



Research Article

Discovering Uncharted Territories: Adding Two New Records to Aphid Fauna of Pakistan, Unveiled in the Pine Plantations of District Battagram, Khyber Pakhtunkhwa Province

Bakht Zada¹, Ahmed Zia², Sardar Azhar Mehmood¹, Abdur Rehman^{3*}, Toheed Iqbal^{4*}, Kiran Shahjeer⁵ and Shabir Ahmed¹

¹Department of Zoology, Hazara University, Mansehra, Dudhial, Khyber Pakhtunkhwa, Pakistan; ²National Insect Museum, National Agriculture Research Centre, Islamabad, Pakistan; ³College of Plant Protection and Institute of Applied Entomology, Yangzhou University, Yangzhou 225009, China; ⁴Department of Entomology, Faculty of Crop Protection Sciences, The University of Agriculture Peshawar, Khyber Pakhtunkhwa, Pakistan; ⁵Department of Zoology, Abdul Wali Khan University, Mardan, Khyber Pakhtunkhwa, Pakistan.

Abstract | Pakistan, characterized by its geographical diversity across four regions, holds a unique position in terms of flora and fauna. However, many regions, including District Battagram in the Khyber Pakhtunkhwa province, remain largely unexplored due to geopolitical challenges, social barriers, and uncertain ground conditions. Despite being covered with dense coniferous forests, District Battagram has never been surveyed for aphids, a prevalent pest in pine plantations globally. This study aimed to investigate the aphid complex affecting pine trees in the district, revealing two species *Cinara atrotibialis* and *Cinara atlantica* that are newly recorded in the country. The study provides detailed information on morphometry, taxonomic descriptions, host plants, and global distribution for each of the identified species.

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***Correspondence** | Abdur Rehman and Toheed Iqbal, College of Plant Protection and Institute of Applied Entomology, Yangzhou University, Yangzhou 225009, China; Department of Entomology, Faculty of Crop Protection Sciences, The University of Agriculture Peshawar, Khyber Pakhtunkhwa, Pakistan; **Email:** toheed.iqbal@aup.edu.pk, rehman.ento@aup.edu.pk

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Keywords | Aphid, *Cinara atrotibialis*, *Cinara atlantica*, Pines, New records, Pakistan



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Introduction

Aphids, commonly known as plant lice, are sucking insect pests that feed on plant sap, causing detrimental effects on plant health, such as leaf curling and weakening of young stems (Jalalizand *et al.*, 2012). Acting as vectors for various microbes,

with viruses being particularly prominent, they inject harmful saliva into host plant bodies and secrete honeydew, fostering the growth of sooty mold that hampers the photosynthesis of host plants (Zia *et al.*, 2010). Belonging to the order Hemiptera, there are approximately 5000 reported aphid species worldwide, with the genus *Cinara*, also known as conifer aphids,

comprising 243 reported species. These aphids exclusively feed on two conifer families, Pinaceae and Cupressaceae, primarily found in temperate and subtropical regions. Most *Cinara* species feed on one or more species of coniferous plants, with specific feeding sites on host plants, ranging from young shoots to large trunks (Mordvilko, 1895; Bradley, 1959). *Cinara* species are known to cause damage to coniferous plantations and can even lead to the destruction of forests (Favret and Voegtlin, 2004). Typically orange, greenish, brown, or black, these aphids in the genus *Cinara* are distinguished by their long legs, spider-like appearance, and high activity level compared to other aphid groups. Measuring about one-sixth of an inch, they are larger than many other aphid species (Kidd, 1991). Although approximately 5000 aphid species are recorded worldwide, only 300 are known in the aphid fauna of Pakistan, with nine species of the genus *Cinara* reported from Pine plantations in the country (Remaudiere and Binazzi, 2003; Bodlah *et al.*, 2012; Blackman and Eastop, 2018; Favret, 2018). Recognizing the significance of *Cinara* species, this study was initiated to explore the aphid fauna of pine trees in Battagram, Khyber Pakhtunkhwa, Pakistan.

Materials and Methods

Samples of aphids were collected during the active season of 2019–2020 from seven different localities (Banna, Pashto, Ugako, Shamlai, Batela, Rashang and Belankot) of district Battagram (Figure 1).

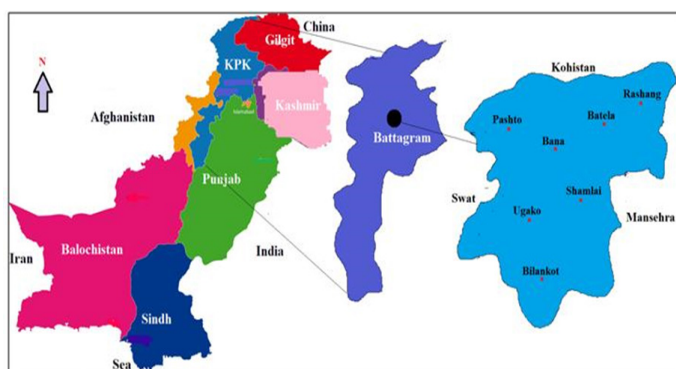


Figure 1: Map showing surveyed sites for aphids collection in district Battagram. All four directions sign should be added in the figure. You just mentioned only North direction.

