RESEARCH ARTICLE

SURVEY FOR INCIDENCE, SEVERITY AND SCREENING OF BRINJAL GERMPLASM LINES AGAINST FRUIT ROT DISEASE OF BRINJAL

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Abstract: A survey was conducted during September to November, 2014 to observe disease prevalence of brinjal fruit rot in Bagalkot district at Northern dry zone of Karnataka. Through the survey disease severity and incidence were recorded. The roving survey revealed the presence of disease in all talukas *viz.*, Bagalkot, Badami, Hunagunda, Jamakandi and Mudhol. The per cent disease index ranged from 13.00 to 54.66. Per cent disease index was high in Bagalkot taluk followed by Badami and Jamakandi taluk. Among different villages under cultivation in these districts, Belur was more prone to disease with per cent disease index of 54.66 followed by Sulikieri which recorded a per cent disease index of 44.00. Screening of 60 genotypes under field conditions revealed that none of the genotypes were found to be immune. Only two genotypes were found resistant and 31 genotypes showed moderately resistant reaction and 27 genotypes showed moderately susceptible reaction.

Keywords: Egg Plant, Pathogenic Fungi, *Solanum melongena*. L., Brinjal

INTRODUCTION

Brinjal (*Solanum melongena* L.) is one of the most important vegetables in South Asia which accounts for almost fifty percent of the world area under cultivation and also popular in some parts of Africa and Central America (Harish *et al.,* 2011). In India, brinjal is an important and indigenous vegetable crop often known as the cash crop for the farmers. Its centre of origin is in the Indo-Burma region (Vavilov, 1928), In India, brinjal is mainly grown in the states like West Bengal, Orissa, Bihar, Gujarat, Maharastra, Andhra Pradesh, Karnataka etc. with an area of 7.22 lakh hectare with a production of 135.58 metric tonnes and productivity of 19.10 tonnes per ha (Anon., 2014). It contributes about 12.47 per cent of the total production of vegetables in India. In Karnataka, brinjal is cultivated over an area of 15,800 ha with a production of 4002.50 tonnes (Anon., 2014). It is mainly grown in the Bagalkot district. The immature tender fruits are used as vegetable, pickle making and in dehydration industries. It can also cure tooth ache, brinjal fruit cooked in til oil acts as an excellent remedy for those suffering from liver complaints (Chauhan, 1981). Contrary to common belief, it is quite high in nutritive value and every 100g of edible portion contains 92.7g moisture, 6.4g carbohydrate, 1.3g protein, 0.3g fat, 1.3g fiber, 124 IU vitamin A, 0.09 mg nicotinic acid, 120 mg vitamin C, 200 mg potassium, 18 mg calcium, 16 mg magnesium, 47 mg phosphorus and 0.9 mg iron (Aykroyd, 1963). There are some biotic and a biotic stresses which are limiting the successful production of brinjal. Among the biotic stresses, the fruit rot complex caused by many fungi is one of the threatening diseases. Though, it is suspected that many fungi are involved, the exact role of these fungi is not documented. And some farmers are using known fungicides indiscriminately and unscientifically which may result in residual toxicity problems in brinjal fruit. On the other hand no resistant variety / line/ germplasm are available for this disease. Hence there is alternative look for the assessment of genetic variation, is a major concern of plant pathologists, breeders and population geneticists. Availability of sufficient variation is required for the production of new varieties that are aimed towards the improvement of crop productivity and able to withstand damage from biotic and a biotic factor. Hence there is need to determine the resistance source.

The literature reveals that not much work has been done on these aspects. Therefore, the following stydy were undertaken in the present study for the management of the disease and survey for collection and assessment of brinjal fruit rot disease severity and screening of genotypes against fruit rot of brinjal and identification of resistance source in Bagalkot district.

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MATERIAL AND METHOD

The survey was carried out during September to November, 2014 to observe the prevalence of fruit rot in brinjal. Survey was carried out in 5 taluks of Bagalkot district *viz.*, Badami, Bagalkot, Hunagunda, Jamakandi and Mudhol. In each taluk five villages were selected and from each village two farmers' fields were selected for recording observations. The incidence and severity of disease were recorded by visual observation in three different spots in a single field. In each spot, 30 fruit rot samples were evaluated for the disease incidence and severity. The severity in terms of per cent Disease Index (PDI) was recorded on fruits by grading them using the 0-5 scale as given by Islam *et al.*,1990 (table 1). The per cent fruit infection and per cent disease index were calculated by formula given below.

$$\text{Per cent fruit infection} = \frac{\text{No. of fruits infected}}{\text{Total no of fruits counted}} \times 100$$

