Plant Pathology Journal

ISSN 1812-5387

science alert

ANSInet
an open access publisher
http://ansinet.com

Plant Pathology Journal 11 (2): 68-72, 2012
ISSN 1812-5387 / DOI: 10.3923/ppj.2012.68.72

A New Disease of Bell Pepper (*Capsicum annuum* var. *grossum*) Caused by *Drechslera bicolor*, Its Pathophysiology, Efficacy of Fungicides and Botanicals

[1]Sapnesh Didvania, [1]Rakesh Shah and [2]Kuldeep Singh Jadon
[1]Department of Plant Pathology, R.C.A. (Mpuaandt), Udaipur-313 001, India
[2]Directorate of Groundnut Research, Junagadh-362001, India

Abstract: Bell pepper blight was observed on leaves and fruits. Pathogenicity was confirmed on bell pepper plants and fruits of bell pepper, chilli, tomato and brinjal. Initial symptoms on bell pepper plants were appeared on 7th day of inoculation. In diseased fruits incubation period varied in between 6-8 days. *In vitro* studies revealed that fungus grew and sporulated well on Potato Dextrose Agar (PDA), 25±2°C temperature, 100% RH, brown light and pH 6.5. Vitavax was found best followed by thiram. Neem leaves inhibited maximum fungal growth followed by *Lantana leaves* extracts.

Key words: Bell pepper, *Drechslera bicolor*, blight, fungicide, plant extract

INTRODUCTION

Sweet or bell pepper (*Capsicum annuum* var. *grossum* (L.) Sendt.) is regarded as one of the most popular and nutritious vegetable. The productivity of sweet pepper is very low in India as compared to USA, Holland, Italy, France and other capsicum growing countries of the world. It is relatively a new entrant into our country. It is mainly cultivated in Himachal Pradesh, Uttaranchal, Uttar Pradesh, Maharashtra, Gujarat, Karnataka, Tamil Nadu and Bihar (Chadha, 2003). It is also grown in the Jaipur, Tonk, Sawai Madhopur and Udaipur districts of Rajasthan. Being a cool season crop, it is planted from February onwards to June in hills, in plains it is planted during March-July and in other parts of the country during June to December. With the advent of shade nets, it is possible to raise capsicum by lowering the temperature even during the hot summer months. Sweet pepper, green or red, may be eaten cooked or row, sliced in salad. In stews a little sweet pepper imparts a novel flavour. Ripe fruits packed with white fish make a delicious dish. Mild sweet pepper are also used for pickling in brine, baking and stuffing, diced green or red sweet peppers are sometimes mixed with corn or other vegetables. It is an important high value crop with respect to nutritive value having high vitamin A (870 IU), vitamin C (175 IU) and calcium (11 mg) and phosphorus (32 mg). It contains 92% water and food value per 100 g of edible portion is 29 calories and protein 1.2 g. To maximize yields and to enhance economic return, right choice of healthy varieties, following the recommended cultural practices, besides appropriate and timely plant protection measures are essential. A large number of diseases caused by fungi, bacteria, viruses and mycoplasmas affect this crop and a major damage is caused to the fruit yield. These pathogens also attack during transit and storage. Major fungal diseases of capcicum are damping off (*Pythium aphanidermatum* and *Phytophthora* spp.), leaf spots (*Cercospora capsici* and *Alternaria solani*), anthracnose and ripe rot (*Colletotrichum capsici*) and fruit rot and leaf blight (*Phytophthora* spp.), powdery mil dew *Erysiphe cichoracearum* and *Leveillula taurica*, Early blight (*Alternaria solani*), wilt (*Fusarium oxysporum*), frog eye rot (*Phaeoramularia capsicicola*), leaf spot (*Septoria lycopersici*), fruit spot (*Phoma destructiva*), stem rot (*Macrophomina phaseoli*), dry rot (*Scterotium rolfsii*) and fruit rot (*Phomopsis* spp.), respectively. The post-harvest rots are caused by *Aspergillus terreus, A. candidus, A. niger, Fusarium moniliforme, F. sporotrichioides, Paecilomyces variotii* and *Penicillium corylophilum* (Bose *et al*., 2002; Gupta and Paul, 2002; Chadha, 2003; Gupta and Thind, 2006).

