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STUDIES OF SUCKING AND SOIL INSECT PESTS OF GROUNDNUT DURING *KHARIF*

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ABSTRACT

This study examines the frequency of pests in protected and unprotected groundnut cultivation at AICRP on Groundnut, MARS, Dharwad, Karnataka during the 2021–2022 *kharif* season. Protection measures were applied at 25 DAS using thiamethoxam 25 WG @ 0.25g/l (protected plot) to keep sucking pests away from the crop. Observations were taken from both plots based on the phenology of the crop. According to their population density and type of damage, soil insect pests such *Forficula auricularia*, *Gonocephalum granulatum* and *Agriotes* sp. were considered less significant than the primary pests *Empoasca kerri*, *Scirtothrips dorsalis* and *Bemisia tabaci*. Compared to protected groundnut variety plots, the incidence of insect pests was higher in the unprotected JL-24 and DH-256 crop plots.

Key words : Groundnut, Protected plot, Sucking pest, Unprotected plot.

Introduction

Groundnut (*Arachis hypogaea* L.) is a significant oilseed crop, also referred to as peanuts, earthnuts, monkey nuts, goober, pindas and manilla nuts. The main application for its oil is in the production of vegetable oil (vanaspati ghee). About 26% protein and 45% oil are found in groundnut seeds. Worldwide, nearly every tropical and subtropical nation grows an important share of groundnut production (Gocher *et al*., 2020). Groundnut (*Arachis hypogaea* L.) is a valuable cash crop for millions of small-scale farmers in the semi-arid tropical regions of South America. Approximately 30% of India's total oil supply comes from this crop, which is one of the most important oil seed crops grown there. In rainfed environments, groundnuts are the main crop grown by resource-constrained Indian farmers (Dahiphale *et al*., 2022). Over 55.71 lakh hectares of land are used in India to grow groundnuts during the kharif, rabi, and summer seasons. The crop yielded 102 lakh tonnes and 1831 kg/ha of productivity in 2020–21 (Anonymous, 2022). Low groundnut productivity is a result of biotic and abiotic stressors that the crop faces throughout growth. The two main biotic stressors on groundnut production are pests and diseases. As noted by Baskaran and Rajavel (2013), over 100 kinds of insect pests attack groundnut crops, resulting in a 40.2% reduction in production overall. Thirteen different kinds of sucking insect pests were found to be feeding on and attacking groundnut crop (Kandakoor *et al*., 2012). Thrips, *Scirtothrips dorsalis* Hood, *Frankliniella schultzei* Trybom, *Thrips palmi* Karny, *Caliothrips indicus* Bagnall; leafhopper, *Empoasca kerri* Pruthi; aphid, *Aphis gossypii* Glover and a few other lesser sucking pests make up the principal sucking insect pest complex of groundnuts. Among these, thrips and leafhoppers are particularly significant for groundnut crops (David and Ramamurthy, 2011). They can cause significant harm to the crop during its growth period, with losses reaching up to 20% and 40%, respectively (Ghewande, 1987). The plants wilted and dried up as a result of their sucking the sap from the sensitive sections

of the plants. It is also recognized that the majority of sucking pests are groundnut disease carriers. The pod production stage of the crop is when earwigs and darkling beetles become more prevalent (Anitha, 1992). The earwig (*Demoptera stali*) feeds on kernels and both nymphs and adults dig into the sensitive and mature pods. Most of the material found inside the bored holes is decomposing pulp, excreta and sand particles (Logan *et al*., 1992). Groundnut insect populations and their natural enemies may have changed recently due to different weather patterns (Srinivasa Rao *et al*., 2010). Consequently, anticipating any outbreaks and warning those who need to be alerted will be made easier with a good understanding of the behavior of insect pests and their natural foes on groundnuts. Developing an economically feasible, ecologically sound and socially acceptable pest control approach requires knowledge of the state and sequence of pest emergence over the crop period, crop losses and forms of damages and thorough information about a pest complex. To find out how common pests are on susceptible and moderately resistant groundnut cultivars, field research was conducted in this area.

