Colegio de Postgraduados

Detection of *Bruggmanniella perseae* in Hass avocado (*Persea americana* cv. Hass) in Morelos, Mexico

García-Escamilla, Paul[1]; Hernández-Castro, Elías[1]; Mora-Aguilera, José Antonio[2]; Durán-Trujillo, Yuridia[1*]; Monteón-Ojeda, Abraham[1]

[1] Universidad Autónoma de Guerrero, Facultad de Ciencias Agropecuarias y Ambientales, Maestría en Ciencias Agropecuarias y Gestión Local. Periférico poniente s/n, Iguala de la Independencia, Carretera Iguala-Tuxpan km 2.5. Iguala de la Independencia, Guerrero, México. C.P. 40101.

[2] Colegio de Postgraduados en Ciencias Agrícolas, Carretera Federal México-Texcoco km 36.5, Montecillo, Texcoco, Estado de México, México. C.P. 56264.

* Correspondence: 18479@uagro.mx; duty_1@hotmail.com

ABSTRACT

Objective: to determine the presence of *Bruggmanniella perseae* in commercial Hass avocado orchards in Tetela del Volcán, Morelos (Mexico).

Design/Methodology/Approach: sampling was carried out in three Hass avocado orchards during October-December 2020. Adults of *B. perseae* were collected by direct collections of small fruits in the form of a spinning top, with symptoms of *B. perseae* infestation inside. The adults thus collected were observed under a stereo microscope and a scanning electron microscope to confirm their identity.

Results: adult specimens of *B. perseae* were captured and analyzed in the laboratory and their presence at the sampling site was confirmed. Avocado fruits with typical symptoms of avocado ovary fly larva infestation were collected. If not controlled at the beginning of fruit tying, it can be a threat to avocado production (yield) in the region. These results are the basis for generating knowledge about this pest, regarding its biology, distribution and control methods.

Results: adult specimens of *B. perseae* were captured and analyzed in the laboratory and their presence at the sampling site was confirmed. Avocado fruits with typical symptoms of avocado ovary fly larva infestation were collected. If not controlled at the start of the fruiting larvae can be a threat to avocado production (yield) in the region. These results are the basis for generating knowledge about biology, distribution and control methods for this pest.

Limitations/Implications of the study: capturing adults of *B. perseae* in the field is difficult, requiring the use of sticky colored traps, or other effective alternatives.

Findings/Conclusions: the presence of *B. perseae* was confirmed in avocado cv. Hass in Tetela del Volcán, Morelos. The information generated can help avocado growers implement management measures and reduce losses from this pest.

Keywords: avocado ovary fly, *Bruggmanniella perseae*, *Persea americana*, Cecidomyiidae.

Citation: García-Escamilla, P., Hernández-Castro, E., Mora-Aguilera, J. A., Durán-Trujillo, Y., & Monteón-Ojeda, A. (2024). Detection of *Bruggmanniella perseae* in Hass avocado (*Persea americana* cv. Hass) in Morelos, Mexico. *Agro Productividad*. https://doi.org/10.32854/agrop.v17i12.3048

Academic Editor: Jorge Cadena Iñiguez
Associate Editor: Dra. Lucero del Mar Ruiz Posadas
Guest Editor: Daniel Alejandro Cadena Zamudio

Received: September 24, 2024.
Accepted: November 25, 2024.
Published on-line: December XX, 2024.

Agro Productividad, 17(12). December. 2024. pp: 197-202.

INTRODUCTION

Morelos is positioned as the sixth largest avocado producer nationwide, and has the first place in terms of quality (SENASICA, 2024; SIAP, 2024). Avocado is the main income for families in the region that today faces a serious threat, the avocado ovary fly

Bruggmanniella perseae (Gagné *et al*., 2004). This insect was discovered in 2004, it represents a significant danger to production, as it attacks immature fruits smaller than 2 cm and causes deformations, abortion, and premature fall (Gagné *et al*., 2004; Sheng-Feng *et al*., 2020).

In Mexico, the presence of *B. perseae* has already been documented in Michoacán, where damage of up to 17% has been recorded in the affected plots (Delgado-Ortiz *et al*., 2015; García-Bonilla *et al*., 2015). In the State of Mexico, the pest has caused damage of up to 90% to the fruits (Laureano-Ahuelicán *et al*., 2022). In Morelos, this study verifies its presence in avocado crops cv. Hass. Safeguarding avocado production in Morelos requires more in-depth research to better understand the biology and behavior of the pest, as well as to develop effective strategies for the monitoring and control of *B. perseae*.