During the month of August, 2006 a new fungal blight caused by *Drechslera bicolor* was observed on the leaves and fruits of bell pepper (cv. Bombay red and Nun 3020 yellow) at Hi-tech Horticultural Polyhouse Farm, RCA, Udaipur. The diseased plant parts were brought to the laboratory for various plant pathological studies. The causal fungus was isolated, purified and the pathogenicity was proved on healthy plants. As a new disease in the state, fungal culture was sent for identification at ITCC, IARI, New Delhi and identified (ID. No. 279/6513-07) as *Drechslera bicolor* (Mitra).

Corresponding Author: Sapnesh Didvania, Department of Plant Pathology, R.C.A. (Mpuaandt), Udaipur-313 001, India

Sharma and Sohi (1980) reported a new disease of chilli caused by *Drechslera* sp. during Kharif 1977-78 causing leaf blight and fruit rot of cv. NP-46A. They found symptoms on margins of leaf lamina, spots on stem, branches and fruits; symptoms on fruit consist of water soaked brown black areas. Seed from infected fruit show very poor germination. Deena and Basuchaudhry (1984) reported *D. bicolor* on seeds of *Capsicum annuum* at Varansi (UP) and were also compiled by Jamaluddin *et al.* (2004). Several workers reported *Drechslera* spp. on seed, fruit and foliar parts of *Capsicum annuum* (Manoharachary and Padmavathy, 1976; Rao and Thirupathaiah, 1979; Datar and Ghule, 1984; Adiver *et al.*, 1987; Sultana *et al.*, 1992; Basak and Choudhary, 1997; Singh *et al.*, 2006).

The genus *Helminthosporium* is divided into several sub-genera among which *Drechslera* was established by Ito (1930). Misra *et al.* (1972) also reported *Helminthosporium bicolor* on three graminaceous hosts as leaf spot disease. The graminaceous hosts were *Melanocenchris abyssinica*, *Andropogon aciculatus* and *Apluda aristata*. They further reported wide host range of *H. bicolor* on *Eleusine coracana*, *E. indica*, *Panicum miliaceum*, *P. atrosanguineum*, *Pennisetum typhoides*, *Paspalum scrobiculatum*, *Sorghum vulgare*, *S. halepense*, *Setaria italica*, *Zea mays*, *Triticum aestivum*, *Hordeum vulgare*, *Avena sativa*, *Cynodon dactylon*, *Dactyloctenium aegyptium*, *Leptochloa filiformis*, *Eragrostis*, *Echinochlea colonum*, *E. frumentacea*, *Oryza sativa* and *Imperata arundinacea*. The occurrence of *H. bicolor* has also been reported earlier by many workers (Mitra, 1931; Richardson, 1942; Tarr, 1951; Putterill, 1954; Paul and Parbery, 1966; Bertus, 1974).

Jain (1973), Hawksworth *et al.* (1995) and Agrios (2005) reported that hyphal and conidiophore cells are mostly uninucleate and a single nucleus passes into initials of hyphal anastomosis occurs frequently and branches, conidiophores and conidia may produce temporary heterokaryotic formation but with no means of perpetuation and soon dissociate. The teleomorph of *Drechslera* spp. is *Pyrenophora* but according to Catalogue Of Life the perfect stage of *Drechslera bicolor* is *Cochliobolus bicolor*. Alexopoulos *et al.* (2002) classified *Drechslera bicolor* as Kingdom: Fungi; Phylum: Ascomycota; Class: Ascomycetes; Order: Pleosporales; Family: Pleosporaceae; Genus: *Drechslera*; Species: *bicolor*.

Morphology of *Drechslera bicolor* was well defined by Ellis (1971) and reported that, conidiophore emerging singly or in small groups, straight or flexeuous, some-times swollen at the base, the upper part often repeatedly geniculate with large; dark sears, golden brown, up to 400 μ long, 5-10 μ thick, conidia straight or rarely slightly curved, cylindrical or rather broader in the middle tapering towards the ends, rarely obclavate, rounded at the apex, often truncate at the base, with 3-14 pseudosepta, 20-135×12-20 μ, mostly 40-80×14-18 μ with 5-9 pseudosepta, central cells of mature conidia often dark brown or smoky brown and sometimes quite opaque but the cell at each and remains hyaline or very pale and is frequently cut off by a very dark septum; hilum flat, dark, 3-5 μ wide. The taxonomy of "*Helminthosporium*" species was well studied by Alcorn (1988). The colony characters of *D. bicolor* was studied by Misra *et al.* (1972) and they reported that fungus grew well on PDA medium with profuse aerial mycelium of bottle green to whitish-grey in colour, colony surface smooth and circular and brownish tinge in colour when aged.

