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### PEST DAMAGE AND MANAGEMENT STRATEGIES FOR GROUNDNUT (ARACHIS HYPOGAEA L.) CULTIVATION: A COMPREHENSIVE OVERVIEW

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Groundnut (*Arachis hypogaea* L.), a major oilseed crop known as the "King of oilseed crops," provides global economic and nutritional benefits. Despite its significance, groundnut cultivation is threatened by various pests, which can cause yield losses ranging from 30% to 100%. This paper addresses the nature of damage and management strategies for key pests, including Leaf miner (*Aproaerema modicella*), Termites (*Odontotermes obesus*), Tobacco caterpillar (*Spodoptera litura*), Gram caterpillar (*Helicoverpa armigera*), Grasshopper (*Cyrtacanthacris septemfasciata*), Aphids (*Aphis craccivora*), and Thrips (*Scirtothrips dorsalis*). The integrated pest management strategies discussed encompass cultural, biological, and chemical approaches, emphasizing the importance of resistant varieties, mechanical interventions, pheromone traps, and targeted use of insecticides. Adoption of these practices ensures sustainable pest management, enhances groundnut productivity, and minimizes environmental impact. This study contributes to empowering farmers with effective techniques for early pest control and achieving optimal crop yields.

Key words: Groundnut, Pests, Management, Termite, Tobacco caterpillar.

### Introduction

Groundnut (Arachis hypogaea L.), often referred to as the "King of oilseed crops" is believed to have originated in Brazil. It is an annual legume crop, also known as peanut, earthnut, monkey-nut and goobers (Yadav and Ameta, 2015). This valuable crop thrives in dry regions across Asia, Africa, Central and South America, Australia, and the Caribbean due to its significant economic, food, and nutritional benefits. Groundnut is a member of the Fabaceae family and falls under the subfamily Papilionaceae (Vasudevan et al., 2014). It is a significant source of oil and food, with an annual global production of about 50 million tonnes. Mainly grown for human consumption, groundnut seeds can be eaten as snacks or processed into products like groundnut butter and oil (FPO, 2022). Despite groundnut hosting over 70 species of insects and mites in India, only a few are considered pests of significant economic importance over large areas (Amin, 1987). These key pests include the Tobacco caterpillar, Spodoptera litura (Fabricius), Leaf miner, Aproaerema modicella (Deventer), White grub, Holotrichia consanguinea, Red hairy caterpillar, Amsacta albistriga, Gram caterpillar, Helicoverpa armigera (Hubner), Termites, Odontotermes obesus (Rambur), Thrips, Thrips palmi (Karny), Scirtothrips dorsalis (Hood), Leafhoppers Empoasca kerri (Pruthi) and aphids, Aphis craccivora (Koch) (Atwal and Dhaliwal, 2015). The insect pest complex has been found to cause 30 to 100% yield loss (Dabhade et al., 2012).

### Nature of damage and management of the important pests in groundnut

#### 1) Leaf miner (Aproaerema modicella, Deventer):

The groundnut leaf miner is a significant pest of groundnut crop, posing a major threat to production during both the rainy and post-rainy seasons. It is considered one of the most critical pests affecting groundnut cultivation (Okello, 2016). The initial indication of larvae in groundnut crops is the appearance of brown mines near the midrib of the leaves. These mines start as serpentine shapes and expand into blotches, causing the



**Fig. 1:** Incidence and damage Leaf miner in groundnut. leaves to become distorted within a few days as shown in Fig. 1 (PWKB, 2022). Young larvae mine the leaves and as they grow older, they exit the mines to web together several leaflets. Typically, *A. modicella* larvae go through five instar stages with the larval development period lasting between 9 and 28 days (Kenis and Cugal, 2006).

Collect and eliminate egg masses and early instar larvae. The lower larval densities when groundnut was intercropped with sorghum, millet or cowpea, than in monoculture groundnut at  $30 \times 10$  cm spacing. (Logiswaran and Mohanasundaram, 1985). However, the lowest larval densities of A. modicella in this trial were recorded in monoculture groundnut at close spacing (15  $\times$  10 cm). Install pheromone traps at a rate of 5 per hectare for mass trapping. Spray a neem-based formulation at 5% (Panse, 2021). Growing leafminer resistant /tolerant varieties like Serenut 10R, SGV0023, SGV 002, SGV 0053, SGV 0084, Samnut 22 and 23, ICGV 87160 (ICG (FDRS) and NCAC 17090 (Okello, 2016). Release Bracon hebetor at 5000 per hectare, twice, at intervals of 7-10 days to combat leaf miners. Applying cypermethrin at 13 weeks after planting (WAP) effectively control. Chlorantraniliprole at 0.0185% has been found highly effective for managing leaf miner larvae, with indoxacarb at 0.01% being another good option. (Waykule et al., 2023).