MATERIALS AND METHODS

Study Site

The study was implemented during the season from October to December 2020, in Hass avocado orchards in the municipality of Tetela del Volcán, Morelos. Presence of *Bruggmanniella perseae* was detected by capturing adults which were preserved in 70% alcohol. The identification of the specimens was done in the laboratory of the master program on Local Agricultural and Environmental Management at the Faculty of Agricultural and Environmental Sciences under the Autonomous University of Guerrero. To do this, a Carl Zeiss West Germany stereo microscope was used, following the description detailed by Gagné *et al*. (2004) and Sheng-Feng *et al*. (2020).

Presence confirmed of *Bruggmanniella perseae*

Presence of *B. perseae* in Tetela del Volcán was confirmed with the collection and preservation of adults, as well as identification with scanning electron microscopy by comparison with the taxonomic description of Gagné *et al*. (2004) and Sheng-Feng *et al*. (2020), which ensures the reliability of this finding.

RESULTS AND DISCUSSION

Bruggmanniella perseae, the pest that threatens avocado

The avocado ovary fly, *Bruggmanniella perseae*, is a species of Diptera belonging to the family Cecidomyiidae that poses a threat to avocado production. This pest specifically attacks small fruits and deforms them as the larva feeds (Gagné *et al*., 2004; Maia *et al*., 2010; Londoño-Zuluaga *et al*., 2020).

Distinctive features of *Bruggmanniella perseae*

Connate eyes: the eyes of *B. perseae* are fused together, forming a single structure in the head. **Wings with reduced venation**: the wings of this pest have a simplified vein network, which differentiates it from other species of Diptera. **Thread-like antennae**: the antennae of *B. perseae* are long and thin, with a thread-like appearance. **Uneven legs**: the first and third pairs of legs are longer than the second pair, that is a distinctive feature of the species. **Claw-shaped tarsal nails**: toenails are small and curved, resembling claws. **Elongated empodia**: the empodia, located between the tarsal nails, are as long as the

claws in *B. perseae*. **Abdomen with eight divisions**: the abdomen is divided into eight segments, the first seven are rectangular-shaped, but the eighth is smaller. **Reduced VIII-sternum in the male**: in the male of *B. perseae*, the eighth sternum is significantly smaller than the others; it is twice as wide as it is long, and lacks hairs. **Pin nail-shaped edeagus**: the edeagus, or male reproductive system of *B. perseae* has the shape of a pin nail (Gagné *et al.*, 2004; Delgado-Ortiz *et al.*, 2015; Rodrigues *et al.*, 2020; Laureano-Ahuelicán *et al.*, 2022) (Figures 1, 2, and 3).

The presence of *B. perseae* in avocado orchards can have a significant impact on production, as the deformation of small fruits by larval feeding leads to their abortion and premature fall. This represents a considerable economic loss for producers.

The detailed description of the morphological characteristics of *B. perseae*, as presented in this report, is essential for its correct identification and differentiation from other species of Diptera. This is crucial to implement adequate control and management strategies to combat this pest effectively.

Evidence of *Bruggmanniella perseae* infestation in avocado cv. Hass fruits

In avocado cv. Hass orchards, it is observed the presence of fruits with characteristic damage signs that coincide with the descriptions of Gagné *et al.* (2004). These fruits show significant deformations that are far from the typical oval shape of the avocado. In some cases, they take on a shape similar to a spinning top, with a wider base that tapers toward the tip. In addition, its size does not exceed 2 cm, as García-Bonilla *et al.* (2015) indicated (Figure 4).

The signature of the pest (clearer signs of infection) includes irregular shapes, the fruits affected by *Bruggmanniella perseae* lose their characteristic oval shape, and present deformations that vary in intensity. Spinning top appearance, in some cases the deformation is so severe that the fruits acquire a shape similar to a spinning top, with a wide base and a narrow tip. Small size, the affected fruits do not reach their normal size, but remain less than 2 cm long (Figure 4).