MATERIALS AND METHODS

D. bicolor was isolated, purified and its pathogenicity was proved on one month old bell pepper plants. Pathogenicity of the fungus was also proved on chilli, tomato and brinjal fruits. Different physiological studies like solid and liquid media (PDA, Czapak-Dox, Malt extract, Richard's Sabouard's, Asthana and Hawker's and Sach's) temperatures (10, 15, 20, 25, 30, 35 and 40°C), light (brown, red, purple, yellow, blue, green and darkness), relative humidity (20, 40, 60, 80 and 100%), effect of relative humidity on spore germination (20, 40, 60, 80 and 100%), pH levels (4, 4.5, 5, 5.5, 6, 6.5, 7, 7.5, 8, 8.5, 9, 9.5 and 10), fungicides (copper oxychloride, thiophanate methyl, carbendazim, metalaxyl, mancozeb, thiram and vitavax) and plant extracts (neem, mahua, amaltas, babool, vilayati babool, garlic, onion, ginger, marigold, tulsi, sarpagandha, ashwagandha, latjeera, datura and *Lantana*) were tried against *D. bicolor*. Fungicides and plant parts extracts were tested against the pathogen using poisoned food technique (Nene and Thapliyal, 1979). The results of various studies were statistically analysed using CRD.

RESULTS AND DISCUSSION

Initial natural symptoms of blight on bell pepper were appeared on the tip of young leaves as brown spot and later on large straw blighted patches were formed Plate-1 (A). The fruit rot was detected in the month of October. Apical portion of bell pepper fruit was found rotted with rapid discolouration and internal decay. Diseased fruits were deformed Plate-1 (B). Pathogenicity tests gave initial symptoms on leaves on the 7th day of inoculation Plate-1 (C). Bell pepper, chilli, tomato and brinjal fruits were found to be infected by *D. bicolor* Table 1 and Plate-1 (D). Several workers also reported *Drechslera* spp. on seed,

Table 1: Pathogenicity tests on fruits in laboratory

Fruit	Species name	Reaction	Incubation period (days)
Bell pepper	*Capsicum annuum* var. *grossum*	+	6
Chilli	*Capsicum annuum*	+	6
Tomato	*Lycopersicon esculentum*	+	8
Brinjal	*Solanum melongena*	+	7

Table 2: Effect of different solid media on growth and sporulation of *Drechslera bicolor*

Medium	Mycelial growth diameter (mm)*	Sporulation
Sach's agar	48.20	+
Asthana and Hawker's	53.45	+
Sabouraud's	57.60	++
Czapek Dox's	69.75	++
Richard's	75.35	+++
Malt extract	82.13	+++
Potato dextrose agar	90.00	+++
±SEM	1.56	
CD at 1%	6.58	

*Average of three replications, +++: Abundant, ++: Good, +: Poor

Table 3: Effect of different liquid media on growth and sporulation of *Drechslera bicolor*

Medium	Dry mycelial weight (mg)*	Sporulation
Sach's	70.85	+
Asthana & Hawker's	82.15	+
Sabouraud's	88.93	++
Czapek Dox's	110.28	++
Richard's	175.33	++
Malt extract	269.12	+++
Potato dextrose	310.55	+++
±SEM	1.68	
CD at 1 %	7.08	

*Average of three replications, +++: Abundant, ++: Good, +: Poor

Table 4: Effect of different temperatures on growth and sporulation of *Drechslera bicolor* on PDA

Temperatures±2°C	Mycelial growth diameter (mm)*	Sporulation
10	0.00	-
15	52.00	++
20	62.75	++
25	90.00	+++
30	71.04	+++
35	38.12	+
40	0.00	-
±SEM	1.63	
CD at 1 %	6.87	

*Average of three replications, +++: Abundant, ++: Good, +: Poor, -: Nil

fruit and foliar parts of chilli (Sharma and Sohi, 1980; Deena and Basuchaudhry, 1984; Sultana *et al*., 1992; Singh *et al*., 2006). During present studies natural symptoms were observed on leaves and fruits in the form of blight whereas other parts were free of infection.

