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Screening and identification of foliar disease-resistant groundnut (*Arachis hypogaea* L.) genotypes for late leaf spot and rust resistance

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Abstract
Groundnut (*Arachis hypogaea* L.) is an important oilseed crop, but its productivity is greatly affected by foliar fungal diseases, particularly late leaf spot (LLS) caused by *Phaeoisariopsis personata* Berk. & Curt. V. Arx) and rust caused by (*Puccinia arachidis* Speg.) The present study was conducted to identify groundnut genotypes resistant to these diseases and to evaluate their yield performance under artificial epiphytotic conditions. Thirty groundnut genotypes, including resistant and susceptible checks, were screened for disease reaction. Disease severity was recorded at 75, 90 and maturity days after sowing (DAS) using Per cent Disease Index (PDI), along with pod yield and kernel yield under disease stress. Analysis of variance revealed highly significant differences among genotypes for disease severity and yield traits, indicating the presence of substantial genetic variability. At maturity, late leaf spot severity ranged from 4.44 to 92.23 per cent, while rust severity varied from 6.67 to 92.22 per cent. Eight genotypes, namely K 1812, Nithya Haritha, Pragathi, K 8, TCGS 2019, TCGS 2555, TCGS 2599 and GPBD 4, were resistant to late leaf spot. Seven genotypes, viz., K 1812, Nithya Haritha, K 7, K 8, TCGS 2019, TCGS 2549 and GPBD 4, exhibited resistance to rust. Among the evaluated entries, K 1812, TCGS 2019, K 7, Nithya Haritha and K 8 recorded low disease severity and higher pod and kernel yields under disease pressure. In contrast, TAG 24, TCGS 2369, TCGS 2491 and K 6 were highly susceptible and suffered considerable yield losses. The identified resistant genotypes can be utilized as potential donor parents for developing high-yielding and foliar disease-resistant groundnut cultivars.

Keywords: Artificial screening, disease resistance, foliar diseases, late leaf spot, rust

Introduction
Groundnut (*Arachis hypogaea* L.) is an important oilseed and food legume crop cultivated extensively in tropical and subtropical regions of the world. It serves as a major source of edible oil, protein, vitamins, and minerals, while also contributing substantially to livestock feed through its haulms. Despite its economic significance, groundnut productivity is constrained by several biotic and abiotic stresses, among which foliar fungal diseases are particularly detrimental.

Late Leaf Spot (LLS), caused by *Phaeoisariopsis personata* (Berk. & M.A. Curtis) S.A. Khan & M. Kamal, and rust, caused by *Puccinia arachidis* Speg., are the most destructive foliar diseases of groundnut. These diseases occur widely in groundnut-growing regions and can cause severe defoliation, reduction in photosynthetic activity, premature senescence, and significant losses in pod and haulm yield (Subrahmanyam *et al.*, 1984) [20]. Under favorable environmental conditions, yield losses due to the combined incidence of Late Leaf Spot and rust may exceed 50–70% in susceptible cultivars (Subrahmanyam *et al.*, 1985) [18].

Chemical control through fungicide applications is effective in managing these diseases; however, repeated use increases production costs and raises concerns regarding environmental safety and sustainability. Host plant resistance is therefore considered the most economical and environmentally sound strategy for disease management (Nigam *et al.*, 1991) [13]. The development of resistant cultivars requires the identification of reliable sources of resistance from available germplasm and breeding materials. Considerable genetic variability for resistance to Late Leaf Spot and rust has been reported among groundnut genotypes (Dwivedi *et al.*, 2002) [5]. Screening and evaluation of diverse genotypes under disease pressure facilitate the identification of resistant lines that can serve as valuable donor parents in resistance breeding programmes. Moreover, the incorporation of disease resistance into high-yielding backgrounds can contribute to the development of cultivars with stable productivity under disease-prone environments.

Therefore, the present study was undertaken to evaluate groundnut genotypes for their reaction to Late Leaf Spot and rust diseases and to identify promising resistant genotypes that can be utilized in future breeding programmes aimed at improving disease resistance and sustaining groundnut productivity.