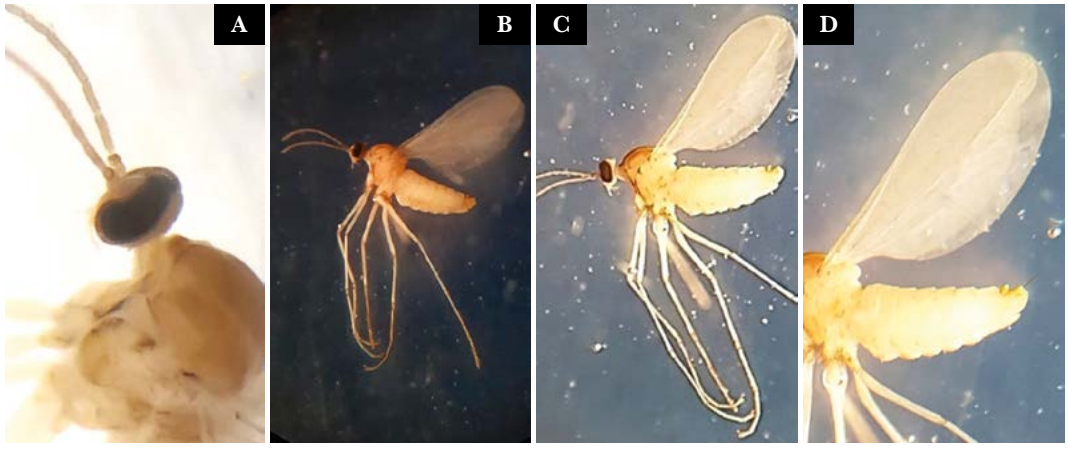

Figure 1. Specimens of *Bruggmanniella perseae* (Diptera: Cecidomyiidae) harvested in avocado orchards cv. Hass in Tetela del Volcán (Morelos) Mexico. A: connate eyes, B: body shape, C: yellow coloration of the body, and D: wings with reduced venation and abdomen with eight segments. Source: photographs by the author, taken with a stereo microscope (Carl Zeiss™, Germany).

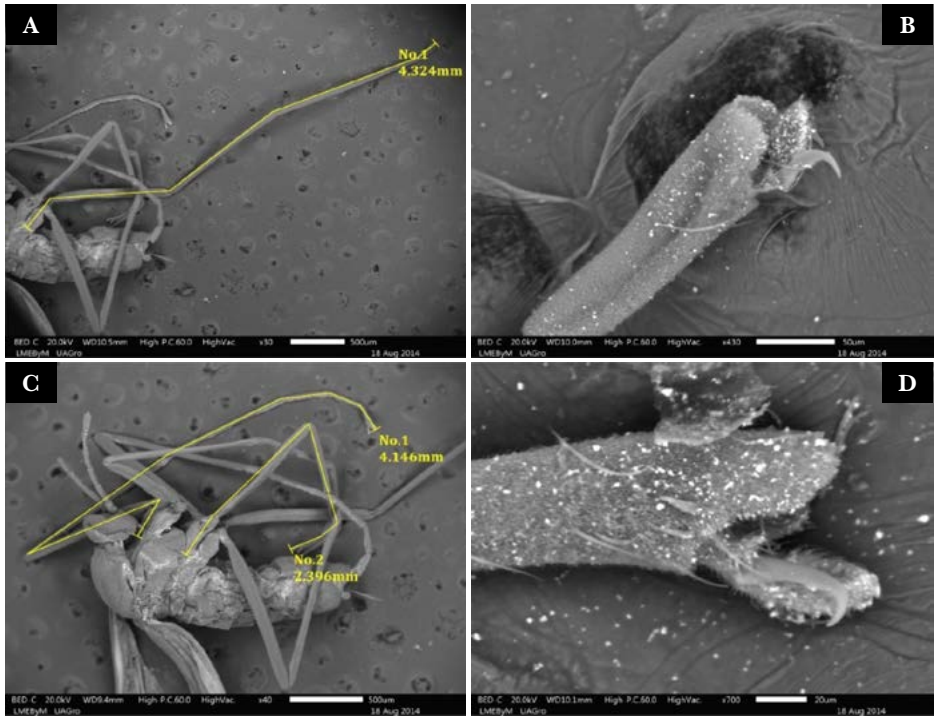

Figure 2. Specimens of *Bruggmanniella perseae* (Diptera: Cecidomyiidae). A: size of a male wings and abdomen; B: connate eyes and thread-like antennae; C: pin-nail-shaped edeagus, and D: size of antennae, head, thorax and abdomen of a male. Source: photographs by the author, with a scanning electron microscope (JEOL™, modelo IT-300LV, USA).