Different physiological tests conducted in vitro revealed that maximum mycelial growth (mm) and sporulation (+ or -) was and obtained on PDA followed by Malt extract and Richard's solid (82.1 mm, 75.4 mm) and liquid media (175.3 and 269.1 mm) respectively (Table 2 and 3). Out of seven temperatures best temperature was 25±2° C (90.0 mm) followed by 30±2°C (71.0 mm) and 20±2°C (62.8 mm) for mycelial growth (mm) and

Table 5: Effect of different levels of relative humidity (RH) on growth and sporulation of *Drechslera bicolor* on PDA

RH (%)	Mycelial growth diameter (mm)*	Sporulation
20	10.35	-
40	20.33	-
60	48.13	++
80	80.65	++
100	90.00	+++
±SEM	1.92	
CD at 1%	8.63	

*Average of three replications, +++: Abundant, ++: Good, -: Nil

Table 6: Effect of different levels of relative humidity (RH) on spore germination of *D. bicolor*

	Spore germination*	
RH (%)	6 h	24 h
20	12.41	14.52
40	24.67	29.45
60	53.23	59.61
80	86.38	89.13
100	94.15	96.56
±SEM	1.17	0.77
CD at 1%	5.26	3.46

*Average of three replications

Table 7: Effect of different kinds of light on growth and sporulation of *Drechslera bicolor* on PDA

Light	Mycelial growth diameter (mm)*	Sporulation
Brown	90.00	+++
Red	87.03	+++
Purple	79.20	+++
Yellow	70.29	++
Blue	65.45	++
Green	53.18	++
Darkness	50.44	+
±SEM	1.89	
CD at 1%	7.95	

*Average of three replications, +++: Abundant, ++: Good, +: Poor

Table 8: Effect of different pH levels on growth and sporulation of *Drechslera bicolor* on PDA medium

pH	Mycelial growth diameter (mm)*	Sporulation
4.0	20.21	++
4.5	31.03	++
5.0	50.20	++
5.5	58.15	++
6.0	80.83	+++
6.5	90.00	+++
7.0	74.20	+++
7.5	38.11	++
8.0	18.50	++
8.5	12.07	++
9.0	10.15	+
9.5	8.20	+
10.0	6.54	+
±SEM	1.08	
CD at 1%	4.25	

*Average of three replications, +++: Abundant, ++: Good, +: Poor, -: Nil

sporulation (+ or -) (Table 4). Relative humidity 100% (90.0 mm) was found best followed by 80% (80.7 mm) level (Table 5). Spore germination was also maximum at 100 (96.6) and 80% (89.1) levels (Table 6). Brown light gave highest mycelial growths (90.0 mm) and sporulation followed by red and purple lights (87.03 and 79.2 mm) respectively (Table 7). Hydrogen ion concentration range 6.5 (90.0 mm) remained best followed by 6 (80.8 mm) and 7 (74.2 mm) (Table 8).

Table 9: Effect of different fungicides on growth and sporulation of *Drechslera bicolor* mycelium on PDA

	Concentration (ppm)							
	100		250		500		1000	
Fungicide	I (%)	Sporulation	I (%)	Sporulation	I (%)	Sporulation	I (%)	Sporulation
Copper oxychloride	28.21	+	30.06	-	45.30	-	53.15	-
Thiophanate methyl	42.75	+	55.40	-	70.35	-	90.10	-
Carbendazim	20.09	+	40.15	-	45.20	-	58.12	-
Metalaxyl	20.15	+	34.58	-	51.47	-	70.30	-
Mancozeb	45.30	+	60.20	-	72.40	-	92.08	-
Thiram	60.45	-	78.04	-	82.80	-	95.55	-
Vitavax	65.20	-	82.40	-	90.58	-	98.60	-
Control	0.00		0.00		0.00		0.00	
CD at 1%	6.68		8.05		7.33		7.12	

Values are average of three replications, +++: Abundant, ++: Good, +: Poor, -: Nil, I: Inhibition

Table 10: Effect of different plant part extracts on growth and sporulation of *Drechslera bicolor* mycelium on PDA

