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Scientific Note
Nota Científica

First Record of *Frankliniella zucchini* (Thysanoptera: Thripidae) in Argentina Associated with an outbreak of *Zucchini Lethal Chlorosis Virus* (ZLCV)

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ABSTRACT. This study reports the first record of *Frankliniella zucchini* Nakahara & Monteiro (Thysanoptera: Thripidae) in Argentina. This thrips, previously confirmed as the only vector for *Zucchini Lethal Chlorosis Virus* (ZLCV), was identified on squash crops (*Cucurbita maxima* Duch.) in the northeastern subtropical region of Argentina, infected with ZLCV, the causal agent of lethal chlorosis of zucchini squash. In addition, the present study presents the morphological characteristics distinguishing *F. zucchini* from the morphologically similar *Frankliniella gemina* Bagnall, along with factors that may influence the potential spread of this ZLCV-bearing thrips to other favorable regions. Currently, the primary factor limiting its global spread appears to be the restricted host range of *F. zucchini*.

KEYWORDS. *Cucurbita*. Invasive species. Pathosystem. Squash. Thrips.

Primer registro de *Frankliniella zucchini* (Thysanoptera: Thripidae) en Argentina asociado a un brote de *Zucchini Lethal Chlorosis Virus* (ZLCV)

RESUMEN. Este estudio reporta el primer registro de *Frankliniella zucchini* Nakahara & Monteiro (Thysanoptera: Thripidae) en Argentina. Este trips, previamente confirmado como el único vector del *Zucchini Lethal Chlorosis Virus* (ZLCV), fue identificado en cultivos de zapallo (*Cucurbita maxima* Duch.) en la región subtropical del noreste de Argentina, los cuales estaban infectados con ZLCV, agente causal de la clorosis letal del zapallo. Adicionalmente, el presente trabajo describe las características morfológicas que distinguen a *F. zucchini* de la morfológicamente similar *Frankliniella gemina* Bagnall, junto con los factores que podrían influir en la potencial dispersión de este trips portador de ZLCV a otras regiones favorables. Actualmente, el principal factor que limita su dispersión global parece ser el rango de hospedantes restringido de *F. zucchini*.

PALABRAS CLAVE. *Cucurbita*. Especie invasora. Patosistema. Trips. Zapallo.

In horticulture, members of the family Cucurbitaceae, which includes several fruits and vegetables such as watermelon, cantaloupes, cucumbers, pumpkins, squash, zucchini squash and gourds, are among the main crop choices for farmer fresh markets and food consumption (Grumet et al., 2021). In 2022, the global production of cucurbits was 251 Mt (megatonnes), with China being the main worldwide cucurbit producer and Mexico and Brazil being the top producers in Latin America (FAO (Food and Agriculture Organization), 2024).

The production of cucurbits around the world is threatened by several diseases and pests, in particular viruses (Desbiez, 2020). More than 70 virus species infecting cucurbits have been well-characterized, and of them, about 20 have been determined to cause severe epidemics in major production areas, occasionally leading to quality and yield loss (Lecoq & Katis, 2014). These viruses spread from infected to healthy cucurbit plants mainly by insect vectors such as aphids, whiteflies, and thrips (Thysanoptera) (Desbiez, 2020; Whitfield et al., 2015).

Although the order Thysanoptera includes about 6,597 extant species (ThripsWiki, 2025), relatively few are important plant pests (de Borbón & Zamar, 2023). Species within the thrips genera *Ceratothripoides* Bagnall, *Dictyothrips* Uzel, *Frankliniella* Karny, *Neohydatothrips* Ramakrishna & Margabandhu, *Scirtothrips* Shull, *Taeniothrips* Amyot & Serville, and *Thrips* Linnaeus (Thripidae) cause direct feeding damage and are also vectors of plant viruses belonging to the genus *Orthotospovirus* (Jones, 2005; Xu et al 2017; Hameed et al., 2022; Meskova et al., 2024). Between 1930 and 2009, six *Orthotospovirus* species infecting cucurbits were described, all of which exhibited both globally and regionally restricted distributions (Desbiez, 2020). However, orthotospoviruses currently seem to be the cause of new epidemics in horticultural crops (Jones 2005), primarily due to the recent identification of new species and the broadening of their host range and geographical spread (Rotenberg et al., 2015).