Material and methods
The field experiment was conducted during *rabi* 2025–26 at the dry land Farm, S.V. Agricultural College, Tirupati, Andhra Pradesh. The experimental farm is situated in the Southern Agro-Climatic Zone of Andhra Pradesh and experiences climatic conditions that are conducive for the development of foliar diseases under artificially induced epiphytotic situations. A total of thirty groundnut (*Arachis*

hypogaea L.) genotypes, comprising twenty-eight test entries along with two checks, were utilized in the study. The genotype GPBD 4 was used as the resistant check, whereas K 6 served as the susceptible check for comparison of disease reactions.

The experiment was established in a Randomized Block Design (RBD) with two replications. Each genotype was grown in three rows of 3 m length, maintaining a spacing of 30 cm between rows and 10 cm between plants. To facilitate uniform spread of disease, susceptible infector rows were planted at a ratio of one infector row for every four test rows. Recommended agronomic and crop management practices were followed throughout the cropping period, except for the application of fungicides, which were intentionally omitted to encourage disease development.

Artificial disease pressure was created using infected leaves collected from groundnut fields affected by late leaf spot and rust. The infected leaves were soaked in water for 4–5 hours to release conidiaspores of *Phaeoisariopsis personata* and uredospores of *Puccinia arachidis*. The spore suspension was filtered through muslin cloth and adjusted to a concentration of approximately 10^3–10^4 CFU ml^{-1}.

The inoculum was sprayed on infector rows and test genotypes using a knapsack sprayer during evening hours. Sprinkler irrigation was provided regularly to maintain high humidity and promote disease development. Inoculations were repeated at weekly intervals until uniform disease establishment was achieved, as confirmed by the appearance of characteristic late leaf spot lesions and rust pustules.

The severity of late leaf spot and rust diseases was assessed at 75 days after sowing, 90 days after sowing and at crop maturity using the standard 1–9 disease rating scale proposed by Subrahmanyam *et al.* (1995) [19]. The recorded disease scores were converted into Per cent Disease Index (PDI) using the following equation:

Based on the PDI values, genotypes were classified into different reaction groups such as resistant, moderately resistant, moderately susceptible and susceptible. Observations on pod yield per plant and kernel yield per plant were recorded under disease-stress conditions. Similar observations were also obtained from protected plants to determine the extent of yield loss caused by foliar diseases. The percentage reduction in pod yield attributable to disease incidence was estimated using the following formula (Gireesha *et al.*(2024) [2]:

Where,

Y_p = Pod yield of healthy or protected genotype (g plant^{-1})

Y_t = Pod yield of treated genotype (g plant^{-1})

The data recorded on disease severity, pod yield and kernel yield were subjected to analysis of variance (ANOVA) appropriate for a Randomized Block Design, following the procedures described by Panse and Sukhatme (1985) [15]. The significance of differences among genotypes was tested using the standard error of difference (SEd) at 5 and 1 per cent levels of probability.

Results and Discussion

Analysis of variance (Table 1.1) revealed highly significant differences among genotypes for late leaf spot severity, rust severity, pod yield and kernel yield. The highly significant mean squares indicated substantial genetic variability among the evaluated genotypes for resistance and yield-related traits. Such variability provides opportunities for effective selection and breeding for disease resistance. These findings corroborate earlier reports of Asish *et al.*(2014), Divyadharsini *et al.* (2016), Wankhade *et al.* (2021) and Mandloi *et al.* (2022) [4, 11, 22], who reported considerable variability for foliar disease resistance in groundnut populations.

