Journal of Scientific Research and Reports

Volume 30, Issue 11, Page 1057-1063, 2024; Article no.JSRR.127374
ISSN: 2320-0227

First Report on the Bark Feeding Wasp Species on Lowland Apple and Stone Fruit Trees of Himachal Pradesh, India

Surender K. Sharma [a++*], Debamitra Chatterjee [a#] and Shivani [a†]

[a] CSKHPKV, Bee Research Station, Nagrota Bagwan, Himachal Pradesh-176047, India.

Authors' contributions

This work was carried out in collaboration among all authors. Author SKS led the research work, managed arrangements, recorded data, and developed the manuscript. Author DC assisted in collecting information, data, and installation of wasp traps. Author Shivani assisted in data recording, data analysis, and manuscript development. All authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/jsrr/2024/v30i112632

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/127374

Short Research Article

Received: 18/09/2024
Accepted: 20/11/2024
Published: 26/11/2024

ABSTRACT

Wasps are predominant in the Oriental and Palaearctic regions, sometimes used as dishes, and are important candidates for different ecosystems as predators and pollinators. In India, more than a dozen predatory wasp species have been reported to contribute to biological pest control. Various wasp species are invasive in some continents and pose an alarming threat to apiaries, households, and orchardists. Wasps feed on tree bark to fulfill their dietary needs but become dangerous to humans in orchards. The scientific reports on tree bark defoliation by wasps are little and scanty. A

[++]Principal Scientist;
[#]Research Scholar;
[†]Bee Professional;
**Corresponding author: E-mail: surender.brs@gmail.com, surrender.brs@gmail.com;*

Cite as: *Sharma, Surender K., Debamitra Chatterjee, and Shivani. 2024. "First Report on the Bark Feeding Wasp Species on Lowland Apple and Stone Fruit Trees of Himachal Pradesh, India". Journal of Scientific Research and Reports 30 (11):1057-63. https://doi.org/10.9734/jsrr/2024/v30i112632.*

field-based survey study assessed the quantum of infestation in fruit orchards and the threat experienced by field workers in the Kangra district of Himachal Pradesh, India during the years 2022 and 2023. Wasps of species, *Vespa basalis* and *V. auraria* were encountered infesting five orchards on tree bark in Samloti (32.08° N, 76.35° E), Shahpur (32.2197° N, 76.1728° E), Nagrota (32.1054° N, 76.3789° E), and Hatwas (32.05 ° N and 76.40 ° E). Average tree per cent infestation during these years was recorded as 26.83%, 28.85%, 40.04%, 75% and 57.91% in lowland apple (*Malus domestica*), pear (*Pyrus communis*), peach (*Prunus persica*), losada (*Cordia myxa)*, and sirish (*Albizia lebbeck*), respectively. This bark-feeding activity rendered the infested trees unfit for optimal growth, feeding on fruits, suggesting a potential threat to local orchard productivity. The noxious presence of wasps hinders activities, obstructs and stings field staff. Escalating wasp damage led farmers to adopt fermented honey bottle traps. This study is the maiden attempt to address the harmful behavior of wasps as tree bark feeders in India and may pave the way for detailed research in orchards. Thus, keeping in view the role of wasps within agricultural landscapes as detrimental agents, mindful management practices are therefore necessary.

Keywords: Wasp; tree bark; orchard; infestation; honey bottle trap.

1. INTRODUCTION

Predatory wasps play a crucial role in ecosystems due to their ability to regulate populations of harmful insects, especially in warm and humid climates (Verma et al., 2023). With over a dozen species documented in India alone (Carpenter & Kojima, 1997), these insects contribute significantly to pest control, particularly by preying on the immature stages of various agricultural pests. For instance, European wasps (native to Europe, Asia, and North Africa) and the invasive Asian hornet *Vespa auraria* have been documented to cause damage to apiaries, with losses reported in up to 30% of bee colonies (Ken et al., 2005). The wasp's role as both predator and pest underscores their importance in maintaining ecological balance.

In India, particularly within the temperate and subtropical regions of the Hindu Kush Himalayas, apiaries face significant predation from five different species of wasps, often resulting in the dwindling or complete desertion of honey bee colonies (Motmayen et al., 2024). Predatory attacks are particularly devastating during the rainy season when colonies are most vulnerable, causing average losses of 25-30% in *Apis cerana* and even higher in *Apis mellifera*. This threat is exacerbated by the wasp species such as *Vespa auraria*, which are particularly aggressive predators of honey bees (Pusceddu et al., 2017).

