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Fungal pathogens of terrestrial weeds of Haryana - II

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During 1994-95 surveys for pathogenic fungi of various terrestrial weeds of Kurukshetra and its surrounding areas, a total of 12 fungal pathogens were identified on 12 weeds belonging to 10 different families of Angiosperms. Pathogenicity of non-obligate fungal pathogens were proved and Koch's postulates were confirmed. Disease symptoms and cultural characteristics of the 12 fungul pathogens are described. A literature search indicates that *Cercospora* sp. -11 on *Mazus rugosus, Gibbago trianthemae* on *Trianthema portulacastrum, Oidium* sp. on *Malvastrum coromandelianum* and *Pseudocercospora* sp. on *Croton bonplandianum* are being reported for the first time in India. *Cercospora achyranthina* on *Achyranthus aspera, C. citrullina on Coccinea indica, Cercospora* sp.-1 on *Cassia occidentails , Colletotrichum punctiformis* on *Oxalis latifolia, Colletotrichum* sp. on *Gomphrena celosioides, Curvularia lunata* on *Cassia obtusifolia, Oidium* state of *Erysiphe convolvulii* on *Convolvulus arvensis* and *Phyllachora cynodontis* on *Cynodon dactylon* are the first report of occurence of these pathogens from this region.

Key words : Biocontrol, fungal pathogens, mycoherbicide, terrestrial weeds

INTRODUCTION

Weeds are and apparently have always been a menace to mankind. They cause more economic losses on agriculture lands than all other pests combined (Kremer and Kennedy, 1996). They may simply compete with crop range or forest plants of importance to man or may attain significance in some other way like producing allergenic pollen, clogging waterways, poisoning livestock, interfering with harvesting and drying of crops, reducing their food and fibre quality (Hasija *et al.,* 1994; Gupta, 1997). In India a total loss of 2,800 crore rupees in crop productivity was reported to weeds only (Anonymous, 1997). With increasing global concern about pesticide residues in the biosphere, difficulties in controlling specific weed species and public demand for pesticide free food, there is a current need to develop alternative weed management strategies (Kennedy and Kremer, 1996; Kremer and Kennedy, 1996). Use of biological control, the deliberate use of natural enemies to suppress the growth or reduce the population of a problem weed species as a direct replacement for or supplement to existing chemical control has become attractive (Charudattan, 1990, Watson, 1993; Muller-Scharer and Frantzen, 1996). Among various biocontrol agents control of weeds with fungal pathogens is receiving considerable attention because of the following reasons: they are easy to handle than bacteria and viruses; their taxonomic position is better defined; their ability for active invasion of plant tissues; their good viability and shelf life and disease cycle over a range of environmental conditions (Hasan, 1983; TeBeest and Templeton, 1985; Charudattan, 1990). Currently, over 100 pathogens have been identified as having the potential for weed biocontrol and the research on biological control agents continue to increase (Kennedy and Kremer, 1996). The three main strategies for biological control are the classical, augmentative (or inundative) and integrated management approach for suppression of weeds (De Bach, 1964; Kennedy and Kremer, 1996). Most of the research on microbial control of weeds has concentrated on fungal plant pathogens for broadleaf weed control. Most notable examples are the use of rust fungi *Puccinia chondrillina* for the control of skeleton weed *(Chondrilla juncea)* and *Phragmidium violaceum* for the control of *Rubus* spp. (blackberries). Mycoherbicides commercially available under the trade name are: De Vine *(Phytophthora palmivora),*

Collego *(Colletotrichum gloeosporioides* f.sp. *aeschynomene)* and Bio Mal (*C. gloeosporioides* f.sp. *malvae)* for the control of stranglervine, northern jointvetch and roundleaf mallow, respectively (Aneja, 1998).

Keeping in view the emphasis being laid on the use of fungal plant pathogens as the promising biocontrol agents of weeds, work was initiated to search for natural enemies associated with various terrestrial weeds of this region.

MATERIALS AND METHODS

Surveys were conducted in the years 1994-1995 for collecting diseased samples of terrestrial weeds of Kurukshetra and its adjoing areas. Infected weeds were collected in sterillized polyethylene bags and brought to the laboratory for the study of symptoms,isolation and identification of pathogens involved. Specimen were pressed, dried and kept as herbarium records. Diseased specimens have been deposited at the CABInternational Mycological Institute,Egham, England and their IMI numbers have been referred in the text.

Isolation, identification and pathogenicity tests were performed using standard techniques as described earlier (Aneja and Kaur, 1995). For identifications various books,monographs and review papers were consulted (Barnett and Hunter, 1972; Ellis 1971, 1976; Deighton, 1976; Sutton, 1980; Simmons, 1986).

