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IMPROVING BIOECOLOGICAL STUDIES AND PHYTOSANITARY MONITORING OF MEDICINAL CHAMOMILE PESTS IN FORESTRY ENTERPRISES

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Abstract. This thesis examines the bioecology of insect and mite pests associated with medicinal chamomile (Matricaria chamomilla L., also known as M. recutita) and proposes a risk-based phytosanitary monitoring framework for plantations managed by forestry enterprises. Evidence from peer-reviewed chamomile studies is combined with official Uzbek policy and forestry-sector information. The proposed approach integrates species identification, phenological surveillance, standardized sampling, meteorological records, beneficial-arthropod counts, and traceable intervention decisions. Published observations indicate that aphids, thrips, plant bugs and certain defoliators may affect chamomile, but their occurrence and economic importance must be verified locally. The thesis presents a practical monitoring schedule, a pest-risk matrix and a decision-support framework suited to medicinal raw-material quality and ecological protection. No original field survey results are claimed.

Keywords: medicinal chamomile; Matricaria chamomilla; forestry enterprises; pest bioecology; phytosanitary monitoring; aphids; thrips; integrated pest management; Uzbekistan.

INTRODUCTION

Medicinal plant plantations have growing relevance to Uzbekistan's forestry sector. The Presidential resolution of 10 April 2020 addressed the protection, cultivated production and processing of medicinal plants, including activities on forest-fund land. A further presidential resolution of 20 May 2022 established targets for medicinal-plant plantations, including areas on forest-fund land. More recently, an official forestry report stated that medicinal and food plant plantations had been established on 5.9 thousand hectares of land managed by forestry enterprises; this figure covers multiple plant species and must not be interpreted as chamomile area.

German chamomile is valued for its flower heads, used as medicinal raw material. Damage to foliage, shoots and inflorescences can influence plant vigor, marketable harvest and raw-material cleanliness. The forestry setting introduces additional ecological considerations: plantation edges may border wild vegetation, shelter natural enemies and also serve as reservoirs for polyphagous pests. Thus, monitoring should consider the whole plantation–edge system rather than only crop rows.

The aim of this study is to substantiate an improved phytosanitary monitoring framework for medicinal chamomile in forestry enterprises, based on pest bioecology, phenology, ecological indicators and the requirements of safe medicinal-plant production.

MAIN BODY

Pest complex and bioecological characteristics. A comprehensive review of German chamomile documents a diverse arthropod complex, including members of Miridae, Thripidae, Pseudococcidae and Pentatomidae, together with some foliage- and flower-damaging insects. A 2026 field study in India reported Aphis gossypii, Thrips tabaci, Nysius cymoides and Nesidiocoris tenuis on chamomile, while recording ladybirds and Chrysoperla carnea among associated natural enemies. These are geographically specific observations, not a verified inventory of pests in Uzbek forestry plantations.

Aphids reproduce rapidly under favorable conditions and extract phloem sap from tender plant tissues; colonies can be accompanied by honeydew and leaf distortion. Thrips use rasping–sucking

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mouthparts, frequently colonize flowers and young tissues, and may cause discoloration or surface damage. Seed bugs and other hemipterans can affect reproductive structures, although species-level feeding behavior requires confirmation. Defoliating caterpillars reduce photosynthetic area, while spider mites may become important under dry, warm conditions. For medicinal chamomile, monitoring of inflorescences is particularly important because flower heads are the principal harvested organ.

Table 1. Literature-based scouting priorities; not a list of species confirmed in Uzbekistan.

Potential pest / group	Bioecological features	Priority scouting site	Interpretive caution
Aphids (e.g., Aphis spp.)	Colonies on tender shoots; rapid population change	Young shoots, underside of leaves	Species and local abundance require verification
Thrips (e.g., Thrips tabaci)	Small, mobile insects; feeding on tender tissues and flowers	Flower heads and young leaves	Presence does not establish economic damage
Plant/seed bugs (Hemiptera)	Mobile sap feeders; some associated with reproductive structures	Buds, flowers, seed heads	Identify to species before assigning pest status
Defoliating larvae	Leaf chewing; often patchy distribution	Leaves and growing points	Separate feeding injury from disease symptoms
Spider mites (Tetranychidae)	Populations may rise in hot, dry periods	Leaf undersides and field edges	Confirm by magnification and local counts

Seasonal dynamics and environmental drivers. Pest populations vary with temperature, relative humidity, crop phenology, surrounding vegetation and natural-enemy activity. In the Indian study, peaks for aphids, thrips and hemipteran species occurred in different meteorological weeks. Those calendar dates should not be transferred directly to Uzbekistan: local sowing dates, altitude and climate differ. Monitoring should instead be synchronized with seedling establishment, vegetative growth, budding, flowering and harvest. Recording degree-days may become useful after local species identification and thermal-development parameters have been validated.

