



Incidence of stem rot disease of groundnut in relation to weather parameters in major groundnut growing areas of Telangana

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ARTICLE INFO

Received : 23 March 2022

Revised : 22 June 2022

Accepted : 28 August 2022

Available online: 15 January 2023

Key Words:

Disease incidence

Groundnut

Stem rot

Sclerotium rolfsii

ABSTRACT

Groundnut (*Arachis hypogaea* L.) is an important oilseed crop and the economic production of groundnut is constrained by soil-borne diseases. Stem rot, caused by the necrotrophic fungus *Sclerotium rolfsii*, was the most common soil-borne disease in groundnut. A roving survey was conducted in major groundnut growing areas of Telangana during *kharif* 2019 and *rabi* 2019-20 to collect a preliminary data of the incidence level and pattern of prevalence of the stem rot disease. The district of Warangal has the highest incidence of stem rot. The lowest incidence of stem rot was found in Telangana's Wanaparthy and Nagarkurnool districts. Disease incidence was correlated with weather parameters, during *Kharif*-2019, temperature, relative humidity and rainfall showed positive correlation, whereas evaporation showed negative correlation, during *Rabi*-2019-20, temperature, relative humidity and evaporation showed positive correlation and rainfall showed negative correlation. This study provided an elementary idea about the per cent disease incidence as well as paved the path for developing ecosystem specific management strategy to reduce impact of soil borne diseases of groundnut in different districts of Telangana.

Introduction

Groundnut (*Arachis hypogaea* L.) is one of the most significant oilseeds and food crops grown in the semi-arid tropics, originated in South America. Groundnut is grown on 29.59 (mha) over the world, with a total production of 48.75 million tonnes (FAOSTAT, 2019). The crop is grown on 4.8 million ha in India, with a yield of 9.2 million tonnes (INDIASTAT, 2019). It is grown to an extent of 0.13 mha in Telangana, with a production of 0.30 mt and a productivity of 2364 kg/ha (Directorate of Economics and Statistics, 2019).

Soil-borne diseases have been identified as one of the key limiting factors for groundnut production. *Aspergillus niger*, *Sclerotium rolfsii*, and

Rhizoctonia bataticola are identified as major soil-borne pathogens (Ghewande *et al.*, 2002). Pre-emergence rotting in seeds, soft rot in emerging seedlings, collar rot, stem rot and dry root rot in mature plants are the symptoms of these pathogens. Stem rot has been found in regions where moisture and temperature levels are high enough for *Sclerotium rolfsii* to develop and survive. *Sclerotium rolfsii* infect groundnut plants at all stages of growth, including the seed germination stage, causing pre-emergence rot and young plant stem rot. The time it has taken for the plants to wilt ranged from 8 to 15 days. Because the infection was more widespread and quick, the younger plants

were found to be more vulnerable. (Patil and Rane, 1983). *S. rolfii* mycelia survives in sandy soils, whereas the sclerotia survive in moist, aerobic conditions near the soil surface. (Punja, 1985).

Material and Methods

During *kharif* 2019 and *rabi* 2019-20, roving surveys were conducted in main groundnut growing areas of Telangana's Warangal, Wanaparthy, and Nagarkurnool districts (Figure-1) when the crop was at the peg and pod development stage and 45-90 days old. In addition, key growing mandals and villages were chosen for the study within each groundnut-producing area. Visual symptoms and signs such as white mycelial development, sclerotia, lesions on the stem, wilting, and/or dead plants were used to determine the incidence of

groundnut stem rot. Five plots, each measuring 5x5 m², were chosen in each field. One of the five plots was placed in the field's central, while the other four were placed at random.

The following formula was used to determine the percent disease incidence in these areas.

$$P = N/T \times 100$$

Where,

P = % disease incidence

N = Number of infected plants

T = Total number of plants

Kadiri-6 (K-6) and local are the prominent variety's grown by the farmers. Majority of farmers applied fungicides like Thiram and Carbendazim as seed treatment.

