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Arthropod Pests of Pulses: Biology and Control

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Pulses are a vital source of dietary protein, carbohydrates, vitamins, and minerals for millions of people worldwide. They are often referred to as the "poor man's meat" due to their affordability and high protein content, especially in developing countries. Globally, pulses such as chickpea, pigeonpea, lentil, cowpea, mungbean, and common bean are widely cultivated. Besides their nutritional value, they also contribute to sustainable agriculture by fixing atmospheric nitrogen, thereby improving soil fertility and reducing dependence on chemical fertilizers. However, pulse crops are highly vulnerable to a wide range of arthropod pests. These pests not only reduce yield in the field but also cause post-harvest losses in storage. According to FAO estimates, field and storage pests together can account for 20–40% yield losses annually, with certain pests like pod borers (Helicoverpa armigera) and storage bruchids (Callosobruchus spp.) causing total seed destruction under favorable conditions. Therefore, a detailed understanding of pest biology, seasonal incidence, and control strategies is crucial for devising sustainable Integrated Pest Management (IPM) approaches.

Major Arthropod Pests of Pulses and Their Biology

1. Pod Borer (*Helicoverpa armigera*)

Biology: One of the most destructive pests globally. Female moths lay up to 1,500 eggs, mostly on flower buds, flowers, and young pods. Eggs hatch within 3–5 days. The larval stage lasts 15–20 days, during which caterpillars bore into pods and feed on seeds. Pupation occurs in soil. Life cycle is completed in 30–40 days.

Damage: Pod boring leads to unfilled seeds, characteristic circular exit holes on pods, and direct seed loss of up to 50%.

2. Aphids (*Aphis craccivora*)

Biology: These soft-bodied insects reproduce rapidly, often parthenogenetically. Colonies are found on tender shoots, leaves, flowers, and pods.

Their population builds up quickly in cool, moist weather.

Damage: Continuous sap sucking causes curling, yellowing, and stunted growth. Honeydew excretion supports sooty mold development. More importantly, aphids transmit viral diseases like Cowpea Aphid-Borne Mosaic Virus (CABMV), leading to huge indirect losses.

3. Whitefly (*Bemisia tabaci*)

Biology: Eggs are laid on the undersides of leaves. Nymphs are sedentary and suck sap continuously. Adults are small, white-winged insects capable of flying and dispersing easily.

Damage: Sap sucking weakens plants, causes yellowing, and reduces photosynthesis. Whiteflies are the primary vectors of Mungbean Yellow Mosaic Virus (MYMV), one of the most destructive viral diseases of pulses.

4. Thrips (*Caliothrips indicus, Frankliniella schultzei*)

Biology: Minute, slender insects that reproduce quickly in hot, dry conditions. They prefer flowers, tender buds, and leaves.

Damage: Scraping of tissues leads to silvering, bronzing, curling of leaves, and poor flower and pod setting. Heavy infestations cause flower shedding and low yields.

5. Bruchids (*Callosobruchus chinensis, C. maculatus*)

Biology: Major storage pests, but field infestation often begins before harvest. Females lay eggs on pods or seeds. The emerging larvae bore directly into the seed, completing their development inside. One generation takes 3–4 weeks, and several generations occur during storage.

Damage: Infested grains show exit holes and powdery residues. Seeds lose germination ability and market value. If unchecked, bruchids can cause 100% grain loss in storage.

6. Pod Bug (*Clavigralla gibbosa*)

Biology: Belongs to Hemiptera. Eggs are laid on leaves and pods. Both nymphs and adults feed by sucking sap.

Damage: Feeding causes shriveled, discolored seeds with reduced viability. Infestation also leads to flower drop and malformed pods.

7. Leaf Miner (*Ophiomyia phaseoli*)

Biology: A small fly that lays eggs in leaf tissues. Maggots mine between leaf layers, creating zig-zag patterns.

Damage: Reduces effective photosynthetic area, leading to poor plant vigor. In severe cases, defoliation occurs.

8. Armyworms and Cutworms (*Spodoptera litura, Agrotis ipsilon*)

Biology: Polyphagous pests. Females lay eggs in clusters covered with brown scales. Caterpillars feed at night on foliage and stems.

Damage: Seedling mortality, defoliation, and cutting of stems near soil level. Losses are severe during early crop stages.

9. Termites (*Odontotermes spp., Microtermes spp.*)

Biology: Social insects living in large colonies. They attack underground parts and sometimes above-ground stems.

Damage: Plants wilt suddenly, seedlings dry up, and yield reduction may exceed 20% in termite-prone areas.

Seasonal Incidence of Major Pests

- **Pod Borer**: Maximum during flowering to pod formation (October–March in subtropics; varies globally).
- **Aphids**: Appear early in crop season, thriving in cool, humid weather.
- **Whitefly:** Active during warm, dry conditions but peak populations coincide with flowering.
- **Thrips**: Abundant in hot, dry climates, especially during pre-flowering.
- **Bruchids**: Predominantly storage pests but infestation begins in the field at maturity.
- **Cutworms/Armyworms:** Damage seedlings after rains at the crop establishment stage.
- **Termites**: Active throughout season in sandy/light soils.

Integrated Pest Management (IPM) in Pulses

Cultural Control

- Early sowing to avoid pest peak periods.
- Deep ploughing to expose pupae of pod borers.
- Crop rotation with non-host crops.
- Maintaining field sanitation by removing alternate hosts and residues.
- Proper drying and storage of seeds.

Host Plant Resistance

Development of resistant varieties against pod borers, aphids, and MYMV is a cost-effective, eco-friendly approach. For example, resistant mungbean lines have shown tolerance against whitefly-transmitted MYMV.

Biological Control

- Egg parasitoids (Trichogramma chilonis) for H. armigera.
- Predators such as ladybird beetles, green lacewings, and syrphid flies for aphids.
- **Pathogens:** *Bacillus thuringiensis* (Bt) and Nuclear Polyhedrosis Virus (NPV) against pod borers.
- Braconid parasitoids (Bracon hebetor) against bruchids in storage.

Botanical Control

- Neem-based formulations (NSKE 5%, neem oil) for sucking pests.
- Sweet flag (Acorus calamus) and pongamia extracts effective in storage pest management.

Chemical Control (Judicious Use Only)

Pod borers: Emamectin benzoate, chlorantraniliprole.

Aphids/whiteflies: Imidacloprid, thiamethoxam.

Thrips: Spinosad or fipronil sprays.

Bruchids in storage: Aluminum phosphide fumigation (in airtight conditions).

Integrated Approach

- Combining resistant varieties, trap crops, biological agents, and need-based insecticide application.
- Farmer field schools and community IPM programs have shown success in Asia and Africa by reducing pesticide use by 30–40% without yield loss.

Conclusion

Arthropod pests pose a major challenge to pulse cultivation worldwide, both in the field and in storage. Understanding their biology and seasonal incidence is essential for sustainable management. While chemical

insecticides provide quick results, their indiscriminate use leads to resistance, resurgence, and environmental hazards. Therefore, emphasis must be placed on eco-friendly IPM practices, including resistant varieties, natural enemies, botanicals, and cultural practices. A globally coordinated strategy is needed to manage pests like pod borers and bruchids that cause extensive losses. Adoption of climate-smart IPM will not only enhance pulse productivity but also ensure environmental safety and long-term food security.

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