In addition to their ecological significance, wasps also have economic importance in regions where entomophagy is widely practiced. For example, over 2100 species of insects, including wasps, are consumed by various ethnic communities worldwide (FAO, 2021). In the North Eastern states of India, wasps are a traditional food source, providing essential nutrients like proteins, vitamins, and minerals. Despite the nutritional benefits, wasp consumption remains limited by challenges in storage and packaging (Thangjam et al., 2020; Mozhui et al., 2020).

However, the presence of wasps near human habitats poses certain risks. Wasp stings can cause severe allergic reactions, including anaphylaxis, which may be fatal. The global incidence of sting-induced fatalities ranges between 0.03 to 0.48 per million inhabitants annually (Ruwanpathirana and Priyankara, 2022). Additionally, reports indicate that wasp venom has therapeutic potential, with research demonstrating its use in traditional medicine to treat arthritis and pain due to its anti-inflammatory properties (Sun et al., 2024; Dongol et al., 2016).

Wasps also contribute to agricultural damage, especially in orchards where they strip bark from trees and damage fruits, which can lead to significant economic losses (Oliver, 2014). The European hornet (*Vespa crabro*), for instance, has been noted for its nocturnal foraging habits that can severely damage fruit trees by puncturing the fruit, thereby reducing its market value (Barbosa et al., 2014). Managing wasp populations to minimize their impact on agriculture while preserving their ecological benefits is a significant challenge, requiring integrated pest management strategies, including the use of baits and traps.

In light of their dual role as both beneficial predators and agricultural pests, understanding

predatory wasps' behavior, and management is essential for optimizing their benefits while mitigating the risks they pose to human activities. This study aims to assess the quantum of infestation in fruit orchards, the threat experienced by field workers in orchards, and management strategies associated with predatory wasps, focussing on the challenges faced by apiaries and fruit orchards in India.

2. MATERIALS AND METHODS

The field survey was conducted in the Kangra district of Himachal Pradesh, India, during the years 2022 and 2023. Four specific locations were selected under mid-hills conditions: Samloti (32.08° N, 76.35° E), Shahpur (32.2197° N, 76.1728° E), Nagrota (32.1054° N, 76.3789° E), and Hatwas (32.05 ° N and 76.40 ° E). Farmers of these orchards have experienced significant wasp infestations during monsoon and autumn season, hence the survey was conducted spanning from May to November in both years, coinciding with the peak period of wasp activity in the region. The study involved a comprehensive survey of fruit orchards, focusing on assessing wasp infestation levels on different tree species. The survey was conducted over two consecutive years:

During the year 2022, a total of 535 lowland apple trees, 75 peach trees, 40 pear trees, 1 losada tree (*Cordia myxa*), and 10 sirish trees (*Albizia lebbeck*) were monitored. In the year 2023; the study included 430 lowland apple trees, 57 peach trees, 35 pear trees, 2 losada trees, and 7 sirish trees.

The survey focused on recording the presence and behavior of two wasp species: *Vespa basalis* and *V. auraria* (Fig 2). These species were observed feeding on the bark of fruit trees and observations were conducted between 10:00 to 14:00h, the period identified as peak foraging time for wasps. A bottle trap containing fermented honey which is replenished on every third day were also installed in three replications in each orchard to manage wasps. The data collected were entered into Microsoft Excel for analysis. It focused on comparing wasp infestation levels between the two years and across different tree species.

3. RESULTS AND DISCUSSION

Wasp damage to fruit trees is a significant concern in Himachal Pradesh, especially for honey bee apiaries as well as for apple and pear trees. The state is pioneer of commercial beekeeping in India. Wasps are mostly confined to higher altitudes, and their incidence is evident from July to November. The results indicate that wasps inflict considerable damage on fruit crops by scrapping the flesh of fruits or expanding existing holes created by birds. The sap exuding from these punctures, which is rich in sugars and other nutrients, acts as a powerful attractant for wasps, exacerbating the damage. This sap-feeding behavior not only compromises the integrity of the fruit but also significantly reduces its market value especially of apple, pear, peach, plum, guava, etc due to unappealing puncture marks, ultimately leading to economic losses for orchard growers. Notably, overripe or already damaged fruits with a pronounced sugary aroma tend to attract wasps more readily, increasing the likelihood of infestation.

