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MORPHOLOGICAL AND BIOCHEMICAL VARIATIONS IN GROUNDNUT GENOTYPES AS RELATED TO THRIPS *SCIRTOTHRIPS DORSALIS* HOOD RESISTANCE

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ABSTRACT

Nineteen groundnut genotypes have been evaluated for resistance to thrips *Scirtothrips dorsalis* Hood. Thrips incidence and foliage damage were assessed and correlated with the morphological and biochemical components. The results revealed that none of the genotypes were completely free. Three genotypes were categorized as resistant (Dh-256, RST-1-2020-12 and INS-1-2020-11). Biochemical analysis indicated that higher amount of proteins, wax content and chlorophyll content were recorded in the resistant Dh 256 and these have negative relationship with incidence and damage.

Key words: *Scirtothrips dorsalis,* amino acids, biochemical characterization, foliage damage, leaf water content, morphological characters, protein, relative chlorophyll content, screening, susceptible, terminal bud, wax content

Groundnut *Arachis hypogaea* L. is an important oilseed crop. More than 50 insects had been reported to attack groundnut. Among them, leafhoppers and thrips*, Scirtothrips dorsalis* Hood is more during summer (Sonawane et al., 2019); *S. dorsalis* alone cause significant economic losses to the tune of 48.5% (Sivasubramanian and Palaniswamy, 1986). Their incidence will be right from vegetative stage till harvesting. They survive in young folded leaflets and flowers and known to transmit peanut bud necrosis disease (PBND) (Rajashree et al., 2021); *S. dorsalis* damage is marked by the "silvering" of leaves (Srinivasan et al., 2018). Insecticides are the most effective weapons for combating sucking insects. Because *S. dorsalis* can develop resistance, employing insecticides on a regular basis is not an effective method (Rahman et al., 2022). Hence, resistant cultivars will be one of the most promising ecofriendly measures and hence this study.

MATERIALS AND METHODS

Nineteen genotypes of *A. hypogaea* were evaluated for resistance to *S. dorsalis* under field conditions. The experiment was carried out at the AICRP on Groundnut, Main Agricultural Research Station in Dharwad during summer 2021. The genotypes were procured from the AICRP Groundnut in Junagadh and Dharwad. The TAG-24 was used as a susceptible check. All the genotypes were sown with susceptible checks after every 2nd entry in 5 m row length and spacing followed is 30 x 10 cm in two replications. The response of cultivars to thrips infestation was recorded based on visual observation of damage. i.e., curling of leaves by following 1 to 9% standard scale (Ranga Rao and Wightman, 1996; Kandakoor et al., 2014; Rahman et al., 2022). Counting thrips/terminal bud was done from randomly selected five plants in every genotype from each replication during early morning hours including susceptible check at 30, 40, 50, 60, 70, 80 and 90 days after germination. Considering the peak activity, the data recorded at 40 DAG has been considered for analysis and interpretation. The morphological parameters (wax content and relative chlorophyll content) and biochemical parameters (amino acid, protein and leaf water content) were estimated following standard procedures. The protein content was calculated using Lowry's method (Lowry et al., 1951; Saleem et al., 2019). Leaf water content was assessed by determining the difference between fresh and dry weight (Gadad et al., 2014; Rajashree et al., 2021). Total free amino acid content was calculated using ninhydrin technique (Moore and Stein, 1954; Naralasetti and Katlam, 2023). The amount of chlorophyll was observed using SPAD chlorophyll meter (Minolta SPAD-502 meter) (Kariya et al., 1982; Naralasetti and Katlam, 2023). The leaf wax was determined using a colorimetric technique (Ebercon et al., 1977; Saleem et al., 2019). These variables were correlated with thrips incidence alongwith morphological attributes and foliage damage, number of *S. dorsalis* (Rajashree et al., 2021).

RESULTS AND DISCUSSION

Scirtothrips dorsalis Hood was the only spieces found and among the 19 genotypes screened, none were completely free. However genotypes viz., Dh 256, RST-1-2020-12 and INS-1-2020-11 were categorized as resistant; 8 genotypes are moderately resistant, 4 susceptible and 4 highly susceptible (INS-I- 2020-1, TG-37A, TAG-24, Higholeic 107) (Table 1). The results indicated that, more the incidence, more foliage damage. Similar screening Patwari (2019) screened 36 groundnut genotypes against thrips and 33 were found moderately resistant/tolerant, 2 were found susceptible and ISKI-2017-05 recorded lowest thrips population.