RESULTS

A total of 12 fungal pathogens were recorded on 12 weeds belonging to 10 different families of Angiosperms. (Table1). Leaf spots, powdery mildews, and tar spots were the main diseases observed. The symptoms by these fungal pathogens on their respective hosts and cultural characteristics of these pathogens are described below.

Cercospora achyranthina Thirum. and Chupp

Symptoms are characterized as round to circular purple bordered spots on leaves.Conidiophores arise in fascicles, geniculate, slightly swollen at the base, mid pale to olivaceous brown in colour, 60 to 80 µm long and 4-6 µm wide. Conidiogenous cells integrated, terminal,sympodial, with conspicious cicatrized scars. Conidia filiform, smooth,hyaline, tapering towards apex, 4-10 septate, 60-155 x 3-4 µm.

On living leaves of *Achyranthus aspera* L., Kurukshetra (IMI:360710).

Cercospora citrullina Cooke

Symptoms appear as circular, whitish spots with brown border on leaves. Conidiophores cicatrized, geniculate, fasciculate, mid pale to olivaceous brown in colour, 80-150 µm long and 4-6 µm wide. Conidia filiform, 11-20 septate, 150-200 x 4-5 µm.

On living leaves of *Coccinea indica* W.A., Kurukshetra (IMI:360708).

***Cercospora sp.*-I**

Symptoms are characterized as small irregular light brown spots on living leaves. Conidiophores straight, fasciculate, loosely arranged, upto 350 µm long, with prominent scars at the tip. Conidia filiform, hyaline, 7-25 septate with a distinct hilum at the base, conidial tip swollen, 50-312x3. 8-4 µm.

On living leaves of *Cassia occidentalis* L., Kurukshetra. (IMI:357747)

***Cercospora* sp.-II**

Symptoms are characterized as blackish brown, large circular spots, 3-4 mm in diameter. Conidiophores straight, arise in fascicles, loosely arranged, pale brown in colour, 50-250 µm long x 4-5 µm wide. Conidia filiform, hyaline, septate, 150-180 x 4-5 µm.

On living leaves of *Mazus rugosus* Lour., Kurukshetra

Colletotrichum Punctiformis (Niessl.) Butter and Bisby

Symptoms are characterized as small black coloured spots on leaf. Acervuli disc shaped, conidiophores simple, brown coloured and septate, formed form the upper cells of the fructification. Conidia hyaline, unicellular, oblong, 11.4-19.00 x 1.4 µm

On living leaves of *Oxalis latifolia*H.B.and K., Kurukshetra.

***Colletotrichum* sp.**

Symptoms are characterized as round,red to purple bordered spots measuring upto 7 mm in diameter. Acervuli disc shaped with typically dark coloured straight, unbranched prominent setae with tapering apex. Conidiophores simple. Conidia one celled, hyline, oblong, 15-19x3.8-4µm.

On living leaves of *Gomphrena celosioides* Mart., Kurukshetra.

Curvularia lunata (Wakker) Boedijn

Symptoms are characterized as round, dark black coloured spots on the leaves ranging from 1 to 4 mm in diameter. Conidiophores mononematous, brown, smooth upto 228 µm long.Conidia curved, 3 septate, pale to dark brown, 19-33x8-16 µm.

On living leaves of *Cassia obtusifolia* L, Kurushetra.

Gibbago trainthemae Simmons
Symptoms are characterized as dark brown, round to irregular, necrotic lessions with marron margins. Conidiophores macronematous, 1-4 transeptate, straw coloured upto 150 µm long and 4 µm wide, with slightly swollen apex. Conidia yellow brown, muriform, ellipsoid, smooth walled, 3-6 complete / partial transverse septa with constrictions and 1-6 complete / partial longitudinal septa, 30-68x19-38 µm.
On living leaves of *Trianthema portulacastrum* L., Kurukshetra (IMI 366406, 377851).
Oidium state of *Erysiphe convolvulii* D.C.
Symptoms are characterized by the presence of white powdery growth on the adaxial surface of leaf. Mycelium grows externally on host. Conidiophores upright, simple, Conidia cylindrical, hyaline, I celled, 30-60x19-27 µm.
On living leaves of *Convolvulus arvensis*, L. Kurukshetra (IMI:337750).
Oidium sp.
Symptoms are characterized by the presence of white powdery growth on the adaxial surface of leaf. Mycelium is external to host. Conidiophores simple, upright. Conidia barrel shaped, simple, hyaline, 1 celled; 22x35-19x23 µm.
On living leaves of *Malvastrum coromandelianum* (L.) Garcke., Kurukshetra.
Phyllachora cynodontis (Sacc.) Niessl.
Symptoms are characterized as black tar spots on leaves. Numerous ascocarps, formed below the clypeus, each provided with an opening., Asci cylindrical, uniformlly thickened, upto 57 µm and 15 µm wide,intemingled with paraphysis. Ascospores ovoid, aseptate, hyaline to dark coloured and arranged linearly. 7.6-15.2x 3.8-7.6 µ
On living leaves of *Cynodon dactylon* (L.) Pers, Kurukshetra (IMI 3459575).
***Pseudocercospora* sp.**
Symptoms are characterized as round, black coloured spots on leaves, 3-4 mm in diameter. Conidiophores loosely arranged simple, septate, unbranched, pale-olivaceous and swolen slightly at the base, usually 300-700 µm long and 4 µm wide. Conidiogenous cells terminal, integrated and percurrent. Conidia hyaline, cylindrical, catenate, pseudoseptate (upto 27 septa). 171-266x7.5-8 µm.