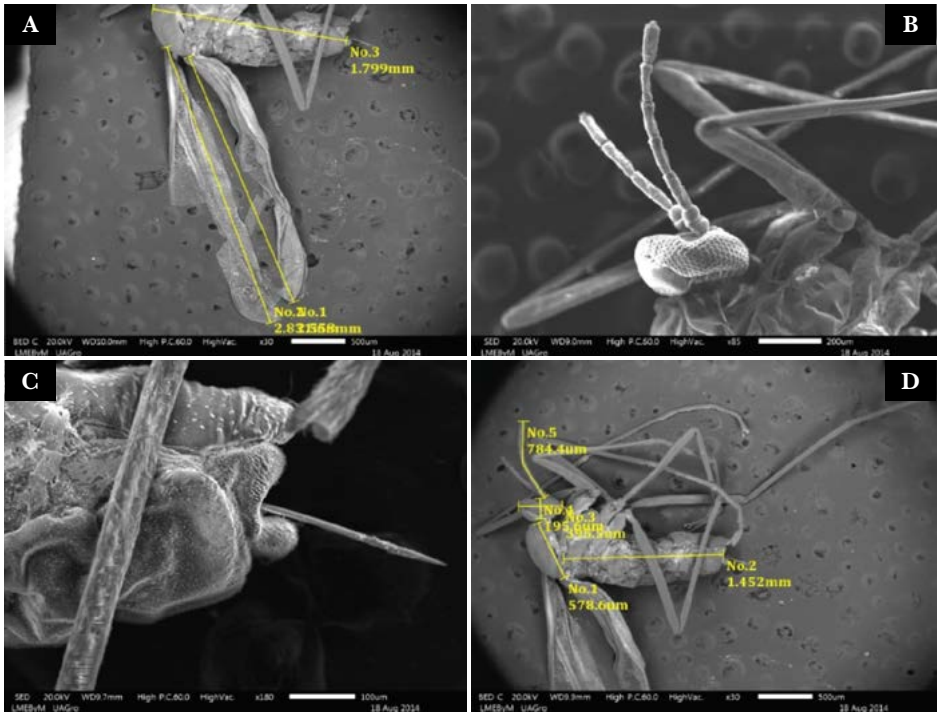

Figure 3. Specimens of *Bruggmanniella perseae* (Diptera: Cecidomyiidae). A: III leg size; B: claw-like nails; C: size of legs I and II; and D: empodium with the same size of the tarsal nails. Source: photographs by the author, with a scanning electron microscope (JEOL™, modelo IT-300LV, USA).

Figure 4. Fruits selected for (A, B): showing signs of the presence of *Bruggmanniella perseae*, collected in cv. Hass avocado orchards in Tetela del Volcán (Morelos) Mexico; which presented (C, D): deformities and did not exceed 2 cm in length. Source: photographs by the author.

These deformations are a clear indication of the attack of *Bruggmanniella perseae*, a pest that mainly affects the young fruits of the avocado. The feeding of the larvae inside the fruit causes its deformation and stunted growth, which in the end leads to abortion or premature fall of the fruit.

This study confirms for the first time the presence of the pest known as avocado ovary fly (*Bruggmanniella perseae*) in cv. Hass avocado plantations in the state of Morelos. This finding represents a fact of great relevance, because it expands the known distribution of the pest in Mexico. Until now, cases of *B. perseae* had been reported in Hass avocados in the State of Mexico (Laureano-Ahuelicán *et al.*, 2022), and in Michoacán (Delgado-Ortiz *et al.*, 2015). Presence confirmed of this pest in Morelos expands the scope of this pest and highlights the need to take measures for its monitoring and control.

The presence of *B. perseae* in cv. Hass avocado orchards in Morelos raises concerns about its potential impact on production. The pest attacks young fruits, because the insect lays its eggs in them. When hatching, the larvae feed on the embryo of the fruit, causing it to deform and fall prematurely, with a size similar to that of a marble. This situation can confuse producers, who could attribute the fall of the fruits to nutritional deficiencies or strong winds, thus underestimating the presence of the pest due to misdiagnosis.

The finding of *B. perseae* in Morelos drives the need to intensify research on this pest of economic importance. Greater knowledge about their biology, behavior, and life cycle is required to develop effective management strategies. Integrated pest management (IPM) is presented as a fundamental tool to combat *B. perseae* in a sustainable way, and to minimize its impact on the environment in order to protect avocado cultivation in Morelos, thus ensuring their future permanence.

CONCLUSIONS

This study marks a milestone by confirming for the first time the presence of *Bruggmanniella perseae*, the avocado ovary fly, in Morelos, Mexico. The detection of this pest in cv. Hass avocado orchards, during the October-December 2020 season, opens a new chapter in the fight to protect this crop, that is vital for producer families in Morelos.

ACKNOWLEDGEMENTS

Authors express sincere gratitude to the avocado producers of Tetela del Volcán, Morelos, for their invaluable collaboration. Their willingness and openness allowed this research to be accomplished successfully, therefore favoring a significant advance in the understanding of this pest that threatens avocado production in that region. We thank M.C. Jazmin López-Diaz and Dr. Oscar Talavera, for providing the scanning electron images and performing the EDS analyses in the Scanning Electronic Microscopy and Microanalysis Laboratory of the Universidad Autónoma de Guerrero (CONACyT, grant 231511)".

