

Infestation of *Aphis gossypii* Glover (Hemiptera: Aphididae) on soybeans in São Paulo state, Brazil

Vinicius Fernandes Canassa^{1,*}  <https://orcid.org/0000-0002-6978-9551>

Edson Luiz Lopes Baldin¹  <https://orcid.org/0000-0002-5912-1339>

André Luiz Lourenção²  <https://orcid.org/0000-0003-4252-9706>

Vanessa Rafaela de Carvalho¹  <https://orcid.org/0000-0002-2229-464X>

1. Universidade Estadual Paulista “Júlio de Mesquita Filho”  – School of Agriculture – Department of Crop Protection – Laboratory of Plant Resistance to Insects and Botanical Insecticides – Botucatu (SP), Brazil.

2. Universidade de São Paulo  – Escola Superior de Agricultura “Luiz de Queiroz” – Department of Entomology and Acarology – Piracicaba (SP), Brazil.

*Corresponding author: vf.canassa@unesp.br

ABSTRACT

Aphis gossypii Glover (Hemiptera: Aphididae), also known as the cotton aphid, is a notable pest of several crops. Its damage can be direct and indirect. The direct damage is due to its feeding, which causes leaf shriveling, deformation of shoots, and loss of plant vigor. The pest's indirect damage is through virus transmission to cotton. In Brazil, *A. gossypii* is considered as a pest to several crops, but there are no references to infestations of this aphid in soybeans. The objectives of this manuscript were to report the presence of *A. gossypii* infesting and colonizing soybean crops in São Paulo state, Brazil, and to alert the scientific community and farmers about this possible new pest in Brazilian soybean fields.

Keywords: cotton aphid; melon aphid; *Glycine max*; polymerase chain reaction.

A polyphagous and cosmopolitan species, the aphid *Aphis gossypii* Glover (Hemiptera: Aphididae) is a serious pest to several crops because it infests economically important plants of the families Asteraceae, Cucurbitaceae, Malvaceae, Rutaceae, and Solanaceae (BLACKMAN; EASTOP, 2006; CABI, 2022). Its damage can be direct, due to its feeding, which causes leaf shriveling, deformation of shoots, and loss of plant vigor, and indirect, mainly through virus transmission. Worldwide, *A. gossypii* is recognized as the transmitter of more than 30 viruses to different crops (EBERT; CARTWRIGHT, 1997; CABI, 2022), and it is the only known vector in the transmission of the polerovirus cotton leafroll dwarf virus to cotton (COSTA et al., 1997; MAHAS et al., 2022).

In Brazil, *A. gossypii* is known as a pest to cotton, cashews, papaya, several cultivated cucurbits, gladioli, and okra. It also acts as a virus carrier for cotton and citrus (ROISTACHER et al., 2010; GALBIERI et al., 2017). However, there are no references to infestations of this aphid in soybeans. Thus, the objective of this document was to report on its presence, infestation, and colonization in soybean crops in São Paulo state, Brazil.

In May 2019, aphid infestation was observed on the leaves of the soybean plants (Fig. 1) in a 1-hectare area of soybean (cv. NA 5909 RG) in the town of Pereiras, São Paulo, Brazil (557 m elevation, 23°08'56"S, 47°57'36"W). The infestation was well distributed among the soybean plants and present throughout the entire area where the oilseed was grown. Leaves in the middle third of the plants presented aphid colonies in large numbers. During the capture of the aphids, it was observed that there were cotton plants at the end of their phenological cycle in adjacent areas. This probably made it possible for the aphids (previously fed on the sap of the cotton plants) to move from this crop and colonize the soybean plants.

DNA extraction, polymerase chain reaction (PCR) amplification, and sequencing Sanger of the collected aphid specimens (nymphs and adults) were performed for identification. Insects were macerated, and DNA was extracted using 10% Chelex resin and proteinase K (20 mg/mL). The mitochondrial cytochrome oxidase I (COI) gene was amplified (SIMON et al., 1994; LAGOS et al., 2012). The PCR mix used was 12.5 uL gotaq, 1 uL of each primer, and 3 uL of DNA completed with water for a final reaction of 25 uL. The thermal cycler protocol used to amplify COI was 95°C 2 min (95°C,30 s; 53°C,30s; 72°C,120s) 40x. The PCR products were run on a 1% agarose gel. In the PCR products that obtained amplified bands, DNA purification was performed with the aid of magnetic beads. The amplified fragments

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were sequenced by an automated Sanger DNA sequencer (Model: ABI 3500, Applied Biosystems), at the Biotechnology Institute of the Universidade Estadual Paulista “Júlio de Mesquita Filho”, in Botucatu, SP. The obtained sequences’ results were compared with those deposited in GenBank, using the BLAST program, accession number: OQ338147.



Figure 1. *Aphis gossypii* colony. (a) Wide view of colonies of *Aphis gossypii* observed on soybean leaves; (b) nymphs of *Aphis gossypii* observed with magnifying glass.

Source: Elaborated by the authors.

Reports of *A. gossypii* colonization on soybeans are rare. However, there have been reports of this happening. On the African continent, this aphid was collected from soybeans in Zambia (LAGOS-KUTZ; HARTMAN, 2021). In North America, *A. gossypii* has been reported to colonize soybeans (BLACKMAN; EASTOP, 2007). In the north-central United States of America, its colonization on this legume also appears to be uncommon, but aphid samples collected on soybeans in Alabama, Georgia, Kansas, Louisiana, and Mississippi contained only *A. gossypii* alone or in mixture with *Aphis glycines* Matsumura (Hemiptera: Aphididae). This suggests that *A. gossypii* may be more common on soybeans in southern regions of the United States of America (LAGOS-KUTZ et al., 2014).