In Brazil, for example, the *Orthotospovirus Zucchini Lethal Chlorosis Virus* (ZLCV), was discovered infecting zucchini squash (*Cucurbita pepo* L.) at experimental fields of Piracicaba, São Paulo state, in 1994 (Bezerra et al., 1999; Rezende et al., 1997). A few years later, this virus caused a severe outbreak in cucurbits across the country (Nagata et al., 1998; Yuki et al., 2000). At the same time, *Frankliniella zucchini* Nakahara & Monteiro, a species of thrips collected on leaves and flowers of ZLCV-infected zucchini plants in Brazil, was confirmed as the only vector for ZLCV (Nakahara & Monteiro, 1999). More recently, ZLCV spread outside Brazil and was first found infecting cultivated squash in northwestern provinces of Argentina (Salta and Jujuy) in 2016 (Pozzi et al., 2019). However, until now, its vector, i.e., *F. zucchini*, had not yet been confirmed in Argentina (de Borbón & Zamar, 2018, 2023).

The present study reports *F. zucchini* in Argentina for the first time and analyzes the potential spread of this ZLCV-bearing thrips to other favorable environments.

Insect sampling. The samplings were conducted in the city of Resistencia, Chaco Province, northeastern Argentina (Fig. 1a, b), in October and December 2023. Leaves and shoots were collected from five cultivated plants of “winter squash zapallito” [*Cucurbita maxima* Duch. var. zapallito (Carrière) Millán], cultivar Magnific Cachi INTA Brillante (Florensa), as well as from a volunteer *C. maxima* plant. The collected material exhibited symptoms consistent with those caused by ZLCV and was subsequently analyzed for virus detection and identification of potential virus-bearing vectors.

Environmental characterization. The environmental conditions of the experimental site and its surrounding areas were characterized based on the Köppen-Geiger classification, which divides global climates into 5 main types and 30 sub-types (Beck et al., 2018). The two- or three-letter combinations of the classification system (Fig. 1c), with capital letters indicating the types and lower-case letters indicating the sub-types of climatic regimes, were linked to the geographical location of our experimental site with QGIS using the present-day (1980-2016) v1 Köppen-Geiger climate classification acquired from https://doi.org/10.6084/m9.figshare.6396959.

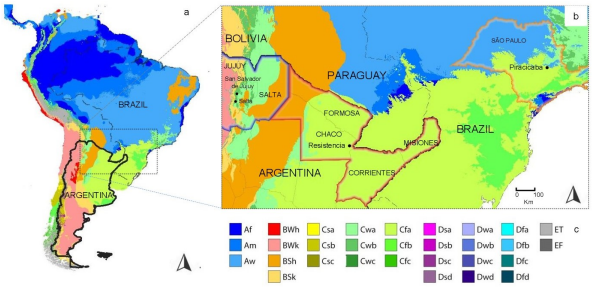


Figure 1: Geographical location of the study area and climate. a. The border of Argentina is highlighted with a black filled line, whereas that of Brazil is highlighted with a dotted line. b. Highlighted colored polygons in the blown-up image indicate the area where *Zucchini Lethal Chlorosis Virus* ZLCV was first detected in northwestern Argentina (blue) in 2016 (Pozzi et al. 2019) and the current first detection of *Frankliniella zucchini* and ZLCV in the city of Resistencia (27°30 'S; 59°W) in northeastern Argentina (red) in 2023. The detection of *F. zucchini* and ZLCV in Brazil in 1994 is also highlighted (orange). c. Letter combinations of the Köppen-Geiger climate classification (Beck et al., 2018).

