IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Dispersal Patterns Of Armoured Scale Insect, *Abgrallaspis Azadirachti* (Homoptera: Coccoidea: Diaspididae) At Agra

Nidhi Sharma and Rajvir Singh Ojha

Department of Zoology, Raja Balwant Singh College, Agra -282002

(Affiliated to Dr. Bhimrao Ambedkar University, Agra), Uttar Pradesh, India

Abstract

The authors found armoured scale *Abgrallaspis azadirachti* infesting *Azadirachta indica* (Neem). Fruit in the orchard is afflicted with armoured scale insects due to Neem trees infested with *Abgrallaspis azadirachti*, and the wind is undoubtedly responsible for the armoured scale insects spread. The majority of armoured scale crawlers settle on their maternal host trees; a small number of adult females are immobile, but a small number of adult males spread by wind to other adjacent plants. Armoured scale insects can spread in two ways – passively on infested plants and through long distance wind borne dispersal of crawlers. The dispersal pattern of *Abgrallaspis azadirachti* crawlers was studied. Windborn crawlers were trapped up to some distance away from the host tree using greased plates scattered around the orchard. Crawlers moved from October to December, peaking in December .In a 48-hour period, a maximum of five crawlers were trapped.

Keywords: *Azadirachta indica*, infested, immobile, crawlers, dispersal pattern

Introduction

Armoured scale insects (Homoptera: Diaspididae) represent one of the most economically important groups of sap-sucking pests affecting agricultural, horticultural, and forest plant species worldwide. Members of the family Diaspididae are distinguished by their hard, waxy protective covering and sessile adult females, characteristics that enhance their resistance to environmental stress and chemical control measures (Gullan & Cook, 2013). Persistent feeding by these insects leads to chlorosis, leaf drop, twig dieback, reduced plant vigor, and in severe infestations, plant mortality. *Abgrallaspis azadirachti* (Ojha) is an armoured scale insect associated primarily with *Azadirachta indica* (neem), a tree of considerable ecological, medicinal, and economic importance in India. Neem trees are extensively planted in urban, peri-urban, and agroforestry systems of Agra, where they contribute to environmental amelioration and sustainable landscaping. Infestation by *Abgrallaspis azadirachti* settlement the physiological health of neem, thereby affecting its ecological services and economic value.

The dispersal biology of armoured scale insects is intrinsically linked to their developmental stages. Adult females are sessile and remain permanently attached beneath their scale cover, whereas dispersal primarily occurs during the first instar nymphal stage, commonly referred to as the "crawler" stage (Beardsley & Gonzalez, 1975). Crawlers are the only actively mobile phase in the life cycle and are responsible for host colonization and population expansion. Detailed behavioral observations of *Abgrallaspis azadirachti* crawlers indicate that they actively search for suitable feeding sites and exhibit selective settlement behavior influenced by host surface characteristics (Sharma & Ojha, 2025). However, their active dispersal is generally limited to short distances on the same host plant.

In addition to active movement, passive dispersal mechanisms significantly contribute to population spread. Wind currents, animals, and anthropogenic activities can facilitate longer-distance movement of crawlers, enhancing colonization of new host plants (Magsig-Castillo et al., 2010). Environmental variables such as temperature, relative humidity, and seasonal wind dynamics further influence crawler survival, settlement success, and spatial distribution patterns (Greathead, 1997). In semi-arid climatic regions such as Agra, seasonal temperature fluctuations and dry wind conditions may play a critical role in shaping dispersal dynamics and infestation intensity.

Despite the ecological importance of neem and the documented behavioral traits of *Abgrallaspis azadirachti*, region-specific studies addressing its dispersal patterns under local agro-climatic conditions remain limited. A comprehensive understanding of dispersal mechanisms is essential for predicting infestation spread, improving surveillance strategies, and designing effective integrated pest management (IPM) programs. Therefore, investigating the dispersal patterns of *Abgrallaspis azadirachti* in Agra is both scientifically significant and practically relevant for sustainable management of neem plantations and urban green ecosystems.

Materials and Methods

Study Area-

The present investigation was carried out in a selected locality of Agra district, Uttar Pradesh, India, where Neem trees (*Azadirachta indica* A. Juss.) were found to be naturally infested with the armoured scale insect *Abgrallaspis azadirachti* (Homoptera: Diaspididae). The site was selected based on the regular occurrence and established population of the pest. Periodic field visits were conducted throughout the study period to monitor crawler activity and to ensure proper maintenance of the experimental setup under natural environmental conditions.

