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Location of seedborne fungi in farmers saved samples of groundnut variety tag 24

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Abstract

Using ISTA technique, component plating of groundnut seed revealed that seed coat (testa) was greatly infected with 25.84 per cent incidence of seed mycoflora followed by cotyledons (16.36%) and embryo (9.98%). *Aspergillus niger* remained the most frequently occurring fungus in both seed coat and cotyledons with 7.23 and 4.48 per cent incidence, respectively. *A. flavus* (4.46%) and *Macrophomina phaseolina* (3.89%) occupied second and third positions, respectively in the seed coat while *Fusarium* (2.82%) and *A. flavus* (2.66%) ranked second and third, respectively in cotyledons. *Fusarium* (2.55%) was the most frequently occurring fungus in the embryo followed by *A. niger* (2.41%) and *M. phaseolina* (2.41%). *Penicillium* remained the least occurring fungus in all the three components of the seed followed by *Rhizopus*. There was a gradual reduction in the occurrence of saprophytic fungi from seed coat to embryo and increase in the incidence of deep seated pathogenic fungi like *Fusarium* and *M. phaseolina*.

Keywords: Groundnut, component plating, location, seed borne fungi

Introduction

Groundnut is an important crop and is considered as the king of oil seeds. It is cultivated globally in 26.4 million hectares with a total production of 37.1 million tonne and an average productivity is 1400 kg ha⁻¹. India ranks first in area with coverage of about 70 lakh hectares in acreage and second in production with an output of about 85 lakh tonnes. Andhra Pradesh ranks second in area (0.66 M ha), next only to Gujarat (16.26 M ha), third in production with 0.83 million tonnes and fourth in productivity with 1272 kg ha⁻¹ in India (IOPEPC survey of groundnut Crop, Kharif-2017) ^[1].

Post-harvest losses in groundnut range from 10 to 25% of the production in Asia. Fungi cause rotting, seed necrosis, loss in germination and toxification of oil seeds. *Macrophomina phaseolina*, *Rhizoctonia solani*, *Fusarium oxysporum*, *Aspergillus flavus* and *A. niger* were found in groundnut, while *A. flavus* was the predominant species responsible for aflatoxin contamination of crops prior to harvest or during storage. *Aspergillus flavus* and *Aspergillus niger* were responsible for storage rot of groundnut (Ihejirika *et al.*, 2005) ^[2]. Seed coat followed by cotyledon and axis were mostly infected by fungi (Rosetto *et al.*, 2005) ^[3].

Both pathogenic and non-pathogenic fungi are located in different parts of seeds including seed coat, cotyledon and embryo. Knowledge of the exact location of the pathogen in seed or the depth of seed infection by a particular pathogen can be helpful in effective control of seed borne diseases. Hence the present studies were carried out to isolate fungi from different components of groundnut seed.

Materials and Methods

Location of the mycoflora in eleven farmers' saved seed samples of groundnut variety, TAG 24 was studied by component plating method as described by Mathur *et al.* (1975) ^[4]. Four hundred seed of each sample were soaked in sterile water in four replications for eight hours and then dissected using sterilized needles and forceps aseptically. The seed parts *viz.*, seed coat, cotyledon and embryo were separated and sterilized with 1.0 per cent sodium hypochlorite solution before incubating in Petri plate containing 50 ml potato dextrose agar at 28±1 °C for seven days under diurnal cycles of 12 h light and 12 h darkness. Incubated seed parts were examined on eighth day under stereo binocular microscope for seed mycoflora and its location in various parts of seed and finally expressed in percentage.

The incidence of each fungus was recorded as suggested by Aslam *et al.* (2015) [5] by counting the number of seed colonized by fungus in each replication and the per cent colonization of seed component was calculated as follows.

$$\text{Percent incidence} = \frac{\text{Number of infected Seed}}{\text{Total number of seed}} \times 100$$

Results and Discussion

Component plating located the fungi in different parts of groundnut seed. Both pathogenic and non-pathogenic fungi were located in all the parts of seed including seed coat, cotyledon and embryo (Fig 1). Seed coat is the highly infected part of the seed with 25.84 per cent incidence (Table 1, Fig 2) of seed mycoflora followed by cotyledons with 16.36 per cent incidence (Table 2, Fig 2). Embryo is the least infected part with only 9.98 per cent incidence of seed mycoflora (Table 3, Fig 2). *Aspergillus niger* remained the most frequently

occurring fungus in both seed coat and cotyledons with 7.23 and 4.48 per cent incidence, respectively (Fig 3). In seed coat *A. flavus* (4.46%) and *Macrophomina phaseolina* (3.89%) occupied second and third positions, respectively. *Fusarium* (2.82%) and *A. flavus* (2.66%) ranked second and third places, respectively in cotyledons. *Fusarium* (2.55%) is the most frequently occurring fungus in the embryo followed by *A. niger* (2.41%) and *M. phaseolina* (2.41%). *Penicillium* remained the least occurring fungus in all the three components followed by *Rhizopus*.