According to this classification, the climate of the current sampling location in northeastern Argentina (Fig. 1 b) is classified as a Cfa regime (C= temperate type, f= without dry season and a= hot summer sub-type, with air temperature of the warmest month≥ 22 °C), also called as humid subtropical sub-type (Chen & Chen, 2013). The Cfa climate covers a broad area of central and northeastern Argentina (Argentine pampas grasslands and lowlands) and extends into areas of Paraguay, Uruguay and Brazil. In contrast, the area where ZLCV was first found in northwestern Argentina (Pozzi et al., 2019) has mainly temperate (C) and arid (B) climate types with warm and hot sub-types (Cwa, Cwb, Bsh, and a small portion of the tropical savannah Aw), except BWk, which is a cold climate, and lacks the Cfa sub-type.

Similarly, to the Argentine regions where *F. zucchini* and ZLCV were first reported, the Brazilian area in São Paulo state (Piracicaba) where ZLCV and *F. zucchini* were first discovered exhibits a temperate Cfa climate bordering the Cwa and Aw subtypes. Moreover, the vast tropical Aw savanna in Brazil was also found to be a suitable habitat for *F. zucchini*; a finding supported by its later occurrence in the Federal District (Brasília), situated almost 800 km north of Piracicaba (Monteiro et al., 2001). This suggests shared ecological, climatic, and natural vegetation characteristics between these regions (Chen & Chen, 2013), which might help to understand the cucurbit-*F. zucchini*-borne ZLCV pathosystem.

In 2023, Argentina experienced high temperature anomalies, with temperatures in the order of 0.96 °C higher

than the average of the 1991-2020 period (Skansi & Poggi 2024). In October 2023, i.e., the time of collection of plant and insect samples for the present study, the experimental site experienced an intermittent rainy season, with rainfalls following days of extreme heat. Thus, at the end of 2023, the daily average temperature and the daily absolute maximum temperature for October, November, and December were 30, 31, 33 °C and 44, 43, 40 °C, respectively, and monthly accumulated rainfall was 73, 125, 266 mm, for October, November and December respectively. In addition, the coldest month of 2023 (July) had a mean temperature of 17 °C, ranging from 11 to 23.7 °C. Thus, mild temperatures during the spring season prior to the ZLCV outbreak may have contributed to the population growth of *F. zucchini* at the experimental site. The establishment of *F. zucchini* is significantly promoted by successive squash monoculture, which subsequently results in an expected rise in both ZLCV incidence and the *F. zucchini* population over time. Consequently, effective primary disease spread management is crucial at the infested site (Moreira et al., 2014).

Insect identification. To identify insects, the surface of leaves and shoots of collected plants was examined under a 60x smartphone magnification lens. Thrips found on the abaxial leaf surface were collected with a small artist brush and transferred to 1.5-mL Eppendorf tubes containing 70% ethanol. At the Laboratory of Entomology of the National Institute of Agricultural Technology (INTA), Mendoza, Argentina, the specimens were discolored with KOH 10%, dehydrated with increased concentrations of ethanol, transferred to clove oil, and mounted onto slides in Canadian Balsam (Mound & Marullo, 1996) for permanent mounting or in Hoyer medium for non-permanent mounting. The specimens were observed under a microscope with phase contrast at 400x. Thrips species were identified with keys (Cavalleri & Mound, 2012; de Borbón & Zamar, 2018) and comparison with descriptions of adults (Nakahara & Monteiro, 1999) and larvae (Lima et al. 2022), whereas aphid species were morphologically identified following previous works (Blackman & Eastop, 1984).

Examined Material. A new record in Argentina, Chaco, Resistencia (27°30 'S; 59°W) of *F. zucchini* (Thysanoptera: Thripidae) (SINAVIMO, Sistema Nacional de Vigilancia y Monitoreo de Plagas N° 1252) was identified among samples of leaves and shoots of *C. maxima* var. zapallito and in the volunteer *C. maxima* plant (Fig. 2 a-c; f): One female, two males and 25 larvae were collected on November 15, 2023, and 12 females on December 22, 2023. The specimens are deposited in the Thysanoptera collection of the Estación Experimental Agropecuaria, Mendoza, INTA. In addition, one specimen of the aphid *Myzus persicae*, Sulzer (Hemiptera: Aphididae) was identified.