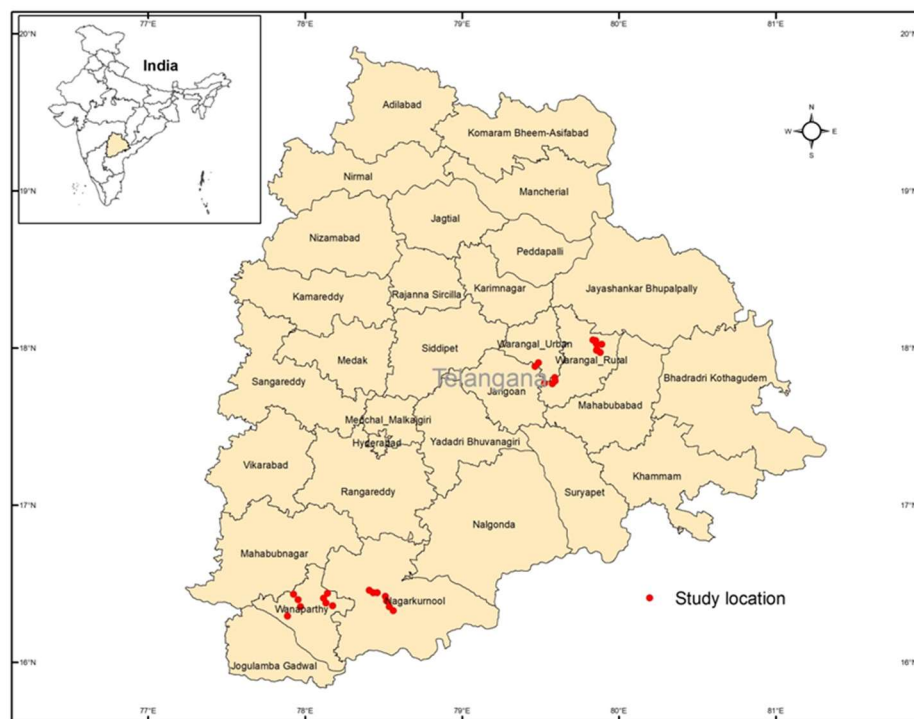


Figure 1: Telangana map showing the sampling locations of *S. rolfii* disease during *Kharif* 2019 and *Rabi* 2019-20 with sampling locations

The impact of weather variables on the disease's occurrence

A study of the effect of weather conditions (Temperature, Relative Humidity, Evaporation, and Rainfall) on percent disease incidence was performed. The weather data of three districts

(Warangal, Wanaparthy, and Nagarkurnool) were obtained from meteorological stations and correlated to the disease's periodic occurrence at the same locations using the Karl Pearson's correlation coefficient, respectively (*r*).

Results and Discussion

During the seasons of *kharif* 2019 and *rabi* 2019-2020, a roving survey was undertaken in Telangana's major groundnut-growing districts, namely Warangal, Wanaparthy, and Nagarkurnool. Thirty villages were surveyed across three districts in seven mandals (Fig.1). Data on percent disease incidence, variety grown, soil type, crop stage at the time of survey, and crop protection measures used were gathered, and the results are presented in (Table 1, Table 2). During the *kharif* season of 2019, stem rot disease was detected in all of the surveyed villages, with disease incidence ranging from 31.24 to 12.1%. (Table 1). The highest disease incidence was found in Kadarigudem village in Wardannapet mandal of Warangal district, as well as Yedutla and Polikapadu villages in Gopalpet mandal of Wanaparthy district (31.24%) and the lowest in Bopally village in Talakpally mandal of Nagarkurnool district (12.1 %). In Warangal district, Kadarigudem (31.24) exhibited the highest disease incidence, while the least disease incidence was observed in Muchimpla village (14.21). Polikapadu village (31.24) had the highest disease incidence in Wanaparthy district and the lowest disease incidence was observed in Apparaala village (13.56). In Nagarkurnool district maximum disease incidence was observed in Thummanpet (23.55), Jinkunta (23.40), Gattunallykuduru (21.40), Gattuthummen (20.15), Zamisthapur (19.80), Pedduru (19.50) and Godal (13.56), while least disease incidence was observed in Bopally village (12.10). The average disease incidence of stem rot in Telangana's major growing areas ranging from 16.93 to 21.80 %. (Table 3). In fact, the Warangal district had the highest mean disease incidence rate of 20.31 %, followed by Wanaparthy (19.86 percent) and Nagarkurnool (19.18 %). In Warangal district stem rot incidence varied from 18.45 % (Narsampet mandal) to 21.80 % (Wardannapet mandal) in 16 villages spread over in four mandals of the district. Majority of the farmers have grown groundnut variety K6 except in 9 villages viz., Rangapur, Kadarigudem, Kammappally, Malakpally, Polikapadu, Apparaala, Gattunally kuduru, Zamisthapur and Godal villages where a local variety was grown. The sowings were done in June-July except in Chennur and Apparaala villages where the sowings were taken up in May,