The parameters such as amino acid content was positively correlated with incidence and foliage damage. In contrast, proteins, chlorophyll content and wax content revealed a negative correlation with their number and % foliage damage. Highest amount of protein, chlorophyll content and wax content is recorded in highly resistant genotype, Dh-256 (Table 1). Whereas, leaf water content was found to be non significant. Correlation of amino acid, protein, leaf water, relative chlorophyll and wax contents revealed coefficients of 0.985, -0.891, -0.101, -0.784 and -.976. With thrips counts; except for lead water content, others were statistically significant (p=0.05). When correlated with foliage damage these values were 0.979, -0.837, -0.070, -0.737 and -0.961, respectively; and except for leaf water content others were statistically significant (p= 0.05). Increased protein content is linked to increased plant defense enzyme activity as well as the synthesis of additional plant defense proteins. (War et al., 2015; Saleem et al., 2019). The main function of amino acids is to stimulate eating. Higher level of amino acids were recorded in highly susceptible variety, TAG-24. These findings closely align with the investigation of Kandakoor et al. (2014) and Naik and Chakravarthy (2017), Rajashree et al. (2021). Highest leaf water content was obtained in highly susceptible genotype TAG-24, whereas, lowest leaf water content was observed in susceptible genotype INS-I-2020-20. Hence, there is no significant role of leaf water content. These results are in confirmation with Somashekhar and Patil (2003), Naik and Somashekhar (2015). Similar results showing a negative correlation with chlorophyll concentration were published by Latha and Hanumanthraya (2018), Naralasetti and Katlam (2023). Increased levels of chlorophyll produced dark-coloured leaves, which may deter thrips (Shaw et al. 1991). Wax interferes with the feeding activity of insect that cause insect to reject host, which is strongly supported by Saleem et al. (2019) who disclosed that the wax composition is higher in the genotype resistant to *Spodoptera litura* in groundnut compared to susceptible check.

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AUTHOR CONTRIBUTION STATEMENT

BM conducted the experiment and wrote the manuscript. RS designed the research and corrected the draft. KB helped in statistical analysis of data and proof reading of the Article. SBK and BSY corrected and proof reading of the article. All the authors read and approved the manuscript.

CONFLICT OF INTEREST

No conflict of interest.

REFERENCES

Ebercon A, Blum A, Jorden W R. 1977. A rapid colorimetric method for epicuticular wax content of sorghum leaves. Crop Science 17(1): 179-180.

Gadad H, Hegde M, Balikai R A. 2014. Screening and biochemical analysis for resistance against groundnut thrips. Biochemical and Cellular Archieves 14(1): 145-149.

Kandakoor S B. 2011. Studies on sucking insect pests of groundnut (*Arachis hypogaea* L.) and their management. M.Sc. Thesis, University of agricultural Sciences, Bengaluru, India. pp 127.

Kandakoor S B, Khan H K, Chakravarthy A K, Kumar C A, Venkataravana P. 2014. Biochemical constituents influencing thrips resistance in groundnut germplasm. Journal Environmental Biology 35(4): 675.

Kariya K, Matsuzaki A, Machida H, Tsunoda K. 1982. Distribution of chlorophyll content in leaf blade of rice plant. Japanese Journal of Crop Science 51(1): 134-135.

Latha S, Hunumanthraya L. 2018. Screening of chilli genotypes against chilli thrips (*Scirtothrips dorsalis* Hood) and yellow mite [*Polyphagotarsonemus latus* (Banks)]. Journal of Entomology and Zoology Studies 6: 2739-2744.

Lowry O, Rosebrough N, Farr A L, Randall R. 1951. Protein measurement with the Folin phenol reagent. Journal of Biological Chemistry 193(1): 265-275.

Mohammad Saleem A, Gopalakrishna Naidu K, Tippannavar P S, Nadaf H L. 2019. Biophysical and biochemical mechanism of resistance to *Spodoptera litura* in groundnut (*Arachis hypogaea* L.). Journal of Entomology and Zoology Studies 7(4): 86-96.

Moore S, Stein W H. 1954. A modified ninhydrin reagent for the photometric determination of amino acids and related compounds. Journal of Biological Chemistry 211(2): 907-913.

Table 1. Relationship of of morphological and biochemical characters of genotypes *S. dorsalis* in incidence and foliage damage in groundnut