Virus identification. Viruses in the squash leaf samples collected were identified using Double Antibody Sandwich Enzyme Linked Immunosorbent Assay (DAS-ELISA) kits specific for the aphid-transmitted *Cucumber mosaic virus* (CMV), *Papaya ringspot virus* (PRSV), *Watermelon mosaic virus* (WMV), and *Zucchini yellow mosaic virus* (ZYMV) detection from BIOREBA SRL Latin America (Mar del Plata, Argentina) and protocols following the manufacturer's instructions. A reverse transcription polymerase chain reaction (RT-PCR) assay was conducted on the RNA extracts obtained from these detection protocols. Specific primers to target the amplification of nucleotides in the nucleocapsid gene region were designed as previously reported for ZLCV and the aphid-transmitted *Zucchini tigré mosaic virus* (ZTMV) detection (Pozzi et al., 2019; Brugo Carivali et al., 2024).

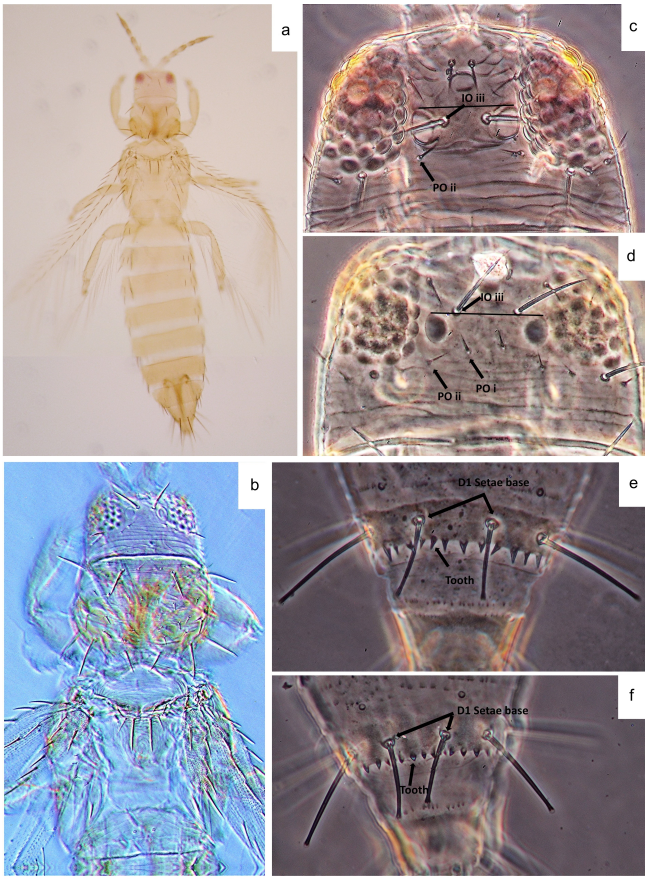


Figure 2. Female adults and larva of *Frankliniella zucchini* Nakahara & Monteiro, and *Frankliniella gemina* Bagnall. a-c, f. Microscopic images of the morphological characters of *F. zucchini* collected in Argentina. a. Adults female, full body. b. Adults female, head and thorax. c. Adults female, head, position of the pair of interocellar setae III (IO iii) and absence of the pair of postocular setae I (PO i). f. Larva, smaller teeth of IX abdominal tergites. d-e. Microscopic image of the morphological characters of *F. gemina* collected in Argentina. d. Adult females, head, position of the pair of interocellar setae III (IO iii) and presence of the pair of postocular setae I (PO i). e. Larva, larger teeth of abdominal tergite IX.