2019. The soil type is red loamy and the crop was at peg to pod formation at the time of survey. However, it was observed that seed treatment with fungicides was not done by majority of the farmers. The stem rot disease was observed in all of the villages surveyed during *Rabi* 2019-20, with disease incidence ranging from 25.66 to 10.11 percent (Table 2). Maximum disease incidence was observed in Yedutla village of Gopalpet mandal of Wanaparthy district (25.66%), while the least disease incidence was noticed in Muchmpla village of Nallabelli mandal of Warangal district (10.11%) and Godal village of Balmoor mandal of Nagarkurnool district (10.11%). In Warangal district maximum disease incidence was observed in Kadarigudem (25.33) village and least disease incidence was observed in Muchimpla village (10.11). In Wanaparthy district maximum disease incidence was observed in Yedutla (25.66) village, while least disease incidence was noticed in Buddaram (10.44) village. In Nagarkurnool district highest disease incidence was noticed in Thummanpet (20.13) while least disease incidence was observed in Godal (10.11). In Telangana's major groundnut growing areas, the average disease incidence of stem rot ranged from 14.23 to 18.88 % (Table 3). In addition, the Warangal district had the highest mean disease incidence rate of 17.53 %, followed by Wanaparthy (17.03 %) and Nagarkurnool (17.03 percent) (14.82 %). In 16 villages spread over four mandals in Warangal district, stem rot incidence varied from 16.61 % (Nallabelli mandal) to 18.88 % (Wardannapet mandal). Majority of the farmers have grown groundnut variety K6 except in 12 villages viz., Rangapur, Kadarigudem, Kammappally, Malakpally, Dharmapur, Polikapadu, Palem, Apparaala, Sankireddypally, Kanimetta, Bopally and Godal villages where a local variety was grown. The sowings were done in November except in Madannapet, Dasaripally, Gattunallykuduru, Zamisthapur and Pedduru villages where the sowings were taken up in October, 2019. The soil type is red loamy and the crop was at peg to pod formation at the time of survey. However, it was observed that seed treatment with fungicides was not done by majority of the farmers. The varied incidence of groundnut stem rot from one locality to the next in this study could be related to the

Table 1: Prevalence of stem rot disease in major groundnut growing areas of Telangana during *Kharif*-2019

State	District	Mandal/Taluka	Village	Variety	Soil type	Planting date	Crop Stage	Crop density	Crop protection	Disease incidence
										<i>Kharif</i> 2019
Telangana	Warangal	Nallabelli	Nandigama	K 6	Red	June	Pod	High	-	16.44
			Muchimpla	K 6	Red	June	Pod	Medium	-	14.21
			Lenkalapalli	K 6	Red	July	Peg	High	Thiram ST	21.33
			Rangapur	Local	Red	June	Pod	High	-	26.55
		Wardannapet	Ramojikummarigudem	K 6	Red	June	Pod	Medium	-	14.50
			Ellanda	K 6	Red	July	Peg	High	-	21.33
			Kadarigudem	Local	Red	June	Pod	High	-	31.24
			Nashkal	K 6	Red	June	Pod	Medium	Thiram ST	20.15
		Narsampet	Madannapet	K 6	Red	July	Peg	Medium	Carbendazim ST	16.40
			Dasaripally	K 6	Red	July	Peg	Medium	Carbendazim ST	15.40
			Chandrayappally	K 6	Red	June	Pod	Medium	-	15.45
			Kammapally	Local	Red	July	Peg	High	-	26.55
		Dharmasagar	Malakpally	Local	Red	June	Pod	Medium	-	21.33
			Dharmapur	K 6	Red	June	Pod	Medium	-	21.44
	Wanaparthy	Gopalpet	Chennur	K 6	Red	May	Pod	Medium	-	14.21
			Buddaram	K 6	Red	June	Pod	Medium	Carbendazim ST	14.55
			Polikapadu	Local	Red	June	Pod	Medium	-	31.24
			Yedutla	K 6	Red	July	Peg	High	-	31.20
		Kothakota	Palem	K 6	Red	July	Peg	Medium	-	14.21
			Apparaala	Local	Red	May	Pod	High	-	13.56
			Sankireddy pally	K 6	Red	June	Pod	Medium	-	24.51
			Kanimetta	K 6	Red	June	Pod	Medium	Carbendazim ST	15.45
	Nagarkurnool	Talkapally	Gattunallykuduru	Local	Red	June	Pod	High	Carbendazim ST	21.40
			Zamisthapur	Local	Red	June	Pod	Medium	Carbendazim ST	19.80
			Bopally	K 6	Red	June	Pod	Medium	-	12.10
			Pedduru	K 6	Red	June	Pod	Medium	-	19.50
		Balmoor	Gattuthummen	K 6	Red	July	Peg	Medium	-	20.15
			Thummanpet	K 6	Red	June	Pod	Medium	-	23.55
			Godal	Local	Red	June	Pod	High	-	13.56
			Jinkunta	K 6	Red	June	Pod	High	Carbendazim ST	23.40

