



Survey for the Incidence of Stem Rot (*Sclerotium rolfsii* sacc) of Groundnut in Andhra Pradesh

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ABSTRACT

Background: Groundnut is an important edible leguminous oilseed crop and stem rot caused by *Sclerotium rolfsii* is one of the major soil borne disease affecting groundnut severely in India. The current study aimed to get an understanding regarding the incidence level and pattern of prevalence of the disease in the agro-ecological condition of Andhra Pradesh.

Methods: Roving survey was taken up from major groundnut growing areas in Andhra Pradesh during *kharif*, 2019 and *kharif*, 2020 in five districts. From each district predominant groundnut growing areas were chosen for assessment of the disease. Five spots of one square meter area in each field were selected randomly and Per cent disease incidence was recorded.

Result: From the data it is observed that the stem and pod rot incidence was higher during *kharif*, 2020 when compared with *kharif*, 2019. The pooled data indicated that the mean stem rot incidence for the two years ranges from 5.39% to 23.56% with highest mean stem rot incidence in Krishnapuram (v), Kothapatnam (m) of Prakasam dist (23.56%) and lowest in Bandarupalli (v), Yerpedu (m) of Chittoor dist (5.39%). Among different districts highest mean stem rot incidence was recorded in Prakasam dist (18.71%) and lowest was recorded in Chittoor dist (7.11%). The stem rot severity was high in sandy soils with TAG24 variety where groundnut is being grown followed by red sandy loams and least in clay loam soils. The groundnut sole crop recorded high disease incidence when compared with intercrop of red gram. Significant positive correlation was recorded between stem rot, pod rot and leaf spot incidence.

Key words: Disease incidence, Groundnut, Leaf spot, Pod rot, *Sclerotium rolfsii*, Stem rot, Survey.

INTRODUCTION

Groundnut (*Arachis hypogaea* L.), a legume crop is widely grown in the tropics and subtropics, being important to both small and large commercial producers. As of 2019, there was a total production of 6,727 MT in India. (Source: Ministry of Agriculture and Farmers Welfare, Government of India). Gujarat, Andhra Pradesh, Tamil Nadu and Rajasthan are the leading producers of groundnut in India each with a production of more than 1000 MT. In Andhra Pradesh groundnut is cultivated in an area of 0.73 M ha with a total production of 10 MT and a total productivity of 1426 kg ha⁻¹. Groundnut productivity is being affected by several abiotic and biotic stresses which include poor soil fertility, moisture stress, viral diseases, collar rot and stem rot.

Stem rot also known as Sclerotium blight, Sclerotium rot, southern blight, southern stem rot, Sclerotium wilt, root rot, pod rot and white mold caused by *Sclerotium rolfsii* Sacc is one of the major constraints in groundnut production as it severely affects the yield and quality of the produce. The necrotrophic soil borne fungus has a very vast host range consisting of agricultural and horticultural crops and is widely distributed in tropics, sub tropics and warm temperate regions of the world. In India, it is prevalent in all the groundnut growing states and most severe in Andhra Pradesh, Maharashtra, Gujarat, Madhya Pradesh, Karnataka, Orissa and Tamil Nadu (Kumar *et al.*, 2013). The disease is having high economic importance and is reported to cause yield losses ranging from 10-15% (Mayee and Datar, 1988) and will be more severe and reach upto 80% when epidemics coincides with wet climatic conditions at

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pod filling. *Sclerotium rolfsii* Sacc. (telomorph: *Athelia rolfsii* Tu and Kimbrough) infects about 500 plant species including groundnut in the warm temperate and tropical regions of the world.