Symptoms initiated on *C. maxima* var. zapallito plants, on new younger leaves growing at the beginning of the flowering developmental stage. Two different classes of symptoms were observed: one showing stunting, yellowing, hardening and upward cupping leaves (plants 1, 2, 5 and 6) and the

other showing mottling, spot and band blistering and yellowing leaves (plants 3 and 4). The first class of symptoms (Fig. 3 a-c) were characteristic of ZLCV infection, consistent with previous observations in Brazilian zucchini crops (Bezerra et al., 1999) and confirmed by RT-PCR analysis. The second class of symptoms (Fig. 3 e-f) resulted positive to ZTMV in correspondence to the contrasting symptomatic phenotype already seen in cucurbits (Brugo Carivali et al., 2024). Although plant 1 had a mixed infection with PRSV, ZTMV and ZLCV, the symptomatic class resembled more that of ZLCV (Fig. 3 a-b) than that of ZTMV observed in plant 3 (Fig. 3 e-f).

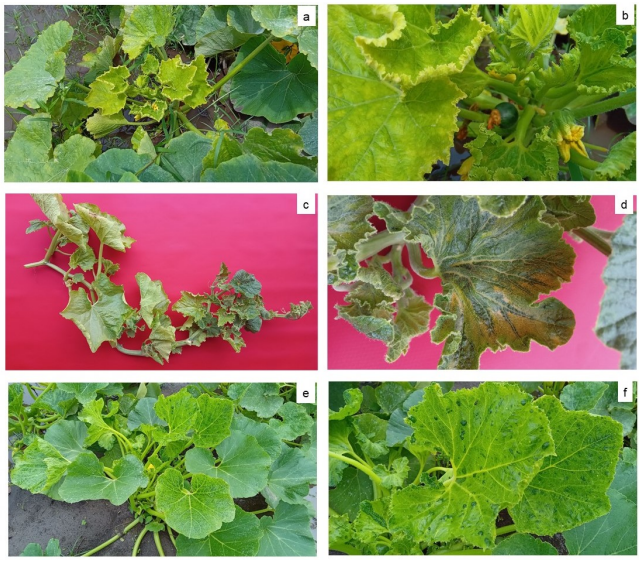


Figure 3. Leaves and shoots from cucurbits with virus-like symptoms, collected in Resistencia, Chaco province, Argentina. a-d. Symptoms of *Zucchini Lethal Chlorosis Virus* (ZLCV) (stunting, yellowing, hardening and upward cupping leaves) observed in (a-b) *Cucurbita maxima* var. zapallito and (c-d) *C. maxima* volunteer plant. e-f. Symptoms of *Zucchini tigré mosaic virus* (ZTMV) (mottling, spots, band blistering, and yellowing) in *C. maxima* var. zapallito.

Taxonomic remarks on *F. zucchini*. Until the present day, 22 species of the genus *Frankliniella* have been identified in Argentina, nine of which are considered pests or potential pests that threaten crops (de Borbón & Zamar 2023). Within the genus *Frankliniella*, *F. zucchini*, which is known to vector only ZLCV, shares most morphological characters with *F. gemina* Bagnall (Nakahara & Monteiro 1999). However, these two thrips species differ in their geographical and host plant distribution and in their vectorial capacity to spread *Orthotospoviruses*. Both belong to the group of small yellow *Frankliniella*, which are commonly found in Brazil in association with crops, but cannot be identified satisfactorily, even as one or several species (Cavalleri & Mound, 2012).

Nakahara & Monteiro distinguished *F. zucchini* from *F. gemina* using key diagnostic characters of the head chaetotaxy. *F. zucchini* is distinct by the absence of the postocular setae I (PO I) and by the position of the interocellar setae III (IO III), which lie between the anterior margins of the posterior ocelli and are separated by a distance approximately equal to the width of the fore ocellus (Fig. 2c). In contrast, *F. gemina* bears PO I setae, and its IO III are aligned with, or slightly anterior to, the anterior margin of the posterior ocelli, with a greater distance between them (Fig. 2d). Examination of *F. zucchini* specimens, both reared and field-collected across different regions, consistently confirms the absence of one or both PO I setae (in ~10% and ~90% of specimens, respectively) (Camelo-García et al., 2019). Additional characters on abdominal tergite IX also separate the two species: in *F. gemina*, the teeth are longer than the diameter of the dorsal setal base D1 (Fig. 2e), acute, and concave at the base; whereas in *F. zucchini* they are typically shorter than the D1 base diameter and convex at the base (Fig. 2f) (de Borbón, 2007; Lima et al., 2022). Identification of larvae remains difficult, as the length of several setae overlaps between the two species (Camelo-García et al., 2019).

