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Survey for *Macrophomina phaseolina* (Tassi) goid incidence in major crops of Telangana state

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Abstract

The present investigation was conducted to know the incidence of *M. Phaseolina* in five major crops of Telangana state. A roving survey was conducted during 2019 in various crops that were grown in Telangana to know the occurrence and distribution of *Macrophomina phaseolina* and diseased sampled were collected from survey fields. Among five crops surveyed the diseases incidence ranged between the crop and within the crop. The highest disease incidence of 64 per cent was recorded in Lakoor village in Velpoor mandal of Nizamabad district reported from soybean. In maize highest incidence of 49.25% was observed in Kamalapur village in Kamalapur mandal of Karimnagar dt. In castor highest diseases incidence (62%) was noticed in Kotakonda village of Narayanpet mandal of Mahabubnagar. The diseases incidence in sesame was recorded as 40 per cent in Thakkalapally village of Jagtial mandal of Jagtial dt and least disease incidence of 25 per cent was recorded in the fields of Kotagandi village of Warangal district from redgram. The pH of the soil collected from infected field's ranged from 5.7 to 6.2 and temperature from 27 °C to 32 °C.

Keywords: *Macrophomina phaseolina*, occurrence and distribution

1. Introduction

Telangana is one among the agriculture dependent states in India. Various crops are grown in the state that includes paddy, maize, soybean, sesame, redgram, groundnut and cotton etc. Among them maize is the second major cultivated crop in the state of Telangana grown in around 14 lakh acres, redgram accounts for 2.75 lakh acres, 80000-85000 hectares of land is cultivated with castor, soybean is cultivated in 3 lakh hectares and 0.25- 0.3 lakh acres is under cultivation of sesame. These five crops are considered to be major crops among the cultivated crops of Telangana (PJ TSAU, 2019-2020). All these crops are generally infected by different obligate and facultative pathogens among them *Macrophomina phaseolina* is one which infects all the crops.

Macrophomina phaseolina is one of the omniphagus pathogen and is a facultative soilborne and seed borne pathogen and infects almost all the crops and non-crop species along with economically important hosts such as soybean, common bean, corn, sorghum, cowpea, peanut and cotton that results in wide diversified symptoms that includes seedling blight in eucalyptus, dry root rot in redgram, cotton and bengal gram and stem rot, wilt and pre to post emergence damping off in black gram leads in decreased stem height, girth, root and head weight, or death of affected plants and charcoal rot in sorghum, soybean, maize and castor (Saleh *et al.*, 2010; Surinder *et al.*, 2012) ^[8, 9].

The present investigation was carried out to know the diseases occurrence and spread of *Macrophomina phaseolina* in five different crops that includes maize, sesame, redgram, soybean and castor.

2. Materials and methods

The present study was carried out in five majorly growing crops of Telangana viz., castor, redgram, sesame, soybean and maize. The survey was carried out from randomly selected mandal covering six districts of Telangana state that includes Adilabad and Nizamabad for soybean charcoal root, mahabaunagar for castor root rot, Warangal for redgram *Macrophomina* wilt, Karimnagar for maize and Jagtial for sesame. The information on disease incidence, weather parameters, name of hybrid grown, cropping history, soil type, pH of the soil, irrigated/ rainfed condition etc., were recorded.

The diseases incidence was calculated in each field by quadrant method. Four 1 m² quadrants were randomly selected in each field and infected plants were counted in each quadrant.

