INTERNATIONAL JOURNAL OF AGRICULTURE & BIOLOGY
1560–8530/2003/05–4–618–620
http://www.ijab.org

# Pathogenicity and Fungicidal Efficacy for *Sclerotinia* Rot of Brinjal

S.M. IQBAL[1], A. GHAFOOR, Z. AHMAD AND A.M. HAQQANI
*National Agricultural Research Centre, Islamabad, Pakistan*
[1]Corresponding author E-mail: Iqbalsh65@hotmail.com

## ABSTRACT

*Sclerotinia* rot of brinjal (*Solanum melongena* L.) in epidemic form was recorded under green house conditions on cultivars "Pusa purple long" and "Multan Selection" that caused 26.7 and 47.3% disease incidence, respectively. Fluffy white mycelial mats on infected tissues of stems, leaves and fruit along with dark sclerotia of irregular shape and size were observed. Nine fungicides (Antracol, Bayton, Benlate, Captan, Daconil, Dithane M-45, Ridomil gold, Tecto-60 and Topsin-M) were tested at two concentrations, i.e., 50 and 100 ppm for their efficacy. Significant decrease in mycelial growth and sclerotial production with higher concentration of fungicide was recorded. Mycelial growth was sensitive to Benlate, Ridomil gold, Tecto-60 and Topsin-M at both the concentrations. Antracol, Bayton and Dithane M-45 were least effective, whereas the most effective fungicides were Ridomil-G, Benlate, Tecto-60 and Topsin-M.

**Key Words:** Brinjal; Fungicdes; *Sclerotinia sclerotiorum*; Fungus; *Sclerotia;* Mycelium

## INTRODUCTION

*Sclerotinia sclerotiorum* (Lib.) de Bary [Syn. *S. libertiana* Fuckel: *Whetzelinia sclerotiorum* (Lib.) Korf and Dunont], commonly called white mold, is a soil-borne pathogen with wide host range and has the ability to survive in soil for long periods in the form of sclerotia (Purdy, 1979; Willetts & Wong, 1980). The pathogen attacks nearly all kinds of succulent plants including flowers, shrubs weeds and almost all vegetables (Chupp & Sherf, 1960). It can be destructive to brinjal (*Solanum melongena* L) under conditions of heavy plant growth and wet weather. It has been reported to be sporadically severe in many areas worldwide. Brinjal was first listed as one of the many hosts of *S. sclerotiorum* in New Zealand in 1932 and the same was later reported from Morocco, Netherlands, Bermuda, Brazil, Argentina and Scotland, and from the United States (Weimer, 1940; Blodget, 1946; Gray & Findlater, 1960). Stem rot (*S. sclerotiorum*) on brinjal with (26.7 to 47.3% disease incidence) has been reported for the first time in Pakistan under greenhouse conditions during 2001. The objectives of this work were to identify causal organism of disease and to report its severe occurrence on brinjal in the fields in Pakistan. The efficacy of available commercial fungicides was also tested against the pathogen causing stem rot in brinjal.

## MATERIALS AND METHODS

**Isolation.** Sclerotia collected in the field from diseased plants of brinjal cultivars "Pusa purple long" and "Multan selection" at NARC, Islamabad were disinfected in 1.0% solution of sodium hypochlorite (NaOCl) for one min, rinsed thoroughly in sterile distilled water (SDW) and plated in petri dishes (9 cm dia) containing 15 mL potato dextrose agar (PDA) amended with 100 µg/mL streptomycin sulphate (Stevens, 1974). These plates were incubated at $25^0$C for seven days.

**Pathogeicity test.** In order to test pathogencity of causal organism, susceptible cultivars "Pusa purple long" and "Multan selection" were grown in clay pots (15 cm dia) under controlled environment. Four days old mycelial culture, derived from single sclerotia of the pathogen on PDA at $25^0$C, was used for inoculation. Six weeks old plants were inoculated by placing 5 mm PDA discs of mycelial culture on wounded stem portions. The wounds were sealed with parafin. The PDA discs containing no culture were used as checks. Pots with inoculated plants and check were covered with polyethylene bags for 72 h after irrigating the pots in order to provide high level of humidity. They were then kept at $25^0$C and examined daily for the development of disease symptoms for 15 days.