In contrast to *F. gemina* Bagnall, which was originally described from Paraguay in 1919 and is now distributed across several South American countries, including Argentina and Brazil (de Borbón et al., 1999; Cavalleri & Mound, 2012), *F. zucchini*, described in 1999, had so far remained restricted to Brazil. *F. zucchini* colonizes cucurbit flowers and foliage of certain preferential cucurbits (Camelo-García et al., 2015; Nakahara & Monteiro, 1999), while *F. gemina* is primarily found on the flowers of various fruit and vegetable crops and weed species (de Borbón et al., 1999). Although laboratory studies have demonstrated the ability of *F. gemina* to transmit *Tomato spotted wilt orthotospovirus* (TSWV) and *Groundnut ringspot virus* (GRSV, its role as a vector under field conditions remains unknown (de Borbón et al., 2006).

Final considerations. This study reports the first record of *F. zucchini* Nakahara & Monteiro (Thysanoptera: Thripidae) in Argentina. It also presents the first detection of *Zucchini lethal chlorotic virus* (ZLCV), for which *F. zucchini* is the only known vector, in northeastern Argentina. Potential habitats of this pest were predicted using the Köppen-Geiger climate classification for the period 1980-2016. Further studies are needed to investigate the virus-vector dynamic in these suitable environments. Several factors contribute to the propensity of phytophagous thrips to become global crop pests, including their wide host range. Currently, a limiting factor in the expansion of *F. zucchini* appears to be its restricted host range within Cucurbitaceae.

COMPETING INTERESTS

The authors have declared that no competing interests exist.

AUTHORS CONTRIBUTIONS

Conceptualization: MCP, CMdB, SEO; Field sampling: SEO; Photos: SEO, EM, CMdB; Insect identification: EM, CMdB; Virus identification: MFBC, CEL, MGC, MCP; Supervision: MCP; Writing - original draft preparation: SEO; Writing – review, editing: All authors read and approved the final version of the manuscript.

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REFERENCES

Beck, H. E., Zimmermann, N. E., McVicar, T. R., Vergopolan, N., Berg, A., & Wood, E. F. (2018). Present and future Köppen-Geiger climate classification maps at 1-km resolution. *Scientific Data, 5*(1), 180214. https://doi.org/10.1038/sdata.2018.214

Bezerra, I. C., de O Resende, R., Pozzer, L., Nagata, T., Kormelink, R., & De Avila, A. C. (1999). Increase of tospoviral diversity in Brazil with the identification of two new tospovirus species, one from chrysanthemum and one from zucchini. *Phytopathology, 89*(9), 823-830. https://doi.org/10.1094/phyto.1999.89.9.823

Blackman, R. L., & Eastop, V. F. (1984) *Aphids on the world's crops: an identification guide*. Wiley.

Brugo Carivali, M., Luciani, C., Celli, M., Carrasco, F., Silva, M., Cabrera Mederos, D., & Perotto, M. (2024). First report of Zucchini tigré mosaic virus naturally infecting two different cucurbit species in Argentina. *New Disease Reports, 49*, e12288. https://doi.org/10.1002/ndr2.12288

Camelo-García, V. M., Lima, É. F. B., & Rezende, J. A. M. (2015). Identification of natural hosts of *Zucchini Lethal Chlorosis Virus*. *Tropical Plant Pathology, 40*(5), 345-349. https://doi.org/10.1007/s40858-015-0044-6

Camelo-García, V. M., Lima, É. F. B., & Rezende, J. A. M. (2019). Rearing *Frankliniella zucchini* Nakahara & Monteiro (Thysanoptera: Thripidae) on zucchini (Cucurbita pepo L. "Caserta') fruits. *Revista Brasileira de Entomologia, 63*(2), 115-118. https://doi.org/10.1016/j.rbe.2019.02.005