Table 1. Fungal pathogens reported on various terristrial seeds of Haryana

Pathogen	Disease	Host	Family
Cercospora achyranthina Thirum and Chupp	Leaf spot	*Achyranthus aspera* L.	Amaranthaceae
C. citrullina Cooke	Leaf spot	*Coccinea indica* W.A.	Cucurbitaceae
Cercospora sp.-I	Leaf spot	*Cassia occidentalis* L.	Casalpiniaceae (Fabaceae)
Cercospora sp.-II	Leaf spot	*Mazus rugosus* Lour.	Scrophulariaceae
Colletotrichum punctiformis (Niessl.) Butler and Bisby	Leaf spot	*Oxalis latifolia* H.B. and K.	Oxalidaceae
Colletotrichum sp.	Leaf spot	*Gomphrena celosioides* Mart.	Amarnathaceae
		Cassia obtusifolia L.	Caesalpiniaceae
Curualaria lunata (Wakker) Boedijn	Leaf spot		(Fabaceae)
Gibbago trianthemae Simmons	Leaf spot	*Trianthema portulacastrum* L.	Aizoaceae
Oidium state of Erysiphe convolvulii D.C.	Powdery mildew	*Convolvulus arvensis*L.	Convolvulaceae
Oidium sp.	Powdery mildew	*Malvastrum coromandelianum*(L.) Garcke.	Malvaceae
Phyllachora Cynodontis (Sacc.) Niessl.	Tar spot	*Cynodon dactylon* (L.) Pers.	Poaceae
Pseudocercospora sp.	Leaf spot	*Croton bonplandianum* Baill.	Euphorbiacceae

On living leaves of *Croton bonplandianum*, Bail., Kurukshetra.

DISCUSSION

During 1994-95 surveys for pathogenic fungi on various terrestrial weeds of Kurukshetra, a total of 12 fungal pathogens were identified on the basis of their morphological characteristics.

Typical disease sympoms were produced by non-obligate pathogens viz.*Colletotrichum punctiformis* on *Oxalis latifolia, Colletotrichum* sp. on *Gomphrena celosioides, Curvularia lunata* on *Cassia obtusifolia* and *Gibbago trianthemae* on *Trianthema portulacastrum* on both wounded and non-wounded detached leaves *in vitro*.Inoculated pathogens were isolated and were found similar to the original isolates in cultural characteristics, thus confirming the pathogenicity to their respective hosts and completing the Koch's postulates.

Literature search (Ellis, 1971, 1976; Holiday, 1980; Mukerji and Bhasin, 1986; Bilgrami *et al.*, 1991) indicates that *Cercospora achyranthina* on *Achyranthus aspera*, *C. citrullina* on *Coccinea indica*, *Cercospora* sp.-I on *Cassia occidentalis*, *Colletotrichum punctiformis* on *Oxalis latifolia*, *Colletotrichum sp. on Gomphrena celosioides*, *Curvularia lunata* on *Cassia obtusifolia*, *Oidium* state of *Erysiphe convolvulii* on *Convolvulus arvensis* and *Phyllachora cynodontis* on *Cynodon dactylon* are first record of occurrence of these pathogens on these hosts for this region. *Cercospora* sp.-II on *Mazus rugosus*, *Oidium* sp. on *Malvastrum coromandelianum* and *Pseudocercospora* sp. on *Croton bonplandianum* are new records of occurence of these fungal pathogens on their respective hosts for India.*Gibbago trianthemae* on *T. portulacastrum*, in addition to a new record for our country is the second report of occurrence of this pathogen from the world. *G. trianthemae* had earlier been reported from the U. S. A. (Simmons, 1986) and has been suggested as a probable biocontrol agent for *T. portulacastrum* (Mitchell, 1988) Of the 12 fungal pathogens recorded on various weeds from this region, two such as *Gibbago trianthemae* on *Trianthema portulacastrum* and *Curvularia lunata* on *Cassia obtusifolia* are being evaluated for their biocontrol potential on their respective hosts in our laboratory.

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