Table 2: Prevalence of stem rot disease in major groundnut growing areas of Telangana during *Rabi*-2020

State	District	Mandal/Taluka	Village	Variety	Soil type	Planting date	Crop Stage	Crop density	Crop protection	Disease i
										<i>Rabi</i> 2020
Telangana	Warangal	Nallabelli	Nandigama	K 6	Red	November	Pod	High	-	15.24
			Muchimpla	K 6	Red	November	Pod	Medium	-	10.11
			Lenkalapalli	K 6	Red	November	Pod	High	Thiram ST	19.56
			Rangapur	Local	Red	November	Pod	High	-	21.54
		Wardannapet	Ramojikummarigudem	K 6	Red	November	Pod	Medium	-	10.12
			Ellanda	K 6	Red	November	Pod	High	-	24.11
			Kadarigudem	Local	Red	November	Pod	High	-	25.33
			Nashkal	K 6	Red	November	Pod	Medium	Thiram ST	15.99
		Narsampet	Madannapet	K 6	Red	October	Peg	Medium	Carbendazim ST	16.33
			Dasaripally	K 6	Red	October	Peg	Medium	Carbendazim ST	15.11
			Chandrayappally	K 6	Red	November	Pod	Medium	-	16.44
			Kammappally	Local	Red	November	Peg	High	-	20.11
		Dharmasagar	Malakpally	Local	Red	November	Pod	Medium	-	15.21
			Dharmapur	Local	Red	November	Pod	Medium	-	20.14
	Wanaparthy	Gopalpet	Chennur	K 6	Red	November	Pod	Medium	-	15.66
			Buddaram	K 6	Red	November	Pod	Medium	Carbendazim ST	10.44
			Polikapadu	Local	Red	November	Pod	Medium	-	23.77
			Yedutla	K 6	Red	November	Peg	High	-	25.66
		Kothakota	Palem	Local	Red	November	Peg	Medium	-	15.12
			Apparaala	Local	Red	November	Pod	High	-	11.23
			Sankireddypally	Local	Red	November	Pod	Medium	-	20.11
			Kanimetta	Local	Red	November	Pod	Medium	Carbendazim ST	12.33
	Nagarkurnool	Talkapally	Gattunallykuduru	K 6	Red	October	Pod	High	Carbendazim ST	16.22
			Zamisthapur	K 6	Red	October	Pod	Medium	Carbendazim ST	15.23
			Bopally	Local	Red	November	Pod	Medium	-	10.25
			Pedduru	K 6	Red	October	Pod	Medium	-	15.22
		Balmoor	Gattuthummen	K 6	Red	November	Peg	Medium	-	15.99
			Thummanpet	K 6	Red	November	Pod	Medium	-	20.13
			Godal	Local	Red	November	Pod	High	-	10.11
			Jinkunta	K 6	Red	November	Pod	High	Carbendazim ST	15.45

Table 3. Stem rot disease incidence in major groundnut growing areas of Telangana state during *kharif*-2019 and *rabi* 2019-20

District	Mandal	% disease incidence	
		<i>Kharif</i> 2019	<i>Rabi</i> 2019-20
Warangal	Nallabelli	19.63	16.61
	Wardannapet	21.80	18.88
	Narsampet	18.45	16.99
	Darmasagar	21.38	17.67
	Mean	20.31 (highest)	17.53 (highest)
Wanaparthi	Gopalpet	22.80	19.38
	Kothakota	16.93	14.69
	Mean	19.86	17.03
Nagarkurnool	Talkapally	18.20	14.23
	Balmoor	20.16	15.42
	Mean	19.18	14.82

Table 4: Weather data of major groundnut growing areas of Telangana during *Kharif* 2019 and *Rabi* 2019-20