Sl. No.	Genotypes	Thrips/ terminal bud	Foliage damage (%)	Amino acids (mg/ g)	Protein (mg/ g)	Leaf water content (%)	Chlorophyll content (nmol/ cm^2)	Wax content (µg/ cm^2)	Reaction
1	INS-I- 2020-1	6.45	35.15	4.81	4.06	71.00	34.30	0.21	HS
2	INS-I- 2020-2	4.78	19.53	3.79	5.32	68.85	37.50	0.32	MR
3	INS-I- 2020-3	4.60	17.62	3.65	5.43	70.94	38.40	0.33	MR
4	INS-I- 2020-8	3.62	12.95	3.08	6.37	65.17	46.80	0.41	MR
5	INS-I- 2020-11	3.10	9.85	2.96	7.16	71.90	46.70	0.41	R
6	INS-I- 2020-12	5.36	23.85	3.91	4.93	61.52	35.50	0.29	S
7	INS-I- 2020-13	5.45	24.25	3.98	4.84	62.82	36.70	0.27	S
8	INS-I- 2020-20	5.86	29.33	4.41	4.59	60.33	29.70	0.24	S
9	INS-I- 2020-21	4.85	19.82	3.80	4.93	62.93	29.20	0.29	MR
10	INS-I- 2020-22	4.10	14.6	3.41	5.45	71.50	42.80	0.37	MR
11	AIS-2020-4	3.67	13.63	3.23	6.14	68.85	35.30	0.39	MR
12	AIS-2020-6	4.56	17.56	3.50	5.54	71.28	40.50	0.35	MR
13	RST-1-2020-12	2.80	9.50	2.78	7.82	72.50	45.10	0.43	R
14	Dhanalaxmi	5.65	27.35	4.05	4.74	67.33	31.00	0.27	S
15	Girnar 4	3.82	14.10	3.70	5.00	69.50	39.25	0.33	MR
16	TG-37A	6.27	34.60	4.56	4.06	68.21	41.20	0.24	HS
17	Higholeic 107	7.56	41.25	5.43	3.36	69.75	29.50	0.19	HS
18	Dh 256	2.56	8.95	2.56	10.03	70.45	48.80	0.46	R
19	TAG-24 (SC)	8.12	43.56	5.65	2.97	73.90	28.60	0.16	HS
	'r' value		0.986*						

The injury rating was done based on brown coloration/ damage on lower surface of leaves: 1-10% damage-injury rating (IR)1; Reaction Resistant (R); 1-20%-IR2, Moderately R; 21-30%-IR3, Susceptible; 31-40%-IR4, Highly Susceptible (HS); 41-50%-IR5, HS; 51-61%-IR6, HS; 61-70%-IR7; HS; 71-80%-IR8, HS; 81-90%-IR9, HS; 91-100%-IR10, HS. SC-susceptible check R-resistant MR-moderately resistant S-susceptible HS- highly susceptible; *significant at p=0.05

Naik S O, Somashekhar. 2015. Phenotypic and biochemical mechanism of resistance in groundnut genotype and varieties against leafhopper and thrips. Ecology, Environment and Conservation Journal 21(1): 535-543.

Naik S O, Chakravarthy A K. 2017. Oviposition and survival of leafhoppers and thrips in groundnut genotypes and their host relationships. Indian Journal of Entomology 79(1): 66-71.

Naralasetti R, Katlam B P. 2023. Physio-morpho and biochemical basis of resistance in groundnut germplasm against thrips. The Pharma Innovation Journal 12(7): 295-299.

Patwari A B. 2019. Management of sucking insect-pests infesting groundnut. M.Sc. Thesis, Vasantrao naik marathwada krishi vidyapeeth, Parbhani, India. 51 pp.

Rahman S M, Vijayalakshmi K, Rani C V D. 2022. Screening and physico-chemical bases of resistance in groundnut germplasm lines against thrips. Biological Forum – An International Journal 14(1): 1241-1247.

Rajashree S B, Kabre G B, More S R, Aghav S T, Thakare R S. 2021. Biochemical traits of groundnut genotypes for their reaction to thrips. The Pharma Innovation Journal, 10(11): 126-132.

Ranga Rao G V, Wightman J A. 1996. Techniques for screening groundnut genotypes for resistance to pests, *Spodoptera litura* (F.) in India. Proceedings. The national scientists forum on *Spodoptera litura,* ICRISAT, Patancharu, Telangana, India. pp. 68-75.

Shaw S S, Ratwat R R, Jamola S S. 1991. Studies on the mechanism of susceptibility in different pea varieties against *Caliothrips indicus* (Bagnall). Indian Journal of Agricultural Research 3(1): 122-127.

Siva Subramanian P, Palaniswamy G A. 1986. Loss in yield due to leaf hopper and thrips on groundnut. Madras Agricultural Journal 73: 530-531.

Somashekar O N, Patil B V. 2003. Mechanisms of resistance in groundnut cultivars against thrips. Proceedings. National symposium on frontier area of entomological research. pp. 5-7.

Sonawane V G, Misal A M, Tavadare P L, Gawali R G, Tathe R G. 2019. Phenotypic and biochemical mechanism of resistance in groundnut genotype against thrips. International Journal of Current Microbiology and Applied Sciences 8(10): 1587-1594.

Srinivasan R, Abney M R, Lai P C, Culbreath A K, Tallury S, Leal-Bertioli S C. 2018. Resistance to thrips in peanut and implications for management of thrips and thrips transmitted Ortho Tospo viruses in peanut. Frontiers in Plant Science 9: 1604.

War A R, Munghate R S, Sharma H C. 2015. Expression of different mechanisms of resistance to insects in groundnut under field conditions. Phytoparasitica 43: 669-677.

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