MATERIALS AND METHODS

Roving survey was taken up by Department of Botany, College of Science and Technology andhra University, Visakhapatnam, Andhra Pradesh, India in major groundnut growing areas of Andhra Pradesh during *kharif*, 2019 and *kharif*, 2020 in 70-100 days old groundnut crop to know the incidence of stem rot and pod rot. Survey was conducted in five districts and from each district predominant groundnut growing areas were chosen for assessment of the disease. For recording the disease, five spots in each field were selected randomly and at each spot one square meter area

was marked for recording data. The total number of plants present and number of plants showing stem rot symptoms due to *Sclerotium rolfsii* at each spot were counted and recorded (Plate 1 and 2). Later the per cent stem rot incidence in these locations was calculated using the following formula;

Stem rot incidence (%) =

$$\frac{\text{Number of stem rot infected plant}}{\text{Total number of plants}} \times 100$$

For recording pod rot incidence, dry pods of five plants were plucked randomly from each spot and total number of pods per plant and number of pods infected by *S. rolfsii* pathogen were counted and recorded. Later the percent pod rot incidence in these locations was calculated using the following formula;

Pod rot incidence (%) =

$$\frac{\text{Number of pods infected plant}}{\text{Total number of pods plant}} \times 100$$

For leaf spot severity 1-9 scale (Subrahmanyam *et al.*, 1980) was adopted and Per cent Disease Index (PDI) was calculated. The PDI was computed using the above scale according to the formula given below;

PDI

$$\frac{\text{Sum of all disease rating}}{\text{Total number of ratings} \times \text{Maximum disease grade}} \times 100$$

RESULTS AND DISCUSSION

The stem rot disease incidence was recorded during *kharif*, 2019 and 2020 in major groundnut growing areas of Andhra Pradesh were presented in Table 1. The pooled analysis of each year data revealed that the disease incidence ranges from 5.8% to 20.5% during *kharif*, 2019 and 4.98% to 26.62% during *kharif*, 2020. The disease incidence during *kharif*, 2019 revealed that the highest average stem rot incidence was recorded in Prakasam district (15.4%) and the lowest average disease incidence in Chittoor district (6.8%). During 2019 *kharif*, highest mean stem rot incidence was recorded in Prakasam district (22.01%) followed by Kurnool district (14.93%) and least per cent stem rot incidence was recorded in Chittoor district (7.42%). Highest pod rot incidence was recorded in Venkatapuram (v), Yemmiganur (m), Kurnool district (20.52%) and lowest pod rot incidence was recorded in Papanaidupeta (v), Yerpedu (m) of Chittoor district (12.40%). Among different districts, the incidence of stem rot is wider in range in Kurnool district (8.0% to 19.5%) and narrow in Srikakulam district (12.3% to 14.3%). The incidence of leaf spot in different districts indicate that highest mean PDI of leaf spot was recorded in Prakasam district (39.07%) followed by Kurnool district (31.70%) and lowest in Chittoor district (16.99%) during *kharif*, 2019. The average incidence of stem rot of both the years indicated that highest



Plate 1: Stem rot incidence in groundnut.



Plate 2: Leaf spot and stem rot incidence in groundnut.

incidence of stem rot was noticed in Prakasam district followed by Kurnool and Srikakulam districts. The high incidence of leaf spot in Prakasam district might be the reason for higher incidence of stem rot (Fig 1).

During *kharif*, 2020 the highest stem rot incidence was recorded in Krishnapuram (v), Kothapatnam (m) of Prakasam district (20.5%) and the lowest stem rot incidence in Bandarupalli (v), Yerpedu (m) of Chittoor district (5.8%). Highest mean pod rot incidence was recorded in Kurnool dist (22.56%) followed by Srikakulam district (19.69%) and lowest in Chittoor district (15.20%). Highest mean leaf spot incidence was recorded in Prakasam district (51.38%) followed by Ananthapuram district (43.46%) and lowest in Chittoor district (18.92%). Among different districts, considering the stem rot incidence in different mandals, wider disease range was recorded in Kurnool district (9.20% - 18.85%) and narrow in Chittoor district (4.98%-9.28%).