Materials and Methods

The research study was carried out in the field in 2021 during the *kharif* season at the AICRP on Groundnut, Main Agricultural Research Station, Dharwad, Karnataka, India. Field investigations were conducted on two distinct groundnut cultivars, JL-24 (susceptible) and Dh-256 (moderately resistant), to determine the relative prevalence of main sucking and soil insect pests. At a spacing of 30 cm × 10 cm, both types were sowed on a plot measuring 10 m × 10 m. Throughout the duration of the study, two distinct JL-24 and Dh-256 protected and unprotected plots were kept. The recommended package of actions was followed in unprotected plots to increase crop yield, with the exception of crop protection measures to prevent chemical influence on insect populations.

In contrast, chemical protection (initial spraying at 25 DAS with thiamethoxam 25 WG @ 0.25g/l for sucking pests) was provided on a need-basis in protected plots. In both protected and unprotected plots, varying insect pest populations were observed from the time of seeding to the stages of harvesting (1-120 days after sowing). Ten randomly chosen plants were observed for observations on various insect species during the following stages: seedling (10–25 days), vegetative (25–35 days), flower initiation (35–45 days), pegging and pod formation (45–75 days), pod filling (75–90 days), maturity (90–110 days), and harvesting (110–120 days). Next, a paired T-test was used to statistically assess the data (Web Agri Stat Package 2.0).

Results and Discussion

Insect pests and natural enemies observed on groundnut

Twelve species of insect pests belonging to 3 orders and 9 families of pests were found to infest the groundnut at AICRP on Groundnut, Main Agricultural Research Station, Dharwad during *kharif* season 2021-22. Among these, sucking pests *viz*., *Empoasca kerri*, *Scirtothrips dorsalis* and *B. tabaci*; defoliators *viz*., *Spodoptera litura*, *Thysanoplusia orichalcea*, *Helicoverpa armigera*, *Maruca vitrata*, *Aproaerema modicella* and *Spilarctia obliqua*; soil insect pest *viz*., *Forficula auricularia*, *Gonocephalum granulatum* and *Agriotes* sp. Natural enemies like coccineliids, spiders and entomopathogens were recorded in both protected and unprotected plot of both the varieties of groundnut.

Unprotected plot

Sucking insect pest : The population range of leafhoppers *viz*., 4.00 to 38.25 and 9.58 to 25.14/10 plants, thrips *viz*., 4.25 to 35.00 and 3.10 to 23.5/10 plants and whiteflies *viz*., 2.00 to 19.10 and 1.00 to 16.05/10 plants in JL-24 and Dh-256 (Table 1). Highest population recorded at flowering stage (38.25, 35.00 and 19.10/10 plants) of JL-24 as compared with Dh-256 (25.14, 23.50 and 16.05/10 plants).

Soil insect pest : Earwig population ranged from 4.00 to 5.46 and 3.20 to 4.50 /10 plants of both varieties. Darkling beetles unprotected plots *viz*., 3.56 of JL-24 /10 plants and 3.10 of Dh-256 /10 plants (Table 1).

Natural enemies : Coccinellids were reported from seedling to pod filling stage in JL-24 (4.00 to 28.0/10 plants) and seedling to pegging and pod formation in Dh-256 (10 to 25.00/10 plants) (Table 2). Spiders were recorded from flowering to harvesting recorded in JL-24 (15.00 to 18.54 /10 plants) and Dh-256 (6.18 to 15.00/10 plants).

Protected plot

Sucking insect pest : Leafhoppers and thrips population found between seedling to maturity of JL-24 *i.e*., 2.00 to 17.10 and 0.58 to 12.00/10 plants in case of Dh-256 seedling to pod filling (2.10 to 13.20 and 6.15 to 10.24/10 plants) (Table 1). Whitefly population of JL-24 from seedling to pod filling (1.00 to 9.28/10 plants) and seedling to pegging and pod formation stage (0.85 to 6.85/ 10 plants).

Soil insect pest : Population of earwig and darkling

Table 1 : Comparative assessment of groundnut varieties JL-24 and Dh-256 for sucking and soil insect pest's incidence.

