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Studies on factors affecting *Rhizoctonia bataticola.* VII. Plant extract

K. M. JHA AND N. D. SHARMA
Department of Plant Pathology, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur 482004, M.P.

Aqueous autoclaved leaf extracts of eighty three plant species were screened *in vitro* for their fungicidal activity against isolates of *Rhizoctonia bataticola.* Paper disc diffusion assay technique revealed that only a few plant extracts viz., *Rannunculus scleratus, Xanthium strumarium, Ipomoea carnea, Ocimum basilicum* and *Eclipta alba* showed varied antifungal activities. The extract of *R. scleretus* was highly effective in inhibiting both the mycelial growth and sclerotia. In poisoned food technique only, growth inhibition at 30% concentration of *O. basilicum* was observed among *X. strumarium, O. basilicum* and *I. carnea,* although all the three extracts had their effects on sclerotia.

Key words : *Rhizoctonia bataticola,* plant extracts, antifungal activities

INTRODUCTION

Chemical control of the diseases causes severe environmental pollution, development of pathogen resistance, biomagnification of pesticides and non-target effects. Consequently, these adverse effects pave the way to develop eco-friendly means to manage diseases (Gautam *et al.,* 2003). The presence of active principles in higher plants and wild vegetation has long been recognized as an important factor to disease resistance (Bambode and Shukla, 1973). Such compounds being biodegradable and selective in their toxicity are considered valuable for controlling different plant diseases (Misra and Dixit, 1979). The toxic chemicals are present in the form of water/solvent soluble, non-volatile and/or volatile, thermostable add/or thermolabile constituents. The present study has been undertaken to identify the fungitoxicity of the locally available plants belonging to different families against isolates of *R. bataticola.*

MATERIALS AND METHODS

Fresh leaves of herbs, shrubs and trees belonging to different families which included weeds, ornamentals and some plants known for their medical properties (Table 1), which were abundantly occurring in Jabalpur district, were collected. Leaves were then thoroughly washed with running tap water followed by distilled water. Extracts from washed leaves were made by crushing fresh leaves with sterile distilled water at the rate of one g tissue in one ml of sterilized distilled water (w/v) separately. The pulverized mass was squeezed through a quadrifold muslin cloth. This formed the standard plant extract solution (100%). The expressed extracts were autoclaved and used for investigation against *R. bataticola.* Inhibitory properties of plant extracts against *R. bataticola* were determined by disc diffusion technique. Discs of 10 mm diameter of Whatman's filter paper No. 42 were soaked in autoclaved plant extracts (121°C for 20 minutes). Four soaked discs, after draining excess extracts, were placed opposite to each other on the surface of plates containing potato dextrose agar and seeded centrally with an 8 mm disc cut out aseptically by a sterile cork borer from the margin of a seven days old culture of *R. bataticola.* Inoculated plates were incubated at 29±1°C and the observations for growth inhibition were recorded after 72 hrs of incubation.

The effective plant extracts were further studied against seven isolates of *R. bataticola.* Desired concentrations (0, 10, 20 & 30%) were made by adding appropriate amount of standard solution of plant extracts to Asthana & Hawker's medium. Amended medium was autoclaved and poured into sterilized Petri-plates in triplicate. The poured plates were inoculated after 24 hrs with 8 mm discs cut out aseptically by a sterile cork borer from margins of seven days old cultures of *R. bataticola* isolates. The inoculated plates were incubated at 29±1°C and observation for growth and morphological characters were recorded on 3rd and 5th day of incubation.

RESULTS AND DISCUSSION

From the results of the investigation shown in the Tables 1 & 2, it was evident from the preliminary screening of the aqueous autoclaved extracts by paper disc diffusion technique that, in most cases the antifungal activity was thermolabile and was lost on autoclaving. But in the case of *Ipomoea carnea,*

Table 1 : Effect of plant extracts on the mycellal growth and sclerotia formation of *Rhizoctonia bataticola* (Disc Diffusion Technique)