Cavalleri, A., C., Piccoli Romanowski, H., & Rodrigues Redaelli, L. (2006). Thrips species (Insecta, Thysanoptera) inhabiting plants of the Parque Estadual de Itapuã, Viamão, Rio Grande do Sul state, Brazil. *Revista Brasileira De Zoologia, 23*(2), 367-374. https://doi.org/10.1590/S0101-81752006000200009

Cavalleri, A., & Mound, L. (2012). Toward the identification of *Frankliniella* species in Brazil (Thysanoptera, Thripidae). *Zootaxa, 3270*, 1-30. https://doi.org/10.11646/zootaxa.3270.1.1

Chen, D., & Chen, H. W. (2013). Using the Köppen classification to quantify climate variation and change: An example for 1901-2010. *Environmental Development, 6*, 69-79. https://doi.org/10.1016/j.envdev.2013.03.007

de Borbón, C. M. (2007). A key for the identification of second instar larvae of some common thrips (Thysanoptera: Thripidae). Mendoza, Argentina. *Revista de la Facultad de Ciencias Agrarias, 39*, 69-81. https://bdigital.uncu.edu.ar/1534

de Borbón, C. M., Gracia, O., & De Santis, L. (1999). Survey of Thysanoptera occurring on vegetable crops as potential Tospovirus vectors in Mendoza, Argentina. *Revista de la Sociedad Entomológica Argentina, 58*(3-4), 59-66.

de Borbón, C. M., Gracia, O., & Piccolo, R. (2006). Relationships between tospovirus incidence and thrips populations on tomato in Mendoza, Argentina. *Journal of Phytopathology, 154*(2), 93-99. https://doi.org/10.1111/j.1439-0434.2006.01066.x

de Borbón, C. M., & Zamar, M. (2018). Two new species of *Frankliniella* (Thysanoptera: Thripidae) from Argentina with a key to species from Argentina and Chile. *Zootaxa, 4369*, 419-431. https://doi.org/10.11646/zootaxa.4369.3.7

de Borbón, C.M., & Zamar, M. (2023). *Thysanoptera*. In L. E. Claps, S. Roig-Juñent & J. J. Morrone (Eds.), *Biodiversidad de Artrópodos Argentinos* (Vol 5, pp. 405-447). INSUE – UNT Ediciones. https://drive.google.com/file/d/1yPpPLgCXpgL1YAjMVfOxtfBuN3WtZ6Ms/view?pli=1

Desbiez, C. (2020). The never-ending story of cucurbits and viruses. En *VI International Symposium on Cucurbits* (Acta Horticulturae No. 1294, pp. 173-192). International Society for Horticultural Science (ISHS). https://doi.org/10.17660/ActaHortic.2020.1294.23

FAO (Food and Agriculture Organization). (2024). *FAOSTAT, Crops*. https://www.fao.org/faostat

Grumet, R., McCreight, J., McGregor, C., Weng, Y., Mazourek, M., Reitsma, K., Labate, J., Davis, A., & Fei, Z. (2021). Genetic Resources and Vulnerabilities of Major Cucurbit Crops. *Genes, 12*, 1222. https://doi.org/10.3390/genes12081222

Hameed, A., Rosa, C., & Rajotte, E. G. (2022). The Effect of Species Soybean Vein Necrosis Orthotospovirus (SVNV) on Life Table Parameters of Its Vector, Soybean Thrips (*Neohydatothrips variabilis* Thysanoptera: Thripidae). *Insects, 13*(7), 632. https://doi.org/10.3390/insects13070632

Jones, D. R. (2005). Plant Viruses Transmitted by Thrips. *European Journal of Plant Pathology, 113*(2), 119-157. https://doi.org/10.1007/s10658-005-2334-1

Lecoq, H., Wipf-Scheibel, C., Nozeran, K., Millot, P., & Desbiez, C. (2014). Comparative molecular epidemiology provides new insights into Zucchini yellow mosaic virus occurrence in France. *Virus Research, 186*, 135-143. https://doi.org/10.1016/j.virusres.2014.01.020

