The Andhra Agric. J 71 (4): 399-405, 2024
doi :10.61657/aaj.2024.151

Survey for the incidence of soil borne fungal diseases of maize in Bapatla and Guntur districts of Andhra Pradesh

P Geethika, V Manoj Kumar, V Prasanna Kumari and P Sudha Jacob
Department of Plant Pathology, Acharya NG Ranga Agricultural University,
Agricultural College, Bapatla - 522101, Andhra Pradesh, India

ABSTRACT

Soil borne fungal diseases in maize were identified as major limiting factor causing potential yield loss. Survey was conducted to assess the incidence of soil borne fungal diseases in predominant maize growing mandals of Guntur and Bapatla districts of Andhra Pradesh and Per cent disease incidence was calculated. The pathogen isolations were done from the diseased samples collected from farmer's field. Guntur district recorded highest incidence of banded leaf and sheath blight (13.73%), Post flowering stalk rot (6.61%) charcoal rot (5.87%) when compared to Bapatla where incidence of banded leaf and sheath blight is (9.08%), post flowering stalk rot (6.31%) and charcoal rot is (4.40%) respectively.

Key words: *Banded leaf and sheath blight, Charcoal rot, Per cent disease incidence, Post flowering stalk rot and Soil borne fungal diseases*

Maize (*Zea mays* L.) is one of the most versatile emerging crops having wider adaptability under varied agro-climatic conditions and is the important food, green forage and industrial crops of the world. It is called as "queen of the cereals" because of its highest genetic yield potential among the cereals. Maize has highest productivity among the cereal crops. In India, the crop is cultivated in almost all the states with an area of 10744 ha, 38085t production and 3545 kg ha^{-1} productivity (Indiastat, 2022-23). Maize suffers from a number of diseases but turcicum leaf blight (*Exserohilum turcicum*), maydis leaf blight (*Drechslera maydis*), polysora rust (*Puccinia apolysora*), brown stripe downy mildew (*Sclerophthora rayssiae* var *zeae*), sorghum downy mildew (*Peronosclerospora sorghi*), Rajasthan downy mildew (*Peronosclerospora heteropogoni*), banded leaf and sheath blight (*Rhizoctonia solani* f sp *sasakii*), bacterial stalk rot (*Erwinia chrysanthemi* pv *zeae*), post-flowering stalk rots (*Fusarium verticillioides*, *Macrophomina phaseolina*), *Curvularia* leaf spot (*Curvularia lunata*) are the important constraints in globe responsible for yield losses. (Khokhar *et al*., 2014). Soil-borne diseases caused by *Rhizoctonia solani*, *Fusarium* spp. and *Macrophomina phaseolina* have been identified as key constrains in maize cultivation. Banded leaf and sheath blight may cause 11 to 40 per cent yield loss (Singh and Sharma, 1976). The disease was first reported as minor disease from Srilanka and was described as 'Sclerotial' disease of maize caused by *Rhizoctonia solani* f. sp. *sasakii* (Kuhn) Exner. (Bertus, 1927). In India, the disease was first reported from Tarai region of Uttar Pradesh in 1960 and the causal organism was reported as *Hypochonus sasakii* (Payak and Renfro, 1966). Fusarium stalk rot is one of the most devastating soil-borne diseases of maize. In India, Fusarium stalk rot was first reported from Mount Abu, Rajasthan (Arya and Jain, 1964). The disease incidence of post flowering stalk rot ranged from 10 to 42% in Karnataka (Harlapur *et al*.,2002). The charcoal rot of maize, caused by *Macrophomina phaseolina* (Tassi) Goid, is an important disease maize crop (Shekhar, 2004; Gill *et al*., 2005; Shekhar *et al*., 2010). Hence the aim of the survey is to determine the prevalence and severity of soil borne diseases of maize in Guntur and Bapatla district of Andhra Pradesh and to identify the areas with higher disease incidence and to develop management practices in susceptible areas.