Based on infected and total number of plants, disease incidence was calculated (Thori, 2012) ^[11]. The *Macrophomina phaseolina* infected samples were collected from surveyed areas, packed in labelled paper bags and brought to the laboratory for isolation of the pathogen (Maruthi *et al.*, 2017) ^[6].

$$\text{Per cent disease incidence} = \frac{\text{Number of plants infected}}{\text{Total number of plants}} \times 100$$

3. Results and discussion

3.1 Survey for occurrence and distribution of *Macrophomina phaseolina* in major crops of Telangana

A roving survey was conducted during 2019 in major crops grown in Telangana to know the occurrence and distribution of disease caused by *Macrophomina phaseolina*. The disease incidence caused by *Macrophomina phaseolina* was assessed in castor of Mahabubnagar dt, maize in Karimnagar dt, soybean in Nizamabad and Adilabad dt, sesame in Jagtial dt and redgram in Warangal dt. A total of sixteen fields were surveyed at random and information on disease incidence, weather parameters, name of hybrid grown, cropping history, soil type, pH of the soil, irrigated/ rainfed condition *etc.* were collected and the data pertaining to survey is given in Table 4.1.

Castor: Three villages *viz.*, Kotakonda, Jajapur and Appampally of Narayanpet mandal were surveyed. The crop was grown in red soil under rainfed conditions. The pH of the soil was 6.1 in Kotakonda, pH - 5.9 in Appampally and pH - 5.7 in Jajapur villages. DCH-519 is the major variety grown by farmers in Kotakonda and Jajapur villages whereas variety GCH-4 was grown in Appampally village. The disease incidence was maximum in Kotakonda village with 62 per cent while in Jajapur and Appampur the disease incidence was 50 per cent.

Maize: Maize is the major crop grown in Karimnagar dt. Data for disease incidence and types of soils and soil pH was collected from four villages *viz.*, Choppadandi, Husnabad, Huzurabad and Kamalapur. The soils were black with soil pH of 6.05, 6.02 and 6.3 in Choppadandi, Husnabad and Huzurabad villages respectively while in Kamalapur village the soils were red with pH of 6.1. Kaveri is the major hybrid grown except in Huzurabad where variety DHM-117 was grown. Maximum disease incidence (60%) was recorded from Kamalapur followed by Husnabad (52%), Huzurabad (45%) and Choppadandi (40%) and mean disease incidence was 49.25 per cent.

Soybean: The villages Lakkor, Amenapoor of Velpoor mandal, Nizamabad dt, Urmik village of Tanur mandal, Adilabad dt and Thakkalappally village of Jagtial mandal were selected for the survey of incidence of *Macrophomina phaseolina*. The soils were black in all the villages with pH ranging from 6.01 to 6.6. Variety JCS 335 was grown in all the villages except in Lakoor village where hybrid Nadiataram was grown. The crop was grown under rainfed but in Lakoor village it is grown under irrigated conditions. The disease incidence was maximum in Lakoor village followed by Amenapoor (45%) and Urmik (40%) of Adilabad dt. In Thkkalappally disease incidence was not recorded.

Sesame: The villages where sesame is traditionally grown

were selected for assessing the root rot disease caused by *Macrophomina phaseolina*. The crop was mostly grown in red soils under rainfed conditions. The soil pH was 6.17 in Thakkalappally, pH-6.8 in Anantharam and pH-6.9 in Polasa villages of Jagtial mandal. Swetha till was the variety grown in all the three villages. However disease incidence was not observed in Anantharam and Polasa villages whereas the disease incidence was 40 per cent in Thakkalappally village.

Redgram: Villages Kotagandi of Warangal dt and Thakkalappally of Jagtial dt were selected where the soil is mostly red with a pH of 6.02 in Kotagandi and 6.8 in Thakkalappally villages. Hybrid Hanuma was grown under rainfed condition. The per cent disease incidence was 25 in Kotagandi but in Thakkalappally disease incidence was not observed.

It is evident from the Table 4.1 that among five crops surveyed the highest mean maximum *Macrophomina phaseolina* incidence was recorded in castor (54%), followed by maize (49.25%), soybean (37.5%), sesame (13.33%) and least in case of red gram (12.5%). The diseases incidence ranged between the crop and within the crop. The highest disease incidence of 60 per cent was recorded from soybean grown in Lakoor village in Velpoor mandal of Nizamabad district and least disease incidence of 25 per cent was recorded in the fields of Kotagandi village of Warangal district from red gram.