Btanical Name	Family	Inhibition Over Control	
		Mycelial growth	Sclerotia formation
1	2	3	4
Abutilon indicum (Linn.) Sweet	Malvaceae	—	—
Acalypha indica Linn.	Euphorbiaceae	—	—
Achyranthes aspera Linn.	Amaranthaceae	—	—
Adenocalyma alliaceum	Bignoniaceae	—	—
Adhatoda vasica Nees	Acanthaceae	—	—
Ageratum conyzoides Linn.	Asteraceae	—	—
Alternanthera sessilis (Linn.) DC.	Amaranthaceae	—	—
Amaranthus viridis Linn.	Amaranthaceae	—	—
Argemone mexicana Linn.	Papaveraceae	—	—
Asteracanthus longifolia (Linn.) Nees	Acanthaceae	—	—
Azadirachta indica A. Juss.	Meliaceae	—	—
Blumea sp. DC., nom. cons.	Asteraceae	—	—
Bougainvillaea spectabilis Willd.	Nyctaginaceae	—	—
Colebrookea oppositifolia J. E. Smith	Lamiaceae	—	—
Calotropis procera (Ait.)	Asclepiadaceae	—	—
Chenopodium album Linn.	Chenopodiaceae	—	—
Cichorium intybus Linn.	Asteraceae	—	—
Clerodendron inerme (Linn.) Gaertn.	Verbenaceae	—	—
Commelina attenuata Koen ex Vahl.	Commelinaceae	—	—
Commelina benghalensis Linn.	Commelinaceae	—	—
Catharanthus roseus (Linn.) G. Don	Apocynaceae	—	—
Croton sp. Linn.	Euphorbiaceae	—	—
Cuscuta reflexa Roxb.	Convolvulaceae	—	—
Cymbopogon flexuosus (Neesex Steud.) Wats.	Graminae	—	—
Cynodon dactylon (Linn.) Pers.	Graminae	—	—
Cyanotis cristata (Linn.) D. Don	Commelinaceae	—	—
Cyperus rotundus Linn.	Cyperaceae	—	—
Dactyloctenium aegyptium (Linn.) Beauv.	Graminae	—	—
Datura metel Linn.	Solanaceae	—	—
Delonix regia (Boj ex Hook.) Rafin	Leguminosae	—	—
Eclipta alba (Linn.) Hassk.	Asteraceae	+	+
Eichhornia crassipes (Mart.) Solms	Pontederiaceae	—	—
Eucalyptus globosus Linn. (globulus) Labill.	Myrtaceae	—	—
Euphorbia geniculata Orf.	Euphorbiaceae	—	—
Euphorbia hirta Linn.	Euphorbiaceae	—	—
Flemingia semialata Roxb.	Fabaceae	—	—
Gnaphalium indicum Linn.	Asteraceae	—	—
Hyptis suaveolens (Linn.) Poit	Labiatae		
Inula indica Linn.	Asteraceae	—	—
Ipomoea carnea Jacq.	Convolvulaceae	++	+
Ixora arborea Roxb. ex. J. E. Smith	Rubiaceae	—	—
Jatropha sp. Linn.	Euphorbiaceae	—	—
Jatropha gossypifolia Linn.	Euphorbiaceae	—	—
Justicia diffusa Willd.	Acanthaceae	—	—
Kalanchoe pinnata (Lam.) Pers.	Crassulaceae		
Lantana camara Linn.	Lythraceae	—	—
Lagerstroemia indica Linn.	Verbenaceae	—	—
Launaea nudicaulis (Linn.) Hook. F.	Asteraceae	—	—
Malvastrum coromandelianum (Linn.) Garcke	Malvaceae	—	—
Medicago denticulata Willd	Malvaceae	—	—
Medicago hispida Gaertn.	Fabaceae	—	—
Melilotus alba Medic. ex. Desr. Lam.	Fabaceae	—	—
Mimosa pudica Linn.	Mimosaceae	—	—
Murraya exotica Linn.	Rutaceae	—	—
Nerium oleander Linn.	Apocyanaceae	—	—
Ocimum basilicum Linn.	Labiatae	++	+

(Continued)