Table 1. Scale for scoring the fruit rot of brinjal (Islam *et al.*, 1990)

Sl. No	Grade	Description
1	0	0% infection on fruit
2	1	1-10% infection on fruit
3	2	10-15% infection on fruit
4	3	15-30% infection on fruit
5	4	30-40% infection on fruit
6	5	50% infection on fruit

The experiment on screening of 60 brinjal lines against fruit rot was conducted at Haveli farm of College of Horticulture Bagalkot, Karnataka, under the natural infection. Seedlings were raised in plastic trays in the net house with proper care and management. A piece of medium high land with good drainage system was selected. The field was prepared by ploughing and harrowing. During field preparation, fertilizers and manures were applied at recommended doses (Anon, 1997). Seedlings of 30 days old were transplanted in the field and watered properly. The lines were planted in the 6m single line in two replications along with the available susceptible line (line no-26) in between every 5 lines. Five seedlings of each line were planted at 60×60 cm spacing and each line was replicated twice. Observations were recorded by screening the lines under natural disease pressure conditions. The lines were graded according to the 0 to 5 scales as suggested by (Islam *et al.*, 1990) and finally PDI was calculated. Sixty genotypes/lines were evaluated under field condition to know their disease reaction against fruit rot of brinjal. Per cent disease index was calculated as described in Table 2. Further the varieties were placed in different categories of resistance and susceptibility on the basis of method given by Pathak *et al.* (1986).

Isolation

Rotten fruits were collected from plantations for investigation in the laboratory. The pathogens were isolated by cutting discs (3mm thick) of rotten tissue under aseptic conditions, after surface sterilization in 0.01% mercuric chloride. The discs were then plated on PDA and other media incubated at 30^0C. Pure isolates of the causative organisms were obtained by the standard technique. 5 samples from each taluka were brought to lab and sorted. For identification of diseases the temporary and permanent slides of the pathogens were prepared in lab. The authenticity of pathogen was established through Koch's postulates. The pathogens were also cultured in lab and were kept in the form of permanent pure culture for further physiological and cultural studies Different media viz. PDA, oat meal agar, corn meal agar, Richard's agar, Asthana and Hawker's and malt extract agar were utilized.

Proving pathogenecity

To confirm the identity of isolated pathogens, pathogenecity tests were performed with fruits of same age of highly susceptible variety (Line -26). Apparently healthy fruits were taken from plants, washed with sterilized distilled water and placed in desiccators. Spore suspension was made from 7 days old cultures with sterilized distilled water and diluted to 250-500 spores per microscopic field. Fruits were inoculated with spore suspension of different pathogens by pin prick method and incubated at 25±2°C temperature and R.H >90% and examined regularly for appearance of characteristic symptoms of disease. The part of the fruit showing characteristic symptom was taken and the pathogen was re isolated by following standard tissue isolation method. The re isolated cultures were again compared with original culture for morphological and cultural characters with the original culture. The temporary and permanent slides of the pathogens were prepared in laboratory. The pathogens were kept in the form of permanent pure culture for further physiological and cultural studies.

RESULT AND DISCUSSION

A roving survey to know the incidence of fruit rot of brinjal was carried out in five taluks of Bagalkot