Rasheed *et al.* (2004) [6] observed that most of the fungi in groundnut seed were located on seed coat (testa) followed by cotyledons and axis. Seed coat was greatly infected by fungi viz., *Alternaria citri* Ellis & Pierce apud Pierce, *Aspergillus flavus* Link ex Gray, *A. niger* van Tieghem, *Fusarium oxysporum* Schlecht, *F. semitectum* Berk & Rav., *F. solani* (Mart) Sacc., *Macrophomina phaseolina* (Tassi) Goid., and *Rhizoctonia solani* Kuhn. Castor.

Table 1: Location of seed borne fungi in farmers' saved samples of groundnut variety TAG 24 (Seed coat)

Village (District)	Sample No.	<i>Aspergillus niger</i>	<i>Aspergillus flavus</i>	<i>Macrophomina Phaseolina</i>	<i>Sclerotium</i> spp.	<i>Alternaria</i> spp.	<i>Rhizopus</i> spp.	<i>Fusarium</i> spp.	<i>Penicillium</i> spp.	Total (%)
Cherukupalli (Guntur)	1	10.50	5.25	2.00	3.00	3.25	2.00	3.75	1.00	30.75
	2	8.75	5.00	2.25	3.50	2.00	1.50	3.25	0.50	26.75
	3	9.00	7.00	2.00	3.00	1.50	2.00	5.00	0.00	29.50
Yazili (Guntur)	4	6.50	3.25	2.50	2.00	1.00	1.75	3.50	0.00	20.50
	5	5.25	3.00	3.75	2.00	1.75	1.00	3.00	1.00	20.75
	6	5.00	4.75	3.00	1.75	3.25	2.50	3.00	0.00	23.25
Dubacherla (West Godavari)	7	4.75	2.00	5.25	2.00	1.00	2.00	3.25	0.25	20.50
	8	4.50	3.00	6.00	3.50	3.50	1.25	4.50	1.00	27.25
	9	6.25	5.50	5.25	3.00	2.25	2.00	3.00	0.00	27.25
Guduru (Nellore)	10	10.00	5.25	6.00	2.50	2.00	2.50	3.50	0.25	32.00
	11	9.00	5.00	4.75	2.00	1.00	1.00	3.00	0.00	25.75
	Mean	7.23	4.46	3.89	2.57	2.05	1.77	3.52	0.36	25.84

Table 2: Location of seed borne fungi in farmers' saved samples of groundnut variety TAG 24 (Cotyledons)

Village (District)	Sample No.	<i>Aspergillus niger</i>	<i>Aspergillus flavus</i>	<i>Macrophomina Phaseolina</i>	<i>Sclerotium</i> spp.	<i>Alternaria</i> spp.	<i>Rhizopus</i> spp.	<i>Fusarium</i> spp.	<i>Penicillium</i> spp.	Total (%)
Cherukupalli (Guntur)	1	5.25	4.50	1.50	4.00	2.75	0.75	3.75	0.50	23.00
	2	5.00	3.00	2.00	2.50	3.00	0.25	2.75	0.25	18.75
	3	5.50	3.25	1.75	2.00	1.75	0.00	3.50	1.00	18.75
Yazili (Guntur)	4	5.00	3.50	1.25	1.25	0.00	1.00	3.00	0.00	15.00
	5	3.25	2.00	2.00	1.00	1.25	0.00	3.00	0.00	12.50
	6	3.00	2.25	2.25	0.50	1.00	0.75	2.00	0.25	12.00
Dubacherla (West Godavari)	7	3.75	1.00	3.00	1.00	0.25	1.00	2.25	0.00	12.25
	8	2.25	2.50	4.25	2.00	2.00	1.00	3.00	0.25	17.25
	9	3.00	2.00	4.00	1.25	1.00	0.00	2.50	0.00	13.75
Guduru (Nellore)	10	7.00	3.25	3.50	0.75	1.25	2.00	3.00	0.25	21.00
	11	6.25	2.00	3.00	1.00	1.00	0.25	2.25	0.00	15.75
	Mean	4.48	2.66	2.59	1.57	1.39	0.64	2.82	0.23	16.36

Table 3: Location of seed borne fungi in farmers' saved samples of groundnut variety TAG 24 (Embryo)