The survey revealed higher levels of disease incidence in rainfed crop than that of the irrigated crop except in Lakoor village of Nizamabad mandal where higher disease incidence was recorded in irrigated conditions. The dry condition prevalent in the rainfed conditions might have favoured the pathogen which could be attributed to maximum disease incidence.

The present findings are in agreement with Thirunarayanan *et al.* (2018) ^[10] where higher disease incidence in sesame crop was recorded under rainfed conditions of Cuddalore district of Tamil Nadu. Similar studies were made Balabhaskar *et al.* (2015) ^[11].

The pH of soil in surveyed fields ranged from 5.7 to 6.2 from the soil samples collected from various *Macrophomina phaseolina* infected fields and the results are in agreement with the findings given by Khokhar *et al.* (2014) at the optimum pH of 5.4 to 6.0 and no incidence was observed in higher pH soil samples.

The temperature recorded during the survey ranged from 27-32 °C. Maximum temperature was recorded in castor infected areas up to 32 °C and least temperature was recorded in red gram infected areas up to 27 °C. The temperature noted is in accordance with favorable conditions of *Macrophomina phaseolina* infection.

The varied diseases incidence is in accordance to the previous studies done by Kaur *et al.* (2012) ^[4] at two districts in pigeon pea growing areas of Uttar Pradesh to know the incidence of *Macrophomina*. The diseases incidence recorded in the range of 0 to 19.5 per cent in 2009-2010 respectively.

Chikkanna *et al.* (2017) ^[3] conducted a survey during *kharif* 2017 of pigeon pea crops in the Farmer's field at district North Eastern Karnataka and noted *M. phaseolina* incidence ranged from 0.33 to 77.33 per cent.

A roving survey was performed by Karibasappa *et al.* (2018) at three major sesame growing districts of Telangana and reported maximum mean dry root rot incidence was 11.98%

followed and least disease incidence was recorded as 2.50%. The present results of high temperature leads to high diseases incidence is in accordance with Chand and Khirbat (2009) [2] who observed that the disease was favored by high temperature. Sharma and Pande (2013) [12] reported that a high temperature (35 °C) and less soil moisture content (60%) predisposes chickpea to dry root rot caused by *Macrophomina phaseolina*.

3.2 Symptomatology and collection of pathogenic isolates of *Macrophomina phaseolina*

The *Macrophomina phaseolina* showed variation in symptomatology from crop to crop under field conditions during survey and the results are presented in Plate 4.1.

Castor: Castor showed root rot symptom by *Macrophomina phaseolina* in field as patches. The above ground symptom was drying and wilting of leaves. The infected plants could be easily pulled out of the ground and the secondary roots were decayed leaving the tap root, which showed signs of drying, and the root bark shredded off easily and sclerotial bodies were observed on such roots. The stem showed blackening at the base of the collar region. The split over stem and root were observed with black discoloration.

Maize: The complete wilted plant was observed in corn field

that was infected from *Macrophomina phaseolina*. This was one of the causes for post flowering stalk rot in maize when stem was split open a black discoloration was noticed at the collar region of the stem. The infected sample observed under microscope showed sclerotial bodies.

Soybean: The infected field exhibited premature yellowing in scattered patches as a symptom that was seen above ground. A reddish-brown discoloration of the vascular elements of roots and lower stem showed grey to black discoloration.

Sesame: The root rot symptoms were observed at mature stages. At maturity stage, the lesion extended upward and downward as a result whole plant became brown colored. The infected plants showed general yellowing, drooping of leaves and ultimately death of the plants. The uprooted infected plant roots were black colored with decay of the secondary roots and shredding, brittleness of the taproot were recorded.

