International Journal of Advanced Technology in Engineering and Science
Vol. No.4, Issue No. 04, April 2016
www.ijates.com
ijates
ISSN 2348 - 7550

MYCOBIOTA OF XANTHIUM *STRUMARIUM* L: POSSIBILITIES OF THEIR EXPLOITATION AS HERBICIDES

Shukla Manisha[1], Pandey A.K.[2] , Mishra M.K.[3]

[1]*Dept. of Plant Science Avvaiyar Govt. College for Women's, Karaikal, U.T. of Puducherry.*

[2]*Chairman, MP. Private University Regulatory Commission, Bhopal, M.P.,*

[3]*Director, R&D, E.G.S. Pillai College, Nagapattinum, Tamilnadu.*

ABSTRACT

A survey of fungi associated with the noxious weed *X. strumarium* L. was undertaken, sampling was done in three different seasons from various parts of Jabalpur .Nine fungal species were isolated as regular members of mycobiota including *Alternaria* sp., *Puccinia xanthi Sch.* ,*Odium xanthi* and these are described and illustrated *Alternaria zinnae*, *Curvularia lunata, Periconia xanthicola, Botrytis cinera, Fusarium oxysporum, F. moniliformae*, have not been recovered previously from *X. strumarium* L. Laboratory observations were conducted to assess their mycoherbicidal potential against the weed.

Keywords: ***X. strumarium, fungal pathogens, herbicidal potential***

I. INTRODUCTION

Xanthium strumarium L. is an introduced and highly problematic weed distributed at very high magnitude in India .Besides causing several problems in agriculture and forestry it is also responsible for severe human and animal health hazards. The weed is difficult to control due to various reasons. It is commonly known as cocklebur, banokra, gokharu, chhota dhatura or Noogra burr and belongs to family Asteraceae. The taxonomy and biology of the genus has been extensively studied by many workers (Love & Dansereau's 1959, Barrentine 1974, Shukla *et al* 1988, Ommachan *et al* 1996). It is most abundant in open moist sites specially waste places, luxuriantly grows on roadsides, railway

tracks and river banks as well as edges of ponds and freshwater marshes and overgrazed pastures.(Holm 1977) .More or less the parts of the weed are highly toxic and allergic to humans and animals(Kingsbury 1964, Parsons 1973). Cocklebur is an extremely competitive weed in corn, cotton and soybean fields .It also grows luxuriantly and seriously infested paddy ,jawar ,and other kharif annual crop fields in Andhra Pradesh ,Maharashtra ,Rajasthan and Madhya Pradesh, (Kaul1965,Deshpande1982).It is a serious challenge in agriculture as well as in recreation areas. Poisoning threats are greatest on ingestion of an amount of seeds 0.3% of animals bodyweight .The allelochemicals produced from different part of weed are also known to inhibit the seed germination and seedling growth of many crops viz .wheat, maize, pearl millet, chick pea, rapeseed, tobacco and lettuce (Cutler 1983) .Looking to the seriousness of problem, an effective management is highly needed.

II. MATERIAL & METHODS

The survey was conducted periodically and symptoms of disease were recorded and infested parts i.e. leaf, stem, inflorescence and seeds were collected, dried and kept for further studies.

Isolation from diseased plant parts as well as direct plating from sprouting structure were made on PDA (Agrawal & Hasija 1986).Subculture was maintained at 28c on PDA. These were identified with the help of monographs; manuals (Ellis 1976, Subramanian 1953, Sutton 1980) spores of obligate pathogens were directly harvested with sterile distilled water and stored in refrigerators.

The inoculums for pathogen city test has been obtained from 7-10 days old PDA cultures, spores were harvested by flooding Petri-plates with sterile water and stored in 150 ml Erlenmeyer flasks in refrigerators. Spores of different pathogens were sprayed to runoff @ 4.5 x 10^{5}on previously grown 20-25 days old seedling of *X. strumarium* in earthen pots 6" x 6" x 6"and placed in Plant growth chamber for 24 hrs at 28+_ and then pots were transferred to green house. Symptoms were observed regularly and severity was estimated by visual observation as per (Chiang *et .al*.1989) (**Table I)**

III. RESULT & DISCUSSION

After microscopic examination and pathogen city test following pathogens were observed and estimated for myco-herbicidal potential.