The sampling methods followed the protocols outlined by Amin *et al.* (2017). Adult aphids were collected using camel hair brushes and handpicking techniques. The gathered samples were preserved in 70% ethanol, and each bottle was meticulously labeled with comprehensive information, including

the collection location, date and time, as well as the humidity and temperature of each locality.

Subsequent to the collection, specimens were examined under an Olympus SZX7 Stereoscope and Labomed CX R4 Microscope. Identification was carried out following the taxonomy of Blackman and Eastop (1994), determining the specimens to the lowest possible taxa. The species are assigned valid names, distributional details and morphological descriptions are provided. Color images of both species were captured using a camera-mounted stereoscope (SZ2-ILST). Taxonomic verification of the collected specimens took place at the National Insect Museum, NARC Islamabad. Preserved samples of the identified species were deposited at the National Insect Museum, NARC Islamabad, Pakistan.

Results and Discussion

The surveys were carried out in densely populated areas with coniferous trees, which had not been previously examined for aphid populations or infestations. 50 aphid samples were collected during the current study, revealing the presence of two species with the following characteristics.

Family: Aphididae

Genus: *Cinara*, (Blackman and Eastop, 1994)

Cinara Curtis, 1835

Cinara atrotibialis (David and Rajasingh, 1968)

Material examined

Batela, 5 apterae, 6-VI-2018, leg. Zada; Pashto, 6 apterae, 10-VI-2018 leg. Zada; Ugako, 4 apterae, 12-VII-2018 leg. Zia; Shamlai, 3 apterae, 16-VII-2018 leg. Zada; Bana, 2 apterae, 12-VII-2018 leg. Zada.

Morphometry

Body length 4.2–5.4 mm, (N =4); body width 2.5–3.5 mm; terminal process 0.1–0.13 mm; rostrum length of IV+V segment 0.13+0.02 mm; siphunculi base 0.15 mm and apex 0.05 mm; cauda 1–1.6 mm.

Taxonomic description

Apterous and large-size aphid with brown and greenish body. There are clear dark spots on the dorsum of the abdomen. Antennal tubercles are undeveloped and have a well-developed proboscis. Antennae are five-segmented and very short compared to body length

(Figure 3A). Siphunculi are very short, darker and dusky at the basal portion (Figure 3B). Cauda is short and rounded with many short fine hairs (Figure 3B). Femur, tibia and tarsi are darker but slightly lighter at their basal position.



Figure 2: Dorsal view of *Cinara atrotibialis*.

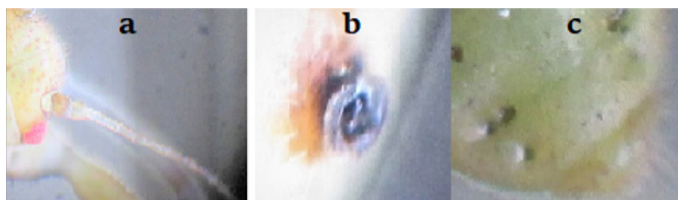


Figure 3: Taxonomic characters of apterous viviparous female of *Cinara atrotibialis* (A) Antennal tubercles and antennae (B) Siphunculi (C) Cauda.

Host plant

Pine trees (Figure 4) are the host and specimens were found scattered at the bark of branches within the bases of the needles of young as well as matured trees and absent on the leaves.



Figure 4: Pine tree (*Pinus wallichiana*).

Distribution

It is a widely distributed species in Asian countries and is known in the pine forests of India (David and Rajasingh, 1968), Thailand (Robinson, 1972) and the Philippines (Eastop and Hille, 1976).

Cinara atlantica (Wilson, 1919)

Material examined

Rashang, 4 apterae, 4-V-2018, collected by Hidayat; Pashto, 3 apterae, 10-VI-2018 collected by Hidayat; Ugako, 5 apterae, 12-VII-2018 collected by Bakht; Shamlai, 3 apterae, 16-VII-2018 collected by Hidayat; Belankot, 5 apterae, 12-VIII-2018, collected by Bakht.



Figure 5: Dorsal view of *Cinara atlantica*.

Morphometry

Body length 5.5-6.4 mm, (N= 4); body width 2.3-3.2 mm; terminal process 0.13-0.16 mm; rostrum length of IV+V segment 0.14+0.03 mm; siphunculi base 0.13 mm; apex 0.05mm and cauda 0.8-1mm.

Taxonomic description

Apterous and large-sized aphid with a dusky color body. Clear dark spots on the dorsum abdomen. Antennal tubercles are undeveloped and have a well-developed proboscis. Antennae are short and five-segmented (Figure 6A). Siphunculi are very short darker and dusky at the basal portion (Figure 6B). Cauda is short and rounded with a bunch of large numbers of fine hairs (Figure 6C). Femur is distally darker, tibia and tarsi are darker but tibia slightly lighter at their basal position.