In addition to damaging fruits, wasps were observed to strip bark from trees in orchard, particularly during late summer and autumn when their colonies reached peak population levels (Fig 3). This activity was especially problematic in orchards where nursery operations inadvertently disturbed subterranean and aerial nests, leading to aggressive defensive behavior from the wasps, often resulting in painful stings to workers. The bark-stripping behavior, poses a severe threat to young nursery saplings, and the grown up trees as girdling can disrupt the flow of nutrients, ultimately causing tree mortality.

The field survey conducted in the Kangra district of Himachal Pradesh during 2022 and 2023 highlights significant patterns of wasp infestation on various fruit trees, specifically apples, peaches, pears, losada (*Cordia myxa*), and sirish (*Albizia lebbeck*). The data reveal several key findings for the first time that are crucial for understanding the impact of wasps on orchard health in mid-hills conditions. The study indicated that the level of infestation of *Vespa basalis* and *V. auraria* varied notably across different locations and years. Both the species were found infesting apple, pear, and losada whereas sirish and peach were exclusively attacked by *V. basalis* indicating that these must have served as a host plant for overwintering. In 2022, the highest infestation rate for apple trees was observed in Nagrota (60%), while the lowest was in Samloti (20%). In 2023, the infestation rates generally decreased, with the highest being 30% in Nagrota and the lowest 15.15% in Samloti

(Fig 1). This reduction in infestation rates could be attributed to various factors, such as changes in environmental conditions, fluctuations in wasp populations, or possibly improved orchard management practices between the two years. However, the persistent presence of wasps, especially in certain locations like Shahpur and Hatwas, underscores the need for ongoing monitoring and targeted pest management strategies.

3.1 Infestation Trends in Different Fruit Trees

Wasp infestation was not limited to apple orchards but extended to other fruit trees such as peaches, pears, losada, and sirish. The data for peach trees showed a higher infestation rate in 2023 (e.g., 50% in some surveyed areas) compared to 2022 (e.g., 40% in Samloti). For pear trees, the infestation rates were generally less compared to lowland apples and peach, with rates ranging between 13.3% to 42.8% across locations and years. This suggests that pear trees might be less attractive to wasps, possibly due to differences in sap exudation or bark texture.

The most striking observation was for losada trees in Samloti where the trees were being infested but did not show any withering. In Losada, there was 100 % infestation rate in 2022 but showed a trend of reduction to 50% in 2023. The sirish trees, on the other hand, displayed an extremely high infestation rate of 80% in 2022, which decreased to 66.6% in 2023 in Nagrota Bagwan. The marked preference for these trees could be related to their bark characteristics and the nutritional value of the sap they exude.

3.2 Management of Wasps

Social wasps, while beneficial as natural predators of insect pests, can also pose a significant threat to orchard crops. A very efficient alternative is the use of traps and baits. Field studies have demonstrated that baits containing acetic acid and karanj oil are particularly successful in reducing wasp populations, providing a targeted and sustainable management option in orchard environments**.** A wasp management technology developed at this centre of BRS Nagrota Bagwa (Palampur trap) (Fig 6) were installed in August 2022 and 2023 in three replications at the farmer's orchard. The traps were replenished with fermented honey on every 3rd day and on average, *Vespa auraria* (10.28± 0.84 wasp/week) and *V. basalis* (7.75± 1.05) were trapped by this device. (QRT progress report(2018-2023) of AICRP on Honey bees and Pollinators).