Alternaria alternate *(Fr.) Keisslar (1912), Beih .Bot .Zbl. 29:434 syn A.tenuis Nees .Expers. A .tenuis C.G. Nees, 1816/17, Syst. Pilze Schwamme: 72*

The fungus incites severe leaf spot disease, leaves shows small irregular black to brown spots on lamina initially. At advanced stages severe chlorosis followed by necrosis and finally death of the leaves were observed. Abundant colonization of the pathogens was observed at higher moisture. Infected part of the plant showed curling from the upper surface, leaves becomes brittle and exhibited irregular shredding in certain cases. Subsequently leaves and petiole withered and finally fall down.

Colonies of pathogen usually dark brown to black powdery due to sporulation, conidiophores arising singly or in groups, simple ,branched ,straight ,rarely geniculate, pale to golden brown, smooth 3.5 -5.0 x 3-6 um. Conidia formed in chains, obclavate ,ovoid or ellipsoidal, with a short cylindrical beak ,pale to golden brown, smooth or verruculose, up to 8 transverse and usually several longitudinal or oblique septa,20 -63 x 9- 13um, beak 2-5 um thick

.Alternaria zinnia Pape Mycol. Pap 131: 22-25, 1972

The pathogen incites severe leaf spot disease which was characterized by appearance of light brown to dark brown irregular spots starting from the margins and rapidly covering the whole lamina. Infected leaves become shredded and abundant premature defoliation of younger leaves was taken place.

Colonies effuse grayish brown to dark blackish brown. Mycelium immersed, conidiophores solitary or in fascicles, sometimes geniculate, paler brown towards the apex, with 1-4 scars, up to 120-150 x 5-10 um. Conidia mostly solitary rarely in chains of 2, obclavate, pale to dark brown, smooth with 5-9 transverse and several longitudinal septa, beak filiform, simple, hyaline to pale brown,55-185 x1.5-2.5 um, often swollen at the apex to 3-4 um.

Alternaria tenuissima (Nees ex Fr.) Wiltshire [as,(Fr.)Wiltshire"],Trans. Br. Mycol. Soc., 18: 157, 1963.

Severe leaf spot disease was incited by the pathogen initially. Light brown irregular spot appeared on tip of lamina, spreading rapidly towards lamina and infected leaves became shredded prematurely. Colonies black, conidiophores solitary or in groups, simple or branched straight or flexuous, more or less cylindrical, septate pale brown, smooth with one or several conidial scars,11.5 x 4-6 um. Conidia solitary or in short chains, straight or curved, obclavate or with the body of the conidium, ellipsoidal tapering gradually to the beak which is up to half the length of the conidium, usually shorter, rarely tapered to a point but more frequently swollen at the apex where there may be several scars, pale to golden brown, usually smooth, sometimes minutely verrucuose, generally with 4-7 transverse longitudinal or oblique septa.22-95 x 9 -19 um, beak 2-4 um thick, swollen at the apex 4-5 um wide. Previously it was reported from Gorakhpur (U.P.). For M.P. this the new report.

Periconia xanthicola Rao (1962), Mycopath. Mycol. Appl., 22:285 -310, 1964

The pathogen incites severe leaf spot disease. Initially small irregular, dark brown spots appeared on the upper surface of leaves covering whole lamina. Lesions become darker and larger with age, infected dried up .Colonies effuse, small and compact, grey brown hairy. Mycelium immersed sometimes partly superficial Stroma frequently present, dark brown pseudo-parenchymatous. Conidiophores macronematous. mostly with a stipe and spherical head looking like rounded head pins, stipe pale to dark brown often appearing black and shining by reflected light, smooth or rarely verrucuose ,conodioblastic cells monoblastic or polyblastic, discrete and stipe and branches determinate, ellipsoidal or sub spherical. Conidia catenate, chains often branched arising at one or more points on the curved surface of the conidiogenous cells,25.68-29.96 x 25.68- 26.70 um

The fungus was originally described by9 Rao 1962) from Maharashtra on the leaves of *X .strumarium;* however it is a new record for M.P.