Study Organism and Host Plant -

The study focused on *Abgrallaspis azadirachti*, an armoured scale insect known to infest Neem trees. The crawler stage, being the only active and dispersive instar in the life cycle of armoured scale insects, was selected for dispersal assessment. *Azadirachta indica* served as the host plant for evaluating the spatial movement and dispersal potential of the crawler stage.

Experimental Design for Dispersal Study-

Dispersal of crawler stages was studied using greased glass plate traps. The trapping methodology was adapted from the cylindrical sticky trap technique described by Close (1959), originally developed for monitoring aphid movement, with necessary modifications suited to crawler dispersal studies.

Glass plates were uniformly coated with commercially available cup grease to create adhesive trapping surfaces. The coated plates were mounted horizontally at the end of wooden supports and secured using metal clips. Traps were installed at predetermined distances from the trunk of infested Neem trees to assess outward dispersal. The plates were arranged at five-feet intervals radiating from the infestation source. Initially, six plates (A1–A6) were arranged, and subsequently four additional plates were

installed to extend the sampling gradient and capture long-range crawler movement. The design allowed quantitative assessment of dispersal intensity at increasing distances from the host tree.

Exposure Period and Monitoring-

The greased plates were exposed continuously for five months, from October to February, covering the post-monsoon and winter seasons. Regular inspections were conducted to ensure that the traps remained intact, properly positioned, and functionally effective throughout the exposure period. Environmental disturbances such as dust accumulation or displacement were corrected during monitoring visits.

Collection and Laboratory Examination-

At the conclusion of the exposure period, the plates were carefully retrieved and transported to the laboratory for examination. The number of crawler stages adhered to each plate was counted under a stereomicroscope. Counts were recorded separately for each trap to determine variation in dispersal density relative to distance from the source tree.

Data Recording and Statistical Analysis-

The number of crawlers captured on each plate was systematically recorded and tabulated. Dispersal data were analyzed to determine spatial distribution patterns and dispersal gradients.

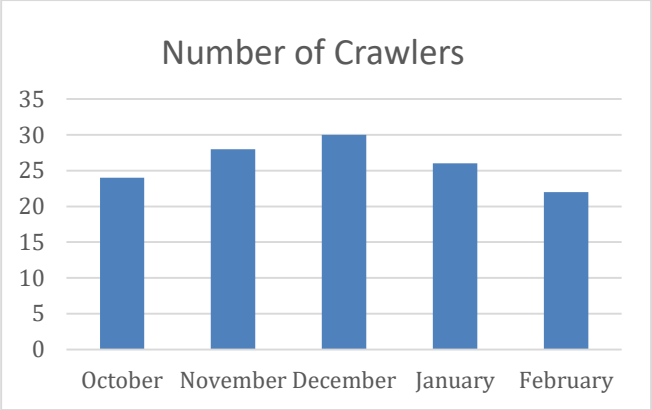
Results

The dispersal of *Abgrallaspis azadirachti* crawlers was studied using greased glass plates at predetermined distances from ,infested Neem plant. The total number of crawlers trapped on all plates during the observation period was 130.

Month-wise variation in crawler dispersal was recorded. A total of 24 crawlers were trapped during October, 28 in November, and the number increased to 30 in December, indicating a peak in dispersal activity during the month of December. A decline in crawler numbers was observed, with 26 crawlers in January, 22 in February.

Table represents monthly variation in the dispersion of number of crawlers of *Abgrallaspis azadirachti*

Month	Numbers of Crawlers
October	24
November	28
December	30
January	26
February	22
Total	130



Graph showing dispersal pattern of crawlers trapped on glass plates in various months

The number of crawlers trapped showed a clear relationship with distance. The number of crawlers decreased progressively with increasing distance from source plant, indicating limited dispersal ability. During a 48-hour exposure period, a maximum of five crawlers were recorded on a single plate.

Overall, the results indicate that crawler dispersal was seasonal, with maximum activity during December, and was largely restricted to shorter distances from the infested host plant.

