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Original Article

Occurrence and identification of aphid (Hemiptera: Aphididae) species on several host plants in the main campus of Hasanuddin University, Makassar

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ABSTRACT

Aphids (Hemiptera: Aphididae) are important agricultural pests that damage host plants and transmit plant viruses. A qualitative survey was conducted from March to May 2026 across various zones of the Hasanuddin University campus, Makassar, Indonesia to document aphid occurrence and host associations. Aphid colonies were collected purposively from agricultural crops, ornamental plants, and weeds, and species identification was performed through microscopic examination of diagnostic morphological characters. Only one species, *Aphis gossypii* Glover, was identified from the collected aphid colonies. This species was associated with *Capsicum annuum*, *C. frutescens*, *Melothria pendula*, and *Ficus benjamina*. These observations provide baseline information on the occurrence and host associations of *A. gossypii* within the campus environment and highlight the potential role of weeds and ornamental plants as alternative hosts supporting aphid persistence. The present inventory provides preliminary information for future monitoring and integrated pest management studies.

Keywords: Alternative host; *Aphis gossypii*; Morphological identification; Integrated pest management; Qualitative survey; Weeds

1. Introduction

Aphids (Hemiptera: Aphididae) represent some of the most destructive pests to agricultural and horticultural ecosystems worldwide (Adjalla et al., 2025). Through their specialized piercing-sucking mouthparts, these insects extract vital phloem sap, inducing severe physiological stress, chlorosis, and stunted growth in host plants (Liu et al., 2024). Aphids exert both direct and indirect pressures on their hosts. Direct feeding activities manifest as distinct symptoms such as leaf curling, chlorosis, stunted growth, and a substantial reduction in overall crop yields (Gebretsadik et al., 2025). Furthermore, the excretion of honeydew by these pests fosters the proliferation of sooty mold on vegetative surfaces. This fungal growth creates a physical barrier that restricts light penetration, thereby impairing photosynthetic efficiency and lowering the market quality of agricultural commodities (Ali et al., 2023).

Indirectly, aphids pose a major threat as highly efficient vectors of destructive plant viruses, which they transmit through both persistent and non-persistent mechanisms (Carr et al., 2020). Viral infections induced by these vectors cause systemic physiological disorders that degrade final product quality (Mahas et al., 2022). The economic impact of these multi-tiered attacks is severe. While direct aphid infestations typically account for yield losses ranging from 10% to 30% under moderate conditions, these figures can escalate to approximately 40% if left unmanaged (Dhillon et al., 2022). Crucially, when aphids function as viral vectors, the resulting secondary infections can devastate crops, precipitating catastrophic yield losses of up to 80% to 90% and severely undermining regional agricultural productivity (Priya et al., 2025).

The evolutionary success of aphids is largely tied to their dietary plasticity, as species exhibit either monophagous lifestyles restricted to a single plant species or genus, or polyphagous behavior that allow them to colonize an extensive variety of host plants (Alotaibi et al., 2023; Zhao et al., 2025). These diverse plant species function as primary or secondary hosts, providing the necessary nutritional resources to support aphid survival and reproduction throughout alternating seasons (Kök et al., 2023). Within Indonesia, aphids have been documented infesting a broad array of economically vital horticultural and agronomic crops, including chili pepper, eggplant, cucumber, mustard greens, lettuce, soybean, groundnut, potato, and various ornamental plants (Irsan et al., 2024; Rim et al., 2023). This versatile colonization capability enables aphid populations to persist across highly fragmented and diverse habitats, ranging from intensely managed cultivated fields and residential gardens to unmanaged wild vegetation (Tian et al., 2025).

The complex interaction between aphids and their botanical hosts serves as a primary driver determining pest distribution and species composition within specific agroecosystems (Rashedi et al., 2019). Consequently, precise identification of aphid species is a fundamental prerequisite for mapping pest distributions and understanding host-plant dynamics (Guan et al., 2026). Classical morphological identification relies heavily on key diagnostic structures, including overall body shape, antennal length and segmentation, cornicle structures, and the distinct shape of the cauda (Suganthi et al., 2023). Despite the agricultural prominence of these pests, comprehensive surveys focusing on the identification of aphid species across varied host plants within local managed landscapes, such as the expansive campus grounds of Hasanuddin University, remain notably sparse.

