**Screening of Groundnut Cultivars for Resistance to Collar Rot Caused by *Aspergillus niger* van Tieghem**

**Abatract:** Groundnut (*Arachis hypogaea* L.) is an important legume crop in tropical and subtropical areas of the world. Quantitative and qualitative yield losses result from a number of biotic and abiotic factors that impact groundnut growth and development. Among the fungal diseases, *Aspergillus niger* van, Teighem causing collar rot of groundnut sometimes referred to as seedling blight is one of the major diseases of groundnut transmitted through soil and seed. The disease has become a serious problem due to its soil and seed borne nature as well as huge economical losses caused by collar rot pathogen. Presently there are many fungicides available that can be used effectively for the management of disease but due to harmful effects of fungicides the use of disease tolerant cultivars is gaining importance in recent years. In this study the disease rating scale given by Mayee and Datar in1986 were used for checking groundnut cultivars reaction. Groundnut yield losses due to collar rot caused by *Aspergillus niger* are significant. In this study, 30 groundnut genotypes were screened under field conditions over two seasons among these 30 cultivars viz., GJG-32, Girnar-2, Avtar, RG-510, TG-37-A, HNG-10, RG-425 and RG-382 showed moderately resistant reaction, whereas twelve cultivars viz., GJG-11, Kadiri-2 Bold, GJG-19, GG-20, TAG-24, Divya, RG559-3, RG-638, Mallika, KDG-128, RG-578 and Kadiri hatitandra showed moderately susceptible reaction, seven cultivars showed susceptible reaction and three cultivars showed highly susceptible reaction. Out of 30 groundnut cultivars, none of the cultivars showed immune or resistant reaction under field conditions, while eight cultivars showed moderately resistant reaction, twelve cultivars showed moderately susceptible reaction, seven cultivars showed susceptible reaction and three cultivars showed highly susceptible reaction.

**Key words:** Collar Rot, Genotypes, Groundnut, Moderately Susceptible, *Aspergillus niger* van, Teighem

**Introduction**

Groundnut (*Arachis hypogaea* L.) is an important legume crop of tropical and sub-tropical areas of the world, described in 1753 by Linnaeus (Pattee and Young, 1982). It is a member of the genus *Arachis* in the sub tribe Stylosanthinae of tribe Aeschynomeneae belongs from the family Fabaceae. It grown largely for high-quality edible oil and easily digestible proteins (Cobb and Johnson, 1973). It is primarily used as an oil seed crop. A popular source of affordable plant-based protein is kernel. Along with being rich in calcium, thiamine and niacin, it has 26% protein, 48% edible oil, 20% carbs and 3% fibers (Haveri, 2017). Groundnut oil is also used as edible oil and for the manufacturing of soap, margarine and other products such as sweets and butter. The shells may be used as manure, animal feed, fuel as a source of energy and raw material for many products (Vankatanarayana, 1952). The residual oil cake contains substantial amounts of nitrogen, phosphorous and potassium and is used as a fertilizer. Its haulms and leaves serve as rich source of cattle feed and raw material for preparation of silage. It plays an important role in the dietary requirements of resources for poor women and children. Cultivation of groundnut helps to improve soil fertility, as it incorporates substantial amount of nitrogen in the soil. At every stage of growth, from seeding to harvest and storage, the crop suffers significantly from the attack of multiple diseases, most of which are caused by fungi. Groundnut experience the same range of diseases carried on by fungus and other microbes as other crops including many tissue injuries, disruptions to the photosynthetic process and significant yield losses are caused by diseases. Among the fungal diseases *Aspergillus niger* van Teighem causing collar rot of groundnut sometimes referred to as seedling blight is one of the major diseases of groundnut transmitted by soil and seed. Groundnut collar rot is prevalent throughout almost all of the world's groundnut-growing regions and is especially seen in countries with tropical and subtropical climates where high temperature is experienced during the rainy season. Jochem (1926) from Java was the first to report this disease, But Jain and Nema (1952) in India were the first to document the *Aspergillus* blight on groundnut caused by *A. niger*. Bakhetia (1983) reported that the disease incidence in Rajasthan might reach up to 50.00 per cent. Dighule *et al.* (2018) calculated that *Aspergillus niger* van Teighem caused groundnut collar rot will result in crop losses in Maharashtra ranging from 28.00 to 50.00 per cent. The first sign of the disease, according to Jain and Nema (1952) was the development of round, brownish patches on the cotyledons. The portion that was discoloured quickly turned soft and rotten, spreading to the stem and hypocotyls which similarly turned yellow, deteriorated, collapsed and the damaged stem breaks off. The surface of the affected regions showed black fructifications of the pathogen and greyish white mycelia. Mycelia and spores borne by seeds and debris in the soil have been shown to be the main source of the collar rot pathogen inoculum (Nema *et al.* 1955). In sandy soil it is a more severe and yield-reducing under biotic stress condition (Gibson 1953 and Chohan 1965a). Since, the disease has become a serious problem due to soil and seed borne nature as well as huge economical losses caused by collar rot pathogen. Presently there are so many fungicides are available which can be used effectively for management of disease but due to harmful effects of fungicides use of disease tolerant cultivar were gaining importance in recent years.