Table 1: Analysis of Variance for Foliar Disease Severity Traits in Thirty Groundnut Genotypes

S.No.	Characters	Mean sum of squares		
		Replications (df:1)	Genotypes (df:29)	Error (df:29)
1.	LLS @75DAS	10.06	201.29**	2.98
2.	LLS @90DAS	13.08	318.35**	3.17
3.	LLS @ 105DAS	14.30	691.83**	3.61
4.	RUST @75DAS	14.83	271.93**	4.58
5.	RUST @90DAS	12.39	398.86**	4.32
6.	RUST @105DAS	9.70	682.45**	2.42
7.	Pod yield plant^{-1}	1.28	43.53**	6.18
8.	Kernel yield plant^{-1}	1.13	23.46**	3.89

**Significant at 1% probability level

Mean performance of groundnut genotypes for foliar disease reaction and yield traits

The evaluation of thirty groundnut genotypes under artificial epiphytotic conditions revealed considerable variation for late leaf spot (LLS), rust severity and yield traits (**Table 1**.2). Late leaf spot severity increased from 2.22–53.34 per cent at 75 DAS to 2.22–72.22 per cent at 90 DAS and 4.44–92.23 per cent at maturity, with corresponding mean values of 16.67, 28.11 and 37.33 per cent, respectively. Similarly, rust severity ranged from 2.22–55.56 per cent at 75 DAS, 5.56–72.22 per cent at 90 DAS and 6.67–92.22 per cent at maturity, with mean values of 17.67, 28.41 and 38.63 per cent, respectively. Genotypes GPBD 4, TCGS 2555, TCGS 2019, Nithya Haritha, K 1812 and K 8 consistently exhibited lower disease severity for both foliar diseases, whereas TAG 24, TCGS 2369, TCGS 2491 and K 6 were highly susceptible. Pod yield per plant varied from 10.58 to 41.20 g with a mean of 23.80 g, while kernel yield per plant ranged from 13.91 to 38.70 g with a mean of 16.61 g. Genotypes K 1812, K 7, TCGS 2019, Nithya Haritha, Kadiri Harithandra and K 8 recorded superior yield performance under disease pressure. Overall, lower disease severity was associated with higher productivity, highlighting the potential of these genotypes as valuable sources of resistance and yield improvement in groundnut breeding programmes.

Screening of genotypes for LLs and rust resistance

Disease reaction at maturity was considered for categorization of genotypes, as it reflects the cumulative effect of pathogen infection throughout the crop growth period and provides a more reliable assessment of resistance than observations recorded at earlier stages. Disease severity recorded at 75 and 90 DAS may not fully represent the actual resistance status of a genotype due to continued disease development with crop advancement.

Based on disease severity at maturity, eight genotypes, namely K 1812, Nithya Haritha, Pragathi, K 8, TCGS 2019, TCGS 2555, TCGS 2599 and GPBD 4, were identified as resistant to late leaf spot (Table 1.3). Among these, GPBD 4 and TCGS 2555 recorded the lowest disease severity (4.44%), followed by Nithya Haritha (6.67%) and TCGS 2019 and TCGS 2599 (7.78%). Similarly, seven genotypes, namely K 1812, Nithya Haritha, K 7, K 8, TCGS 2019, TCGS 2549 and GPBD 4, exhibited resistant reactions against rust (Table 1.4), with K 8 recording the lowest rust severity (6.67%), followed by K 7 and TCGS 2019 (7.78%).

In contrast, TAG 24, TCGS 2369, TCGS 2491 and K 6 exhibited high susceptibility to both diseases, while TCGS 2456 was particularly susceptible to rust. The wide range of disease severity observed among the genotypes indicated substantial genetic variability for resistance to foliar fungal diseases. Similar variability for resistance to late leaf spot and rust has been reported by Dinakaran *et al.* (1992), Waliyar *et al.* (1993), Divyadharsini *et al.* (2016) [3, 4, 21], Roy (2017), Mandloi *et al.* (2022), Bhat *et al.* (2024), Mushtaq *et al.* (2024), Pandey *et al.* (2024) and Saravanan *et al.* (2025) [2, 11, 12, 14, 17].

The resistant reaction exhibited by GPBD 4 corroborates earlier reports identifying it as a stable and durable source of resistance to both late leaf spot and rust (Bhat *et al.*, 2024) [12]. The progressive increase in disease severity from 75 DAS to maturity in susceptible genotypes may be attributed to continuous pathogen multiplication and favourable environmental conditions that enhanced disease development. The identification of resistant genotypes in the present study highlights their potential use as donor parents in breeding programmes aimed at developing high-yielding groundnut cultivars with durable resistance to foliar diseases.