S. no.	Stage of the crop	Leafhoppers / top 3 leaves				Thrips / terminal buds				Whiteflies / top 5 leaves				Earwigs				Darkling beetles			
		JL-24		Dh-256		JL-24		Dh-256		JL-24		Dh-256		JL-24		Dh-256		JL-24		Dh-256	
		UP	P	UP	P	UP	P	UP	P	UP	P	UP	P	UP	P	UP	P	UP	P	UP	P
1	Seedling	12.58	13.00	9.58	9.75	9.15	9.10	6.24	6.15	4.00	4.52	1.00	0.85	-	-	-	-	3.21	3.45	2.86	2.75
2	Vegetative	29.00	15.59	20.52	11.15	26.00	10.00	17.00	10.24	16.40	6.15	9.51	5.04	-	-	-	-	-	-	-	-
3	Flower initiation	38.25	17.10	25.14	13.20	35.00	12.00	23.50	8.10	19.10	9.28	16.05	6.85	-	-	-	-	-	-	-	-
4	Pegging and pod formation	22.10	12.00	19.10	8.15	21.00	11.00	18.15	7.20	14.15	4.24	12.21	3.21	-	-	-	-	-	-	-	-
5	Pod filling	16.89	9.52	11.00	2.10	13.40	6.50	11.05	6.48	8.00	1.00	5.12	-	4.00	2.01	3.20	0.59	-	-	-	-
6	Maturity	4.00	2.00	-	-	4.25	0.58	3.10	-	2.00	-	-	-	4.85	3.58	4.16	2.49	-	-	-	-
7	Harvesting	-	-	-	-	-	-	-	-	-	-	-	-	5.46	5.10	4.50	3.87	3.56	2.51	3.10	2.15
	$T_{(Cal)}$	3.43		3.25		3.29		3.45		3.20		2.57		2.09		2.01		1.54		1.58	
	$T_{(Tab)}$ @ 0.05	2.44		2.44		2.44		2.44		2.44		2.44		2.44		2.44		2.44		2.44	

UP: Unprotected; P: Protected.

beetles of JL-24 were 2.01 to 5.10 and 2.51 to 3.45/10 plants and 3.20 to 4.50 and 2.15 to 2.75/10 plants of Dh-256 (Table 1).

Natural enemies : Coccinellids were reported from seedling to Pegging and pod formation in both the varities *i.e.*, JL-24 (10.00 to 25.00/10 plants) and Dh-256 (1.50 to 16.00/10 plants) (Table 2). Seedling to pegging and pod formation in Dh-256 (10 to 25.00/10 plants). Spiders were recorded from flowering to harvesting recorded in JL-24 (6.15 to 12.50 /10 plants) and flowering to maturity in Dh-256 (0.42 to 6.42/10 plants).

By considering above results all the sucking pests and defoliators were significantly differed from unprotected plot and protected plots of both the varieties and highest population were recorded in JL-24 than Dh-256. By supporting this Dh- 256 is tolerant to defoliators *viz.*, *S.litura* and leaf miner and sucking pests like leafhoppers and thrips (Pal *et al.*, 2021). JL-24 is susceptible to defoliators and sucking pests with confirmation of research conducted on biochemical and biophysical characters like phenols, wax, trichome density was lower as well as higher sugars in JL-24, which the harbouring of pests of groundnut (Mohammad Saleem *et al.*, 2019). In protected plots recorded lowest population because of using insecticides for controlling of sucking pest *i.e.*, thiamethoxam 25 WG @ 0.25g/l and leaf eating caterpillars *i.e.*, flubendiamide 20 WG @ 0.5g/l. In order to ensure crop yields and reduce post-harvest losses, the use of pesticides, such as insecticides, has evolved from ancient times to become a crucial and strictly necessary agricultural component. Plant protection products are highly toxic to the pests they are intended to control. Utilising them is intended to lessen or get rid of pests totally. The results are in line with Sujatha *et al.* (2023) recorded mean population aphids was highest in untreated control (154.3/ top 10 cm shoot) than thiamethoxam 25% WG treated plot (5.95/top 10 cm shoot) in mustard crop. Gocher *et al.* (2019), noticed Thiamethoxam 25 WG sprayed plot had lowest population of leafhoppers as compared with untreated control. Thiomethoxam 25 WG (0.16/3 leaves) showing greater reduction of whitefly population in cotton followed by imidacloprid 17.8 SL (0.19 /3 leaves) and highest in unprotected plot (0.27 /3 leaves) of cotton (Javalage *et al.*, 2019). Additionally, Raju and Tayde (2022), who on spraying thiamethoxam 25% WG @ 0.25 g/ lit recorded 33.63 aphids over control (171.96). The population of sucking pests was found to be highest during the crop's vegetative stage. The findings are

