct or indirect harmful effects byone plant on another throughthe production of chemical compounds that escape into the environment. According to Datta and Sinha Roy(1974),allelopathy is distinct from competitionin that it impliesthe removal or suppression of some factor which is required by some other species, sharing the same habitat, and the factors thut may thus be removed or suppressed inclde water, minerals, food and light. Different groups of chemicals reside in different plant parts, showing deliterious efffects, which have a very significant effect on the composition of a plant community.

De Candolle(1832)suggested the possibility that plants may excrete something from their roots which is injurious to other plants. Allelopathic substances are secondary substances produced and excreted by the plant into the environment.(Pickett & Baskin,1973). According to Datta & Chatterjee (1980), plants sometimes contribute to pollution, releasing toxins from their bodies or their debris. Whittaker(1970) suggested a number of ways in which allelopathy may influence timing and sequence of plant succession. The inhibitary substances may be present in the whole plant. Allelopathics exert their influence in a variety of ways on the growth, anatomy and physiology of plants(Olmstead& rice,1970). They cause chlorosis and wilting in tobacco and sunflower (Einhellig et al., 1970). Water extracts of many weeds inhibited the seed germination and seedling growth (Kohlmuenzer,1965), and in all dilutions from 1: 1 to 1: 500 (Bieber&Hoveland, 1968). Evanari(1949) gave a long list of species that have been shown to produce inhibitors of seed germination of numerous crop and forage plants. Lahiri & Kharabanda (1962) reported the presence of potent, water- soluble, heat- stable seed germination inhibitors in the glumes of three forage species. Considerable work on allelopathy of some parts of the plant body has been done by many workers(Vieitez & Ballester, 1972, Bell & Muller,1973, Rice & Pancholy,1973, and others).

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Since *D.aegyptium* is a very troublesomeweed in many crops likerice, chillies, greengram, etc.adversely affectingthe yields, the allelopathic effects of its roots, shoots and inflorescenceswere studied in the above crop plants. From the present study it can be stated inhibitors act mainly by leaching phenomenon and exudation from roots. In all the experiments, the percentage germination, lengths of root and shoot of seedlings and their dry weight decreased in the above crops and weeds.Similar results were alsoobtained by Foy et al.(1971) Neill & Rice (1971), Rice (1971), and Bell & Muller (1973) in various plants. Allelopathic chemicals are ecologically important because they influence dominance, productivity, succession, species diversity, composition of plant communities and vegetation dynamics (Whittaker,1970). The utilization of allelopathy for weed suppression seems most fit ecologically the new approach to agroecosystem management, as suggested by Altiari & Doll(1978).From the present studies it is obvious that D.aegyptium has inhibitors in its root and shoot. So it grows vigorously in dense patches in the grasslands, causing growth retardation of other weeds. It was also reported that the seeds of this weed contain cyanogenetic glycosides which are toxic to men and cattle (Bor,1960). Further the allelopathic studies on D.aegyptium suggest the presence of phytotoxic chemicals in low quantities, as evident from the fact that the crop plants or weeds did not die throughout the experiment, but only showed slow growth. A more detailed study is required to know the chemical nature, properties and specific action of the phytotoxic chemicals present in D. aegyptium. As this is a ubiquitous weed, associated with diverse crops, it is appropriate that its allelopathics should be tested against all important crops.

ACKNOWLEDGEMENTS: My sincere thanks are due to Dr.(Mrs.) T.N.Mary, my research guide for her constant encouragement during the work and the university authorities for providing me the facilities to conduct the experiments.

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