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INHIBITION OF AFLATOXIN PRODUCTION ON SOME AGRICULTURAL COMMODITIES THROUGH AQUEOUS PLANT EXTRACTS[1]

PREMLATA SINGH AND K. K. SINHA

Mycotoxin Laboratory, Post-Graduate Department of Botany, Bhagalpur University, Bhagalpur

ABSTRACT

Of the twenty two plants screened, aqueous extracts of *Adiantum* sp., *Euphorbia hirta*, *Gynandropsis pentaphylla*, *Justicia gendarussa* and *Thuja orientalis* significantly inhibited aflatoxin production on some agricultural commodities like rice, wheat, maize and groundnut.

INTRODUCTION

Natural occurrence of aflatoxins in a wide variety of agricultural and industrial commodities exerts deleterious effects on the associated substrates. When ingested, these aflatoxin contaminated food commodities can also induce severe diseases in animals and human beings due to their hepatocarcinogenic nature (Purchase, 1974 ; Anonymous, 1976). Attention is now, therefore, diverted towards achieving effective control measures against aflatoxin production on food commodities. Several physical, chemical and biological methods have been proposed for removal and detoxification of aflatoxins (Hesseltine, 1973 ; Giddey, 1978) but practical and economical methods are still wanting. Some of the effective chemicals are commercially not acceptable due to high proceessing cost or deterioration in the quality of food commodities.

Plants are known for their medicinal and antifungal properties since ancient times. Their use in controlling some of the fungal, bacterial and viral diseases are also common (Ark and Thompson, 1958 ; Dixit *et al.*, 1976). In an attempt to inhibit the production of aflatoxins in liquid culture, aqueous extracts of more than a hundred plant species were screened (Bilgrami *et al.*, 1979 ; 1980). Different parts of the effective plans were subsequently analysed in liquid medium in order to locate the inhibitory components in specific regions (Singh, 1979). In the present investigation, saps of plant parts exhibiting maximum efficacy for aflatoxin inhibition in liquid culture were evaluated on some agricultural commodities in order to assess their practical utility.

MATERIALS AND METHODS

Effective plant parts viz., root/rhizome, stem, leaf and flower of twenty two plants were examined on the seeds/grains of four important agricultural commodities i.e., maize (var. Ganga-2), wheat (var. S-308), rice (var. Sita) and groundnut (var. AK-12-24) for their efficacy to inhibit

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aflatoxin production on these substrates. Twenty five gm seeds of the each variety were soaked in 25 ml aqueous plant extracts (2/10, w/v) for 20 hrs. in 250 ml. Erlenmeyer flasks. For the control lots, same amount of seeds were soaked in distilled water. After soaking, extra amount of extract/water was drained out and these were subsequently autoclaved for 10 minutes at 15 lbs p.s.i. On the following day, the seeds were inoculated with 0.5 ml spore suspension of *Aspergillus parasiticus* (NRRL-3240) and finally incubated for 11 days at 28±1 °C.

Seeds were dried, powdered and extracted with aqueous methanol and chloroform on 12th day (Jones, 1972). Aflatoxins were estimated qualitatively on TLC plates using toluene : isoamyl alcohol : methanol (90 : 32 : 2, V/V) solvent systems (Reddy *et al.*, 1970) and quantitatively by spectrophotometer (Nabney and Nesbitt, 1965).

RESULTS AND DISCUSSION

Different parts of the plants showed varying degrees of inhibition on various agricultural commodities (Table-I).

TABLE I

EFFECT OF PLANT EXTRACTS ON AFLATOXIN PRODUCTION ON AGRICULTURAL COMMODITIES

Sl. No.	Plant species	Parts used	% inhibition in aflatoxin B_1 production on			
			Rice	Wheat	Maize	Groundnut
1.	*Abutilon indicum* G. Don.	Leaf	41.77	45.50	29.47	10.00
2.	*Acalypha indica* L.	Leaf	30.00	44.00	42.99	10.00
3.	*Adiantum* sp.	Rhizome	62.50	55.00	40.00	60.00
		Leaflet	43.75	15.00	31.25	40.00
4.	*Antigonon leptopus* Hook & Arn.	Root	58.44	19.00	43.90	71.50
5.	*Anona squamosa* L.	Leaf	20.00	42.00	35.72	20.00
6.	*Capsicum annuum* L.	Leaf	50.00	29.00	42.99	80.00
7.	*Cocculus hirsutus* (L.) Diels.	Root	18.19	20.00	30.77	44.00
8.	*Commelina hasskarlii* Clarke	Whole plant	58.44	19.00	31.00	71.50
9.	*Coriandrum sativum* L.	Leaf	49.00	16.77	42.99	40.00
10.	*Euphorbia geniculata* Orteg.	Stem	0.00	10.00	0.00	50.00
11.	*Euphorbia hirta* L.	Whole plant	50.00	45.00	47.00	66.67
12.	*Ficus religiosa* L.	Leaf	10.00	60.00	37.50	60.00
13.	*Gynandropsis pentaphylla* DC.	Leaf	81.88	12.50	43.00	68.00
14.	*Hibiscus rosa-sinensis* L.	Leaf	18.75	20.00	10.00	44.00
15.	*Justicia gendarussa* L.f.	Stem	58.34	50.00	58.80	72.23
16.	*Nicotiana plumbaginifolia* Viv.	Root	22.73	28.00	34.62	51.00
17.	*Ocimum sanctum* L.	Root	48.00	40.00	25.00	30.00
18.	*Opuntia* sp.	Stem	50.00	12.00	61.50	40.00
19.	*Ricinus communis* L.	Stem	55.36	18.00	23.08	40.00
20.	*Rosa indica* L.	Leaf	37.50	40.00	43.75	70.00
21.	*Solanum nigrum* L.	Stem	58.44	14.00	30.00	52.00
22.	*Thuja orientalis* L.	Leaf	81.88	45.00	29.50	80.00

Aflatoxin production on riee and groundnut was inhibited between 50 to 81.88% by aqueous extracts of the rhizome of *Adiantum* sp., roots of *Antigonon leptopus*, stem of *Justicia gendarussa*, *Solanum nigrum*, leaves of *Capsicum annuum*, *Gynandropsis pentaphylla*, *Thuja orientalis* ; plants of *Commelina hasskarlii* and *Euphorbia hirta* (Table I).

Extracts of the stem of *Opuntia* sp. and *Ricinus communis* inhibited aflatoxin production on rice only by 50 and 55.46% respectively whereas roots of *Nicotiana plumbaginifolia* and leaves of *Ficus religiosa* and *Rosa indica* had inhibition range of 51 to 70% on groundnut. More than 50% inhibition in aflatoxin production was exhibited by the stem of *Justicia gendarussa* on wheat and maize, leaves of *Ficus religiosa* and rhizome of *Adiantum* sp. on wheat and stem of *Opuntia* sp. on maize (Table I).

On the basis of present investigation it is evident that aflatoxin contamination can be minimised to a great extent by the direct use of aqueous plant extracts as besides being harmless the cost will be negligible. Direct spray of aqueous plant extracts will be convenient for the farmer because these can be easily prepared and its application does not require any technical know how. Moreover, any residual effect is not expected because these can be easily and quickly degraded.

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