Up to now, there have been no reported infestations of *A. gossypii* on soybean in Brazil. However, there are extensive areas of soybean cultivation in different Brazilian regions, often near areas of cotton crops, which is a favorite host for this aphid. Thus, after finding this infestation, in Brazilian regions where cotton and soybeans are planted in successive plantings, *A. gossypii* has become, from the present record, an insect that will need greater attention from the scientific community due to its potential to colonize and cause damage to soybeans.

AUTHORS' CONTRIBUTIONS

Conceptualization: Baldin, E.L.L. **Data curation:** Baldin, E.L.L.; Canassa, V.F. **Funding acquisition:** Baldin, E.L.L.; Lourenção, A.L. **Investigation:** Baldin, E.L.L.; Lourenção, A.L.; Canassa, V.F. **Methodology:** Baldin, E.L.L.; Canassa, V.F.; Carvalho, V.R. **Project administration:** Baldin, E.L.L. **Supervision:** Lourenção, A.L. **Writing – original draft:** Lourenção, A.L.; Canassa, V.F.; **Writing – review & editing:** Canassa, V.F.

AVAILABILITY OF DATA AND MATERIAL

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

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CONFLICTS OF INTEREST

All authors declare that they have no conflict of interest.

ETHICAL APPROVAL

Not applicable.

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REFERENCES

- BLACKMAN, R.L.; EASTOP, V.F. (eds.). *Aphids on the world's herbaceous plants and shrubs*. Chichester: John Wiley & Sons, 2006. Available from: <http://www.aphidsonworldsplants.info>. Access on: Jan. 25, 2023.
- BLACKMAN, R.L.; EASTOP, V.F. Taxonomic issues. In: VAN EMDEN, H.F.; HARRINGTON, R. (eds.). *Aphids as crop pests*. Oxfordshire: CAB International, 2007. p.1-29. <https://doi.org/10.1079/9780851998190.0001>
- CABI - CENTER FOR AGRICULTURE AND BIOSCIENCES INTERNATIONAL. *Aphis gossypii* (cotton aphid). CABI Compendium, 2022. Available from: <https://www.cabidigitalibrary.org/doi/10.1079/cabicompdiu.6204>. Access on: Dec. 23, 2022.
- COSTA, A.S.; JULIATTI, F.C.; RUANO, O. Algodão (*Gossypium hirsutum* L.): doenças causadas por vírus. In: VALE, F.X.R.; ZAMBOLIM, L. (eds.). *Controle de doenças de plantas: grandes culturas*. Viçosa: UFV, 1997. p.571-582.
- EBERT, T.A.; CARTWRIGHT, B. Biology and ecology of *Aphis gossypii* Glover (Homoptera: Aphididae). *Southwestern Entomology*, College Station, v.22, n.1, p.116-153, 1997.
- GALBIERI, R.; BOLDT, A.S.; SCOZ, L.B.; RODRIGUES, S.M; RABEL, D.O.; BELOT, J.L.; VASLIN, M.; SILVA, T.F; KOBAYASTI, L.; CHITARRA, L.G. Cotton blue disease in central-west Brazil: Occurrence, vector (*Aphis gossypii*) control levels and cultivar reaction. *Tropical Plant Pathology*, Viçosa, v.42, n.1, p.468-474, 2017. <https://doi.org/10.1007/s40858-017-0165-1>
- LAGOS, D.M.; PUTTLER, B.; GIORDANO, R.; VOEGTLIN, D.J. A new species of *Aphis* (Hemiptera: Aphididae) in Missouri on St. John's Wort, *Hypericum kalmianum*, and re-description of *Aphis hyperici* Monell. *Zootaxa*, Auckland, v.3478, n.1, p.81-92, 2012. <https://doi.org/10.11646/zootaxa.3478.1.10>
- LAGOS-KUTZ, D.; FAVRET, C.; GIORDANO, R.; VOEGTLIN, D.J. Molecular and morphological differentiation between *Aphis gossypii* Glover (Hemiptera, Aphididae) and related species, with particular reference to the North American Midwest. *ZooKeys*, Sofia, v.459, n.1, p.49-72, 2014. <https://doi.org/10.3897/zookeys.459.7850>
- LAGOS-KUTZ, D.; HARTMAN, G.L. New record of the cotton aphid, *Aphis gossypii* (Hemiptera: Aphididae) on soybean in Zambia. *International Journal of Tropical Insect Science*, Nairobi, v.41, n.1, p.883-885, 2021. <https://doi.org/10.1007/s42690-020-00170-3>
- MAHAS, J.W.; HAMILTON, F.B.; ROBERTS, P.M.; RAY, C.H.; MILLER, G.L.; SHARMAN, M.; CONNER, K.; BAG, S.; BLYTHE, E.K.; TOEWS, M.D.; JACOBSON, A.L. Investigating the effects of planting date and *Aphis gossypii* management on reducing the final incidence of cotton leafroll dwarf virus. *Crop Protection*, Amsterdam, v.158, 106005, 2022. <https://doi.org/10.1016/j.cropro.2022.106005>
- ROISTACHER, C.N.; GRAÇA, J.V.; MÜLLER, G.W. Cross protection against Citrus tristeza virus - a review. *International Organization of Citrus Virologists Conference Proceedings*, Riverside, v.17, n.17, p.1-27, 2010. <https://doi.org/10.5070/C573v0t59c>
- SIMON, J.C.; FRATI, F.; BECKENBACH, A.; CRESPI, B.; LIU, H.; FLOOK, P. Evolution, weighting, and phylogenetic utility of mitochondrial gene sequences and a compilation of conserved polymerase chain reaction primer. *Annals of the Entomological Society of America*, Annapolis, v.87, n.6, p.651-701, 1994. <https://doi.org/10.1093/aesa/87.6.651>