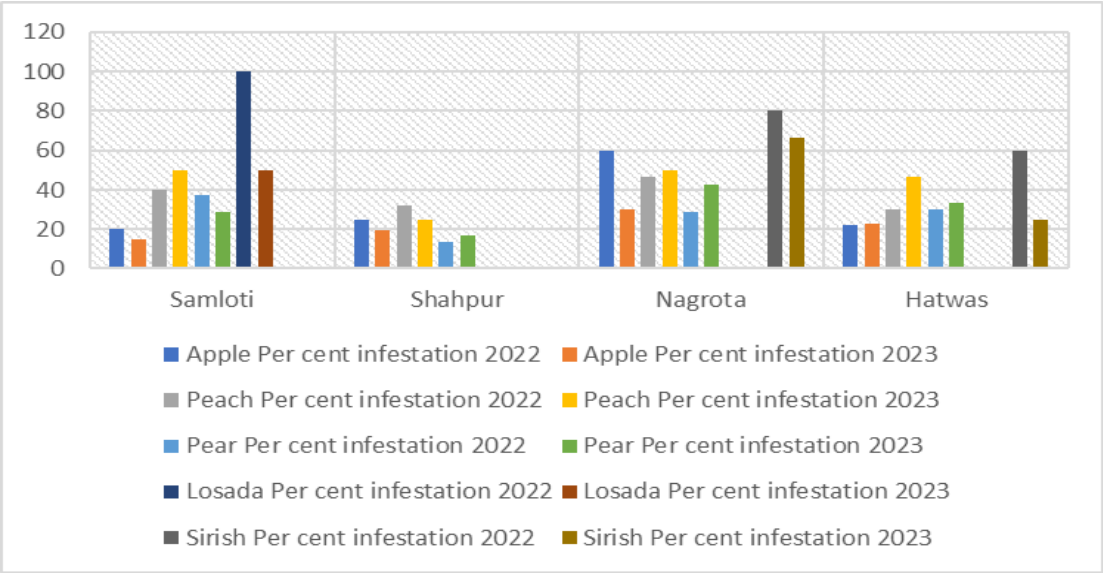

Fig. 1. Wasp Infestation (%) in different fruit tree species across surveyed locations during 2022 and 2023 in Kangra district of Himachal Pradesh

Fig. 2 a. Adult worker of *V. auraria* (Left)

Fig. 2 b. Adult worker of *V. basalis* (Right)

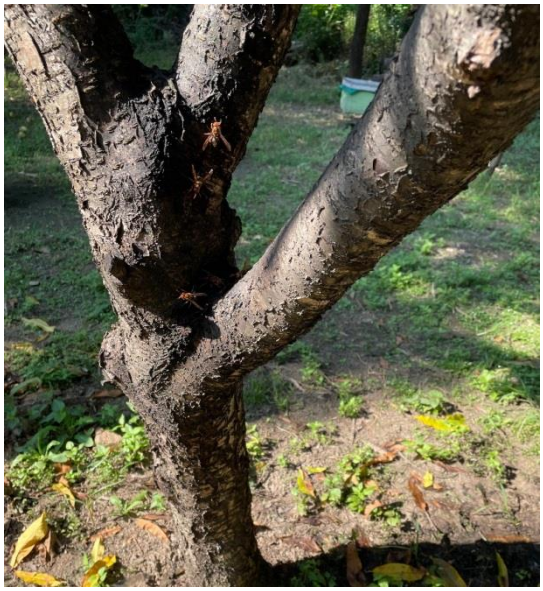

Fig. 3. Wasps feeding on the bark of peach trees

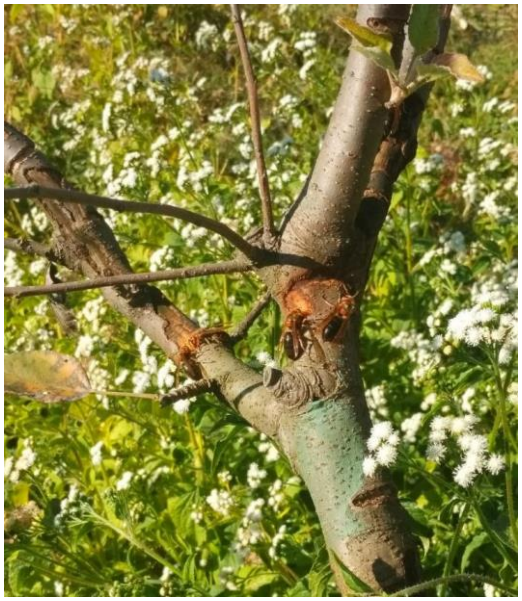

Fig. 4. Wasps on lowland apple trees

Fig. 5. Wasps feeding on losada trees

Fig. 6. Wasp trap

4. CONCLUSION

This study is a first report of damage caused to bark of fruit trees by wasp species *V. auraria* and *V. basalis* .The study included quantifying wasp infestation in fruit orchards in mid-hills regions of Kangra district of Himachal Pradesh. It demonstrated that wasp species, particularly *Vespa basalis* and *V. auraria*, inflicted considerable damage on apple, peach, pear, losada, and sirish trees. The infestation rates varied by location and tree species, with apple and peach trees being particularly vulnerable. An increase or decrease in infestation due to change in climatic conditions and adoption of management practices contributes every year. Wasp damage to bark of fruit crops and nursery trees, combined with the risk of stings to orchard workers, underscores the need for effective management strategies. Installation of bottle traps in tree basins with fermented honey as bait significantly reduced wasp numbers in orchards, provided a sustainable management. Study emphasized monitoring of orchards for wasp infestation and using a honey bottle trap for wasps to protect fruit crops and ensure the safety of orchard workers.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