**Materials and Methods**

30 cultivars of groundnut were screened against collar rot of groundnut to locate the sources of resistance under natural field conditions at Instructional Farm, College of Agriculture, Jodhpur, Agricultural University, Jodhpur during *Kharif* season 2023 and 2024. Observations on per cent seed germination and per cent disease incidence were recorded at 30, 45 and 60 days after sowing. After estimating disease incidence, the cultivars were categorized into different groups based on disease reaction *viz*., immune, resistant, moderately resistant, moderately susceptible, susceptible and highly susceptible as per (Mayee and Datar, 1986).

Per cent disease incidence was assessed by using the formula as follows.

|  |  |  |
| --- | --- | --- |
| Per cent disease incidence = | Number of infected plants | X 100 |
| Total number of plants |

**Table 1: - The following Groundnut cultivars were selected for the present study**

|  |  |  |  |
| --- | --- | --- | --- |
| **S. NO.** | **Name of cultivars** | | |
| 1 | Girnar-4 | 16 | Pratap mungphali -1 |
| 2 | GJG-32 | 17 | RG559-3- |
| 3 | GJG-11 | 18 | RG-638 |
| 4 | Kadiri-2 Boald | 19 | TG-37-A |
| 5 | GJG-19 | 20 | Mallika |
| 6 | Girnar- 2 | 21 | HNG-69 |
| 7 | Girnar-1 | 22 | RG-425 |
| 8 | HNG-10 | 23 | Girnar-5 |
| 9 | HNG-123 | 24 | KDG-128 |
| 10 | Avtar | 25 | RG-382 |
| 11 | GG-20 | 26 | KDG-123 |
| 12 | RG-510 | 27 | RG-578 |
| 13 | TAG-24 | 28 | Kadiri hatitandra |
| 14 | Divya | 29 | Mandor local |
| 15 | Pratap mungphali - 2 | 30 | Jodhpur local |

**Table 2: - Reaction of cultivars against collar rot diseases**

|  |  |  |
| --- | --- | --- |
| **Disease rating** | **Disease incidence** | **Reaction** |
| **0** | No symptom | Immune |
| **1** | < 1 % mortality | Resistant |
| **3** | 1-10 % mortality | Moderately resistant |
| **5** | 11-20 % mortality | Moderately susceptible |
| **7** | 21-50 % mortality | Susceptible |
| **9** | >51 % mortality | Highly susceptible |

**Results**

**Screening of groundnut** **cultivars against collar rot**

The results of first year data *Kharif* season 2023 revealed that none of the groundnut cultivar were found immune and resistant against collar rot. Although, GJG-32, Girnar-2, Avtar, RG-510, TG-37-A, HNG-10, RG-425 and RG-382 were found moderately resistant as these showed 8.01, 6.68, 8.34, 7.38, 5.70, 4.75, 8.45 and 8.45 per cent disease incidence, respectively. GJG-11, Kadiri-2 Bold, GJG-19, GG-20, TAG-24, Divya, RG559-3, RG-638, Mallika, KDG-128, RG-578 and Kadiri harithanhra were found moderately susceptible these showed 17.70, 16.45, 15.08, 16.19, 17.09, 16.67, 15.95, 14.14, 16.84, 16.67, 15.82 and 15.17 per cent disease incidence, respectively. Girnar-4, Girnar-1, HNG-69, HNG-123, Pratap mungphali–2, Pratap mungphali -1 and Girnar-5 found susceptible these showed 47.09, 42.79, 38.38, 40.50, 44.31, 29.45 and 45.45 per cent disease incidence, respectively. Further, three varieties namely Mandor local (63.06 % incidence), Jodhpur local (60.82 % incidence) and KDG-123 (56.75 % incidence) were found highly susceptible to the disease.