From a landscape ecology perspective, highly modified environments such as university campuses do not function as uniform spaces, but rather as complex landscape mosaics governed by patch-matrix dynamics and spatial heterogeneity (Forman, 1995). Within this urban-agricultural interface, the landscape is partitioned into distinct patches: intensively managed agricultural plots, ornamental vegetative corridors, and unmanaged ruderal or weed patches, all embedded within a hostile built-environment matrix (Simelton et al., 2021). These distinct patches create pronounced edge effects and ecological ecotones where microclimatic conditions, host-plant availability, and resource connectivity fluctuate dramatically over short spatial scales (Rand et al., 2006). For small, piercing-sucking herbivores like aphids, which rely heavily on passive wind dispersal and localized host availability, this spatial heterogeneity dictates colonization success (Klinnert et al., 2024). Unmanaged weed patches embedded within the matrix often function as critical structural refugia or green bridges, allowing pest populations to persist when primary crop patches are fallow or highly managed. Grounding baseline inventories within this landscape mosaic framework is therefore vital to understanding how spatial heterogeneity influences pest distribution across human-modified ecosystems.

To address this knowledge gap, this study aimed to identify the specific aphid species (Hemiptera: Aphididae) associated with different host plants within this distinct ecosystem. Concurrently, this study aimed to identify potential alternative host plants, such as *Melothria pendula*, that host this species. Ultimately, the insights generated from this exploratory survey provide foundational snapshot data regarding aphid-host co-occurrences.

2. Materials and Methods

2.1. Study Area

This study was conducted from March to May 2026 on the campus of Hasanuddin University, Makassar, South Sulawesi, Indonesia (Figure 1), under relatively stable environmental conditions with an average temperature of approximately 30 °C. The campus landscape is characterized by diverse vegetation, including cultivated agricultural crops, managed ornamental plants, and unmanaged wild vegetation, all of which may serve as potential host plants for aphid populations.

Structurally, the university campus represents a localized landscape mosaic characterized by high spatial heterogeneity. To capture the ecological dynamics of this mosaic, specimen sampling was stratified across three distinct patch types embedded within the institutional matrix where aphid infestations were actively observed:

1. Managed agricultural patch, location A: Faculty of Agriculture (Figure 1A). Characterized by relatively low plant diversity, frequent human disturbance, and the dominance of cultivated crop plants, particularly *Capsicum* spp.
2. Cultivated and ornamental plant assemblage, location B: Experimental Farm (Figure 1B). This location was characterized by cultivated plants such as *C. annuum* interspersed with unmanaged wild vegetation and ruderal plant species, such as *Ficus benjamina*, and *M. pendula* commonly distributed throughout the area.
3. Mixed cultivated and semi-natural vegetation, location C: Plant Protection Experimental Farm (Figure 1C). Characterized by the presence of cultivated plants interspersed with unmanaged wild vegetation and ruderal plant species, including *C. annuum*, which potentially function as ecological refugia for aphid populations.

2.2. Field Sampling of Aphids

Aphid specimens were collected from host plants exhibiting clear signs of infestation, including dense aphid colonies, leaf curling, and honeydew accumulation on vegetative surfaces. Field sampling employed a purposive sampling approach targeting plants with active aphid colonization. A total of nine collection events were conducted during the March–May 2026 study period, with three sampling events performed each month. For each infested host plant, approximately 10 adult aphid individuals were collected from the observed colonies for taxonomic identification and morphological examination. In total, three representative adult specimens per host plant were successfully slide-mounted and prepared for microscopic observation.

To prevent morphological damage, individual aphids were carefully dislodged from infested leaves, stems, or floral structures using fine camel-hair brushes pre-moistened with alcohol. The recovered specimens were immediately transferred into 5 mL microcentrifuge vials filled with 70% ethanol for preservation and transport. Each vial was meticulously labeled with a unique sample identification code, the specific collection date, GPS coordinates of the host site, and the preliminary field identification of the host plant species (Suganthi et al., 2023).