MATERIAL AND METHODS

A roving survey was conducted during *rabi* 2023-2024 in Guntur and Bapatla districts of Andhra Pradesh to assess the incidence of soil borne fungal diseases in maize. Three mandals from each district, two villages from each mandal and two fields from each village were surveyed. In each field, disease incidence was recorded in one square meter areas at five different plots, one each from four corners (excluding the border rows) and one from the centre. The number of diseased plants in each plot are counted and per cent disease incidence is calculated.

$$PDI = \frac{\text{Number of plants affected}}{\text{Total number of plants observed}} \times 100$$

The disease incidence of banded leaf and sheath blight is calculated by disease severity scale by Shekhar and Kumar, 2012.

Table 1 Disease severity scale for banded leaf and sheath blight in maize (Shekhar and Kumar, 2012)

Scale	Percentage of infection
1	Infection is on one leaf sheath, lesions are one or few, non-coalescent
2	Infection is on two to three leaf sheaths lesions are few and non-coalescent on third leaf sheath from ground level.
3	Infection is not up to the ear shoot but on more than two leaf-sheaths
4	Infection is on all leaf sheaths up to the ear shoot but shank is not infected
5	Infection presents beyond the ear shoot; reduced ear size, husk leaves bleached and caked with or without sclerotial development and kernel formation absent or rudimentary.

RESULTS AND DISCUSSIONS

The banded leaf and sheath blight was observed at vegetative stage and prevalent in both the Guntur and Bapatla districts with mean intensity of 13.73 and 9.08 per cent respectively. Post flowering stalk rot was observed after flowering stage with mean incidence of 6.61 and 6.31 per cent in respective districts. charcoal rot was observed at maturity mean incidence was observed as 5.87 and 4.40 per cent in Guntur and Bapatla districts respectively.

In Guntur district, among the surveyed mandals, per cent disease incidence (PDI) of banded leaf and sheath blight (BLSB) was recorded in the range of 10.74 per cent in Tadepalli mandal to 30.47 per cent in Ponnur mandal while there was no disease occurrence in Vatticherukuru mandal. Post flowering was recorded in the range of 9.00 per cent in Tadepalli mandal to 10.83 per cent in Ponnur mandal and there was no disease occurrence in Vatticherukuru mandal. Charcoal rot incidence was observed only in Vatticherukuru mandal *i.e.*, 9.00 per cent.

Among six villages of Guntur district *viz.*, Aremanda, Ponnur, Anatavarapadu, Vinjanampadu, Nutkki and Vaddeswaram, per cent disease incidence (PDI) of BLSB was recorded in the range of 21.46 per cent in Nuttakki village to 34.64 per cent in Aremanda village, while it is 26.31 per cent in Ponnur village. There was no disease occurrence in Anatavarapadu, Vinjanampadu and Vaddeswaram villages. Post flowering stalk rot ranged from 18.00 per cent in Vaddeswaram village to 21.67 per cent in Aremanda village while no disease occurrence was observed in the other villages. Per cent incidence of charcoal rot was recorded in the range of 16.34 per cent in Vinjanampadu village to 18.88 per cent in Anatavarapadu village and no disease occurrence was observed in other villages (Table 1 and Fig 3).

In Bapatla district among surveyed mandals, BLSB intensity was recorded in the range of 13.45 per cent in Bapatla to 13.81 per cent in Tsundur while there was no disease occurrence in Cherukupalli mandal. Post flowering stalk rot was recorded in range of 5.80 per cent in Tsundur to 13.13 per cent in Cherukupalli with no disease occurrence in Bapatla while, charcoal rot was recorded only in Cherukupalli *i.e.*,13.20 per cent and no disease incidence was observed in Tsundur and Bapatla.

In Bapatla district, six villages *i.e.,* Yedlapali, Chinaparimi, Bapatla, Appikatla, Rajavolu and Reddlapalem were surveyed. The intensity of banded leaf and sheath blight was recorded in the range of 26.90 per cent in Yedlapalli village to 27.63 per cent in Bapatla village while no disease occurrence was observed in other villages. Post flowering stalk rot incidence was in the range 11.60 per cent in Chinaparimi to 26.25 per cent in Redlapalem while no disease occurrence was observed in other villages. Charcoal rot incidence was only observed in Rajavolu *i.e.*, 26.40 per cent and no disease was observed in other villages (Table 2 and Fig 3).