Discussion

The present study clearly demonstrates that the crawler dispersal in *Abgrallaspis azadirachti* is governed by seasonal variation and distance from the source host plant. The observed peak in crawler activity during December suggests that dispersal is synchronised with favourable environmental conditions. Similar seasonal peaks in crawler emergence and movement have been reported for several diaspidid species, where moderate temperature and suitable microclimate conditions promote crawler survival and mobility (Beardsley and Gonzalez, 1975, Miller and Davidson, 2005). The gradual decline in crawler numbers from January onwards may be attributed to unfavorable climatic conditions, reduced fecundity of adult females, or increased mortality of crawlers. Seasonal suppression of crawler activity during cooler periods has been widely documented in armoured scale insects and is known to influence population dynamics and infestation intensity (Kosztarab, 1996; Miller and Davidson, 2005).

Distance played a crucial role in determining crawler abundance, with the number of crawlers decreasing steadily as distance from the infested Neem plant increased. This confirms that dispersal in *Abgrallaspis azadirachti* is largely short range in nature. Restricted dispersal ability of crawlers has been recognised as a defining characteristic of Diaspididae, where most crawlers settle close to the material population, resulting in localized and aggregated infestations (Beardsley and Gonzalez, 1975; Kosztarab, 1996). The low number of crawlers captured within a 48-hour period further supports the motion that crawler movement is slow and limited. Crawlers primarily disperse through short-distance crawling, while long-distance dispersal occurs only occasionally through passive agents such as wind,

animals, or human activity Close (1959), proved effective in capturing dispersing crawlers and assessing their movement patterns.

The limited dispersal ability observed in the present study explains the clustered distribution pattern commonly observed in armoured scale infestations on host plants. Such aggregation has significant implications for pest management, as control measures can be more effective when targeted at infestation foci during peak crawler activity (Kosztarab,1996; Miller and Davidson,2005). Since the crawler stage is the most vulnerable phase in the life cycle, timely interventions during periods of maximum dispersal can substantially improve management outcomes. Overall, the present findings contribute to the understanding of dispersal ecology of *Abgrallaspis azadirachti* and are consistent with earlier studies on armoured scale insects. The study emphasis the importance of season and spatial proximity in crawler dispersal and provide a scientific basis for optimizing monitoring and management strategies against armoured scale infestations on Neem.

Acknowledgments

I would like to sincerely thanks my supervisor, Dr. Rajvir Singh Ojha, for their invaluable guidance and support throughout this research. I am grateful to the faculty and Head Dr. Kamal Singh, Zoology Department for providing the necessary resources and a conductive environment. I also extend my thanks to the principal, Dr. Vijay Shrivastava, for their encouragement and support. Finally, I appreciate everyone who contributed, directly or indirectly, to the completion of this work.

References

1. Beardsley, J. W., & Gonzalez, R. H. (1975): The biology and ecology of armored scale insects. *Annual Review of Entomology*, **20**: 47–73.
2. Close, R. C. (1959): The use of sticky traps for studying aphid dispersal. *New Zealand Journal of Agricultural Research*, **2**: 471–482.
3. Greathead, D. J, (1997): Crawler behavior and dispersal in scale insects. *Crop Protection*, 16(**5**): 469–475.
4. Gullan, P. J., & Cook, L. G. (2013): Phylogeny and higher classification of scale insects (Hemiptera: Sternorrhyncha: Coccoidea). *ZooKeys*, **166**: 413–425.
5. Kosztarab, M.(1996): Scale Insects of North eastern North America. Virginia Museum of Natural History.
6. Miller, D.R. & Davidson, J.A.(2005): Armoured Scale Insect Pests of Trees and Shrubs. Cornell University Press.
7. Magsig-Castillo, J., Morse, J. G., Walker, G. P., Bi, J. L., Rugman-Jones, P. F., & Stouthamer, R. (2010): Phoretic dispersal of armored scale crawlers (Hemiptera: Diaspididae). *Journal of Economic Entomology*, 103(**4**): 1172–1179.
8. Sharma, N., & Ojha, R.V. S. (2025): Behavioral study of crawler (first stage larva) of *Abgrallaspis azadirachti* (Homoptera: Coccoidea: Diaspididae). *International Journal of Entomology Research*, 10(**9**): 52–54.
9. Timlin J. S.(1964): The biology, bionomics, and control of *Parlatoria pittospori* Mask. (Hemiptera, Diaspididae): A pest on apples in New Zealand, New Zealand Journal of Agricultural Research, 7(**4**): 536-550.