1	2	3	4
Opuntia dillenii (Kol. Gawl.) Haw.	Cactaceae	—	—
Parthenium hysterophorus Linn.	Asteraceae	—	—
Peltophorum pterocarpum (DC.) Backer ex K. Heyne.	Cesalpiniaceae	—	—
Phalaris minor Retz.	Graminae	—	—
Phyllanthus urinaria Linn.	Euphorbiaceae	—	—
Physalis minima Linn.	Solanaceae	—	—
Polyalthia longifolia (Sonn.) Thw.	Annonaceae	—	—
Pongamia glabra Vent.	Leguminosae	—	—
Punica granatum Linn.	Punicaceae	—	—
Raneunculus sceleratus Linn.	Rannunculaceae	+++	++++
Rumex dentatus Linn.	Polygonaceae	—	—
Saponaria vaccaria Linn.	Caryophyllaceae	—	—
Sansevieria trifasciata Hort. ex. Prain	Agavaceae	—	—
Sida spinosa Linn.	Malvaceae	—	—
Solanum nigrum Linn.	Solanaceae	—	—
Solanum xanthocarpum Schrad & Wendl.	Solanaceae	—	—
Sonchus arvensis Linn.	Asteraceae	—	—
Sphaeranthus indicus Linn.	Asteraceae	—	—
Tabernaemontana coronaria (Jacq.) Willd.	Apocyanaceae	—	—
Tagetes minuta Linn.	Asteraceae	—	—
Thevetia nerifolia Juss. ex Steud.	Apocyanaceae	—	—
Trianthema portulacastrum Linn.	Aizoaceae	—	—
Tridax procumbens Linn.	Asteraceae	—	—
Typha latifolia Linn..	Typhaceae	—	—
Urena lobata Linn.	Malvaceae		
Vernonia cinerea (Linn.) Less.	Asteraceae	—	—
Xanthium strumarium Linn.	Asteraceae	++	+

— = No inhibition ; + = 25 % inhibition ; ++ = 50 % inhibition ; +++ = 75 % inhibition ; ++++ = 100 % inhibition.

Table 2 : Effect of plant extracts on the morphological characters of different isolates of *R. bactaticola*

Plant	Isolate	Conc. (%)	Colony Pattern / Margin	Hyphae Pattern / Colour	Sclerotia			
					L x W μ	Size / Shape	Pattern / Initiation	Colour
1	2	3	4	5	6	7	8	9
Control	Rb1	Nil	Appr./Even	Dn/LB to B	105.62 x 88.25	Md/R to O	Dn/Ely	Bl
	Rb2		Flocc/Wavy	Dn/LB to B	112.22 x 95.81	Md/R to O	Dn/Ely	Bl
	Rb3		Flocc/Wavy	Dn/B.	79.63 x 73.24	Small/R to O	Sp/Ely	Bl
	Rb4		Appr./Even	Sp/H to LB	124.4 x 110.31	Large/R to O	Dn/Ely	Bl
	Rb5		Flocc/Wavy	Dn/LB	96.29 x 86.54	Md/R to O	Dn/Ely	DB
	Rb6		Appr./Even	Dn/LB to B	107.86x 95.37	Md/Irre	Dn/Ely	Bl
	Rb7		Flocc/Wavy	Dn/LB to B	92.68 x 84.08	Md/R to O	Sp/Dly	B
Ipomoea carnea	Rb1	10	Appr./Even	Sp/H to LB	95.33 x 83.41	Md/R to O	Dn/Ely	Bl
	Rb2		Flocc/Wavy	Sp/H to LB	105.62 x 97.50	Md/R to O	Dn/Ely	Bl
	Rb3		Flocc/Wavy	Dn/LB.	49.59 x 46.93	V. Small/D	Sp/Dly	DB
	Rb4		Appr./Wavy	Sp/H	103.75 x 88.75	Md/R to O	Dn/Ely	Bl
	Rb5		Flocc/Even	Dn/B	75.34 x 62.04	Small/R to O	Dn/Ely	Bl
	Rb6		Appr./Even	Dn/B	67.50 x 61.25	Small/Irre	Dn/Ely	Bl
	Rb7		Flocc/Even	Dn/B	62.00 x 52.25	Small/R to O	Sp/Dly	DB
	Rb1	20	Flocc/Even	Sp/H to LB	95.44 x 85.54	Md/R to O	Dn/Ely	Bl
	Rb2		Flocc/Wavy	Sp/H to LB	86.66 x 74.47	Small/R to O	Dn/Ely	Bl
	Rb3		Flocc/Wavy	Dn/LB.	46.50 x 42.45	V. Small/D	Sp/Dly	DB
	Rb4		Appr./Wavy	Sp/H	79.62 x 65.00	Small/R to O	Dn/Ely	Bl
	Rb5		Flocc/Even	Dn/B	60.06 x 53.75	Small/R to O	Dn/Ely	Bl
	Rb6		Appr./Even	Dn/B	64.44 x 57.79	Small/Irre	Dn/Ely	Bl
	Rb7		Flocc/Even	Dn/B	53.25 x 44.94	Small/R to O	Sp/Dly	DB
	Rb1	30	Flocc/Even	Sp/H to LB	97.91 x 88.36	Md/R to O	Dn/Ely	Bl
	Rb2		Flocc/Wavy	Sp/H to LB	83.95 x 75.83	Small/R to O	Dn/Ely	Bl
	Rb3		Flocc/Wavy	Dn/LB.	43.29 x 40.34	V. Small/D	Sp/Dly	DB
	Rb4		Appr./Wavy	Sp/H	75.88 x 65.22	Small/R to O	Dn/Ely	Bl
	Rb5		Flocc/Even	Dn/B	62.63 x 55.81	Small/R to O	Dn/Ely	Bl
	Rb6		Appr./Even	Dn/B	64.54 x 58.35	Small/Irre	Dn/Ely	Bl
	Rb7		Flocc/Even	Dn/B	52.31 x 44.75	Small/R to O	Sp/Dly	DB