In both the districts surveyed, Rice – Maize cropping pattern was found predominant, and Maize-

Table 1 Prevalence of soil borne fungal diseases in maize in Guntur district

District name	Mandal name	Village name	Field code	Variety	GPS Coordinates	Crop stage	Banded leaf and sheath blight			Post flowering stalk rot			Charcoal rot		
							Village mean	Mandal mean	District Mean	Village Mean	Mandal mean	District mean	Village PDI(%)	Mandal mean	District mean
Guntur	Ponnur	Aremanda	F1	Siri 5608	16.084739ºE 80.547697ºN	Silking stage	34.64	30.47	13.73	21.67	10.83	6.61	-	-	5.87
			F2	Siri 5608	16.084736ºE 80.547794ºN	Maturity Stage									
		Ponnur	F1	Siri 5608	16.084585ºE 80.547838ºN	Silking Stage	26.31			-			-		
			F2	Siri 5608	16.0518689ºE 80.542013ºN	Silking Stage									
	Vatticherukuru	Anatavarapadu	F1	P-3344	16.228976ºE 80.464417 N	Maturity Stage	-	-		-	-		18.88	17.61	
			F2	Kaveri 50	16.2289323ºE 80.464598ºN	Maturity stage									
		Vinjanampadu	F1	Syngenta NK 7720	16.239305º E 80.4146481ºN	Maturity stage	-			-			16.34		
			F2	Pioneer	16.230371°E	Maturity									

Table 2 Prevelence of soil borne fungal diseases in maize in Bapatla district

District name	Mandal name	Village Name	Field code	Variety	GPS Coodinates	Crop stage	Banded leaf and sheath blight			Post flowering Stalk rot			Charcoal rot		
							Average PDI (%)	Mandal mean	District mean	Average PDI (%)	Mandal Mean	District mean	Average PDI (%)	Mandal mean	District mean
Bapatla	Tsundur	Edlapalli	F1	Siri 5608	16.224095ºE 80.582467ºN	Silking stage	26.91	13.45	9.08	-	5.80	6.31	-	-	4.40
			F2	Siri 5608	16.224108ºE 16222123ºN	Silking stage									
		Chinaparimi	F1	Winner 8352	16.119862ºE 80.630481ºN	Silking stage	-			11.6			-		
			F2	Siri 5608	16.200653Eº 80.630348ºN	Maturity stage									
	Bapatla	Bapatla	F1	Winner 8352	15.887726ºN 80.465118ºE	Vegetative phase	27.63	13.81		-	-		-	-	
			F2	Winner 8352	15.887751ºN 80.465096ºE	Silking stage									
		Appikatla	F1	Winner 8352	15.969539ºN 80.511875ºE	Vegetative phase	-			-			-		
			F2	Winner	-	Vegetative									