#### 2) Termite (Odontotermes obesus, Rambur):

Termites damaged the seedlings by cutting either just below or above the soil surface. In mature plant, termites feed on root system and inside the stems, which directly kills the plant or indirectly lowers yield through decreased translocation of water and nutrients (Gohil, 2021). Damage to the tap root often resulted in the premature death of the plant. The above-ground symptoms were



Fig. 2: Incidence and damage of termite in groundnut.

typical of those caused by water shortage, with the leaflets turned inwards. However, as the plant gradually died, the leaflets turned brown and later the entire foliage became black and can be easily pulled up (Johson, 1981). It also feed on the pod shell and scarify the pods externally rendering them more susceptible in invasion by soil fungi that can attack seeds, usually such seeds rot (Ikisan, 2024).

Crop rotation is beneficial, as termites often attack plants. Digging up termite mounds to expose and destroy the queen is another effective method. Irrigation is also used to minimize the effect of the termites (Kumari *et al.*, 2013). Applying kerosene oil at 5 ml/kg of kernel before sowing reduced infestation by 26.80% (Monim *et al.*, 2010). Additionally, soil drenching with imidacloprid 40% + fipronil 40%-80 WG @ 250 g/ha was found to be the most effective treatment against termites in groundnut crops (Patel *et al.*, 2010). The most successful methods of controlling soil pests in groundnuts were determined to be seed treatment with imidacloprid 600 FS @ 6.5 ml/ kg seed, furrow application of *Beauveria bassiana* 0.5g/ m<sup>2</sup> and application of imidacloprid 17.8 SL@ 300 ml/ha at 22 DAS (Jakhar *et al.*, 2020).

# **3)** Tobacco caterpillar (*Spodoptera litura*, Fabricius):

The larvae typically attack the crops in August and September, targeting the late vegetative and early reproductive stages (Natikar and Balikai, 2017). The 1<sup>st</sup> and 2<sup>nd</sup> instar larvae of *Spodoptera* damaged the groundnut leaves and apex of the shoots and gregariously attack the same plants and leaves. Later on, the 3rd and onward instars dispersed and moved from one plant to another and feed on the older leaves, stems, shoots, and flowers causing serious damage to the plant (Biswas, 2014).

According to Nath, the incidence of tobacco caterpillar infestations in groundnut crops is influenced by sowing dates as a pest control measure. Early sowing, specifically on June 5<sup>th</sup> or July 20<sup>th</sup>, leads to a lower incidence of tobacco caterpillar. Deep ploughing during the summer months is necessary to expose the pupae. It



Fig. 3: Incidence and damage of S. litura in groundnut.



Fig. 4: Incidence and damage of *H. armigera* in groundnut. is advisable to sow resistant or tolerant crop varieties and use the recommended seed rate for each specific crop (Natikar and Balikai, 2017). Mechanical weeding 15-20 days after sowing reduces the pest's oviposition sites. Installing light traps can help attract moths. Biological practices Releasing Telenomus remus (Nixon) and Apanteles africanus (Cameron). Trichogramma Chilonis at 50,000 per hectare, with additional releases every 7-10 days. Releasing Bracon hebetor at 5,000 per hectare twice, with applications 7-10 days apart. Spraying SINPV at 250 LE per hectare (Dwivedi, 2020). Tolfenpyrad at 2.5 ml/l, which has proven highly effective against Spodoptera (Priyanka et al., 2024). Applying Quinalphos 20% EC at 750 ml/ha, Dichlorvos 76% WSC at 750 ml/ha, Indoxacarb 14.5% SC at 250 ml/ha, Spinosad 45% SC at 125 ml/ha and Diflubenzuron 25% WP at 300 g/ha (Soren and Bouri, 2023).

## 4) Gram caterpillar (*Helicoverpa armigera*, Hubner):

It is a polyphagous insect and is known to attack various other crops as well. Small or large irregular feeding holes on the leaves. They cause extensive damage, including seed loss, reduced quality, and susceptibility to fungal infections. Larvae damages by boring into fruits and feeds on inner contents of the pods (Singh, 2023).

Deep summer ploughing and intercropping with one row of red gram for every 5 or 6 rows can help reduce infestation. Crop rotation with sorghum, maize, pearl millet, and sugarcane also minimize termite and pest problems (Singh *et al.*, 2016). Use resistant varieties like Co-6 and Co-7. Planting border crops such as red gram, cowpea, or black gram can enhance the presence of



Fig. 5: Incidence of grass hopper in groundnut.