Redgram: Red gram was infected by *Macrophomina* occurs at flowering stage and named as *Macrophomina* wilt. The symptoms exhibited by infected plants showed yellowing and drying of leaves at flowering stage and this yellowing started from the lower portion of plant and extended upwards. This was followed by wilting and finally death of entire plant.



Soybean charcoal rot



Sesamum charcoal rot



Redgram *Macrophomina* wilt



Castor root rot



Maize post flowering stalk rot

Plate 1: Symptoms of *Macrophomina phaseolina* observed on different crops under field conditions during survey

Table 1: Details of survey on *Macrophomina phaseolina* infecting major crops of Telangana state

Name of the crop	District	Mandal	Village	Soil pH	Soil Type	Cropping History	Hybrid grown	Temp (°c)	Rainfed /Irrigated	PDI
Castor	Mahabubnagar	Narayanpet	Kotakonda	6.1	Red soil	Red gram	DCH 519	32	Rainfed	62
Castor	Mahabubnagar	Narayanpet	Jajapur	5.7	Red soil	Castor	DCH 519	30	Rainfed	50
Castor	Mahabubnagar	Narayanpet	Appampally	5.9	Red soil	Castor	GCH 4	30	Rainfed	50
Soybean	Nizamabad	Velpoor	Lakoor	6.06	Black soil	Turmeric	Nadia taram	30	Irrigated	64
Soybean	Nizamabad	Velpoor	Amenapoor	6.01	Black soil	Turmeric	JCS 335	27	Rainfed	45
Soybean	Adilabad	Tanur	Urmik	6.1	Black soil	Cotton	JCS 335	28	Rainfed	40
Soybean	Jagtial	Jagtial	Thakkalapally	6.6	Black soil	Turmeric	JCS 335	29	Rainfed	0
Maize	Karimnagar	Choppadandi	Choppadandi	6.05	Black soil	Maize	Kaveri	29	Irrigated	40
Maize	Karimnagar	Husnabad	Husnabad	6.02	Black soil	Maize	Kaveri	28	Irrigated	52
Maize	Karimnagar	Huzurabad	Huzurabad	6.3	Black soil	Maize	DHM117	28	Rainfed	45
Maize	Karimnagar	Kamalapur	Kamalapur	6.1	Red soil	Maize	Kaveri	30	Rainfed	60
Sesame	Jagtial	Jagtial	Thakkalapally	6.17	Red soil	Sesame	Swethatill	29	Rainfed	40
Sesame	Jagtial	Jagtial	Anantharam	6.8	Red soil	Maize	Swethatill	28	Rainfed	0
Sesame	Jagtial	Jagtial	Polasa	6.9	Red soil	Maize	Swethatill	29	Rainfed	0
Red gram	Warangal	Warangal	Kotagandi	6.02	Red soil	Maize	Hanuma	27	Rainfed	25
Red gram	Jagtial	Jagtial	Thakkalapally	6.8	Red soil	Red gram	Hanuma	29	Rainfed	0

4. Summary and conclusions

A survey was conducted among five crops that include maize, soybean, red gram and castor for *M. phaseolina* incidence in Telangana. Among five crops surveyed the diseases incidence ranged between the crop and within the crop. The highest disease incidence of 64 per cent was recorded in Lakoor village in Velpoor mandal of Nizamabad district reported from soybean. In maize highest incidence of 49.25% was observed in Kamalapur village in Kamalapur mandal of Karimnagar dt. In castor highest diseases incidence (62%) was noticed in Kotakonda village of Narayanpet mandal of Mahabubnagar. The diseases incidence in sesame was recorded as 40 per cent in Thakkalapally village of Jagtial mandal of Jagtial dt and least disease incidence of 25 per cent was recorded in the fields of Kotagandi village of Warangal district from redgram. The disease was more prevalent in pH ranged from 5.7 to 6.2 from the soil samples collected from various *Macrophomina phaseolina* infected fields. The maximum temperature was recorded in castor infected areas up to 32°C and least temperature was recorded in red gram infected areas up to 27 °C.

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