	Concentration (%)					
	10		20		30	
Plant extracts	I (%)	Sporulation	I (%)	Sporulation	I (%)	Sporulation
Neem leaves	58.20	-	64.08	-	70.00	-
Mahua leaves	39.35	+	42.15	+	50.25	-
Amaltas leaves	30.65	+	40.8	+	45.85	-
Babool leaves	22.02	+	40.50	+	40.55	-
Vilayati babool leaves	20.65	+	32.09	+	42.88	-
Garlic cloves	50.06	-	55.80	-	62.90	-
Onion bulb	17.75	+	35.40	+	46.33	-
Ginger rhizomes	35.40	+	38.02	+	49.15	-
Marigold leaves	40.12	+	42.85	+	48.40	+
Tulsi leaves	45.10	+	48.08	+	52.40	-
Sarpagandha leaves	28.75	+	39.40	+	50.20	-
Ashwagandha leaves	32.04	+	34.20	+	50.02	-
Latjeera leaves	24.13	+	32.18	+	47.80	-
Datura leaves	42.08	+	49.50	+	52.02	-
Lantana leaves	52.30	-	57.45	-	65.10	-
Control (without plant extracts)	0.00	+	0.00	+	0.00	-
Control (with fungicide vitavax @ 0.01% conc.)	65.20					
CD at 1 %	7.02		7.88		8.02	

Values are average of three replications, +++: Abundant, ++; Good, +: Poor, -: Nil, I: Inhibition

All fungicides inhibited the growth of the fungus at all concentrations tried compared to control. Progress of inhibition positively correlated with the increase in concentration of all fungicides tried. Vitavax (98.6%) found the most potent fungicide followed by Thiram (95.6%), Mancozeb (92.1%) and Thiophanate methyl (90.1%) (Table 9). Hiremath *et al*. (1989) found potato dextrose broth as best for *D. hawaiiensis*. Yadav (2007) reported 30°C as best for *D. graminea* followed by 25°C, he also reported pH 6.5 as best followed by 7 and Vitavax as best followed by thiram and captan.

The results of antifungal activities of different botanicals revealed that the growth of *D. bicolor* was inhibited by all the three concentrations tested and compared to control. Maximum inhibition was obtained by neem leaves extract (70.0 %) followed by *Lantana* leaves (65.1%) and garlic cloves (62.9%), respectively. Tulsi (54.4%), datura (52.0%), mahua (50.2%), sarpagandha (50.2%) and ashwagandha (50.0%) plant part extracts had also proved to be good alternatives against the fungus (Table 10). Shivpuri *et al*. (1997) studied ethanol extracts of onion, garlic, neem, oak, datura, tulsi, sadabahar and satayanashi against *Colletotrichum capsici*. Meena (2004) found neem extract as best against *P. citri* causing citrus fruit rot. Yadav (2007) found *Lantana* as best botanical followed by neem against *D. graminea* in pot experiments.

As a new disease the present investigations were restricted to patho-physiological studies of new fungal disease caused by *D. bicolor*. Further detailed studies are essentially needed to be taken on mycology, symptoms, epidemiology and integrated disease management.

ACKNOWLEDGMENT

The first author is thankful to Professor and Head, Department of Plant Pathology and Dean, Rajasthan College of Agriculture, Udaipur for providing necessary facilities to carry out PG (Plant Pathology) research work.

REFERENCES

Adiver, S.S., P.C. Hiremath, N.K. Patil, R.K. Hegde and P.R. Dharmatti, 1987. Seed mycoflora of chilli and their role on seed germination. Curr. Res., 16: 70-72.

Agrios, G.N., 2005. Plant Pathology. 5th Edn., Academic Press, New York, USA., ISBN-13: 9780120445653, pp: 395.

Alcorn, J.L., 1988. The taxonomy of *Helminthosporium* species. Ann. Rev. Phyopathol., 26: 37-56.

Alexopoulos, C.J., C.W. Mims and M. Blackwell, 2002. Introductory Mycology. John Wiley and Sons, New York, USA., Pages: 449.

Basak, A.B. and I.D. Choudhary, 1997. Leaf disease of chilli occurring in Chittagong district. Chittagong Univ. Stud. Sci., 21: 127-131.

Bertus, A.L., 1974. A graminicolous species of *Drechslera* on gladiolus. J. Phytopathol., 80: 181-185.

Bose, T.K., J. Kabir, T.K. Maity, V.A. Parthasarthy and M.G. Som, 2002. Vegetable Crops. Vol. 1, Naya Prokash Publ., Calcutta, India, pp: 168-204.

Chadha, K.L., 2003. Capsicum. In: Handbook of Horticulture, Chadha, K.L. (Ed.). Vol. 3. Indian Council of Agriculture Research, New Delhi, India, pp: 368-371.

Datar, V.V. and K.K. Ghule, 1984. Fruit rot of chilli caused by *Drechslera austarliensis*, a new host record from India. Indian J. Plant Pathol., 2: 187-188.