Table 2: Mean Performance of Thirty Groundnut Genotypes for Foliar Disease Resistance and Yield under Disease Stress

Genotypes	LLS PDI (%)			Rust PDI (%)			Yield plant^{-1}	
	75 DAS	90 DAS	Maturity	75 DAS	90 DAS	Maturity	PYPD	KYPD
K 1812	4.44 (12.16)**	7.78 (16.16)	8.89 (17.35)	2.22 (8.57)	7.78 (16.16)	8.89 (17.22)	41.20	38.70
Dheeraj	15.56 (23.18)	30.00 (33.21)	34.45 (35.93)	24.45 (29.54)	33.34 (35.22)	50.00 (45.00)	15.28	15.28
Nithya Haritha	6.67 (17.37)	6.67 (14.97)	6.67 (14.97)	5.56 (13.57)	7.78 (16.16)	10.00 (18.41)	30.34	33.34
Pragathi	2.22 (8.57)	7.78 (16.16)	10.00 (18.19)	14.45 (22.32)	23.33 (28.88)	30.00 (33.21)	28.38	28.38
K 7	4.44 (12.16)	7.78 (15.66)	11.11 (19.47)	2.22 (8.57)	5.56 (13.57)	7.78 (16.16)	35.21	35.21
TAG 24	38.89 (38.58)	64.44 (53.39)	91.11 (72.78)	38.89 (38.58)	64.44 (53.39)	91.11 (72.78)	10.58	11.58
ICAR Konark	13.34 (21.35)	16.67 (23.99)	18.89 (25.75)	20.00 (26.53)	32.22 (34.58)	41.11 (39.88)	22.57	22.57
Kadiri Amaravathi	13.33 (21.41)	25.56 (30.36)	28.89 (32.50)	10.00 (18.41)	25.56 (30.36)	26.67 (31.09)	15.58	15.58
Rohini	16.67 (24.09)	27.78 (31.76)	30.00 (33.21)	16.67 (24.09)	27.78 (31.76)	30.00 (33.21)	25.90	25.90
K 8	4.45 (10.37)	7.78 (16.16)	10.00 (18.19)	3.33 (10.37)	6.67 (14.76)	6.67 (14.97)	29.09	29.09
Kadiri Harithandra	14.45 (19.47)	24.45 (29.61)	30.00 (33.21)	3.33 (10.37)	12.22 (20.44)	26.67 (31.09)	30.88	30.88
ICGV 00350	12.22 (20.44)	32.22 (34.58)	41.11 (39.88)	11.11 (19.47)	16.67 (24.09)	32.22 (34.58)	15.54	15.54
TCGS 2019	3.33 (10.37)	7.78 (16.16)	7.78 (16.16)	4.44 (12.16)	7.78 (16.16)	7.78 (16.16)	33.48	35.98
TCGS 2306	18.89 (25.68)	46.67 (43.08)	58.89 (50.12)	18.89 (25.68)	46.67 (43.08)	58.89 (50.12)	17.77	18.77
TCGS 2369	41.11 (39.88)	61.11 (51.42)	92.22 (73.84)	41.11 (39.88)	61.11 (51.42)	92.22 (73.84)	18.39	18.89
TCGS 2447	12.22 (20.44)	23.33 (28.88)	27.78 (31.80)	12.22 (20.44)	23.33 (28.88)	27.78 (31.80)	23.62	23.62
TCGS 2452	13.34 (21.35)	21.11 (27.34)	28.89 (32.50)	13.34 (21.35)	21.11 (27.34)	28.89 (32.50)	23.09	23.09
TCGS 2456	12.22 (20.44)	27.78 (31.80)	36.67 (37.27)	55.56 (48.19)	72.22 (58.20)	85.56 (67.68)	13.91	13.91
TCGS 2474	18.89 (25.75)	36.67 (37.27)	53.33 (46.91)	15.56 (23.18)	18.89 (25.75)	25.56 (30.36)	19.04	19.04
TCGS 2484	21.11 (27.34)	36.67 (37.25)	57.78 (49.48)	21.11 (27.34)	36.67 (37.25)	58.89 (50.12)	21.69	21.69
TCGS 2491	43.33 (41.17)	62.22 (52.07)	88.89 (70.62)	43.33 (41.17)	66.67 (54.78)	88.89 (70.62)	14.37	14.37
TCGS 2549	12.22 (20.44)	21.11 (27.28)	28.89 (32.50)	3.33 (10.37)	7.78 (16.16)	8.89 (17.35)	27.18	27.18
TCGS 2555	2.22 (8.57)	2.22 (8.57)	4.44 (12.17)	4.45 (11.77)	5.56 (13.57)	17.78 (24.94)	20.96	19.22
TCGS 2557	12.22 (20.44)	21.11 (27.34)	24.44 (29.63)	12.22 (20.44)	21.11 (27.34)	24.44 (29.63)	23.64	23.64
TCGS 2599	3.33 (10.37)	7.78 (16.16)	7.78 (16.16)	2.22 (8.57)	7.78 (16.16)	12.22 (20.44)	20.33	20.33
TCGS 2604	26.67 (31.07)	40.00 (39.21)	46.67 (43.09)	26.67 (31.07)	40.00 (39.21)	46.67 (43.09)	16.55	16.55
TCGS 2605	31.11 (33.90)	36.67 (37.27)	70.00 (56.82)	31.11 (33.90)	36.67 (37.27)	58.89 (50.12)	18.16	18.16
TCGS 2608	14.45 (22.20)	36.67 (37.27)	44.44 (41.81)	14.45 (22.20)	36.67 (37.27)	60.00 (50.77)	12.53	12.53
K 6 (c)	53.34 (46.91)	72.22 (58.20)	92.23 (74.18)	53.34 (46.91)	72.22 (58.20)	84.44 (66.77)	18.31	18.31
GPBD 4 (c)	2.22 (8.57)	3.33 (16.16)	4.44 (12.17)	4.45 (11.77)	6.67 (14.76)	10.00 (18.19)	18.34	18.84
Mean	16.67	28.11	37.33	17.67	28.41	38.63	23.80	16.61
C.V.%	7.65	5.83	5.45	9.34	6.76	4.13	10.43	11.87
S.E.(m)	1.22	1.26	1.40	1.51	1.47	1.10	1.75	1.39
S.E.(d)	1.73	1.78	1.99	2.14	2.08	1.56	2.49	1.97
C.D.(5%)	3.54	3.64	4.07	4.37	4.25	3.18	5.08	4.03

