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Original Research Article

A Comparative Study of the Preservative Effect of Vacha and Apamarga Ghana Vati on Stored Grains of Chanak (Cicer arietinum) with Special Reference to Their Insecticidal Activity

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Abstract: ***Background:*** Storage pest infestation in pulses leads to considerable agricultural and economic loss. Synthetic grain protectants pose residue and safety concerns. Ayurveda mentions *Vacha (Acorus calamus)* and *Apamarga (Achyranthes aspera)* as **Krimighna** and **Rakshoghna**, suggesting preservative potential.
Aim: To evaluate and compare the preservative and insecticidal effects of **Vacha Ghana Vati** and **Apamarga Ghana Vati** on stored *Cicer arietinum* for three months, using **Parada pellets** as standard.
Methods: Chickpea grains were divided into four groups: Control, Vacha Ghana Vati, Apamarga Ghana Vati, and Standard (Parada Pellets). Dose: 500 mg Ghana Vati / 1 kg grain; 1 Parada pellet / 1 kg grain placed in muslin sachets. Artificial infestation was induced using *Callosobruchus spp.* Parameters assessed were oviposition count, adult emergence, grain damage %, weight loss %, moisture %, and sensory quality. GC–MS profiling identified active phytoconstituents. Statistical analysis used ANOVA with $p < 0.05$ as significant.
Results: Vacha Ghana Vati showed minimum oviposition, adult emergence, grain perforation and weight loss, followed by Parada and Apamarga Ghana Vati. Control showed maximum deterioration. GC–MS demonstrated β-asarone and volatile oils in Vacha and saponins/alkaloids in Apamarga supporting observed biological effects.
Conclusion: Vacha Ghana Vati exhibits superior preservative and insecticidal efficacy, with Apamarga Ghana Vati showing significant protective effect. These formulations may serve as effective and eco-friendly grain protectants.

Keywords: Vacha Ghana Vati, Apamarga Ghana Vati, Chickpea storage, Insecticidal activity, Preservative effect, Ayurveda, GC–MS.

INTRODUCTION

Pulses such as *Cicer arietinum* are nutritionally important but highly vulnerable to storage pest infestation, particularly *Callosobruchus spp.* resulting in quantitative and qualitative loss [1]. Conventional fumigants and pesticides, while effective, pose risks including toxic residues, resistance development, and environmental hazards [2,3]. There is increasing demand for safe, sustainable and biodegradable storage protectants.
Ayurveda describes several botanicals and Rasashastra formulations with **Krimighna** (insecticidal) and **Rakshoghna** (protective) actions. *Vacha (Acorus calamus)* is described as Tikshna, Ushna and Krimighna, while *Apamarga (Achyranthes aspera)* possesses Rakshoghna and Krimighna properties [4,5]. Previous pharmacological studies demonstrate insect repellent and antimicrobial activity of these plants [6–9].
This study evaluates and compares **Vacha Ghana Vati** and **Apamarga Ghana Vati** for preservative effect in stored chickpea grains over three months, using **Parada pellets** as standard, correlating findings with GC–MS phytochemical analysis.

MATERIALS AND METHODS

Study Design

This was a controlled laboratory experimental study designed to compare the preservative and insect-protective effects of two Ghana Vati preparations over a defined storage period. The experimental structure followed a parallel-group design with four treatment arms and triplicate observations to improve reliability of interpretation.

Materials

Grain Selection

Clean, mature, and infestation-free Cicer arietinum grains were procured from a reliable source. Grains were manually examined to exclude cracked, discolored, or damaged seeds to ensure uniform baseline quality. Each experimental unit consisted of 1 kg of chickpea grains.

Formulations Under Study

Vacha Ghana Vati (Acorus calamus) 500 mg tablets
Apamarga Ghana Vati (Achyranthes aspera) 500 mg tablets.
Both prepared using standard Ghana (aqueous extract concentrated to semi-solid and dried) methodology ensuring herbal integrity.
Standard Comparator
Traditional Parada pellets were used as the classical Rasashastra comparator owing to historical documentation of preservative action.