(Continued)

1	2	3	4	5	6	7	8	9
Ocimum basilicum	Rb1	10	Appr./Even	Dn/B	66.13 x 55.05	Small/Irre	Dn/Ely	Bl
	Rb2		Flocc/Even	Dn/LB	89.37 x 77.18	Small/R to O	Sp/Ely	Bl
	Rb3		Flocc/Wavy	Dn/LB	48.59 x 44.53	V. Small/D	Sp/Dly	DB
	Rb4		Appr./Even	Sp/LB	94.79 x 78.54	Md/R to O	Dn/Ely	Bl
	Rb5		Flocc/Irre	Dn/B	73.12 x 65.00	Small/R to O	Dn/Ely	Bl
	Rb6		Appr./Even	Dn/B	76.25 x 65.29	Small/Irre	Dn/Ely	Bl
	Rb7		Flocc/Wavy	Dn/B	65.00 x 56.87	Small/R to O	Sp/Dly	DB
	Rb1	20	Appr./Even	Dn/B	65.00 x 57.61	Small/R to O	Dn/Ely	Bl
	Rb2		Flocc/Even	Dn/LB	81.25 x 73.12	Small/R to O	Dn/Ely	Bl
	Rb3		Flocc/Even	Dn/LB	45.59 x 42.05	V. Small/D	Sp/Dly	DB
	Rb4		Appr./Even	Sp/LB	87.50 x 73.75	Small/R to O	Dn/Ely	Bl
	Rb5		Flocc/Even	Dn/B	67.16 x 62.83	Small/R to O	Dn/Ely	Bl
	Rb6		Appr./Irre	Dn/B	74.75 x 65.25	Small/Irre	Dn/Ely	Bl
	Rb7		Flocc/Wavy	Dn/B	65.20 x 57.08	Small/R to O	Sp/Dly	DB
	Rb1	30	Appr./Even	Dn/B	58.50 x 53.62	Small/R to O	Dn/Ely	Bl
	Rb2		Flocc/Even	Dn/B	85.33 x 75.29	Small/R to O	Dn/Ely	Bl
	Rb3		Flocc/Even	Dn/LB	46.99 x 44.34	V. Small/D	Sp/Dly	DB
	Rb4		Appr./Wavy	Sp/LB	75.83 x 65.00	Small/R to O	Dn/Ely	Bl
	Rb5		Flocc/Irre	Dn/B	65.63 x 57.04	Small/R to O	Dn/Ely	Bl
	Rb6		Appr./Even	Dn/B	76.44 x 66.32	Small/Irre	Dn/Ely	Bl
	Rb7		Flocc/Even	Dn/B	62.87 x 54.92	Small/R to O	Sp/Dly	DB
Xanthium strumarium	Rb1	10	Appr./Wavy	Dn/LB	75.83 x 68.61	Small/R to O	Dn/Ely	Bl
	Rb2		Flocc/Even	Dn/LB	66.62 x 61.75	Small/R to O	Sp/Ely	Bl
	Rb3		Flocc/Even	Dn/LB	46.62 x 40.11	V. Small/D	Sp/Dly	B
	Rb4		Appr./Even	Sp/H to LB	95.17 x 87.05	Md/R to O	Dn/Ely	Bl
	Rb5		Flocc/Wavy	Dn/LB	88.47 x 81.25	Small/R to O	Sp/Ely	Bl
	Rb6		Appr./Even	Dn/B	60.56 x 54.65	Small/Irre	Dn/Ely	Bl
	Rb7		Flocc/Even	Dn/B	65.96 x 57.25	Small/R to O	Sp/Dly	DB
	Rb1	20	Appr./Wavy	Dn/LB	75.89 x 67.08	Small/R to O	Dn/Ely	Bl
	Rb2		Flocc/Even	Dn/LB	67.32 x 60.35	Small/R to O	Sp/Ely	Bl
	Rb3		Flocc/Even	Dn/LB	48.50 x 42.05	V. Small/D	Sp/Dly	B
	Rb4		Appr./Even	Sp/H to LB	97.5 x 92.08	Md/R to O	Dn/Ely	Bl
	Rb5		Flocc/Even	Dn/LB	85.31 x 79.25	Small/R to O	Sp/Ely	Bl
	Rb6		Appr./Wavy	Dn/B	54.65 x 48.75	Small/R to O	Sp/Ely	Bl
	Rb7		Flocc/Even	Dn/B	68.56 x 60.23	Small/R to O	Sp/Dly	DB
	Rb1	30	Appr./Even	Dn/LB	65.00 x 58.22	Small/R to O	Dn/Ely	Bl
	Rb2		Flocc/Even	Dn/LB	64.75 x 57.00	Small/R to O	Sp/Ely	Bl
	Rb3		Flocc/Even	Dn/LB	46.22 x 41.39	V. Small/D	Sp/Dly	B
	Rb4		Appr./Wavy	Sp/H to LB	88.37 x 82.83	Small/R to O	Dn/Ely	Bl
	Rb5		Flocc/Even	Dn/LB	66.62 x 60.12	Small/R to O	Sp/Ely	Bl
	Rb6		Appr./Wavy	Dn/B	55.92 x 48.65	Small/R to O	Sp/Ely	Bl
	Rb7		Flocc/Even	Dn/B	64.37 x 57.73	Small/R to O	Sp/Dly	DB