Village (District)	Sample No.	<i>Aspergillus niger</i>	<i>Aspergillus flavus</i>	<i>Macrophomina Phaseolina</i>	<i>Sclerotium</i> spp.	<i>Alternaria</i> spp.	<i>Rhizopus</i> spp.	<i>Fusarium</i> spp.	<i>Penicillium</i> spp.	Total
Cherukupalli (Guntur)	1	2.25	2.25	2.00	1.00	1.00	0.25	4.00	0.25	13.00
	2	3.00	1.50	2.00	0.50	0.75	0.00	3.00	0.00	10.75
	3	2.50	1.00	1.75	0.25	1.00	0.00	3.25	0.50	10.25
Yazili (Guntur)	4	2.00	1.00	1.00	1.25	0.00	1.00	3.00	0.00	9.25
	5	1.00	1.25	2.00	0.00	0.50	0.00	2.00	0.00	6.75
	6	1.75	2.00	2.00	0.00	1.00	0.00	2.00	0.25	9.00
Dubacherla (West Godavari)	7	1.50	0.00	3.00	1.00	0.00	0.25	1.50	0.00	7.25
	8	1.25	0.25	3.50	2.00	1.00	0.50	3.00	0.00	11.50
	9	3.00	1.00	3.25	0.25	1.00	0.00	2.00	0.00	10.50
Guduru (Nellore)	10	4.25	1.25	3.00	0.00	1.00	0.25	2.25	0.25	12.25
	11	4.00	0.25	3.00	0.00	0.00	0.00	2.00	0.00	9.25
	Mean	2.41	1.07	2.41	0.57	0.66	0.20	2.55	0.11	9.98



Fig 1: Seed Component plating

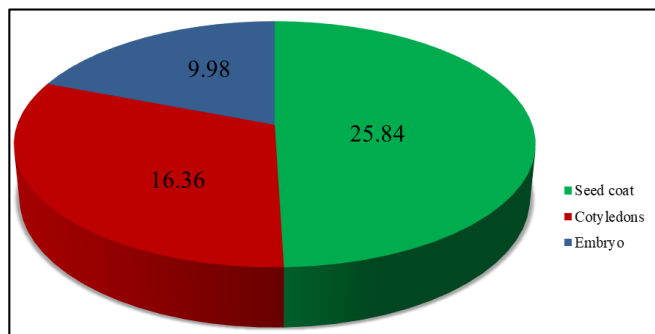


Fig 2: Per cent incidence of mycoflora in different parts of groundnut seed

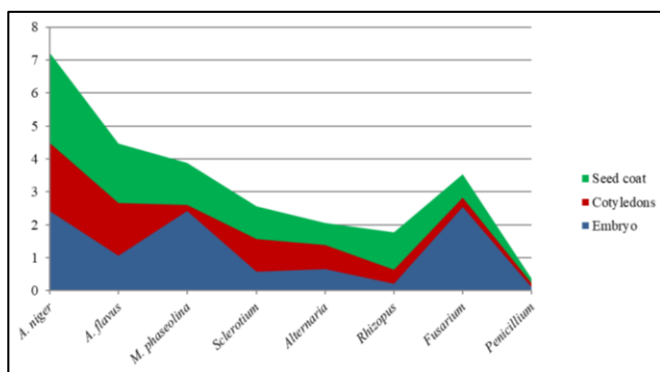


Fig 3: Frequency of fungal species occurring in different seed components of groundnut

Seed coat (6.7%) and cotyledons (3.3%) showed highest incidence of *M. phaseolina* ranging between 2-12% in seed coat, 0-8% in cotyledons while embryonic axis showed least incidence (0.1%) in the range of 0-1% (Nagaraja and Krishnappa, 2016) [7].

Fusarium moniliforme was the only fungus recovered from embryo of three sorghum varieties tested by Sultana *et al.* (1988) [8]. Nahar *et al.* (2005) [9] isolated *Macrophomina phaseolina*, *Rhizoctonia solani* and *Trichoderma harzianum* from all component parts of sunflower seed, whereas, *Fusarium solani* was isolated only from cotyledons and axis. Dawar *et al.* (2007) [10], through component plating in chickpea, recorded that seed coat and cotyledons were infected by large number of fungi followed by axis (radical + plumule). *Macrophomina phaseolina* and *Rhizoctonia solani* were isolated from all three components of the seed *viz.*, seed coat, cotyledons and axis. Ashwini and Giri (2014) [11] showed that per cent association of seed borne fungi in greengram was high on seed coat (5.50) followed by cotyledons (3.50) and embryo (1.50). *Aspergillus flavus* and *A. niger* were majorly confined to seed coat and cotyledons where as *Macrophomina phaseolina* was found in all three components of the seed. Ahmed *et al.* (2016) [12] located seed mycoflora of soybean using component plating method and concluded that cotyledon was the most active site of infection

by fungi as thirteen out of the fifteen tested cultivars showed 40–100% of infection of the cotyledons.

Conclusion

The present results showed that seed coat is the most infected part of the seed followed by cotyledons in the farmers' saved seed samples of groundnut variety, TAG 24. There was a gradual reduction in the occurrence of saprophytic fungi like *A. niger*, *A. flavus*, *Rhizopus* and *Penicillium* from seed coat to embryo and increase in the incidence of deep seated pathogenic fungi like *Fusarium* and *M. phaseolina*.

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