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Screening of groundnut varieties against leaf miner *Aproaerema modicella* Deventer*

The low level of groundnut productivity in India is largely because the crop is raised under rainfed conditions. Groundnut is considered by farmers as the most remunerative crop with relatively low chance of crop failures despite an unpredictable mansoon. But the insect pests and diseases form the important constraints in its production. Collar rot and tikka are important diseases, while white grubs (*Holotrichia* spp.), thrips and leaf miner (*A. modicella*) are the important insect pests of groundnut.

The groundnut leaf miner, *A. modicella* Deventer belongs to family Gelechiidae, order Lepidoptera. It is an oligophagous pest and feeds only on leguminous host plants and a serious pest of groundnut in both rainy and post rainy season in India and of groundnut and soybean in South and South East Asia.Being an oligophagous pest, in addition to groundnut it has been reported to attack soybean *Glycine max* Mirr., Gram, *Phaseolus aureus* Roxb. Pigeon pea, *Cajanus cajan* Millsp. (Lefroy and Howlett, 1909), and Lucerne, *Medicago sativa* (Linn) and two weeds viz., *Indigifera hirsuta* (Linn.) and *Phaseolus calcaratus* Roxb.(Jai Rao and Sindagi, 1977) in India.

The leaf miner is considered as the most important insect pest of groundnut in India and particularly in rainfed situations (Ayyar, 1963; Nair, 1975; Reddy, 1988). The pest initially appears as a leaf miner causing short blister like mines. Older larvae fold the leaflets and feed within. As a result, the leaflets turn brown, shrivel and dry up. Severly infested crop gives a burnt up appearance and yield losses can reach upto 76 per cent (Anon, 1986).

The experiment was conducted during summer 2009, at Agricultural Research Station, Bagalkot, to find out the resistant sources of leaf miner. A total of 25 entries (Dh-101, Dh-107, Dh-108, Dh-109, Dh-112, Dh-116, Dh-2001-1, Dh-4-3, Dh-86,G-2-29, G-2-52, GPBD-4, GPBD-5, ICGS-11, KRG-1, R-2001-2, R-2001-3, R-8808, R-9214, R-9227, R-9251, R-9271, S -206, TAG-24, TMV-2) were collected from All India Co-coordinated Research Project (AICRP) on groundnut centres Dharwad and Raichur. Each entry was sown in five rows of 3 m length with a spacing of 30 cm between rows and 10 cm between plants. The crop was raised as per the recommended package of practices except for the plant protection measures against pests. The reaction of genotypes/varieties was assessed by visual grading of damage and absolute insect count on each entry.

Visual observations were made on per cent foliage damage due to leaf miner (0-100%) during the peak infestation period by following the standard scale (1-10) (Anon., 1986). The observation on per cent leaflet damage was made by counting total number of leaflets and damaged leaflets from 10 randomly selected plants of each entry and expressed as per cent leaflet damage. Leaflet damage score was given by using the standard scale (1-100) given by Anon., 1986 (Table 1). The larval population was recorded from same randomly selected plants that were used for studying per cent leaflet damage and later expressed both as larvae per plant and larvae per leaflet.

Table 1. Damage score of per cent damage and related category to calculate severity index

Leaflet damage (%)	Score (A)	Foliage damage (%)	Score (B)
0	1	0	1
21-30	3	21-30	3
31-40	4	31-40	4
41-50	5	41-50	5
1-20	2	1-20	2
51-60	6	51-60	6
61-70	7	61-70	7
71-80	8	71-80	8
81-90	9	81-90	9
91-100	10	91-100	10

Severity index is the index showing the severity of infestation in terms of severity of burning/drying symptoms. The severity index was calculated by using the formula:

$$SI = \frac{A \times B}{100}$$, as given by Anon.,1986

Where, A = mean leaflet damage score

B = mean foliage damage score

Categorization of genotypes/varieties was made based on severity index by following the methodology of Ghule *et al.* (1988) (Table 2). After the crop-attained maturity, the pods were harvested separately from each screening plot, dried properly and pod weight was recorded. The reaction of groundnut genotypes/varieties against leaf miner was assessed mainly by visual recording of per cent foliage damage. Per cent leaflet damage was also recorded for calculating severity indices. Similarly, absolute population of leaf miner larvae per plant was recorded. The per cent foliage damage and per cent leaflet damage in 1-10 scale (Anon., 1986) were recorded, along with pod yield (Table 3)

Field screening of groundnut varieties against leaf miner revealed that the genotypes Dh-4-3, ICGS-11, R-9227, R-8808 and R-9214 were moderately resistant with 25 to 35 per cent foliage damage and higher pod yield whereas Dh-107, Dh-112, GPBD-3, R-2001-2, TAG-04 and Dh-116 were moderately susceptible with 45 to 60 per cent foliage damage. Other varieties being highly susceptible (Dh-101, Dh-108, GPBD-5, R-9271, TMV-2, Dh-109, Dh-2001-1, G-2-29, KRG-

Table 2. Per cent of damage and selected category of resistant level

Foliage damage (%)	Category
0	Immune
1-20	Resistant
21-40	Moderately resistant
41-60	Moderately susceptible
61-100	Highly susceptible

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Table 3. Performance of selected ground nut genotypes/ varieties against leaf miner under field conditions (summer-2009) at zone 3 agroclimatic conditions of Karnataka