2.3. Preparation of Specimens

Laboratory processing and specimen preparation were conducted at the designated departmental laboratory facility. Preserved aphid samples were initially transferred to Petri dishes and sorted prior to slide preparation. To facilitate detailed taxonomic examination, selected adult specimens underwent a standard slide-mounting procedure. Individual aphids were transferred into test tubes containing 95% ethanol and heated at approximately 80–100 °C for 3 min to enhance tissue clarification. Following this process, the specimens were carefully cleaned and dehydrated through a graded ethanol series. In the final preparation stage, the specimens were immersed in clove oil to improve transparency and subsequently mounted individually on clean glass microscope slides using Canada balsam as a permanent mounting medium. Coverslips were gently applied, and the completed slide preparations were cured in a drying oven at 40 °C for approximately two weeks to ensure medium stability and optimal optical clarity (Blackman & Eastop, 2000; Maharani & Hidayat, 2023).

2.4. Identification of Aphids

The taxonomic identification of the slide-mounted aphid specimens was conducted using a Nikon Eclipse E100 compound microscope (Nikon Corporation, Tokyo, Japan) equipped with an ocular micrometer. Species determinations were based on a comprehensive set of diagnostic microscopic morphological characters. These qualitative and quantitative traits included overall body shape, the number and relative length of antennal segments, the arrangement of rhinaria, the structural length and ornamentation of the cornicles, and the distinct shape and chaetotaxy of the cauda. Final taxonomic classifications and species validations were established by utilizing dichotomous taxonomic keys, regional diagnostic guides, and authoritative reference literature specifically covering the families and subfamilies of Hemiptera: Aphididae (Maharani & Hidayat, 2023).

3. Results

3.1. Occurrence and Host Plant Associations of *Aphis gossypii*

Field collection efforts across the designated campus coordinates yielded a spatial inventory of aphid occurrences associated with different host plants during the sampling period (Table 1). A total of 50 adult *A. gossypii* specimens were collected, of which 15 representative specimens were successfully slide-mounted and taxonomically verified through microscopic examination. The compiled records summarize the host plant associations of *A. gossypii* across the surveyed locations.

The distribution records showed that *A. gossypii* occurred across all collection sites, including the locations A, B, and C where it was associated with *C. frutescens*, *C. annuum*, *M. pendula*, and *F. benjamina*. These observations indicate that both cultivated and unmanaged vegetation may function as potential host reservoirs supporting aphid occurrence during the observation period.

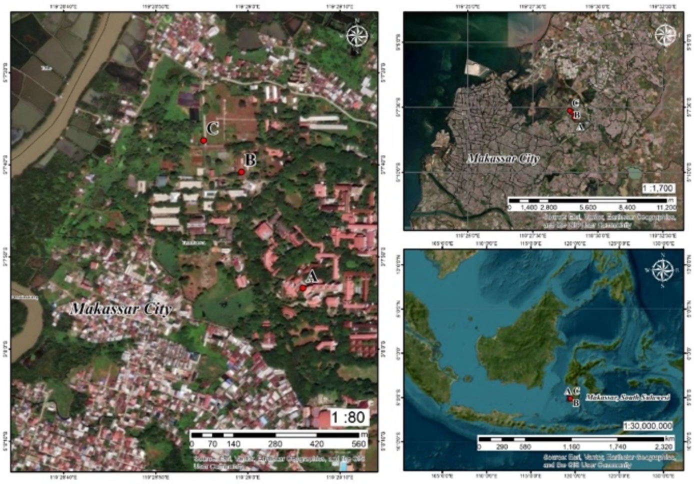

Figure 1. Study area and sampling locations at Hasanuddin University, Makassar, South Sulawesi, Indonesia including locations: (A) Managed agricultural patch (Faculty of Agriculture), (B) Cultivated and ornamental plant assemblages (Experimental Farm), and (C) Mixed cultivated and semi-natural vegetation (Plant Protection Experimental Farm).

Table 1. Distribution of *Aphis gossypii* on different host plants across sampling locations.

Locations	Host plants	Number collected (n)	Slide-mounted adults (n)	Verified specimens (n)
Location A (-5.1314962, 119.4851187)	*Capsicum frutescens*	10	3	3
Location B (-5.1281749, 119.4831459)	*C. frutescens*	10	3	3
	Ficus benjamina	10	3	3
	Melothria pendula	10	3	3
Location C (-5.1270465, 119.4816590)	*C. annuum*	10	3	3

Table 2. Morphometric measurements of *Aphis gossypii*.