District	<i>Kharif</i>				<i>Rabi</i>			
	Temperature	Relative humidity	Evaporation	Rainfall	Temperature	Relative humidity	Evaporation	Rain fall
Warangal	27.29	75.43	2.62	8.17	23.63	69.91	4.35	0.40
Wanaparthi	26.33	74.06	5.31	4.00	22.75	67.52	4.26	0.47
Nagarkurnool	26.33	74.06	5.31	4.00	22.75	67.52	4.26	0.47

cultivation of different groundnut types (K 6 and local cultivars) and the presence of diverse soil conditions (temperature and soil moisture content). It could also be attributable to the fungus's pathogenic variability. The findings are consistent with those of (Kulkarni, 2007), who observed different levels of stem rot incidence in various groundnut growing villages in the Dharwad district of Karnataka, and Siddaramaiah *et al.* (1979), who observed varying levels of stem rot incidence in various groundnut growing villages in the Dharwad district of Karnataka. Similarly, Ramakrishna and Kolte (1988) reported varying levels of stem rot incidence in India's major crop-growing areas, ranging from 15 to 30 %.

Amrutha Veena *et al.* (2019) reported highest stem rot incidence in Nellore and Chittoor districts of Andhra Pradesh. Palaiah *et al.* (2019) noticed 22.72 % stem rot incidence in Chitradurga district of Karnataka. Divya Rani *et al.* (2016) noticed the varied levels of incidence of stem rot of groundnut in different villages of Andhra Pradesh during *kharif*, 2012 and *kharif*, 2013. Further, Kadam *et al.* (2011) recorded higher incidence of stem rot in cultivar JL 24 (17.3%) among various cultivars

grown in marathwada region of Maharashtra. Additionally, Ghewande *et al.* (2002) reported the average incidence of 27 % in major groundnut growing areas of India. They also noticed higher incidence of stem rot in Maharashtra, Saurashtra region of Gujarat compared to other areas surveyed. The present findings are also in agreement with Okabe and Matsumoto (2000) who reported 10 to 40 % incidence of stem rot in different groundnut growing areas of Japan. During the investigation, it was found that the incidence of stem rot was higher in pod-stage than in mature crops (Table 1 and Table 2). The findings support Pande and Rao's (2000) hypothesis that stem rot occurs in seedlings but becomes more common as the crop matures.

Correlation of weather parameters with stem rot disease incidence caused by *Sclerotium rolfsii*

Variations in meteorological conditions (temperature, relative humidity, evaporation, and rainfall) in each area could explain the variations in disease incidence (Table: 4). Significant relationships between mean per cent disease incidence, mean temperature, mean relative humidity, evaporation and mean rainfall were

Table 5: Correlation of weather parameters with incidence of stem rot disease

S.No.	Correlation coefficient (r)		
	Weather parameters	Kharif-2019	Rabi-2020
1	Temperature	0.80	0.64
2	Relative humidity	0.83	0.69
3	Evaporation	-0.79	0.65
4	Rainfall	0.81	-0.72

found. Temperature, relative humidity, and rainfall were shown to have positive correlations with disease incidence in *kharif* 2019, however evaporation was found to have a negative correlation. In *rabi*, 2020 temperature, relative humidity, and evaporation were found to have positive correlations with disease incidence, but rainfall was found to have a negative correlation., (Table: 5). The prevalence of *S. rolfsii* in warm regions of the world, according to Punja, Z. K. (1985), is a reflection of the high temperature required for its growth and sclerotial formation. The hyphal extension and dry weight production temperature range is 8-40°C, with maximum growth and sclerotial formation occurring at 27-30°C. *S. rolfsii* mycelia survives in sandy soils, whereas the sclerotia survive in moist, aerobic conditions near the soil surface.

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Conclusion

The roving survey conducted during *kharif*, 2019 and *rabi*, 2019-20 revealed the incidence of stem rot in major groundnut growing areas of Telangana and was ranged from 12.1 to 31.24 % and 10.11 to 25.66 % respectively. In Warangal district highest disease incidence was observed in both *kharif* and *rabi*. Temperature, relative humidity, and rainfall were shown to have positive correlations with disease incidence in *kharif* 2019, however evaporation was found to have a negative correlation. In *rabi*, 2020 temperature, relative humidity, and evaporation were found to have positive correlations with disease incidence, but rainfall was found to have a negative correlation. In the present study, the varied incidence of stem rot of groundnut from one locality to another was might be due to cultivation of different groundnut varieties, prevalence of different weather conditions (temperature, relative humidity, evaporation and rainfall) and adoption of different cropping patterns.

Conflict of interest

The authors declare that they have no conflict of interest.

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