Cercospora xanthi strumari, Bhartiya et al., Kavak, 25:43-51, 1997,

The pathogen incites severe leaf spot disease. Disease initially appeared as light brown, irregular spots on the upper surface of leaves. Later on, spots coalesced rapidly formed amphigenous circular to irregular spots covered entire leaf surface and became necrotic.

Colonies amphiphyllous effuse hyphae internal branched, septate, light olivaceou s stromata well developed, epidermal, pseudo parenchymatous, pale olivaceous, and 10-26 um in diameter. Conidiophores arising in fascicles of 2-6 from stromata macronematous, fasciculate ,erect straight to sub straight, branched smooth,1-18 septate, geniculate ,light brown. 30 -410 x 4-6 um .Conidiogenous cells integrated, terminal to intercalary. Sympodial polyblastic, geniculate, scars conspicuous, rim like. Conidia dry ,solitary, acropleurogenous, holoblastic, unbranched,1-10 septate, smooth hyaline ,straight to sub straight, base truncate, apex acute to sub obtuse, hilum thickened 20-144 x 2 - 4 um. The fungus was originally recorded and described by (Bhartiya et al 1997) from Gorakhpur U.P. This is a new record for M.P.

Puccinia xanthi Schw. Morin & Auld, 1993

The pathogen incites severe rust disease in the weed. Infected leaves showed chlorotic patches on upper surface and dark sori in clusters on the lower side. Severely affected leaves were distorted and curled.

The telia are hyphophyuous, arranged in a compact spiral or circular group, up to 20 in diameter, individually brown, but dark brown to black in clusters, becoming ash colored from center. Teliospores narrowly ellipsoidal to ovoid, apex rounded to obtuse, base tapered usually constricted at septum, 41.1-57.1 x 16.5 -22.6 um,

pedicels persistent, yellow to brown 26-36 um long, wall dark brown smooth. It is macrocyclic rust, abundantly reported from various parts of the world including India (Jadhav & Somani 1978, Khun 1978).

Odium xanthami, Bhatnagar & Kothari 1986

The pathogen incites severe powdery mildew disease. The disease is characterized by appearance of several irregular white powdery spots on upper surface of leaves. Colonies spread rapidly and gradually covered entire surface of leaves. Infected leaves became curled and shredded. Diseased plant was pre-flowered and its growth was also retarded significantly. Colonies white, powdery, epiphyllous, mycelium amphigenous, white effuse, coalesced, persistent .branched, 4-6 um wide, appresoria nipple shaped. Elongated conidiophores, erect, straight, 55-95 x 6-12 um, 4-6 celled doliform. Previously it was reported by (Bhatnagar & Kothari1986). Later on(Ahmed 1989) reported this from Almora (U.P.).This is a new report for M.P.

Arthrinium puccinoides (DC ex Merat) Kunze.

Arthrinium puccinoides ex Fr., 1821, Klunze & Kunze & Schmidt, 1817, Mykol.Hefti,1;9: Fries 1821,Syst Mycol., 1 XLIV.

The pathogen incite sever leaf spot disease .Several dark spots appeared on leaves enlarged rapidly and covered entire leave at high moisture content. On PDA medium colonies dark brown, powdery white abundant cottony mycelia mat, turned dirty green after sporulation. Mycelium partly superficial, immersed superficial part composed of a network of branched and anatomizing, septate colorless to pale brown, smooth, immersed, hyphae colorless conidiophores erect or ascending, rough, pale brown with dark spots. Conidia dark brown with a hyaline band at the junction, triangular to oval 6.07-7.00 x 8.91 -12.55 um .This is the first record on *X. strumarium* L. from Jabalpur M.P.