Characteristics	n	Range (mm)	Mean±SD (mm)
Body length	15	0.9–2.00	0.36±0.52
Cornicle length	15	0.25–0.47	0.35±0.06
Cauda length	15	0.10–0.20	0.14±0.03

3.2. Morphological Identification of *Aphis gossypii*

Morphometric analysis of *A. gossypii* revealed moderate variation in several diagnostic morphological characters (Table 2). The examined adult specimens exhibited body lengths ranging from 1.0 to 2.0 mm, with a mean body length of 1.43 ± 0.51 mm. The cornicles were cylindrical and measured from 0.25 to 0.45 mm in length, while the cauda ranged from 0.10 to 0.20 mm.

The diagnostic morphological features of *A. gossypii* are presented in Figure 2. Species identification was established through the examination of diagnostic characters associated with the head capsule, antennae, cornicles, and cauda. The general body shape was oval and soft-bodied (Figure 2a). The antennae were elongated and distinctly segmented, whereas the antennal tubercles were weakly developed and inconspicuous (Figure 2b, 2c). The cornicles were cylindrical, dark brown in coloration, and gradually tapered toward the distal end (Figure 2d). These observed morphological characteristics were consistent with the diagnostic descriptions reported by Maharani & Hidayat (2023).

4. Discussion

The morphological evaluation conducted in this study confirmed that *A. gossypii* was the only aphid species identified across the surveyed campus landscapes of Hasanuddin University. The observed occurrence patterns across sampling locations highlight the host plant associations and localized habitat suitability of *A. gossypii* within these managed environments (Jalalizand et al., 2012; Loxdale & Balog, 2018). High-resolution microscopic discrimination relied on stable diagnostic structures, including the architecture of the antennae, the orientation of the antennal tubercles, the pigmentation and length of the cornicle, the shape of the cauda, and the distribution of body setae. These features remain primary, globally accepted taxonomic anchors for resolving species limits within the family Aphididae (Batz et al., 2023).

4.1. Host Associations and Diagnostic Foundations

A. gossypii was recorded across the surveyed landscape patches and was associated with several host plants. The species was recorded in the managed agricultural patch of the Faculty of Agriculture (location A) on *C. frutescens*. In the cultivated, ornamental, and wild vegetation assemblages of the Experimental Farm (location B), the species was recorded on *C. frutescens*, *M. pendula*, and *F. benjamina*. In the mixed cultivated and semi-natural vegetation area of the Plant Protection Experimental Farm (location C), it was recorded on *C. annuum*.

The occurrence of *A. gossypii* across different host plant taxa indicates a relatively broad host range and considerable ecological adaptability. This finding is also consistent with the observations of Blackman & Eastop (2000), who described *A. gossypii* as a polyphagous aphid species capable of utilizing both cultivated crops and unmanaged vegetation as alternative hosts. The taxonomic placement of the collected specimens was supported by diagnostic morphological characters and morphometric measurements. *A. gossypii* was distinguished by inconspicuous antennal tubercles, gradually tapering dark brown cornicles, and a pale cauda bearing 4–7 setae. These observed morphological characteristics closely corresponded with the diagnostic criteria reported by Maharani & Hidayat (2023).

The repeated occurrence of *A. gossypii* across multiple host plants and habitat categories highlights the role of cultivated crops, ornamental vegetation, and unmanaged wild plants as interconnected host reservoirs within the campus landscape mosaic. Similar findings have shown that unmanaged vegetation can serve as alternative refugia supporting aphid survival and recolonization (Liu et al., 2017). In this study, the occurrence of *A. gossypii* on the ornamental woody host *F. benjamina* further suggests that non-crop vegetation contributes to localized aphid persistence. Ma et al. (2019) reported associations of *A. gossypii* with ornamental and cultivated hosts that provide suitable habitats for colony establishment. Host characteristics, including leaf morphology, trichome density, sap quality, and secondary metabolites, influence aphid probing behavior, fecundity, and survival. Similar patterns have also been observed in other aphid systems, where host suitability and environmental interactions shape spatial distribution (Hartl et al., 2024).