The stem and pod rot incidence was higher during *kharif*, 2020 when compared with *kharif*, 2019. The mean disease incidence for the two years of study is presented in Table 2. The mean stem rot incidence for the two years ranges from 5.39% to 23.56%.

The highest mean stem rot incidence was recorded in Krishnapuram (v), Kothapatnam (m) of Prakasam district (23.56%) and lowest was recorded in Bandarupalli (v),

Yerpedu (m) of Chittoor district (5.39%). Among different districts highest mean stem rot incidence was recorded in Prakasam district (18.71%) over two years followed by Kurnool district (14.32%) and lowest was recorded in Chittoor district (7.11%). The groundnut is being cultivated in sandy soils of the coastal belt using sprinkler irrigation. Frequent irrigation with sprinklers and high plant population might be the reasons for higher incidence of stem rot in this district. The mandal wise disease range is wider in Kurnool district

i.e., from 8.60% in Gonegandla (m) to highest in Venkatapuram (m) (19.18%) and is due to variation in cultivation practices and also soils where groundnut is grown. The range of per cent stem rot incidence is narrow in different mandals in Ananthapur district (10.65% to 12.80%) as groundnut is continuously grown in the same soils and with similar cultivation practices under rainfed conditions. Highest mean pod rot incidence was recorded in Kurnool district (20.64%) and almost equal in Prakasam

Table 1: Stem and pod rot incidence in major groundnut growing districts of Andhra Pradesh during *kharif*, 2019 and 2020.

District	Mandal	Village	Per cent disease incidence					
			Kharif, 2019			Kharif, 2020		
			Stem rot	Pod rot	Leaf spot	Stem rot	Pod rot	Leaf spot
Ananthapuramu	Beluguppa	Hanimireddipalli	12.0	12.77	20.91	12.90	17.31	44.67
		Ramanepalli	9.2	13.43	19.57	12.10	16.73	41.75
	Brahmasamudram	Vankarathanda	10.1	12.73	19.10	11.30	15.31	40.29
		Royalappadoddi	10.7	15.50	22.92	14.90	17.56	47.13
		Mean	10.5	13.61	20.63	12.80	16.73	43.46
Kurnool	Yemmiganur	Venkatapuram	19.5	26.02	36.88	18.85	22.32	35.22
		Kalugotla	11.5	16.15	27.27	12.98	21.21	38.13
	Gonegandla	Gonegandla	8.0	13.37	25.91	9.20	17.48	26.67
		Pilligandla	16.1	19.29	36.74	18.67	29.23	35.43
		Mean	13.7	18.71	31.70	14.93	22.56	33.86
Prakasam	Kothapatnam	Krishnapuram	20.5	25.11	46.62	26.62	22.08	52.65
		Kothapatnam	13.8	22.53	35.28	21.55	17.91	50.08
	Singarayakonda	Pakala	13.6	18.55	33.49	19.78	16.14	46.30
		Karedu	13.7	22.06	40.89	20.10	16.33	56.50
		Mean	15.4	22.06	39.07	22.01	18.12	51.38
Chittoor	Vadamala	Vadamala	7.5	13.48	13.28	9.28	13.48	19.76
		TC Agraharam	5.92	17.42	15.72	8.80	17.42	20.40
	Yerpedu	Bandarupalli	5.8	17.50	17.55	4.98	17.50	16.71
		Papanaidupeta	8.2	12.40	21.43	6.60	12.40	18.79
		Mean	6.8	15.20	16.99	7.42	15.20	18.92
Srikakulam	Saribujili	Nakkalapeta	12.8	19.20	29.12	13.55	21.70	36.22
		Rottavalasa	13.8	20.17	29.08	16.25	23.87	31.58
	Santhakavitam	Valtair	12.3	15.63	32.88	9.08	16.93	35.79
		GN Puram	14.3	13.11	30.51	7.83	16.26	29.19
		Mean	13.3	17.03	30.40	11.68	19.69	33.20