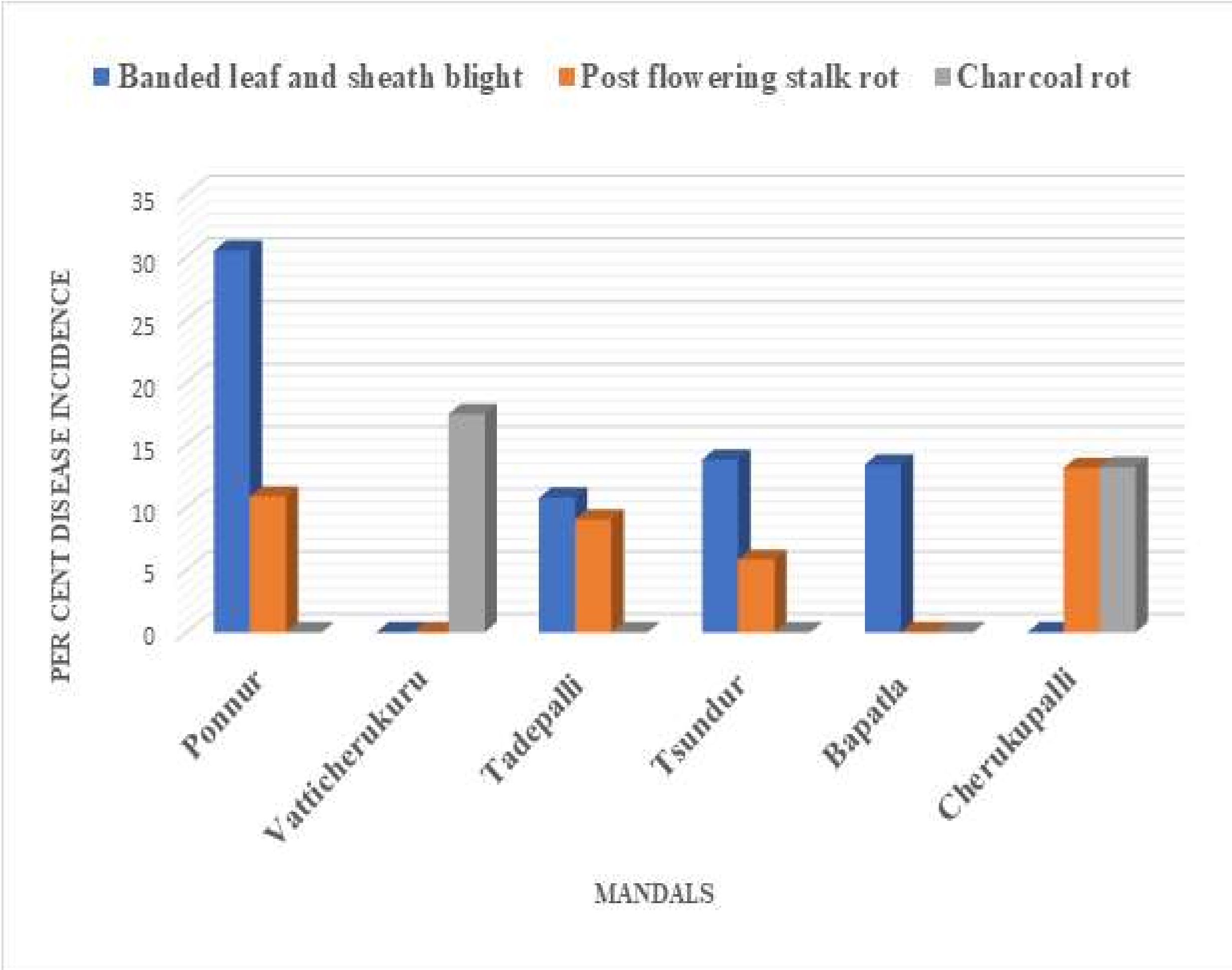

Fig 1 Per cent disease incidence of soil borne fungal diseases in maize in Guntur and Bapatla district of Andhra Pradesh

Fig 2. Symptoms of banded leaf and sheath blight on maize in field

Fig 3. Symptoms of post flowering stalk rot in maize in field conditions

Black gram cropping pattern was also observed in some parts during the survey. The incidence of banded leaf and sheath blight was high in rice fallow maize crop. The disease incidence was prevalent in black soil. The variation in the disease incidence might be due to changes in environmental conditions, amount of pathogen inoculum present in the soil and cultural practices followed by the farmers. Similar findings were reported by Rajput and Harlapur (2014) who reported BLSB incidence was low to severe form with the incidence that ranged from 10.75 to 52.45 per cent with mean per cent disease incidence of 46.67 per cent in major maize growing areas of Karnataka. Mamatha *et al*. (2020) reported the incidence of post flowering stalk rot in 13 villages of four major maize growing districts of Telangana state, *viz*., Karimnagar, Khammam, Warangal and Rangareddy. The disease incidence ranged from 27.0 per cent in Narsimhapuram village of Khammam district to 76.8 per cent in Thimmapur village of Karimnagar district. Lal *et al*. (1998) reported that the incidence of post flowering stalk rot complex (Charcoal rot, Fusarium stalk rot, late wilt) varied from 5 to 40 per cent in different parts of the country. Bhavani *et al*. (2022) conducted survey in maize crop during *kharif* -2021 in 30 villages in 9 districts of Telangana and observed that incidence of post flowering stalk rot vary from 1.66 % to 48.52% in different villages Porandla (Thimmapur) village of Karimnagar district was stated to be recorded with maximum disease incidence while minimum disease incidence was recorded in Appajipally (Balanagar) village of Mahabubnagar district.