REFERENCES

Delgado-Ortiz, F., Vargas-Sandoval, M., Ayala-Ortega, J.J., Bucio-Soto, G., Lara-Chávez, M.B.N., Gutiérrez-Contreras, M. (2015). Distribución geográfica de *Bruggmanniella perseae* (Díptera: Cecidomyiidae) en la franja aguacatera de Michoacán, México. *Rev. Protección Veg. Vol. 30* Número Especial: 141. https://bioone.org/journals/southwestern-entomologist/volume-47/issue-2/059.047.0220/Bruggmanniella-perseaeGagn%C3%A91-Affecting-Fruit-of-Avocado-in-the-State/10.3958/059.047.0220.short

Gagné, J.R., Posada, F., Gil, Z.N. (2004). A new species of *Bruggmannzella* (Diptera: Cecidomyiidae) Aborting young fruit of avocado, *Persea americana* (Lauraceae), in Colombia and Costa Rica. *Proc. Entomol. Soc. Wash. 106*(3): 547-553.

García-Bonilla, C.A., Bastida-Alcaraz, C.Y., Vargas-Sandoval, M., Lara-Chávez, M.B.N., Ávila-Val, T.C., Aguirre-Paleo, S., Lomeli-Flores, R. (2015). Una plaga emergente para el aguacate mexicano. SESIÓN: GESTIÓN DE SISTEMAS DE VIGILANCIA. *Fitosanidad, vol. 19*, núm. 2, pp. 108-112. Instituto de Investigaciones de Sanidad Vegetal La Habana, Cuba. http://www.redalyc.org/articulo.oa?id=209149784010

Laureano-Ahuelicán, B., Hernández-Romero, O., Equihua-Martinez, A., Pérez-Silva, M., Martínez-Domínguez, E., Rodríguez-Vélez, B. (2022). *Bruggmanniella perseae* Gagné Affecting Fruit of Avocado in the State of Mexico, Mexico. *Southwestern Entomologist 47*(2), 443-448. https://doi.org/10.3958/059.047.0220

Londoño-Zuluaga, M.A., Kondo, T., Carabalí-Muñoz, A., Caicedo-Vallejo, A.M., Varón-Devia, E.H. (2020). Actualización tecnológica y buenas prácticas agrícolas (bpa) en el cultivo de aguacate. Capítulo VI. Insectos y ácaros. Mosca del ovario del aguacate. Editorial Agrosavia, 518-520 pp. Consultado el 08 de enero de 2023 en: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://editorial.agrosavia.co/index.php/publicaciones/catalog/download/162/150/1125-2?inline=1?inline=1

Maia, V.C., Fernandes, G.W., Oliveira, L.A. (2010). A new species of *Bruggmanniella* (Diptera, Cecidomyiidae, Asphondyliini) associated with *Doliocarpus dentatus* (Dilleniaceae) in Brazil. *Revista Brasileira de Entomologia 54*(2): 225-228, junho 2010.

Rodrigues, A.R., Carvalho-Fernandes, S.P., Maia, V.C., Oliveira, L.A. (2020). Three new species of *Bruggmanniella Tavares*, 1909 (Diptera, Cecidomyiidae) from Brazil with a key to species. *Revista Brasileira de Entomologia, 64*(1), e201917. https://www.scielo.br/j/rbent/a/ZkTSX5D5XDCzp9wSsW9ZRqh/?lang=en

SIAP (Servicio de Información Agroalimentaria y Pesquera). (2024). Consultado 20 julio, 2024. Producción anual por estado. http://www.siap.gob.mx/cierre-de-la-produccion-agricola-por-estado/

SENASICA (Servicio Nacional de sanidad, Inocuidad y Calidad Agroalimentaria). (2024). Consultado 20 julio, 2024. México Primer productor mundial de aguacate. https://www.gob.mx/senasica/articulos/mexico-primer-productor-mundial-de-aguacate?idiom=es

Sheng-Feng, L., Man-Miao, Y., Tokuda, M. (2020). Molecular Phylogeny Revealing the Single Origin of Cinnamomum-associated *Bruggmanniella* (Diptera: Cecidomyiidae) in Asia, with Descriptions of Three New and One Newly Recorded Species from Taiwan. *Zoological Studies* 59:66. doi:10.6620/ZS.2020.59-66. https://www.academia.edu/download/82524657/59-66.pdf

Vargas, J.M., Palacio, E.E. (2011). Método Analítico: Determinación mediante caracteres morfológicos de *Bruggmanniella perseae* Gagné (Díptera: Cecidomyiidae) en Colombia.