(C): Check

** Values in parenthesis are angular transformed values

PDI: Per cent Disease Index
LLS: Late leaf spot
PYPD: Pod yield plant^{-1} (Disease)
KYPD: Kernel yield plant^{-1} (Disease)

Table 3: Categorization of Groundnut Genotypes Based on Their Reaction to Late Leaf Spot Disease at Maturity

Diaease reaction	Resistant (1.00 to 3.00)			Moderately resistant (4.00 to 5.00)			Moderately susceptible (6.00 to 7.00)			Susceptible (8.00 to 9.00)		
No. of Genotypes	8			9			8			5		
	Genotypes	PDI (%)	Score	Genotypes	PDI (%)	Score	Genotypes	PDI (%)	Score	Genotypes	PDI (%)	Score
	K 1812	8.89	3	Konark	18.89	4	Dheeraj	34.45	6	TAG 24	91.11	9
	Nithya Haritha	6.67	3	Kadiri Amaravathi	28.89	5	ICGV 00350	41.11	7	TCGS 2369	92.22	9
	Pragathi	10.00	3	Rohini	30.00	5	TCGS 2306	58.89	7	TCGS 2491	88.89	9
	K 8	10.00	3	K 7	11.11	4	TCGS 2456	36.67	6	TCGS 2605	70.00	8
	TCGS 2019	4.44	2	Kadiri Harithandra	30.00	5	TCGS 2474	53.33	7	K 6 (C)	92.23	9
	TCGS 2555	7.78	2	TCGS 2447	27.78	5	TCGS 2484	57.78	7			
	TCGS 2599	7.78	3	TCGS 2452	28.89	5	TCGS 2604	46.67	7			
	GPBD 4 (C)	4.44	2	TCGS 2549	28.89	5	TCGS 2608	44.44	7			
				TCGS 2557	24.44	5						