Table 2 : Comparative incidence of natural enemies of insect pests on groundnut var. JL-24 and Dh-256.

S. no.	Stage of the crop	Coccinellids/10 plants				Spiders /10 plants			
		JL-24		Dh-256		JL-24		Dh-256	
		UP	P	UP	P	UP	P	UP	P
1	Seedling	24.00	25.00	15.60	16.00	-	-	-	-
2	Vegetative	26.00	18.00	17.21	9.85	-	-	-	-
3	Flower initiation	28.09	15.60	19.00	3.07	11.00	9.50	6.18	6.42
4	Pegging and pod formation	19.00	10.00	10.00	1.50	15.50	8.50	10.05	3.00
5	Pod filling	4.00	-	-	-	17.00	6.15	13.20	1.00
6	Maturity	-	-	-	-	18.54	10.00	15.00	0.42
7	Harvesting	-	-	-	-	15.00	12.50	9.00	-
$T_{(Cal)}$	3.02	2.68	3.70	3.40					
$T_{(Tab)}$ @ 0.05	2.44	2.44	2.44	2.44					

UP: Unprotected, P: Protected.

corroborated by Prasad and Gedia (2011) noted the highest population of thrips (26.60/5 sweeps) and leafhoppers (16.60/ 5 sweeps) in the groundnut at 30 DAS and the lowest populations at 45 and 60 DAS (10.80, 14.00, 9.40 and 12.50/5 sweeps). During the vegetative and pod development stages, thrips 2.90 to 5.20/terminal bud and leafhoppers 1 to 5.10/top 3 leaves (Anonymous, 2018). As per Nayak *et al.* (2019), leafhopper population peaked in the first week of September with 3.80/top 3 leaves, while thrips population peaked in the fourth week of September with 5.68 /top 3 leaves. Leafhopper population peaked in the second week of August.

The population of soil insect pests were non-significant among the two different varieties under unprotected and protected conditions. The findings are supported by Anitha (1992), who reported that, earwig and darkling beetle predominant at later stages of the crop *i.e.*, pod formation stage (tender pods or immature pods). Unprotected plots documented highest number of natural enemies. The results presented here were supported by Pandiyan (2020), who found that the untreated plot had a higher population of spiders and coccinellids than the treated plot. Additionally, imidacloprid 200SL was found to have the highest number of predatory coccinellids (0.51/ plant), spiders (0.27/ plant). According to Amirzade *et al*. (2014), thiamethoxam was less harmful to predatory coccinellids than acetamiprid and imidacloprid.

Conclusion

Throughout the crop phenological stages, the pest incidence changed. In terms of types, the prevalence of sucking pests was higher than that of soil insect pests. By doing this, we are reducing the use of specific pesticides for the targeted pest and providing Dh-256 resistance to the primary groundnut pests. Farmers benefit from better management and cheaper protection expenses as a result, enabling them to assure higher yields and more profitability.

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Conflict of interest

The authors have no competing interests to declare that are relevant to the content of this article.

Author contribution

Kolli Bharghavi: Planned and executed the research, original drafts preparation, Rohini Sugandi: Supervised and guided the research, R. Channakeshava: Correction and proof reading of the article, B.S. Yenagi: Data curation and correction, Burjikindi Madhuri : Analysis and proof reading of the article.

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