The results of second year *Kharif* season 2024 also depicted a similar trend of results as in *Kharif* season 2023. Among these 30 groundnut cultivars, GJG-32, Girnar-2, Avtar, RG-510, TG-37-A, HNG-10, RG-425 and RG-382 were found moderately resistant as these showed 6.68, 5.30, 7.28, 5.54, 4.35, 2.90, 7.15 and 7.11 per cent disease incidence, respectively. GJG-11, Kadiri-2 Bold, GJG-19, GG-20, TAG-24, Divya, RG559-3, RG-638, Mallika, KDG-128, RG-578 and Kadiri harithanhra were found moderately susceptible these showed 16.43, 14.78, 14.04, 14.49, 15.70, 14.50, 14.14, 13.38, 15.20, 15.15, 14.62 and 13.84 per cent disease incidence, respectively. Girnar-4, Girnar-1, HNG-69, HNG-123, Pratap mungphali –2, Pratap mungphali -1 and Girnar-5 found susceptible these showed 45.74, 39.32, 36.28, 37.84, 41.70, 28.04, and 42.85 per cent disease incidence, respectively. Further, three varieties namely Mandor local (62.35 % incidence), Jodhpur local (58.84 % incidence) and KDG-123 (55.09 % incidence) were found highly susceptible to the disease.

The results of pooled data revealed that none of the groundnut cultivar were found immune and resistant against collar rot while GJG-32, Girnar-2, Avtar, RG-510, TG-37-A, HNG-10, RG-425 and RG-382 were found moderately resistant as these showed 7.35, 6.01, 7.87, 6.51, 5.04, 3.85, 7.82 and 7.81 per cent disease incidence, respectively. GJG-11, Kadiri-2 Bold, GJG-19, GG-20, TAG-24, Divya, RG559-3, RG-638, Mallika, KDG-128, RG-578 and Kadiri harithanhra were found moderately susceptible these showed 17.09, 15.77, 14.57, 15.41, 16.54, 15.58, 15.07, 13.77, 15.97, 15.91, 15.27 and 14.53 per cent disease incidence, respectively. Girnar-4, Girnar-1, HNG-69, HNG-123, Pratap mungphali –2, Pratap mungphali -1, and Girnar-5 found susceptible these showed 46.44, 41.16, 37.39, 39.20, 43.08, 28.53 and 44.19 per cent disease incidence, respectively. Further, three varieties namely Mandor local (62.78 % incidence), Jodhpur local (59.88 % incidence) and KDG-123 (55.96 % incidence) were found highly susceptible to the disease.