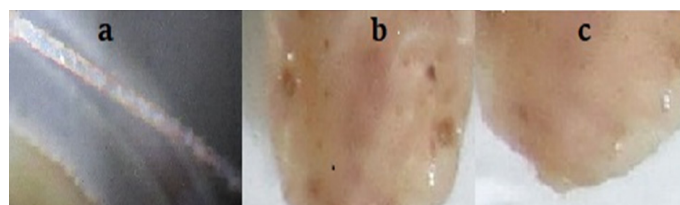


Figure 6: Taxonomic characters of an apterous viviparous female of *Cinara atlantica* (A) Antennae (B) Siphunculi (C) Cauda.

Host plants

Pine trees (Figure 7): Specimens were found scattered

at the bark of young branches within the bases of the needles of young as well as matured trees and absent on the leaves.



Figure 7: Pine tree (*Pinus roxburgii*).

Distribution

It is a widely distributed species in the USA, Canada, Cuba, Jamaica, and Brazil ([Lazzari and Zonata, 2000](#)).

Remarks

It is a sizable aphid characterized by a dusky-colored body. The antennal tubercles are not well-developed, and they possess a distinct proboscis. The antennae are short and consist of five segments. The siphunculi are very short, appearing darker and dusky at the basal portion. The cauda is short and rounded, featuring numerous fine hairs. The femur is darker towards the distal end, while the tibia and tarsi are also darker, with the tibia being slightly lighter at its base. All these characteristics were compared to references such as [Smith and Parron \(1978\)](#), [Lee et al. \(1994\)](#), [Delfino and Binazzi \(2005\)](#), and [Favret et al. \(2010\)](#), confirming their alignment.

Genus *Cinara*, commonly known as conifer aphids, encompasses 243 reported species worldwide, posing a significant threat to coniferous plantations. As outlined in the introduction, they predominantly feed on two conifer families: Pinaceae and Cupressaceae. While some *Cinara* species are host-specific, others can be found across multiple hosts ([Mordvilko, 1895](#)). In Pakistan, both host plant families, Pinaceae and Cupressaceae, are prevalent, with *Pinus wallichiana* and *Pinus roxburgii* being crucial coniferous species. These pines, widely distributed along the Himalaya Range, contribute to construction, furniture, and carpentry due to their excellent workability ([Ahsan and Khan, 1972](#)). The pine plantations in Pakistan span areas like Battagram, Kohistan, Mansehra, Torghar, Abbottabad, Muree, Haripur, Swat, Dir,

Chitral, Gilgit, and Azad Kashmir, falling under the Khyber Pakhtunkhwa Province, with altitudes ranging from 5000 to 10000 feet.

Khyber Pakhtunkhwa Province (KPK) exhibits diverse ecological and altitudinal gradients, harboring rich flora and fauna. Battagram, a mountainous district within KPK, boasts lush greenery, varying slopes, and expansive forest swamps, with an altitude range of 525m to 4690m, dominated by pine flora ([Haq et al., 2012](#)). Despite its abundant forest resources, minimal research has been conducted on pests, particularly aphids, in Battagram. The present survey in District Battagram aimed to fill this gap by thoroughly exploring aphid populations in *Pinus* plantations. Notably, only nine *Cinara* species are documented in the country, focusing on Pinaceae plantations ([Remaudiere and Binazzi, 2003](#)). *Cinara atrotibialis*, widely distributed in Asian countries, including India, Thailand, and the Philippines, was recorded in pine trees across different locations in Battagram. *Cinara atlantica*, known globally in countries like the USA, Canada, Cuba, Jamaica, and Brazil, was also documented in the district.

This study, revealing two new records of aphids in District Battagram, underscores the potential for further exploration of pine forests and their insect pests in Pakistan through extensive surveys and research, likely leading to the discovery of more new and significant species.

Conclusions and Recommendations

The outcomes of this study strongly suggest that the district of Battagram and its environs hold significant potential for the discovery of crucial aphid species, particularly within the *Cinara* genus. It is imperative to conduct thorough explorations in this region to unveil and document additional important species records.

Novelty Statement

The present work hereby brought forward records of two new species of aphids from the study area. It is certainly an important scientific contribution for the country as well as to the Aphidoidea fauna globally, reporting new niches and adding geographic ranges to these species.

Author's Contribution

Bakht Zada: Performed the research, identified the collected specimens, and prepared the manuscript.

Ahmed Zia: Conceived the idea, Helped in the identification of collected specimens, and provided the necessary literature.

Sardar Azhar Mehmood: Reviewed the manuscript

Abdur Rehman: Suggested the problems and reviewed the manuscript.

Toheed Iqbal: Reviewed and submitted the manuscript.

Kiran Shahjeer: Reviewed the manuscript and provided financial support.

Shabir Ahmed: Helped in the aphid collection.

Conflict of interest

The authors have declared no conflict of interest.

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