**Evaluation of fungicides.** Sensitivity of *S. sclertiorum* mycelium and the production of sclerotia to nine fungicides; Antracol, Bayton, Benlate, Captan, Daconil, Dithane M-45, Ridomil gold, Tecto-60 and Topsin-M at two concentrations (50 & 100 ppm) was studied using a poisoned food technique (Nene & Thaplyal, 1979). Fungicidal concentrations were obtained by adding calculated amount of solution to sterilized PDA medium cooled to about $45^0$C. The sterilized medium without fungicides served as control. Five plates (9 cm diameter) were poured with the medium for each treatment. After solidification of medium, agar plugs (4 mm diameter) containing *S. sclerotiorum* mycelium were cut from seven days old culture plates using sterilized cork borer and placed in the center of each plate. The plates were incubated at $25^0$C. To see the effect of fungicides on sclerotial germination, the sclerotia from 25 day old culture

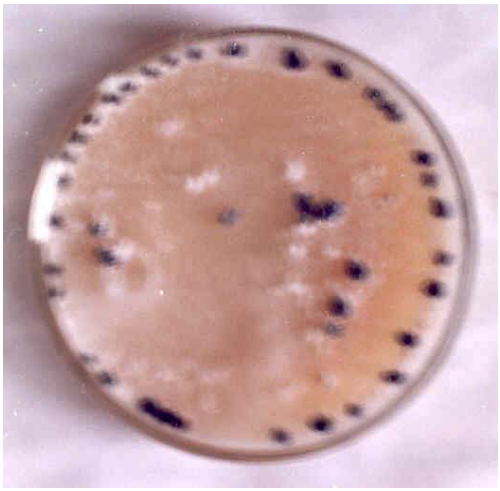
were dipped in different fungicide solutions, i.e., 50 and 100 ppm for 5 minutes. Fifty treated sclerotia were placed in each plate. Three plates were kept under each treatment and incubated at $25^0$C. Germination of sclerotia was recorded after 72 h of incubation.

## RESULTS AND DISCUSSION

Under natural field conditions at NARC, Islamabad, severely affected plants exhibited yellowish green symptoms, which turned light brown or straw coloured causing death of the plants. Characteristic symptoms such as fluffy white mycelial mats were found on the surface of infected tissues of stem, leaves and fruits (Fig. 1). This was

**Fig. 1. Typical symptoms of stem rot (*Sclerotinia sclerotiorum*) on brinjal plant in the form of fluffy white mycelial mat with dark sclerotia**

**Fig. 2. Culture of *Sclerotinia sclerotiorum* on agar medium showing fluffy white mycelium and sclerotia of the fungus**



associated with the development of many prominent dark sclerotia of irregular shape and size measuring from 2.0 to 8.0 mm in diameter. Sclerotia were also observed inside the affected stems and fruits.

Sclerotia germinated myceliogenically on PDA medium and pure culture of fluffy white mycelium with hyaline, branched and spetate hyphae were developed. Black sclerotia ranging from 2-6 mm in diameter and spherical to irregular in shape generally formed within 5- 7 days of incubation at $25^0$C. The sclerotia were silvery white in the initial stages of development but turned dark with increasing age of the culture (Fig 2). The cultural characteristics were in conformity with the description of the large sclerotial forms of the fungus (Purdy, 1955, 1979).

The disease developed when six weeks old brinjal plants were wound inoculated with mycelial culture. Inoculated plants first exhibited soft rot symptoms within 5-8 days of inoculation. Most of the plants died after 10-15 days. The causal organism was reisolated from the infected