district *viz.*, Badami, Bagalkot, Mudhol, Jamakandi and Hunagunda. Five villages from each taluk and two fields in each village were surveyed. Incidence of fruit rot of brinjal was noticed in all the places surveyed on two commonly grown local brinjal cultivars and Mahycho super-10 hybrids. The results are described as in Table 1. In Bagalkot taluk the per cent disease index (PDI) ranged from 21.33 to 54.66. The highest PDI of 54.66 was recorded at Belur followed by Anadinni (36.00) village and Jalyal recorded least (21.33). In Bagalkot taluk highest fruit rot infection of 86.67 was recorded in Belur followed by 46.66 in Anadinni and 40.00 in Irapur. Sannadinni and Jalyal (33.33) recorded least per cent fruit infecton among all villages.In Badami per cent disease index (PDI) ranged from 17.33 to 44.00.The highest PDI was recorded in Sulikeri (44.00) followed by Asangi (41.33) and Holealur (38.66) and Badagi (37.33). The lowest PDI was recorded in Kerkalmatti (17.33). The highest per cent fruit rot infection was recorded in Asangi (66.67) and Sulikeri (66.67) and Badagi (37.33) followed by Holealur (38.66). Least per cent fruit rot was observed in Kerakalmatti (46.67). In Jamakandi taluk Tummankatti (29.33) recorded highest per cent disease index followed by Navalagi (25.00) and Mahalingapur (25.00). The least incidence was recorded in Dawaleswar (13.33) and Jagadhal (13.33). The data pertaining to fruit infection reveals that Tummanakatti (53.33) recorded highest followed by Navalagi. The lowest fruit infection was recorded in Dawaleswar (20.00) among the five villages surveyed. In Mudhol taluk highest per cent disease incidence was recorded in Mugalkod (41.33) followed by Hebbal (35.00), Belagali (33.33) and Muddapur (26.66). The lowest was recorded in Kadakol (21.66). The data recorded with respect to the fruit rot infection resulted that Mugalkod (80.00) recorded highest fruit rot infection followed by Belagali (53.33) and Hebbal (53.33). The least per cent of fruit rot infection was recorded in Muddapur (46.67). In Hunagunda taluk Kamatagi recorded highest per cent disease incidence followed by Rakkasagi (29.00) and Aminagada (25.00). The least incidence was recorded in the village Kamblihal (13.00) followed by Gorbal (17.00). The data recorded with respect to the fruit rot infection revealed that Rakkasagi (53.00) recorded highest followed by Gorbal (46.67) and Kamatagi (40.00). The least fruit rot infection was recorded in the village Kamblihal (20.00). A detailed survey was undertaken in few parts northern Karnataka to gather information on the incidence and spread of *Alternaria alternata*, *Colletotrichum melongenae* and *Phomopsis vexans* causing fruit rot of brinjal from different localities of Bagalkot district. This information is highly useful to identify the hot spots for this disease in Bagalkot district where brinjal is extensively grown as commercial crop. From the survey it is evident that the incidence of this disease varied from locality to locality depending on the type of variety cultivated and management practices followed. The incidence of the disease was also dependent on inoculum load and environmental conditions prevailing in different localities. Among different the taluks surveyed the highest per cent disease index (54.66) of fruit rot was noticed in Belur village of Bagalkot taluka and the lowest (13.00) in Kamblihal village in Hunagunda taluka indicating that the disease was not consistent in all localities. These results are close conformity of Hossain *et al.* (2010) who conducted the survey on major diseases of vegetable and fruit crops including fruit rot of brinjal in Chittagong region and found that the amount of crop and fruit losses to particular disease varied from place to place because of the existence of different races, biotypes or strains of the pathogen. Sharma *et al*. (2011) conducted extensive periodic survey of major brinjal growing areas of Jammu division. The survey revealed presence of the disease in all the locations with varying per cent incidence and intensity. The fruit rot of brinjal was severe in Bagalkot taluk than in other taluks. This could be because of favourable environmental conditions and initial inoculum prevailed. Also could be continuous growing of the crop. The variety/hybrid used cultivation practices and disease management practices in Bagalkot (not practicing crop rotation and management practices as evidenced during survey) taluk vary with other taluk. This might have helped in rapid development of the disease in further stages of the crop growth when environmental conditions became congenial. Sixty brinjal genotypes were screened against fruit rot under natural epiphytotic condition as described in material and methods and the results are presented in Table 2. The data revealed that, among the 60 genotypes none of them were found immune. Per cent Disease Index ranged between (15.00 –40.40%). Two genotypes *viz.*, CBB-3 (10.50) and CBB-26 (15.52) were found resistant, 31 genotypes *viz.*, CBB-1 (18.84), CO-2 (22.45), CBB-5 (16.20), CBB-6 (24.60), CBB-7 (20.10), CBB-11 (23.10), CBB-15 (21.26), CBB-16 (18.00), CBB-17 (18.45), CBB-19 (18.64), CBB-20 (20.60), CBB-22 (25.40), CBB-27 (25.36), CBB-28 (21.28), CBB-30 (20.46), CBB-31 (24.62), CBB-32 (25.34), CBB-33 (16.26), CBB-34 (30.04), CBB-37 (18.60), CBB-41 (22.42), CBB-43 (16.84), CBB-44 (20.62), CBB-45 (25.46), CBB-46 (21.80), CBB-50 (24.32), CBB-54 (25.50), CBB-56 (20.45), CBB-57 (24.64), CBB-58 (20.20) and CBB-59 (16.40) showed moderately resistant reaction, 27 genotypes *viz.*,CBB-2 (30.20), CBB-4 (27.00), CBB-8 (30.25), CBB-9 (28.30), CBB-10 (35.20), CBB-12 (36.00), CBB-13 (27.62), CBB-14 (40.24), CBB-21 (30.00), CBB-23 (32.30), CBB-24 (27.54), CBB-25 (35.40), CBB-29 (30.40), CBB-34 (30.04), CBB-35 (28.43), CBB-36 (26.14), CBB-38 (35.58), CBB-39 (40.40), CBB-40 (32.64), CBB-42 (30.49), CBB-47 (26.74), CBB-48 (28.23), CBB-49 (34.22), CBB-51 (28.20),