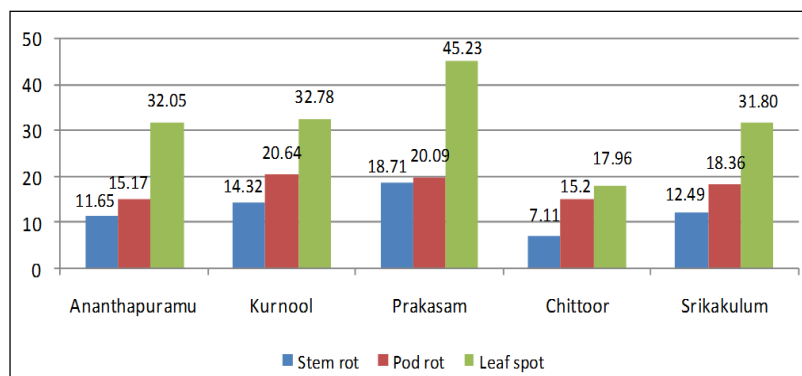


Fig 1: Average incidence of stem rot during 2019-20 and 2020-21 in groundnut in the study area.

Table 2: Mean stem and pod rot incidence in major groundnut growing districts of Andhra Pradesh.

District	Mandal	Village	Per cent disease Incidence		
			Stem rot	Pod rot	Leaf spot
Ananthapuramu	Beluguppa	Hanimireddipalli	12.45	15.04	32.79
		Ramanepalli	10.65	15.08	30.66
	Brahmasamudram	Vankarathanda	10.70	14.02	29.70
		Royalappadoddi	12.80	16.53	35.03
		Mean	11.65	15.17	32.05
Kurnool	Yemmiganur	Venkatapuram	19.18	24.17	36.05
		Kalugotla	12.24	18.68	32.70
	Gonegandla	Gonegandla	8.60	15.43	26.29
		Pilligandla	17.39	24.26	36.09
		Mean	14.32	20.64	32.78
Prakasam	Kothapatnam	Krishnapuram	23.56	23.60	49.64
		Kothapatnam	17.68	20.22	42.68
	Singarayakonda	Pakala	16.69	17.35	39.90
		Karedu	16.90	19.20	48.70
		Mean	18.71	20.09	45.23
Chittoor	Vadamala	Vadamala	8.39	13.48	16.52
		TC Agraharam	7.36	17.42	18.06
	Yerpedu	Bandarupalli	5.39	17.50	17.13
		Papanaidupeta	7.40	12.40	20.11
		Mean	7.11	15.20	17.96
Srikakulam	Saribujili	Nakkalapeta	13.18	20.45	32.67
		Rottavalasa	15.03	22.02	30.33
	Santhakavitam	Valtair	10.69	16.28	34.34
		GN Puram	11.07	14.69	29.85
		Mean	12.49	18.36	31.80
		Overall mean	12.85	17.89	34.57

district too (20.09%) and least in Ananthapur district (15.17%) and is almost equal with Chittoor district (15.20%). Mean highest leaf spot incidence was recorded in Karedu (v), Singarayakonda (m) of Prakasam district (48.70% and lowest in Vedamala (VandM) of Chittoor district. (16.52%). Among different districts highest mean district leaf spot incidence was recorded in Prakasam district (45.23%) followed by Kurnool district (32.78%) and lowest was recorded in Chittoor district (17.96%). The overall mean stem rot severity in the state is 12.85% with pod rot and leaf spot incidence of 17.89% and 35.47% respectively. The mean leaf spot severity (PDI) was found to have strong positive correlation during both the years with stem rot severity ($r=0.72$ and 0.54 during *kharif* 2019 and 2020 respectively). Further the leaf spot severity has also showed significant positive correlation with pod rot severity during both the years. Leaf spots defoliate the plants and the litter at the base of the plants might serve as substrate for the pathogen and also improves microclimate for increased stem rot incidence. Significant positive correlation was observed during both the years between stem rot and pod rot incidence ($r=0.62$ and $r=0.64$ during 2019 and 2020 respectively). Ramakrishna and Kolte (1988) found that, the average incidence of pod rot in groundnut in India was about 15-