Table 4: Categorization of Groundnut Genotypes Based on Their Reaction to Rust Disease at Maturity

Diaease reaction	Resistant (1.00 to 3.00)			Moderately resistant (4.00 to 5.00)			Moderately susceptible (6.00 to 7.00)			Susceptible (8.00 to 9.00)		
No. of Genotypes	7			10			8			5		
	Genotypes	PDI (%)	Score	Genotypes	PDI (%)	Score	Genotypes	PDI (%)	Score	Genotypes	PDI (%)	Score
	K 1812	8.89	3	Pragathi	30.00	5	Dheeraj	50.00	7	TAG 24	91.11	9
	Nithya Haritha	10.00	3	Kadiri Amaravathi	26.67	5	Konark	41.11	7	TCGS 2369	73.33	8
	K 7	7.78	3	Rohini	30.00	5	ICGV 00350	32.22	6	TCGS 2456	85.56	9
	K 8	4.44	2	Kadiri Harithandra	26.67	5	TCGS 2306	58.89	7	TCGS 2491	84.44	9
	TCGS 2019	7.78	3	TCGS 2447	27.78	5	TCGS 2484	58.89	7	K 6 (C)	92.22	9
	TCGS 2549	8.89	3	TCGS 2452	28.89	5	TCGS 2604	46.67	7			
	GPBD 4 (C)	10.00	3	TCGS 2474	25.56	5	TCGS 2605	58.89	7			
				TCGS 2555	17.78	4	TCGS 2608	60.00	7			
				TCGS 2557	24.44	5						
				TCGS 2599	12.22	4						

Effect of Foliar Diseases on Yield

Foliar diseases exerted a pronounced negative effect on productivity. Genotypes exhibiting lower disease severity maintained higher pod and kernel yields under disease stress (Table 1.5), whereas susceptible genotypes suffered severe reductions (Gopal *et al.* (2006), Hossain *et al.* (2007) and Killada *et al*. (2023) [8, 9, 10].

Yield reduction in resistant genotypes ranged from only 3.61-6.61% for pod yield and 3.40-5.89% for kernel yield. Similar findings were reported by Gaikpa *et al.* (2017) and Bhat *et al.* (2024) [2, 6].

Conversely, susceptible genotypes such as TCGS 2369, TAG 24, K 6 and TCGS 2491 experienced severe yield reductions ranged from 47.71 to 50.93 per cent for pod yield and 44.55 to 47.61 per cent for kernel yield. These findings are in agreement with Killada *et al.* (2023) [10], who reported that increased disease severity reduces photosynthetic area, accelerates defoliation and significantly lowers pod production.

Based on combined performance for disease resistance and yield under disease stress, K 1812 emerged as the most promising genotype, followed by TCGS 2019, K 7, Nithya Haritha and K 8. These genotypes consistently recorded low disease scores and high yield performance. Similar conclusions regarding the importance of combining disease resistance and productivity were reported by Wankhade *et al.* (2021), Bhat *et al.* (2024) and Saravanan *et al.* (2025) [2, 17, 22].

The identified resistant genotypes can serve as valuable donor parents in hybridization programmes aimed at developing high-yielding cultivars with durable resistance to both late leaf spot and rust.

Conclusion

The study revealed substantial genetic variability among thirty groundnut genotypes for resistance to late leaf spot and rust diseases, supporting earlier findings of Asish *et al.* (2014), Divyadharsini *et al.* (2016) and Wankhade *et al.* (2021) [4, 22]. Eight genotypes were resistant to late leaf spot and seven genotypes were resistant to rust under artificial epiphytotic conditions. K 1812, TCGS 2019, K 7, Nithya Haritha and K 8 exhibited superior performance by combining strong disease resistance with high pod and kernel yields. Disease severity showed a clear negative association with productivity, as also reported by Gopal *et al.* (2006) and Killada *et al.* (2023) [8, 10]. These resistant genotypes may be utilized as donor parents in future breeding programmes for the development of high-yielding and foliar disease-resistant groundnut cultivars.