Insect Culture

Laboratory-maintained Callosobruchus spp. colony was used. The culture was sustained on pulse grains under controlled laboratory conditions, ensuring insect vitality and suitability for infestation induction.
Grouping
Samples were divided into four experimental groups:
Control Group – No treatment
Vacha Group – Chickpeas treated with Vacha Ghana Vati
Apamarga Group – Chickpeas treated with Apamarga Ghana Vati
Standard Group – Chickpeas treated with Parada pellets
Each group was set in triplicate to account for observational consistency.

Dose and Application

One unit of treatment (500 mg Ghana Vati tablet or Parada pellet) was used per kilogram of chickpea grains. The tablets and pellets were enclosed in clean muslin cloth sachets to avoid direct contact with grains and allow free volatilization and diffusion of active constituents.Sachets were fixed in the center of each grain mass within storage containers.

Storage Containers and Conditions

Grains were stored in airtight, moisture-free containers to simulate real storage conditions. Containers were clearly labeled and maintained under standard laboratory environmental settings. Efforts were made to minimize external contamination throughout the duration of the study.

Infestation Procedure

Adult beetles were introduced to simulate storage infestation.
Each sample received:
10 male + 10 female Callosobruchus spp. adults
allowed 7 days oviposition period Following oviposition, adults were manually removed to allow infestation to proceed under natural larval emergence dynamics.
Duration and Observation Schedule
The total study duration was 90 days, reflecting realistic storage conditions. Observation intervals:
Day 30
Day 60
Day 90
This allowed assessment of early, progressive, and late-stage storage effects.

Parameters Assessed

1. Oviposition Behaviour
Tendency of egg-laying on grain surface, presence of egg clusters, and visible reproductive interference effects were evaluated comparatively between groups.
2. Adult Emergence
Observed trend of new adult insects emerging from grains served as an indicator of reproductive success and protection failure.
3. Grain Damage and Perforation
Visible structural perforations, integrity loss, and degree of surface erosion were examined qualitatively.
4. Weight Stability Trend
Weight stability was monitored as a general indicator of protection against degradation and insect feeding-related loss.
5. Moisture Trend
Observational moisture change assessment considered surface feel, condensation tendency, and general environmental stability.
6. Sensory Quality
Colour, odour, surface shine, and acceptability were qualitatively assessed, reflecting consumer relevance.

GC–MS Analysis

Methanolic extracts of Vacha Ghana Vati and Apamarga Ghana Vati were subjected to GC–MS analysis.
Instrument equipped with DB-5MS capillary column
Helium used as carrier gas
Electron Ionization mode at 70 eV
Chromatographic run parameters optimized for phytoconstituent identification
Chromatographic peaks were interpreted through comparison with available spectral libraries, enabling phytochemical profile interpretation.

RESULTS

Vacha Ghana Vati showed minimum oviposition, adult emergence, grain perforation, weight loss, and moisture rise. Apamarga Ghana Vati demonstrated significant but comparatively moderate efficacy. Parada pellets exhibited strong protective effect validating standard comparison. Control showed maximum deterioration.

GC–MS showed β-asarone, α-asarone, sesquiterpenes and volatile constituents in Vacha indicating strong fumigant effect. Apamarga revealed saponins, alkaloids and phytosterol derivatives suggesting insect deterrent properties.

DISCUSSION

Findings confirm significant preservative and insecticidal potential of both formulations. Superior efficacy of Vacha Ghana Vati may be attributed to β-asarone-rich volatile constituents responsible for fumigant and neurotoxic insecticidal action [6,7]. This aligns with its Ayurvedic classification as Tikshna, Ushna and Krimighna.

Apamarga Ghana Vati demonstrated effective protection, likely due to saponins and alkaloids influencing insect physiology and oviposition behavior [8,9], consistent with its Rakshoghna and Krimighna properties.

Parada pellets supported classical Rasashastra claims of preservative action [10]. The strong correlation between GC–MS findings and biological outcomes provides modern validation of Ayurvedic concepts.

CONCLUSION

- Vacha Ghana Vati showed maximum insecticidal and preservative efficacy.
- Apamarga Ghana Vati demonstrated significant preservation.
- Parada pellets acted as effective standard.
- GC–MS profiling supported bioactivity.
- Ayurvedic Ghana Vati preparations may serve as eco-friendly, safe grain storage protectants.

Limitations

Laboratory setting only; residue and toxicity analyses not included; limited to chickpea.

Future Scope

Field validation, toxicological studies, commercialization potential assessment, application to other grains.

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