CBB-52 (35.56), CBB-53 (36.40) and CBB-55 (27.32) were susceptible. None of the genotypes showed highly susceptible reaction. Breeding for the disease resistance has been an effective, economical and practical method of disease control. Cultivation of resistant variety seems to be the best alternative and most economical to keep the activity of fruit rot pathogen under control. In all crop improvement programmes, growing of resistant varieties has been found to be appropriate choice to combat the disease. The use of resistant cultivars is perhaps the most desirable method of controlling diseases in crops (Wharton and Diéguez-Uribeondo, 2004; Than *et al.*, 2008). This approach, according to Voorrips *et al.* (2004), has been less exploited in fruit and vegetable crops mainly due to the longer time required for breeding and selecting for resistance and the short term advantage of chemical control. Efforts have been made to locate the source of resistance for this disease in India.

In the present investigation, the reaction of different genotypes against fruit rot was carried out in field conditions. Sixty brinjal genotypes were screened against brinjal fruit rot under natural condition as described in material and methods. The data revealed that, among the 60 genotypes evaluated, none was found immune. Two genotypes *viz.*, CBB-3 and CBB-26 were found resistant, 31 genotypes were moderately resistant and 27 genotypes showed susceptible reaction. None of the genotypes showed highly susceptible reaction. The results are in contrary with findings of Pandey *et al.* (2002) who conducted the experiment to evaluate 41 entries of brinjal under natural epiphytotic condition against *Phomopsis* blight disease. Among 41 lines evaluated, none of the entries were found resistant to fruit rot. Two varieties *viz.,* Ramanagar giant and KS-233 showed moderate resistance and others showed susceptibility. However both DBR-91 and baramasi recorded high susceptibility with fruit rot intensity of 4.72 / plant and per cent fruit infection of 47.5% and 85% respectively. In the present investigation, according to phenotypic analysis CBB-1 & CBB-26 were found resistant so, by above result it revealed that same can be used in the breeding strategies for the crop improvement programme to develop resistant varieties.

SUMMARY AND CONCLUSION

Survey revealed the presence of disease in all talukas *viz.*, Bagalkot, Badami, Hunagunda, Jamakandi and Mudhol. The per cent disease index ranged from 13.00 to 54.66. Per cent disease index was high in Bagalkot taluk followed by Badami and Jamakandi taluk. Among different villages under cultivation in these districts, Belur was more prone to disease with per cent disease index of 54.66 followed by Sulkieri which recorded a per cent disease index of 44.00.The isolated fungus *Alternaria alternata, Colletotrichum melongenae and Phomopsis vexans* proved to be pathogenic on brinjal fruits after artificial inoculation (as per pathogenicity). Screening of 60 genotypes under field conditions revealed that none of the genotypes were found to be immune. Only two genotypes were found resistant and 31 genotypes showed moderately resistant reaction and 27 genotypes showed moderately susceptible reaction.

Table 2. Survey for severity of fruit rot of brinjal in Bagalkot district

Taluka	Village	Total Area Surveyed (Acre)	Variety/Hybrid	Percent fruit infection	Percent disease index
Bagalkot	Anadinni	4.5	Mahyco	46.66	36.00
	Belur		Local	86.67	54.66
	Irappur		Mahyco	40.00	32.00
	Jalyal		Local	33.33	21.33
	Sannadinni		Mahyco	33.33	26.62
Badami	Asangi	5.15	Local	66.67	41.33
	Badagi		Local	53.33	37.33
	Holealur		Local	66.67	38.66
	Kerkalmatti		Mahyco	46.67	17.33
	Sulikeri		Mahyco	66.67	44.00
Hunagunda	Amingada	1.25	Mahyco	33.33	25.00
	Gorabal		Local	46.67	17.00
	Kamatagi		Mahyco	40.00	32.00
	Kamblihal		Mahyco	20.00	13.00
	Rakkasagi		Local	53.00	29.00
Jamakandi	Dawaleswar	1.15	Mahyco	20.00	13.33
	Jagadhal		Local	20.00	13.33
	Mahalingpur		Local	33.33	25.00
	Navalagi		Local	40.00	25.00
	Tummanakatti		Local	53.33	29.33

Mudhol	Belagali	1.30	Mahyco	66.67	33.33
	Hebbal		Mahyco	53.33	35.00
	Kadakol		Local	53.33	21.66
	Muddapur		Mahyco	46.67	26.66
	Mugalkod		Mahyco	80.00	41.33

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