Table 5: Assessment of Yield Loss Due to Foliar Diseases in Groundnut Genotypes

GENOTYPES	Pod yield plant^{-1} (Protected)	Pod yield plant^{-1} (Disease)	Pod yield reduction due to foliar diseases (%)	Kernel yield plant^{-1} (Protected)	Kernel yield plant^{-1} (Disease)	Kernel yield reduction due to foliar diseases (%)	Late leaf spot score at 105DAS (PDI %)	Late leaf spot disease reaction	Rust score at 105DAS (PDI %)	Rust Disease Reaction
K 1812	40.17	38.70	3.61	29.34	28.07	4.31	8.89	R	8.89	R
Dheeraj	26.67	15.28	42.88	19.19	11.95	37.72	34.45	MS	50.00	MS
Nithya Haritha	34.96	33.34	4.65	23.50	22.28	5.19	6.67	R	10.00	R
Pragathi	30.92	28.38	8.27	22.00	19.44	11.60	10.00	R	30.00	MR
K7	37.71	35.21	6.61	24.43	22.97	5.89	11.11	R	7.78	R
TAG 24	23.08	11.58	50.08	15.59	8.23	47.61	91.11	S	91.11	S
ICAR Konark	30.06	22.57	24.99	21.22	15.83	25.64	18.89	MR	41.11	MS
Kadiri Amaravathi	18.63	15.58	16.27	13.44	11.28	15.63	28.89	MR	26.67	MR
Rohini	31.13	25.90	16.83	21.81	18.73	14.22	30.00	MR	30.00	MR
K8	30.90	29.09	5.83	19.16	18.50	3.40	10.00	R	4.44	R
Kadiri Harithandra	36.93	30.88	16.36	25.41	21.88	13.67	30.00	MR	26.67	MR
ICGV 00350	26.43	15.54	41.27	19.49	12.18	37.59	41.11	MS	32.22	MS
TCGS 2019	37.40	35.98	3.79	23.40	22.48	3.98	7.78	R	7.78	R
TCGS 2306	31.80	18.77	40.80	21.63	13.96	36.04	58.89	MS	58.89	MS
TCGS 2369	38.49	18.89	50.93	26.49	14.34	45.87	92.22	S	73.33	S
TCGS 2447	28.12	23.62	15.90	17.93	15.77	12.02	27.78	MR	27.78	MR
TCGS 2452	28.06	23.09	17.38	19.76	16.72	15.32	28.89	MR	28.89	MR
TCGS 2456	25.02	13.91	44.40	17.38	10.37	40.46	36.67	MS	85.56	S
TCGS 2474	25.73	19.04	25.76	18.60	13.46	27.75	53.33	MS	25.56	MR
TCGS 2484	36.29	21.69	40.17	25.19	16.43	34.80	57.78	MS	58.89	MS
TCGS 2491	27.50	14.37	47.71	19.84	11.05	44.55	88.89	S	88.89	S
TCGS 2549	30.96	27.18	12.43	20.13	17.72	12.23	28.89	MR	8.89	R
TCGS 2555	21.90	19.22	12.26	14.91	13.44	9.93	7.78	R	17.78	MR
TCGS 2557	28.46	23.64	16.90	21.47	18.59	13.41	24.44	MR	24.44	MR
TCGS 2599	23.22	20.33	12.49	15.04	13.11	12.71	7.78	R	12.22	MR
TCGS 2604	27.92	16.55	40.62	18.48	11.83	35.87	46.67	MS	46.67	MS
TCGS 2605	30.73	18.16	40.53	21.17	13.06	38.47	70.00	S	58.89	MS
TCGS 2608	22.75	12.53	44.90	12.46	7.97	35.99	44.44	MS	60.00	MS
K 6 (C)	37.05	18.31	50.65	26.22	14.33	45.39	92.23	S	84.44	S
GPBD 4 (C)	19.70	18.84	4.34	12.94	12.28	4.95	4.44	R	10.00	R

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