**Table 3: - Screening of groundnut cultivars against collar rot disease during *kharif* season 2023 and 2024**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Cultivars** | **Average germination (%)** | **Mean PDI at 30 DAS** | **Mean PDI at 45 DAS** | **Mean PDI at 60 DAS** | **Mean 2023** | **Mean PDI at 30 DAS** | **Mean PDI at 45 DAS** | **Mean PDI at 60 DAS** | **Mean 2024** | **Pooled Collar rot incidence** |
| 1 | Girnar-4 | 80.13 | 33.33 | 52.38 | 55.56 | 47.09 | 32.22 | 50.16 | 54.84 | 45.74 | 46.44 |
| 2 | GJG-32 | 90.38 | 5.68 | 8.45 | 9.90 | 8.01 | 4.35 | 7.13 | 8.57 | 6.68 | 7.35 |
| 3 | GJG-11 | 83.97 | 15.24 | 18.21 | 19.66 | 17.70 | 13.87 | 16.91 | 18.50 | 16.43 | 17.09 |
| 4 | Kadiri-2 Bold | 85.90 | 14.04 | 16.86 | 18.46 | 16.45 | 12.86 | 16.01 | 15.46 | 14.78 | 15.77 |
| 5 | GJG-19 | 82.05 | 10.97 | 15.58 | 18.69 | 15.08 | 9.39 | 13.94 | 18.79 | 14.04 | 14.57 |
| 6 | Girnar-2 | 89.10 | 4.29 | 7.19 | 8.57 | 6.68 | 2.84 | 5.87 | 7.19 | 5.30 | 6.01 |
| 7 | Girnar-1 | 77.56 | 35.14 | 43.32 | 49.92 | 42.79 | 32.92 | 37.51 | 47.54 | 39.32 | 41.16 |
| 8 | HNG-69 | 78.21 | 29.09 | 40.61 | 45.45 | 38.38 | 28.47 | 36.89 | 43.49 | 36.28 | 37.39 |
| 9 | HNG-123 | 78.21 | 31.19 | 41.03 | 49.29 | 40.50 | 29.74 | 37.84 | 45.95 | 37.84 | 39.20 |
| 10 | Avtar | 90.38 | 6.95 | 8.40 | 9.68 | 8.34 | 5.75 | 7.34 | 8.73 | 7.28 | 7.87 |
| 11 | GG-20 | 80.77 | 14.14 | 15.66 | 18.76 | 16.19 | 11.21 | 14.55 | 17.73 | 14.49 | 15.41 |
| 12 | RG-510 | 85.90 | 5.93 | 7.38 | 8.83 | 7.38 | 3.04 | 6.07 | 7.52 | 5.54 | 6.51 |
| 13 | TAG-24 | 82.05 | 15.60 | 17.05 | 18.63 | 17.09 | 14.04 | 15.35 | 17.71 | 15.70 | 16.54 |
| 14 | Divya | 78.21 | 14.52 | 16.11 | 19.37 | 16.67 | 11.60 | 13.44 | 18.45 | 14.50 | 15.58 |
| 15 | Pratap mungphali - 2 | 77.56 | 39.44 | 45.87 | 47.62 | 44.31 | 38.39 | 41.57 | 45.15 | 41.70 | 43.08 |
| 16 | Pratap mungphali -1 | 78.85 | 24.21 | 29.05 | 33.89 | 29.05 | 23.22 | 28.15 | 32.75 | 28.04 | 28.53 |
| 17 | RG559-3 | 82.69 | 12.34 | 16.96 | 18.54 | 15.95 | 10.91 | 14.24 | 17.27 | 14.14 | 15.07 |
| 18 | RG-638 | 83.97 | 10.55 | 13.66 | 18.21 | 14.14 | 10.78 | 12.23 | 17.14 | 13.38 | 13.77 |
| 19 | TG-37-A | 89.10 | 4.29 | 5.68 | 7.13 | 5.70 | 2.90 | 4.35 | 5.80 | 4.35 | 5.04 |
| 20 | Mallika | 82.69 | 13.78 | 16.81 | 19.91 | 16.84 | 10.91 | 15.76 | 18.94 | 15.20 | 15.97 |
| 21 | HNG-10 | 89.10 | 2.84 | 4.29 | 7.13 | 4.75 | 1.45 | 2.90 | 4.35 | 2.90 | 3.85 |
| 22 | RG-425 | 90.38 | 7.07 | 8.45 | 9.84 | 8.45 | 5.74 | 7.13 | 8.57 | 7.15 | 7.82 |
| 23 | Girnar-5 | 77.56 | 39.44 | 47.62 | 49.29 | 45.45 | 35.06 | 45.16 | 48.33 | 42.85 | 44.19 |
| 24 | KDG-128 | 91.67 | 12.51 | 18.02 | 19.47 | 16.67 | 11.51 | 15.62 | 18.34 | 15.15 | 15.91 |
| 25 | RG-382 | 90.38 | 7.00 | 8.45 | 9.90 | 8.45 | 5.68 | 7.07 | 8.59 | 7.11 | 7.81 |
| 26 | KDG-123 | 77.56 | 50.71 | 57.30 | 62.22 | 56.75 | 48.42 | 55.09 | 61.77 | 55.09 | 55.96 |
| 27 | RG-578 | 82.69 | 12.27 | 15.30 | 19.91 | 15.82 | 10.89 | 14.14 | 18.83 | 14.62 | 15.27 |
| 28 | Kadiri harithanhra | 83.97 | 12.21 | 15.17 | 18.14 | 15.17 | 10.78 | 13.68 | 17.08 | 13.84 | 14.53 |
| 29 | Mandor local | 69.87 | 54.58 | 65.50 | 69.10 | 63.06 | 53.70 | 64.81 | 68.52 | 62.35 | 62.78 |
| 30 | Jodhpur local | 71.15 | 55.46 | 60.82 | 66.18 | 60.82 | 54.58 | 58.28 | 63.65 | 58.84 | 59.88 |

\*Average of three replications

**Table 4: - Response of different groundnut cultivars against collar rot of groundnut**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Groups** | **Disease incidence (%)** | **Cultivars reaction** | **Details of cultivars** | **Total** |
| **Group I** | No symptom | Immune | Nil | 0 |
| **Group II** | < 1% | Resistant (R) | Nil | 0 |
| **Group III** | 1-10% | Moderately Resistant (MR) | GJG-32, Girnar-2, Avtar, RG-510, TG-37-A, HNG-10, RG-425, RG-382 | 8 |
| **Group IV** | 11-20% | Moderately Susceptible (MS) | GJG-11, Kadiri-2 Bold, GJG-19, GG-20, TAG-24, Divya, RG559-3, RG-638, Mallika, KDG-128, RG-578, Kadiri hatitandra | 12 |
| **Group V** | 21-50% | Susceptible (S) | Girnar-4, Girnar-1, HNG-69  3, HNG-123, Pratap mungphali – 2, Pratap mungphali -1, Girnar-5 | 7 |
| **Group VI** | More than 50% | Highly susceptible (HS) | KDG-123, Mandor local, Jodhpur local | 3 |