Varieties	Leaflet damage (%)	Score (A)	Foliage damage (%)	Score (B)	Severity index (SI)	Larva/ plant	larva/ leaf	Yield/plot (kg)
Dh-101	92.38	10	65.0	7	0.70	11.76	0.09	9.46
Dh-107	91.98	10	50.0	5	0.50	9.01	0.11	10.78
Dh-108	91.20	10	70.0	7	0.70	12.53	0.08	9.29
Dh-109	94.89	10	75.0	8	0.80	13.92	0.07	8.10
Dh-112	96.78	10	45.0	5	0.50	8.13	0.12	10.18
Dh-116	91.35	10	60.0	6	0.60	9.76	0.10	10.31
Dh-2001-1	87.82	9	75.0	8	0.72	15.62	0.06	9.28
Dh-4-3	91.07	10	30.0	3	0.30	6.90	0.05	12.53
Dh-86	91.65	10	90.0	9	0.90	16.53	0.06	8.54
G-2-29	91.89	10	77.5	8	0.80	15.42	0.06	9.49
G-2-52	92.23	10	85.0	9	0.90	18.18	0.06	8.74
GPBD-4	85.89	9	45.0	5	0.45	8.73	0.11	10.43
GPBD-5	93.05	10	65.0	7	0.70	10.56	0.09	9.22
ICGS-11	79.47	8	25.0	3	0.24	7.03	0.05	12.46
KRG-1	93.37	10	75.0	8	0.80	14.24	0.07	9.64
R-2001-2	88.78	9	45.0	5	0.45	8.35	0.12	10.53
R-2001-3	93.60	10	87.0	9	0.90	19.33	0.14	8.80
R-8808	92.99	10	35.0	4	0.40	7.97	0.13	11.45
R-9214	95.34	10	35.0	4	0.40	7.37	0.05	11.24
R-9227	92.94	10	25.0	3	0.30	7.63	0.13	11.46
R-9251	91.74	10	85.0	9	0.90	19.72	0.14	8.98
R-9271	90.59	10	65.0	7	0.70	12.77	0.08	9.24
S-206	94.03	10	72.5	8	0.80	14.72	0.07	9.38
TAG-24	91.61	10	50.0	5	0.50	8.50	0.12	10.85
TMV-2	92.12	10	67.5	7	0.70	10.65	0.09	9.10

$$SI = \frac{A \times B}{100}$$

Plot size = 5m x 3 m

1, S-206, Dh-86, G-2-52, R-9251 and R-2001-3) registered 65 to 90 per cent foliage damage (Table 4).

The varieties under moderately resistant group harboured larval population ranging from 6.90 (Dh-4-3) to 19.72 larvae per plant (R-9251) and registered the severity indices of 0.24 (ICGS-11) to 0.40 (R-9214 and R-8808). Conversely, the corresponding values for the highly susceptible group were 10.65 (TMV-9) to 19.72 larvae per plant (R-9251) with severity indices of 0.70 to 0.90. The pod yield of the genotypes ranged from 8.10 to 12.53 kg/plot. The present findings are in line with that of Satyanarayana Rao (2000), Anon., (1987, 1989, and 1994a), whereas ICGS-11 (moderately resistant) was reported as highly susceptible line recording highest leaf let damage.

ICGS-11 (moderately resistant) recorded 7.03 larvae per plant and registered severity index of 0.24 is in line with Naik (2002) who reported ICGS-11 as resistant considering per cent leaf let damage rather than overall foliage damage, contradictory to the findings of Anon. (1987), Anon.(1989), Anon. (1993a) and Praveen (2005), wherein more number of larvae per plant and leaf damage were recorded.TMV-2 recorded highest number of larvae per plant with higher damage which was catagorized as highly susceptible endorses the results of Bindra (1970), Mahadevan *et al*. (1988), Anon. (1993a) ; Satyanarayana Rao (2002) and Naik (2002).

Performance of TAG-24 (Moderately susceptible) is in line with the findings of Jeena *et al*. (1996) and Praveen (2005). The genotype R-9251 (highly susceptible) reaction of is in line with the findings of Naik (2002). R-9227, R-8808 and R-9214 were found to be moderately resistant and KRG-1 is found to be highly susceptible, and these present investigations are similar with the findings of Praveen (2005). There was difference in the

Table 4. Categorization of screened groundnut varieties based on their reaction to leaf miner under field conditions (summer-2009)

Varieties	Scoring	Category	Total No.
-	0	Immune	0
-	1-20	Resistant	0
Dh-4-3, ICGS-11, R-9227	21-30	Moderately resistant	3
R-8808, R-9214	31-40		2
Dh-107, Dh-112, GPBD-4, R-2001-2, TAG-24	41-50	Moderately susceptible	5
Dh-116	51-60		1
Dh-101, Dh-108, GPBD-5, R-9271, TMV-2	61-70	Highly susceptible	5
Dh-109, Dh-2001-1, G-2-29, KRG-1, S-206	71-80		5
Dh-86, G-2-52, R-9251, R-2001-3	81-100		4
		Total	25

methodology followed for screening, as the earlier workers considered per cent leaflet damage of categorization of genotypes. Similar studies have been carried out by many workers *viz*, Cherian and Basheer (1942), Bindra (1970), Lewin *et al.* (1971), Jai Rao and Sindagi (1977), Sathiomoorthy *et al.* (1978), Amin *et al.* (1985), Ghule *et al.* (1988), Mahadevan *et al.* (1988 and 1989), Nigam *et al.* (1992), Reddy *et al.*(1992), Satyanarayana Rao (2002) and Sharma *et al.* (2003). However, the resistant and moderately resistant genotypes/varieties identified in the present study under high pest pressure will add to the already existing ones which can either be cultivated in endemic areas of leaf miner or utilized in breeding programmes

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