30%. Pande and Rao (2000) conducted survey in the fields of five districts of AP, two districts of Karnataka and one district of Tamil Nadu and recorded highest incidence of stem rot in Raichur district of Karnataka (29%) and lowest in Chittoor district of AP. Durgarani *et al.* (2016) when surveyed for incidence of stem rot and collar rot in two districts each in AP and Telangana and recorded highest incidence in Chittoor district and lowest in Mohaboonagar and Warangal districts. Veena *et al.* (2019) reported that among ten mandals surveyed in each district, highest root rot incidence was noticed in Ananthapur district, stem rot incidence in Nellore and Chittoor districts, collar rot incidence in Kadapa district. Incidence of stem rot was found varying among different states in India also in different groundnut growing areas in the states. This might be the variety grown, climatic conditions, farming situation and also cultivation practices adopted. The results obtained from the present study also indicate variation in severity of stem and pod rots and leaf spot in different districts.

The study pertaining to the incidence of stem rot in different soils revealed that, the disease incidence was high in red loamy soils during *kharif*, 2019 (16.10%) and sandy soils during *kharif*, 2020 (22.01%) (Table 3). The least stem rot incidence was noticed in clay loams during both the years

Table 3: Stem rot and pod rot incidence in groundnut grown in different soils.

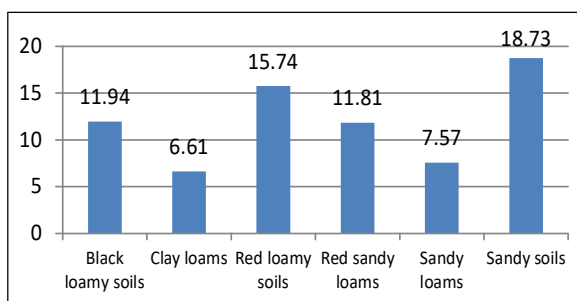
Soils	2019-20			2020-21			Mean		
	Stem rot incidence	Pod rot incidence	Leaf spot incidence	Stem rot incidence	Pod rot incidence	Leaf spot incidence	Stem rot incidence	Pod rot incidence	Leaf spot incidence
Black loamy soils	9.70	15.98	29.99	14.18	24.60	29.18	11.94	20.29	29.59
Clay loams	6.60	16.16	15.77	6.61	16.16	17.09	6.61	16.16	16.43
Red loamy soils	16.10	20.34	32.73	15.37	21.33	36.67	15.74	20.84	34.70
Red sandy loams	11.40	15.32	25.51	12.21	18.21	27.31	11.81	16.77	26.41
Sandy loams	7.11	14.45	17.95	8.03	14.45	20.33	7.57	14.45	19.14
Sandy soils	15.45	22.06	39.07	22.01	27.10	51.38	18.73	24.58	45.23

Table 4: Stem rot and pod rot incidence in different groundnut varieties.

Variety	2019-20			2020-21			Mean		
	Stem rot incidence	Pod rot incidence	Leaf spot incidence	Stem rot incidence	Pod rot incidence	Leaf spot incidence	Stem rot incidence	Pod rot incidence	Leaf spot incidence
Kadiri 6	10.64	15.77	23.97	11.21	17.84	26.29	10.93	16.81	25.13
Dheeraj	12.80	19.63	34.24	16.31	25.29	32.21	14.56	22.46	33.23
TAG24	15.45	22.06	39.07	22.01	27.10	51.38	18.73	24.58	45.23

Table 5: Stem rot and pod rot incidence in different cropping systems of groundnut.