**Discussion**

In general, testing of resistance is a continuous process because of evolution of new biotypes of the pathogen or it may be due to break down of resistance in host genotypes. Plant diseases management with the principal of host resistance is an economic and environmentally safe. In the present case, out of 30 cultivars/genotypes, tested for two consecutive cropping seasons no were found resistant while eight cultivars/genotypes, *i.e*. (GJG-32, Girnar-2, Avtar, RG-510, TG-37-A, HNG-10, RG-425 and RG-382) were found moderately resistance, twelve moderately susceptible (GJG-11, Kadiri-2 Bold, GJG-19, GG-20, TAG-24, Divya, RG559-3, RG-638, Mallika, KDG-128, RG-578 and Kadiri hatitandra) seven susceptible (Girnar-4, Girnar-1, HNG-69, HNG-123, Pratap mungphali – 2, Pratap mungphali -1 and Girnar-5) three highly susceptible (KDG-123, Mandor local and Jodhpur local) to the pathogen. None of the cultivars/genotypes were found immune against the disease. Our results are in agreement with the findings of Bhatia and Gangopadhyay (1996), Nathawat *et al*. (2014) and Kumari *et al*. (2016). Bhatia and Gangopadhyay (1996) have been evaluated of 600 groundnut germplasm for three consecutive years, among these US 12A, US71 and GR 3 were found free from collar rot. Other three entries, *viz*., Shulamith, Lambuy and U-4-47-7 showed highly resistant reaction. Seventeen entries were resistant, 11 moderately resistant and majority of the entries showed susceptible to highly susceptible reaction. Nathawat *et al*. (2014) evaluated five varieties against collar rot of groundnut caused by *A. niger* and only GG 2 was found tolerant to collar rot, while GG 5, GG 7, GG 20 and GG 37 were susceptible to highly susceptible. Kumari *et al*. (2016) have also been screened 14 varieties of groundnut against collar rot. Among these, five varieties were found moderately resistance (RG-425, CSNG-1 9-1, SNG-69, GG-21 and RG-559-3), six were susceptible (RG-578, RG-378, RG-582, M- 13, Girnar-2 and SNG-123) and three were found highly susceptible (RG-382, RG-51 0 and Chitra). Divya Rani *et al*. (2018) also Screened 40 advance breeding lines against collar rot (*A. niger*) in a greenhouse condition along with susceptible check JL-24, J-11 and TMV-2. Out of 40 lines, 10 lines were found to be resistant and have less than 15% disease incidence, according to the results. The genotypes ICGV 00202, ICGV 00211, ICGV 86590, ICGV 91114, ICGV 05155, ICGV 00350, ICGV 93261, ICGV 92195, ICGV 92035 and ICR 48 are among those that show resistance. Similarly, Nathawat et al. (2021) evaluated forty genotypes/varieties of groundnut revealed that none of the entries was found free or resistance from the disease. However, five genotypes /varieties were found moderately resistant (< 20%) against collar rot disease Girnor-3, HNG-69, TG-37, ICMS-6 and ICMS-28. Twenty-five genotypes/varieties were found tolerant (20-40%) against collar rot disease (GG-21, GG-16, RG-559, HPS-1, CSMG-2003, Malika, K-7, K-9, HNG-123, ICMS-117, HNG-123, K-4, K-6, ISL-16, ICMS-149, ICMS-142, ICMS-4, ICMS-79, ICMS-13, ICMS-26, ICMS-83, ICMS-114, ICMS-100, ICMS-32 and ICMS-101).

**Conclusion**

Among 30 cultivars of groundnut, none of the cultivars showed immune or resistant reactions under field conditions, while GJG-32, Girnar-2, Avtar, RG-510, TG-37-A, HNG-10, RG-425 and RG-382 were found moderately Resistant, GJG-11, Kadiri-2 Bold, GJG-19, GG-20, TAG-24, Divya, RG559-3, RG-638, Mallika, KDG-128, RG-578 and Kadiri hatitandra were found moderately susceptible while rest were found susceptible and highly susceptible to the disease.

**Disclaimer (Artificial intelligence)**

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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