**Fig. 3. Effect of fungicides on the sclerotial germination (%) of *Sclerotinia sclerotiorum***

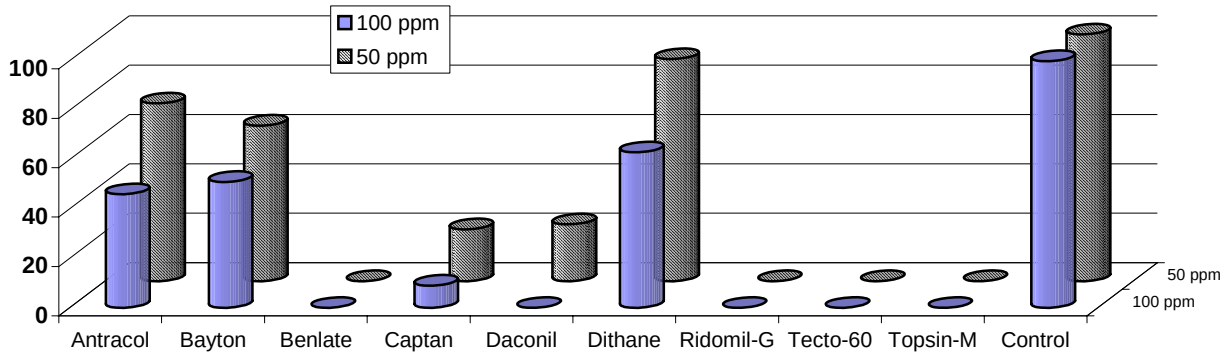


**Table I. Effect of fungicides on the radial growth and number of sclerotia of *Sclerotinia sclerotiorum***

| | | @ 50 ppm | | @100 ppm | |
|---|---|---|---|---|---|
| **Fungicides** | **Active ingredient** | **Radial growth (mm)** | **No. of sclerotia** | **Radial growth (mm)** | **No. of sclerotia** |
| Antracol | 70 WP | 8.5 a | 30 b | 6.8 a | 25 c |
| Bayton | 25 EC | 7.4 a | 24 b | 5.6 b | 17 d |
| Benlate | 50 WP | 0.0 c | 0 d | 0.0 c | 0 f |
| Captan | 70 WP | 3.4 b | 11 c | 0.9 a | 6 e |
| Daconil | 75 WP | 3.0 b | 8 c | 0.2 c | 0 f |
| Dithane M-45 | WP | 9.0 a | 35 a | 7.2 a | 27 b |
| Ridomil gold | 60 WP | 1.8 b | 0 d | 0.0 c | 0 f |
| Tecto-60 | 60 WP | 0.0 c | 0 d | 0.0 c | 0 f |
| Topsin-M | 70WP | 0.0 c | 0 d | 0.0 c | 0 f |
| Control | | 9.0 a | 38 a | 9.0 a | 38a |
| LSD (0.5%) | | 73.48 | 7.20 | 3.43 | 6.79 |

*Figures having the same letters are not significantly different

stem portions of all the artificially inoculated plants, thus confirming its pathogenicity. Uninoculated healthy plants (check) remained symptomless and no organism was isolated from them.

Although, *S.sclerotiorum* has already been reported in the country on different vegetables like pea (Iqbal *et al*., 1997) cabbage (Mirza & Yasmin, 1988), carrot (Mirza *et al*., 1991), cauliflower and turnip (Mirza, 1996a, b), this appears to be first report of its occurrence on brinjal from Pakistan.

**Evaluation of fungicides.** The sensitivity of mycelial growth of *S. sclerotiorum* to each fungicide varied considerably (Table I). There was a significant decrease in mycelial growth with the increase of concentration of each fungicide. Four of the test fungicides completely inhibited the fungus growth at both doses. The mycelial growth of *S. sclerotiorum* was most sensitive to Benlate, Ridomil gold, Tecto-60 and Topsin-M. Captan and Daconil exhibited an intermediate whereas Antracol, Bayton and Dithane M-45 showed least effectiveness in controlling mycelial growth.

Efficacy of Daconil has been reported against *Cercospora* leaf spot on mungbean (Iqbal *et al*., 1990) and mungbean anthracnose (Bashir *et al*., 1985). Benlate, Tecto-60 and Topsin-M have already been proved effective against *Fusarium oxysporum* and *Rhizoctonia solani* (Iqbal *et al*., 1996) and *A. lentis* (Rauf *et al*., 1996). Visawakaram and Chaudhary (1982) have also reported significant effect of Benalte on *F. oxysporum* and *R. solani*. Tecto and Benalte are chemically related compounds (Benzimidazole group), which show systemic fungicidal activity in diseases of many crop plants (Erwin *et al*., 1969; Fuchs *et al*., 1970).

Among the fungicides tested, the most effective fungicides in inhibiting the sclerotial germination were Ridomil gold, Benlate, Tecto-60 and Topsin-M (Fig-3). At both concentrations there was no germination of sclerotia at all in Ridomil gold, Benlate, Tecto-60 and Topsin-M. In case of Daconil, the germination percentage was 23%, however, there was no germination at 100 ppm concentration. The effect of Captan and Daconil was intermediate, whereas Antracol, Bayton and Dithane M-45 proved to be the least effective. Antracol and Dithane M-45 were not effective against the sclerotial germination, whereas Daconil showed intermediate effect as already reported by Bajwa *et al*. (1998) in bottle gourd. Benlate, Ridomil-G, Tecto-60 and Topsin-M were the most effective in controlling stem rot in brinjal, thus recommended for further study.