Barbosa, B. C., Paschoalini, M. F., & Prezoto, F. (2014). Temporal activity patterns and foraging behavior by social wasps (Hymenoptera, Polistinae) on fruits of *Mangifera indica* L. (*Anacardiaceae*). *Sociobiology*, 61(2), 239–242. https://doi.org/10.13102/sociobiology.v61i2.239-242

Carpenter, J. M., & Kojima, J. (1997). Checklist of the species in the subfamily Vespinae (Insecta: Hymenoptera: Vespidae). *Natural History Bulletin of Ibaraki University*, 1, 51–92.

Dongol, Y., Dhananjaya, B. L., Shrestha, R. K., & Aryal, G. (2016). Wasp venom toxins as a potential therapeutic agent. *Protein and Peptide Letters*, 23(8), 688–698. https://doi.org/10.2174/0929866523666160713150051

Food and Agriculture Organization (FAO). (2021). Looking at edible insects from a food safety perspective: Challenges and opportunities for the sector. *FAO, Rome*. https://doi.org/10.4060/cb4094en

Ken, T., Hepburn, H. R., Radloff, S. E., Yusheng, Y., Yiqiu, L., Danyin, Z., & Neumann, P. (2005). Heat-balling wasps by honeybees. *Naturwissenschaften*, 92(10), 492–495. https://doi.org/10.1007/s00114-005-0026-5

Motmayen, M. I., Sharma, S. K., Sharma, P. C., & Shivani (2024). Predatory behavior of wasp species, antagonistic defense mechanism of *Apis mellifera* honey bees, and effective wasp management in apiaries. *Agricultural Research*. https://doi.org/10.1007/s40003-024-00000-0

Mozhui, L., Kakati, L. N., Kiewhuo, P., & Changkija, S. (2020). Traditional knowledge of the utilization of edible insects in Nagaland, North-East India. *Foods*, 9(7), 852. https://doi.org/10.3390/foods9070852

Oliver, J. B., Landolt, P. J., Youssef, N. N., Basham, J. P., Vail, K. M., & Addesso, K. M. (2014). Trapping social wasps (Hymenoptera: Vespidae) in nurseries with acetic acid and isobutanol. *Journal of Entomological Science*, 49(4), 352–368. https://doi.org/10.18474/0749-8004-49.4.352

Pusceddu, M., Floris, I., Buffa, F., Salaris, E., & Satta, A. (2017). Agonistic interactions between the honeybee (*Apis mellifera ligustica*) and the European wasp (*Vespula germanica*) reveal context-dependent defense strategies. *PLOS ONE*, 12(7), e0180278. https://doi.org/10.1371/journal.pone.0180278

Ruwanpathirana, P., & Priyankara, D. (2022). Clinical manifestations of wasp stings: A case report and a review of literature. *Tropical Medicine and Health*, 50(1), 82. https://doi.org/10.1186/s41182-022-00379-5

Sun, H., Qu, Y., Lei, X., Xu, Q., Li, S., Shi, Z., & Yang, Z. (2024). Therapeutic potential of bee and wasp venom in anti-arthritic

treatment: A review. *Toxins*, 16(11), 452. https://doi.org/10.3390/toxins16110452

Thangjam, R., Kadam, V., Ningthoujam, K., & Sorokhaibam, M. (2020). A review on edible insects and their utilization in Northeastern Himalaya. *Journal of Entomology and Zoology Studies*, 8(3), 1309–1318.

Verma, R. C., Waseem, M. A., Sharma, N., Bharathi, K., Singh, S., Anto Rashwin, A et al.(2023). The role of insects in ecosystems, an in-depth review of entomological research. *International Journal of Environment and Climate Change*, *13*(10), 4340-4348.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/127374