Deena, E. and Basuchaudhary, 1984. Studies on seed borne mycoflora of Chilli. Indian Phytopathol., 37: 151-153.

Ellis, M.B., 1971. Dematiaceous Hyphomycetes. Commenwealth Mycological Institute, Kew, Survey, England, pp: 422-423.

Gupta, S.K. and T.S. Thind, 2006. Disease Problems in Vegetable Production. Scientific Publishers (India) Ltd., Jodhpur, India, pp: 335-380.

Gupta, V.K. and Y.S. Paul, 2002. Disease of Vegetable Crops. Scientific Publishers (India) Ltd., Jodhpur, India, pp: 96-102.

Hawksworth, D.L., P.M. Kirk, B.C. Sutton and D.N. Pegler, 1995. Ainsworth and Bisby's Dictionary of the Fungi. CAB International, UK., pp: 142.

Hiremath, S.V., S. Kulkarni and R.K. Hedge, 1989. Cultural studies of *Drechslera hawaiiensis* (Bugnicourt) Subram. and Jain ex M.B. Eillis, causing leaf blight of wheat. Karnataka J. Agric. Sci., 2: 41-46.

Ito, S., 1930. On some new ascigerous stages of the species of *Helminthosporium* parasitic on cereals. Proc. Imperial Acad. Jpn., 6: 352-355.

Jain, B.L., 1973. Cytology of *Drechslera bicolor*. Nova Hedwigia, 24: 493-503.

Jamaluddin, M.G. Goswami, B.M. Ojha and K.S. Bilgrami, 2004. Fungi of India 1989-2001. Scientific Publishers (India) Ltd., Jodhpur, India, ISBN-13: 9788172333546, pp: 51.

Manoharachary, C. and K. Padmavathy, 1976. Fungi associated with chilli seeds. Geobios, 3: 99-100.

Meena, N.L., 2004. Pathological and physiological investigations of *Phomopsis citri* (Fawcett) causing fruit rot in *Citrus reticulata* (Blanco). M.Sc. Thesis, Department of Plant Pathology, RCA, Maharana Pratap University of Agriculture and Technology, Udaipur

Misra, A.P., Omprakash and R.A. Singh, 1972. *Helminthosporium bicolor* on three *Graminaceous* hosts. Indian J. Mycol. Plant Pathol., 2: 195-197.

Mitra, M., 1931. A comparative study of species and strains of *Helminthosporium* on certain Indian cultivated crops. Trans. Br. Mycol. Soc., 15: 254-293.

Nene, Y.L. and P.N. Thapliyal, 1979. Fungicides in Plant Disease Control. Oxford and IBH Publishing Co. Pvt. Ltd., New Dehli, India, Pages: 507.

Paul, A.R. and D.G. Parbery, 1966. The perfect state of *Helminthosporium bicolor*. Trans. Br. Mycol. Soc., 49: 385-386.

Putterill, K.M., 1954. Some graminicolous species of *Helminthosporiutm* and *Curvularia* occurring in South Africa. Bothalia, 6: 347-378.

Rao, S.S. and V. Thirupathaiah, 1979. A new die-back disease of chillies caused by *Drechslera*. Sci. Culture, 45: 288-288.

Richardson, J.K., 1942. Studies on root rot of corn in Ontario. Can. J. Res., 20: 241-256.

Sharma, S.R. and H.S. Sohi, 1980. A new diseases of chilli caused by *Drechslera*. Curr. Sci., 49: 747-748.

Shivpuri, A., O.P. Sharma and S.L. Jhamaria, 1997. Fungitoxic properties of plant extract against pathogenic fungi. J. Mycol. Plant Pathol., 27: 29-31.

Singh, R.P., A.K. Singh and K. Singh, 2006. Seed borne mycoflora of chilli and their management. Ann. Plant Prot. Sci., 14: 485-487.

Sultana, N., A.K. Khanzadr and M. Aslam, 1992. A new cause of fruit rot of chillies in Pakistan. Pak. J. Sci. Ind. Res., 35: 461-462.

Tarr, S.A.J., 1951. Plant pathology reporter. Res. Div. Min. Agric. Sudan Govt., 1948-49, pp: 47-65.

Yadav, S.C., 2007. Symptomatology, histopathology and management of stripe disease of barley caused by *Drechslera graminea* (Robenh Ex. Schlecht) Shoemaker. Ph.D. Thesis, Maharana Pratap University of Agriculture and Technology, Udaipur.