Fig 4. Symptoms of charcoal rot in maize in field conditions

CONCLUSIONS

Based on the survey data obtained Guntur district recorded highest incidence of banded leaf and sheath blight, post flowering stalk rot and charcoal rot compared to Bapatla. The banded leaf and sheath blight mostly observed at vegetative stage, while post flowering stalk rot was observed from flowering to maturity stage and charcoal rot was mostly observed at maturity stage. It was observed that Siri 5608 is predominant variety in surveyed areas in Guntur district and Winner 8352 is predominant variety in surveyed areas in Bapatla district. The variation in the disease incidence might be due to change in environmental conditional, amount of pathogen inoculum present in the soil and cultural practices followed by the farmers.

LITERATURE CITED

Arya H C and Jain B L 1964. *Fusarium* seedling blight of Maize in Rajasthan. *Indian Phythopathology*.17(1): 51-57.

Bertus L S 1927. A sclerotial disease of Maize (*Zea mays* L.) due to *Rhizoctonia solani* Kühn. Year book. *Department of Agriculture*, Ceylon. 46–48.

Bhavani M, Mallaiah B, Bhadru D, Prameela M and Vanisri S 2022. Survey on the Status of Post Flowering Stalk Rots in Telangana State. *Biological Forum – An International Journal*. 14(2a): 178-183.

Gill P, Kaur G and Saxena V K 2005. Genetic Studies of some biochemical compounds and their relationship with charcoal rot resistance in maize (*Zea mays* L.). *Journal of Research* (India). 42(1).

Harlapur S I, Wali M C, Prashant M and Shakuntala N M 2002. Assessment of yield loss in maize due to charcoal stalk rot in Ghataprabha Left Bank Cannal (GLBC) command area of Karnataka. *Karnataka Journal of Agricultural Sciences*. 15(3) :590-591.

Indiastat, 2022-23. https://www.indiastat.com agriculture-data/2/stats.aspx

Khokhar M K, Hooda K S, Sharma S S and Vimla Singh V S 2014. Post flowering stalk rot complex of maize-present status and future prospects. *Maydica.* 59.

Lal S, Leon D C, Saxena V K, Singh S B, Singh N N and Vasal S K 1998. Maize stalk rot complexes: Innovative breeding approaches. In *Proc Seventh Asian Regional Maize Workshop, Los Banos, Philippines*.

Mamatha C, Mallaiah B, Vidyasagar B and Bhadru D 2020. *In vitro* evaluation for antifungal activity of native isolates of *Trichoderma viride* against maize stalk rot pathogen incited by *Fusarium verticillioides. Trends in Biosciences.* 13(7): 388-393.

Payak M M and B L Renfro 1966. Diseases of maize new to India. *Indian Phytopathology*. 19 (1):122

Rajput L S and Harlapur S I 2014. Studies on banded leaf and sheath blight of maize caused by *Rhizoctonia solani* f. sp. *sasakii* Exner. *Karnataka Journal of Agricultural Sciences*. 27 (1): 82-84.

Shekhar M 2004. Studies on variability in *Macrophomina phaseolina* (Tassi) Goid incitant of charcoal rot of maize (Zea mays L). *PhD thesis*. Meerut:Department of Botany, Meerut College, CCS University.

Shekhar M and Kumar S 2010. Potential biocontrol agents for the management of *Macrophomina phaseolina*, incitant of charcoal rot in maize. *Archives of Phytopathology and Plant Protection*. 43(4): 379-383.

Shekhar M and Kumar S 2012. Inoculation methods and disease rating scales for maize diseases. Directorate of Maize Research. *Indian Council of Agricultural Research*. New Delhi. 8-11.

Singh B M and Sharma Y R 1976. Evaluation of maize germplasm to banded sclerotial disease and assessment of yield loss. *Indian Phythopathology*.29(2): 129-132.

Received on 14.09.2024 and Accepted on 17.10.2024