Cropping system	2019-20			2020-21			Mean		
	Stem rot incidence	Pod rot incidence	Leaf spot incidence	Stem rot incidence	Pod rot incidence	Leaf spot incidence	Stem rot incidence	Pod rot incidence	Leaf spot incidence
Groundnut sole crop	13.00	19.04	30.85	14.62	21.43	36.07	13.81	20.24	33.46
Groundnut+Redgram intercrop	9.50	14.12	22.00	12.15	18.07	23.75	10.83	16.10	22.88

**Fig 2:** Incidence of stem rot in different groundnut growing soils.

and the incidence is same during both the years. The mean The stem rot incidence was higher in sandy soils (18.73%) followed by red sandy loams (15.74%) and lowest in clay loam soils (6.61%). The stem rot incidence in black loamy soils and red sandy loams is almost similar with 11.94 and 11.81% respectively. The pod rot incidence has also recorded with similar observations as stem rot with highest disease incidence in sandy soils (24.58%) and lowest in clay loams (16.16%). The leaf spot also recorded similar trend and the sandy soils has recorded highest leaf spot incidence (45.23%). Highest incidence of stem rot and pod rot in sandy soils and red sandy loams is due to frequent irrigations with sprinklers which might create congenial micro

climate for the development of the disease (Fig 2). Moreover groundnut is continuously cultivated in red sandy loams especially in Ananthapur and Kurnool districts which encourage the pathogen to survive in the soils. Continuous cultivation of any crop over the seasons and years will build up the inoculum level to such an extent that epidemic will become a common phenomena (Chaube and Singh, 2001).

The response of variety grown and the stem rot incidence recorded revealed that highest stem rot incidence was recorded in TAG24 during both years (15.45% and 22.01% respectively) was due to the frequent irrigation with sprinklers besides high plant population and low plant stature, since the variety is being grown in sandy soils. This was followed by Dheeraj and K6 where in the disease incidence recorded was almost similar during 2019 but was 16.31% in Dheeraj and 11.21% in K6 during 2020 (Table 4). The mean stem rot incidence was also highest in TAG24 followed by Dheeraj and K6.

Among the two cropping systems, groundnut sole crop recorded highest stem rot incidence (13.00% and 14.62%) with a mean disease incidence of 13.81% followed by groundnut intercropped with red gram (9.50% and 12.15%) with a mean disease incidence of 10.83% (Table 5). The pod rot and leaf spot also showed similar observations with a mean pod rot incidence of 20.24% and mean leaf spot incidence of 33.46% in groundnut sole crop while the mean

pod rot incidence was 16.10 and mean leaf spot incidence was 22.88% in groundnut intercropped with redgram. The intercrop has shown some hindrance affect for the development of stem and pod rots which may be due to variation in the microclimate which might not be congenial for the development of pathogen.

CONCLUSION

Survey conducted at different agro-ecological conditions in Andhra Pradesh during the crop growing season of *kharif*, 2019 and 2020 in groundnut regarding incidence level and pattern of prevalence of the stem rot (*Sclerotium rolfsii*) disease revealed that stem and pod rot incidence was higher during *kharif*, 2020 when compared with *kharif*, 2019. The mean stem rot incidence for the two years revealed that Krishnapuram village, Kothapatnam mandal of Prakasam district (23.56%) recorded highest mean stem rot incidence and Bandarupalli village, Yerpedu mandal of Chittoor district (5.39%) recorded the lowest mean stem rot incidence. The stem rot severity was high in sandy soils with TAG24 variety where groundnut is being grown followed by red sandy loams and least in clay loam soils. The groundnut sole crop recorded high disease incidence when compared with intercrop of red gram. Significant positive correlation was recorded between stem rot, pod rot and leaf spot incidence. Thereby this survey helps in identifying the agro-ecological conditions suitable for groundnut cultivation with least incidence of stem rot which indicates that clay loam soils with an intercrop is suitable for reducing the stem rot incidence. This survey gives an overall idea on disease

situation in different agro-climatic regions of Andhra Pradesh, thus helping the researchers to plan their research priorities.

Data available on request from authors

Conflict of interest: None.

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