Fig. 6: Incidence aphids in groundnut.

natural enemies (Vinoth *et al.*, 2017). For pest control, release *Trichogramma chilonis* at 1 lakh per hectare or *Chrysoperla carnea* at 50,000 per hectare at 40 and 50 days after sowing of groundnut. Additionally, apply *Ha*NPV at 250 LE per hectare, *Bt* (*Bacillus thuringiensis*) at 1 kg per hectare, or 5% NSKE to monitor eggs and early instar larvae (agritech, 2024). Spray chlorantraniliprole 18.5 SC at 30 g a.i. per hectare, which has proven to be highly effective (Mishra *et al*, 2024), or use Spinetoram (0.08  $\mu$ g a.i./cm<sup>2</sup>), Spinosad (0.17  $\mu$ g a.i./cm<sup>2</sup>), or Methomyl (0.18  $\mu$ g a.i./cm<sup>2</sup>) for further control.

### 5) Grass hopper (Cyrtacanthacris septemfasciata):

They feed on young, unfolded leaves, causing the symmetric holes found on opened leaflets. In contrast, feeding caterpillars tend to attack the leaves later, leaving behind randomly distributed holes (Wightman, 1990). The pest population increases significantly during seasons of heavy rain, potentially decimating the entire crop. However, during periods of low rainfall, their numbers are insufficient to cause substantial damage (Dirsh, 1951).

Turning over the soil can destroy grasshopper eggs, and it is essential to time this correctly, typically in late fall or early spring. Planting a less valuable crop around the edges of a field can serve as a buffer, protecting the main crop from heavy feeding (PPO, 2024).



Fig. 7: Incidence of thrips in groundnut.

#### 6) Aphid (Aphis craccivora, Koch):

Both nymphs and adult pests suck the cell sap from leaves, shoots and reproductive parts, often attacking in groups (Oaya, 2020). They prefer terminal twigs and tender parts of the plant, causing curling of leaves and stunted growth (Kumar *et al.*, 2023). The secretion of honeydew by these pests promotes the growth of sooty mold, which can cover the leaves and block sunlight, thereby reducing photosynthesis (Ghosh, 2020). Additionally, this pest is a vector for at least seven viruses that attack groundnuts, with the groundnut rosette virus (GRV) being the most significant (Minja, 1999).

Plant groundnuts early in the rainy season to benefit from lower aphid populations. Regularly inspect plants and promptly remove and destroy any that are early infected. Fill the gaps created by the removal to maintain crop density. Sow fast-growing cereals like maize, pearl millet, and sorghum. These crops, when used as inter and border cropping, can interfere with the movement of vector aphids, thereby reducing the risk of pest infestation (Waliyar et.al., 2007). Plant to ensure an adequate and uniform stand Avoid excessive nitrogen by fertilizing based on soil (Drees, 1993). On the basis of aphid population, the groundnut varieties TAG-24, RG-510 and genotype RG632 were proved to be highly resistant (Gocher, 2020). Use of yellow sticky traps management of aphid. Neemix (neem extract) was more effective insecticide against aphids (Dhakal et al., 2019). Imidacloprid 70 FS 5 ml/kg used as a seed treatment at 30 DAS, thiamethoxam 25 WG at 0.4 ml/l was spray. Use Imidacloprid 70 FS at a rate of 5 ml/kg as a seed treatment. Apply this treatment at 30 days after sowing (DAS). Apply Thiamethoxam 25 WG at a concentration of 0.4 ml/l as a foliar spray to control aphids (Karuppuchamy, 2016).

### 7) Thrips (Scirtothrips dorsalis, Hood):

Both adults and nymphs feed on young leaves, resulting in dull yellow-green patches on the upper surface of the leaves and dark brown necrotic patches on the lower surface (Singh and Oswalt, 1992). Fundenbrenk *et al.* (1998) reported that a severe thrip infestation during the early stages of crop development could lead to significant losses in both biomass and kernel yield. It also acts as a vector of groundnut Bud Necrosis Virus (Reddy and Wightman, 1988), tomato spotted and other viruses (Singh, 1990).

The resistant variety TGLPS-3 has shown resistance to thrips (Gadad *et al.*, 2014). Azadirachtin 1% spray applied at 2 ml/l at 30 days after sowing (DAS), combined with growing cowpea as a trap crop or cumbu as an intercrop, significantly reduced thrips populations (Karuppuchamy, 2016). Seed treatments with imidacloprid at a rate of 2.0 to 5.0 g active ingredient per kg of seed were found to be highly effective in reducing insect populations (Nataraja, 2016). Additionally, Fipronil 5% SC at 400-500 ml per acre, Spinosad 45% SC at 60-90 ml per acre, or Imidacloprid 70% WG at 2-3 grams per 15 liters of water are recommended for managing insect populations (KSK, 2024).

### Conclusion

Early insect pest management in groundnut is crucial for ensuring healthy crop development and maximizing yield. Implementing strategies such as mechanical weeding, the use of light traps, and biological control agents can effectively reduce pest populations and damage. Additionally, selecting resistant varieties and applying recommended chemical treatments as necessary can further protect crops from early pest infestations. By adopting these integrated pest management practices, farmers can sustainably manage pests and enhance groundnut production.

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