The plantation perimeter merits particular attention. Sampling should include both edge and interior plots, because vegetation structure and microclimate may differ. Counts of predators and parasitoids should accompany pest observations to avoid unnecessary interventions that disrupt biological regulation.

Improved phytosanitary monitoring protocol. A practical monitoring system should use a permanent georeferenced sampling design. For each relatively uniform field block, establish at least five fixed observation points, covering edges and the interior. At each point, inspect ten randomly selected plants, giving 50 plants per survey block. This is a proposed operational starting design, not a statistically validated national sampling standard; the number of samples should be adjusted according to field heterogeneity and preliminary variance estimates.

Weekly monitoring is appropriate as a baseline during active growth, with additional checks during budding and flowering or after rapid pest increases. At each survey, record crop stage, pest identity (or specimen code), number of affected plants, abundance per defined plant part, visible injury, predator counts, temperature, relative humidity, irrigation and any treatment. Suspected species should be preserved or photographed and identified by an entomologist using reliable taxonomic keys.

Table 2. Proposed stage-specific monitoring protocol for forestry-managed chamomile plantations.

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Crop stage	Recommended observation	Core indicator	Suggested management response
Establishment	Seedlings and weeds; field perimeter	Infested plants / 50 sampled	Verify species; improve sanitation
Vegetative growth	Shoots and leaf undersides	Individuals per shoot; infestation %	Track trends and natural enemies
Budding	Buds and adjacent foliage	Damaged buds / inspected buds	Increase inspection frequency if rising
Flowering	Flower heads and beneficial insects	Pests per flower head; injury %	Protect medicinal quality; use only authorized options
Pre-harvest / post-harvest	Harvestable heads, residues, storage hygiene	Visible contamination; injury records	Respect withholding periods and traceability

Three indicators are recommended: infestation incidence I (%) = 100 × infested plants / examined plants; mean pest density D = counted individuals / examined plant units; and flower-head damage F (%) = 100 × damaged heads / inspected heads. For each sampling date, the same plant unit and counting method must be maintained. Trend analysis should compare successive observations and field blocks, rather than relying on a single snapshot.

Ecologically sound intervention and quality assurance

Integrated pest management (IPM) should begin with prevention: healthy planting material, suitable sowing density, balanced irrigation, weed management and removal of severely affected residues where appropriate. The conservation of ladybirds, lacewings and other natural enemies should be considered before interventions. A 2026 chamomile study assessed environmentally oriented control options involving neem oil, Beauveria bassiana, Chrysoperla carnea and integrated treatments; nevertheless, its treatment results cannot substitute for local registration, efficacy testing or medicinal-product residue requirements.

No universal economic threshold is established here. A locally justified action threshold requires replicated data linking pest density, flower-head injury, dry flower yield, quality and treatment cost. Any pesticide or biological preparation should be used only where legally authorized for the crop and purpose, with full observance of label instructions, pre-harvest intervals and medicinal raw-material quality requirements. Monitoring records should remain linked to the harvested lot to support traceability.

Digital field logs, GPS-tagged observation points and standardized photo records can make surveillance more consistent. A seasonal database can support early-warning models once sufficient locally verified observations become available. The effectiveness of monitoring improvements should be assessed through identification accuracy, detection time, avoidable treatments, flower-head quality and pest-related yield loss not simply by counting interventions.

CONCLUSION

The evidence indicates that medicinal chamomile can host a varied arthropod complex, but the actual species composition and damaging status in Uzbekistan’s forestry enterprises must be

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established through local surveys. A scientifically sound monitoring system should integrate repeated pest counts, crop phenology, edge-to-interior comparisons, meteorological observations and natural-enemy assessments. Standardized indicators and digital records can improve the comparability of results and support timely, proportionate decisions. The proposed framework also recognizes that the protection of medicinal flower heads requires special attention to product safety and traceability. The next research priority is multi-season field validation across forestry plantations, including species identification, seasonal population curves, pest–damage relationships and evaluation of locally permitted IPM measures.

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