Curvularia lunata (Waked) Boed.Uebereinige Phragmosporem Dematiazeen .Bull.Jord.Bot.Buitenz III, 13; 120-134.The fungus incites severe leaf spot disease. The disease initially appeared as minute, chloretic spots at the tip of lamina, increased rapidly towards back, resulted into larger necrotic dark brown spots and leaves became curled and prematurely shredded. Severe infection on seedling, buds and inflorescence were also observed. Infected seedling showed significant reduction in the burr formulated and died within 10 days .Colonies on PDA medium grey to black. Mycelium dark brown, septate, freely branched,3.0 -6.0 um thick, conidiophores pale brown, septate, simple, geniculate at the tip. Conidia spirally arranged at the tip, pale brown 3 -4 septate, third cell from the base larger and darker than others, unequally ventricose to fusiform and 23.4 -39 x 7.8 -15.6 um .(Shrivastav1951).

Fusarium oxysporum Schl. *Ex .Fries.*

The pathogen incites severe wilting and blight of the seedlings. Wilted plants showed drooping of apical leaves and with advancement of disease lower leaves became also involved and stem growing tips became blackish, T.S. of root showed the presence of the pathogen in conducting tissues, seedling became rapidly killed and rapid colonization was observed on dead seedlings. Mycelium composed of branched, septate hyaline aerial as well as submerged hyphae, 3.2 -4.2 um thick, conidiophores arising from aerial hyphae, simple unbranched , pointed at the apex, hyaline to pale yellow bearing a whirl of phialids, generally single , conidia hyaline variable, mainly two types, macro conidia several celled (mostly 3 - 4 septate) slightly curved at the pointed ends 12.8 -21.4 x 3.2 – 4.2 um , micro conidia one celled , ovoid or oblong, 6.4, 8.5 x 3 – 4 um some intermediates 2-3 celled , were also present colonies on PDA after 7 days, white to light pink orange in color, effused cottony. The

pathogenicity test conducted under controlled conditions for all of these pathogens showed that species of *Alternaria and Curvularia lunata* is having herbicidal potential against the weed.

TABLE I: **PATHOGENECITY OF FUNGAL PATHOGENS**

S.NO.	NAME OF PATHOGEN	MORTALITY %	DI **
1.	*Alternaria alternate*	100	4
2.	*A. tenuissima*	91.6	4
3.	*A.zinnae*	91.5	4
4.	*Curvularia lunata*	100	4
5.	*Fusarium oxysporium*	16.6	1
6.	*Periconia xanthicola*	33.3	2
7.	*Arthrinium puccinoides*	23.2	1
8.	*Odium xanthi**	100	4
9.	*Puccinia xanthi **	50	2
10.	*Cercospora xanthi strumari*	50	3

*** In natural condition**

****disease index,**

0 - 25% = 1

26 -50 % = 2

51 -75 % = 3

76 -100 % = 4

IV. AKNOWLEDMENT

Authors thankfully acknowledge the support offered by Dept. of Biological Science, RDVV, Jabalpur M.P., for providing necessary facilities for carrying out present research work. Author Manisha Shukla is thankful to UGC to provide teacher fellowship for Ph. D Finally MS is thankful to the Principal Hitkarini College Garha, Jabalpur, M.P. for providing cooperation and support during fellowship period.

REFERENCE

[1]. Agrawal and Hasija 1986 .Microorganisms in the laboratory. A laboratory guide for Mycology, Microbiology and Plant Pathology. Print House, Lucknow (India). 155 P.P.

[2]. Ahmed, N.1989.Taxonomic studies on the powdery mildews of Northen India. Ph. D. thesis, university of Gorakhpur, Gorakhpur. India.

[3]. Barrentine, W. L. 1974. Common cockleber competition in soybean. Weed. Sci.22 600-603.

[4]. Bhartiya and Singh 1997. Foliaceous fungi in the forest flora of North- Eastern Uttar Pradesh Kavak 25:43-*51*.

[5]. Bhatnagar and Kothari 1996.Oidial stage on *Xanthium strumarium* L. Sci. &Cult.32:422.