## REFERENCES


Bajwa, K.M., T.Z. Khan and M.N. Bajwa, 1998. Effect of fungicides on *Rhizoctonia solani* Kahn causing root rot of bottle gourd. *Pakistan J. Phytopathol.*, 10: 23–5

Bashir, M., S.S. Alam and S.H. Qureshi, 1985. Control of mungbean anthracnose by foliar fungicides. *Pakistan J. Agric. Res.*, 6: 173–5

Blodget, E.C., 1946. The *Sclerotinia* rot disease of beans in Idaho. *Plant Dis. Rep.* 30: 137–44

Chupp, C. and A.F. Sherf, 1960. *Sclerotinia diseases in Vegetable Diseases and their Control.* pp: 43–6. The Ronald Press Company, New York.

Erwin, D.C., C.J.J. Sims and J. Patridge, 1969. Evidence for the systemic fungitoxic activity of 2,4-thiazolyl benzimidazole in the control of *Verticilium* wilt of cotton. *Phytopathol*., 59: 860–5

Fuchs, A., A.L. Hamans and F.W. Devris, 1970. Systemic activity of benomyl against *Fusarium* wilt of pea and tomato plants. *Phytopathol*., 59: 330–45

Gray, E.G. and W.T. Findlater, 1960. *Sclerotinia sclerotiorum* on peas in Kincardinesthire. *Plant Pathol*., 9: 130–2

Ilyas, M.B. and M.N. Bajwa, 1984. *Sclerotinia* wilt of eggplant. *Pakistan J. Agric. Sci.*, 21: 248–9

Iqbal, S.M., M.R. Malik and B.A. Malik, 1990. Economics of foliar fungicides to control *Cercospora* leaf spot disease in mungbean. *Sarhad J. Agric.*, 6: 485–9

Iqbal, S.M., M. Bashir, C.A. Rauf and B.A. Mali, 1996. Efficacy of fungicides against soil-borne pathogens of chickpea. *Pakistan J. Phytopathol.*, 8: 65–7

Iqbal, S.M., M.S. Mirza, C.A. Rauf and T. Mahmood, 1997. *Sclerotinia* rot of peas in Pakistan. *Sarhad J. Agric.*, 14: 157–9

Mirza, M.S. and A. Yasmin, 1988. Cabbage: A new host of *Sclerotinia sclerotiorum* for Pakistan. *Agronomics*, 8: 85–7

Mirza, M.S., A. Yasmin and M. Ayub, 1991. *Sclerotinia* rot of carrot caused by *Sclerotinia sclerotiorum*. *Pakistan J. Agric. Res.*, 12: 226–7

Mirza, M.S., 1996a. Cauliflower: As a new host of *Sclerotinia sclerotiorum* in Pakistan. *Abstr. First Intern. Plant Protection Conf. and Symposium.* March 6-7, 1996 at Peshawar.

Mirza, M.S., 1996b. *Sclerotinia sclerotiorum*: A new pathogen of turnip in Pakistan. *Abstr. Crop Protection Conf.* March 20-22, 1996 at NWFP Agric. Univ. Peshawar.

Nene, Y.L. and P.N. Thaplyal, 1979. *Fungicides in Plant Disease Control.* pp: 307. Oxford & IBH Publ. Co., New Delhi, India.

Purdy, L.H., 1955. A broader concept of the species of *Sclerotinina sclerotiorum* based on the variability. *Phytopathol.*, 45: 421–7

Purdy, L.H., 1979. *Sclerotinia sclerotiorum*. History, diseases and symptomlogy host range, geographic distribution and impact. *Phytopathol.*, 69: 875–80

Rauf, C.A., S.M. Iqbal and S. Rahat, 1996. Fungicidal efficacy against *Ascochyta lentis*. *Pakistan J. Phytopathol*., 8: 49–51

Stevens, R.B., 1974. *Mycology Guidebook Committee, Mycology Society of America.* p. 703. University of Washington Press, Seattle and London

Viswakaram, S.N. and K.C.B. Chaudhary, 1982. Seed treatment to control root rot diseases of gram. *Pesticides*, 16: 33–4

Weimer, J.L., 1940. Australian winter field peas diseases and their control in the south *U.S. Dep. Agric. Res.*, 565

Willetts, H.J. and A.L. Wong, 1980. The biology of *Sclerotinia sclerotiorum*, *S. trifoliorum* and *S. minor* with emphasis on specific nomenclature. *Bot. Rev.*, 46: 101–65


**(Received 01 June 2003; Accepted 10 August 2003)**