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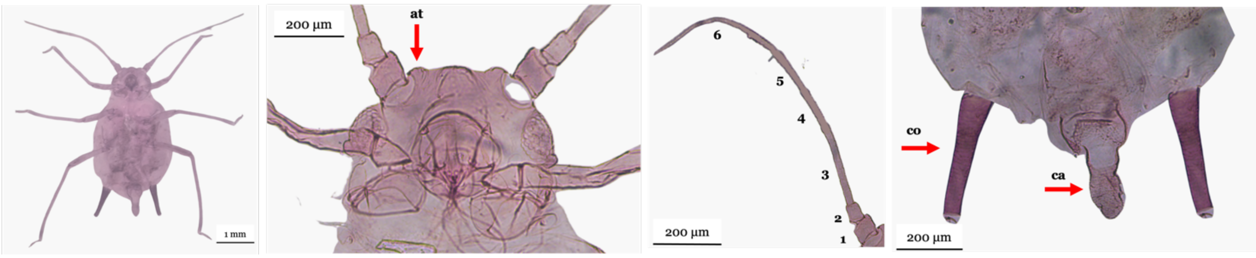

(a) (b) (c) (d)

Figure 2. Morphological characteristics of *Aphis gossypii*: (a) General habitus (whole body), (b) Antennal tubercle (at), (c) Antenna, and (d) Cornicle (co) and cauda (ca).

4.2. Conceptual Integrated Pest Management Implications and Candidate Weed Management Hypotheses

Given that the field observations of this survey represent a localized ecological baseline derived from sampling conducted over a three-month observation period (March–May 2026), long-term regional pest management protocols cannot yet be directly derived from these findings alone. However, the occurrence of aphid populations on cultivated crops, ornamental vegetation, and unmanaged wild plants provides important ecological insights into potential host associations and localized persistence mechanisms within fragmented institutional landscapes (Ma et al., 2019).

The occurrence of *A. gossypii* on *M. pendula* suggests that this weed may serve as a potential alternative host, although its reservoir role requires confirmation through longer-term monitoring for integrated pest management (IPM) within tropical urban-agricultural interfaces (Yates & Michel, 2018). Unmanaged campus greenspaces and ruderal margins populated by wild Cucurbitaceae weeds may function as structural pest reservoirs. During periods when cultivated solanaceous crops (*Capsicum* spp.) are absent or when field conditions become less favorable, these unmanaged vegetation patches may provide refuge sites and alternative nutritional resources that support localized aphid persistence. Consequently, when new *Capsicum* crops are established, surrounding unmanaged vegetation may contribute to recolonization processes by dispersing alate aphids back onto cultivated host plants (Ben-Issa et al., 2017; Liu et al., 2017).

In addition, the occurrence of *A. gossypii* on *F. benjamina* suggests that ornamental vegetation within fragmented institutional landscapes may also contribute to localized aphid maintenance (Dong et al., 2024). Managed ornamental plants may provide stable vegetation structure and favorable microhabitats that support colony establishment outside primary agricultural areas. Similar ecological patterns involving aphid persistence within heterogeneous vegetation assemblages have been discussed by Hartl et al. (2024), who emphasized the importance of environmental heterogeneity and habitat suitability in influencing aphid distribution dynamics under changing environmental conditions.

Collectively, these observations indicate that cultivated crops, ornamental vegetation, and unmanaged weeds may function as interconnected components within localized aphid reservoir networks. Such heterogeneous vegetation assemblages may reduce host plant isolation and provide suitable microhabitats that facilitate aphid persistence during periods of agricultural disturbance. Further long-term ecological studies are therefore required to clarify the seasonal movement patterns and persistence mechanisms of aphid populations across cultivated and unmanaged vegetation patches within tropical institutional landscapes (Wieczorek et al., 2025).

5. Conclusion

This study documented the occurrence and identification of aphid species associated with several host plants on the main campus of Hasanuddin University, Makassar. Based on diagnostic morphological characters, including antennal tubercles, cornicle morphology, and caudal characteristics, this study confirmed the presence of *A. gossypii* as the only aphid species identified. This species was recorded on *C. frutescens*, *C. annuum*, *M. pendula*, and *F. benjamina*. These findings indicate that cultivated crops, ornamental vegetation, and unmanaged wild plants may contribute to aphid occurrence within the campus environment. Further studies over longer observation periods are required to better understand aphid distribution and host associations.

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