[6]. Cartwright and Templeton 1992. Preliminary assessment of *Colletotrichum capsici* as a potential Mycoherbicide for control of pitted morning glory. Plant Dis. 76: 995- 998.

[7]. Chiang et al.1989.Evaluation of endemic foliar fungi for potential biological control of Johnson grass (*Sorghum halepense*): screening and host range test. Plant Disease.73:459-464.

[8]. Cutler, H. G. 1983. Carboxyatractyloside: a compound from *Xanthium strumarium* and *Atraetylis gummifera* with plant growth inhibiting properties. The probable "Inhibitor A". J. Natural Product's 46: 609-613.

[9]. Deshpande, K. 1982. Biocontrol of *Parthenium hysterophorus* L. and *Xanthium strumarium L*. through phytopathogens. P-48, In Abstracts of paper's Annual conference of Indian society of weed science.

[10]. Doworth, C. E. 1995. Biological control of red alder (*Alnus rubra*) with fungus, *Neetria ditissima.* Weed Techno!. I: 243-248.

[11]. Ellis, M.B. 1976.More Dematiaceous Hyphomycetes .CAB International Mycological Research Institute, Kew, Surrey, England, 507pp.

[12]. Holm,*et al.* 1977.The world's worst weeds. University Press of Hawaii, Honolulu.609 pp.

[13]. Jackson, C. R. 1959. Symptoms and host - parasite relations of the *Alternaria* leaf spot disease of cucurbits. Phytopatho. 49: 731 - 733.

[14]. Jonson, C. 1940 .The maintenance of high atmospheric humidity for entomological work - Glycerol water mixture. Ann. Appl. BioI. 22: 295- 299.

[15]. Kaul, V 1965.Physiological ecology of *X. strumarium* L.1. Seasonal, morphological variants and distribution. Tropical Ecology. 6: 72 - 87.

[16]. Kings bury, J. M. 1964. Poisonous plants of the U. S. and Canada. Prentice- Hall, Inc. Engle wood, Cliffs N. I. 626 pp.

[17]. Jadhav and Somani 1978 .*Puccinia xanthi* –a report from India. Indian Phytopathol. 31:369-371.

[18]. Khune, N.N. 1978.A new rust record on *Xanthium strumarium L.J. Maharashtra. Agric.Univ.3 (2):143.*

[19]. Love and Dansereau, 1959.Biosystematic studies on *Xanthiu*m: taxonomic appraisal and ecological status. Can. J. Bot., 37:173-208.

[20]. Morin, and Auld, 1993.Host range of *Puccinia xanthi* and post penetration development on *Xanthium occidentale*.Can.J.Bot.71; 956-965.

[21]. Ommachan M, and Shrivastav J.L., 1996. Flora of Jabalpur (M.P.).Scientific Publishers, Jodhpur India.23.

[22]. Parsons, W. T. 1973. Noxious weeds of Victoria. Inkata Press, Ltd., Melbourne, Australia, 300 pp.

[23]. Rao, P.N. 1962.Some *Cercospora* sps. From Hydrabad. India. Indian Phytopath. 15:112-122

[24]. Rao V.G. 1962, .Two new parasitic species of *Periconia* from India. *Mycopath. et. mycol. appl.17:332-333.*

[25]. Shrivastav, J.P. 1951.Studies on *Curvularia lunata* (Wakker).Proc.Nat. Acad.Sci. India. 21:117-137.

[26]. Shukla, B., Rao J.P. & Gupta S.N., 1988 .Systematic position of *Xanthium* –A chemosynthetic approach. Proc. Nat. Acad. Sci. India.58 (B).I :81-85.

[27]. Subramanian, C.V.1953, Fungi imperfecti from Madras-V *Curvularia,* 3.Proc.Nat. Acad.Sci.3B:27-39.

[28]. Sutton, B.C.1980.The Ceolomycetes: Fungi imperfecti with pycnidia, acervuli and stromata.CAB International Mycological Research Institute, Kew Surry.England.696 pp.

[29]. Vargas, R. (1984}. Weed Management system for cotton .pp 52-56. In: Proceedings 36th Annual California Weed Conference. 164 pp.