Appr. – Appressed, D – Deformed, Flocc. – Floccose, Irre – Irregular, Dn – Dense, Sp – Sparse, B – Brown, DB – Dark Brown, Bl – Black, LB – Light Brown, LB1 – Light Black, Md – Medium, R – Round, O – Oval, E – Elongated, Ely – Early, Dly – Delayed, H – Hyaline, V – Very.

Ocimum basilicum, Xanthium strumarium, Eclipta alba and *Rannunculus scleratus* there was less effect of autoclaving on fungitoxicity. Extract of *Rannunculus scleratus* was highly toxic in inhibition of mycelial growth and sclerotia formation. The fungitoxicity of *Ipomoea carnea, Ocimum basilicum* and *Xanthium strumarium* was almost equal. *Eclipta alba* showed less inhibition of mycelial growth as compared to others. The results is in conformity with the findings of Bambode and Shukla (1973). Jha *et al.* (2000) reported antifungal activity of *E. alba* on *M. phaseolina*. Anwar *et al.* (1994) reported antifungal activity of inflorescence of *O. basilicum* and *I. carnea* on *M. phaseolina*. Leaf extracts of *Ipomoea carnea, Ocimum basilicum* and *Xanthium strumarium* were further investigated against seven isolates employing poisoned food technique to know their effect on sclerotia. Results indicated that *Ipomoea carnea* and *Xanthium strumarium* did not show any growth inhibition at 10, 20 and 30% concentrations. Only 30% concentration of *Ocimum basilicum* inhibited growth of isolates at some extent. It was observed that all the leaf extracts reduced the size of sclerotia at all the concentrations. Generally at higher concentration sclerotial size reduction was more pronounced as compared to lower concentration. However, Gautam *et al.* (2003) showed growth inhibition of *R. solani* in alcoholic

extracts of *Xanthium strumarium.*

The inactivity of the plant extracts excluding the effective ones on *R. bataticola* may be due to thermolabile substances which was inactivated on autoclaving (Bambode and Shukla, 1973) or absence of active principles against *R. bataticola.* According to Skinner (1955) presence of antibiotic contributed to the inhibiting activity of the the plant extracts.

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