Lima, É. F. B., Silva, L. de M. R., Fontes, L. da S., & de Borbón, C. M. (2022). Identification of second instar larvae of thrips (Thysanoptera: Thripidae) vectors of Orthotospovirus (Tospoviridae) in South America. *Austral Entomology, 61*(2), 199-208. https://doi.org/10.1111/aen.12597

Meskova, M., Zvarikova, M., Masarovic, R., Balcercik, J., & Fedor, P. (2024). Rediscovery of tospovirus vector *Dictyothrips betae* (Thysanoptera: Thripidae) in Slovakia after 72 years - Short Communication. *Plant Protection Science*, *60*(4), 407-410.

https://pps.agriculturejournals.cz/artkey/pps-202404-0007.php

Monteiro, R. C., Mound, L. A., & Zucchi, R. A. (2001). Espécies de *Frankliniella* (Thysanoptera: Thripidae) de importância agrícola no Brasil. *Neotropical entomology, 30*(1), 65-72. https://doi.org/10.1590/S1519-566X2001000100011

Moreira, A. S., Cônsoli, R. C. M., Barbosa, J. C., Filho, A. B. & Rezende, J. A. M. (2014). Spatiotemporal dynamics of Zucchini Squash Lethal Chlorosis and its relationship with the *Frankliniella zucchini* population. *Journal of Phytopathology*, *162*, 481-490. https://doi.org/10.1111/jph.12221

Mound, L. A., & Marullo, R. (1996). *The thrips of Central and South America: An introduction (Insecta: Thysanoptera)* (Memoirs on Entomology International, Vol. 6). Associated Publishers.

Nagata, T., Resende, R., Elliot, K., Costa, H., Inoue-Nagata, A., & Ávila, A. (1998). First Report of Natural Occurrence of *Zucchini Lethal Chlorosis Tospovirus* on Cucumber and Chrysanthemum Stem Necrosis Tospovirus on Tomato in Brazil. *Plant Disease, 82*, 1403. https://doi.org/10.1094/pdis.1998.82.12.1403a

Nakahara, S., & Monteiro, R. C. (1999). *Frankliniella zucchini* (Thysanoptera: Thripidae), a new species and vector of tospovirus in Brazil. *Proceedings of the Entomological Society of Washington, 101*(2), 290-294. https://biostor.org/reference/55404

Pozzi, E. A., Luciani, C. E., Celli, M. G., Conci, V. C., & Perotto, M. C. (2019). First Report of *Zucchini Lethal Chlorosis Virus* in Argentina Infecting Squash Crops. *Plant Disease, 104*(2), 602. https://doi.org/10.1094/PDIS-05-19-1064-PDN

Rezende, J., Galleti, S., Pozzer, L., Resende, R., Ávila, A. C., & Scagliusi, S. (1997). Incidence, biological and serological characteristics of a tospovirus infecting experimental fields of zucchini in São Paulo State, Brazil. *Fitopatologia Brasileira, 22*, 92-95. https://www.scielo.br/j/fb/grid

Rotenberg, D., Jacobson, A. L., Schneweis, D. J., & Whitfield, A. E. (2015). Thrips transmission of tospoviruses. *Current opinion in virology, 15*, 80-89. https://doi.org/10.1016/j.coviro.2015.08.003

Skansi, M. M., & Poggi, M. M. (2024). *Estado del clima en Argentina 2023*. Buenos Aires, Argentina. http://hdl.handle.net/20.500.12160/2740

ThripsWiki. (2025). *ThripsWiki - providing information on the World's thrips*. https://thrips.info/wiki/Main_Page

Whitfield, A. E., Falk, B. W., & Rotenberg, D. (2015). Insect vector-mediated transmission of plant viruses. *Virology, 479-480*, 278-289. https://doi.org/10.1016/j.virol.2015.03.026

Xu, Y., Gao, X., Jia, Z., Li, W., Hu, J., Li, Y., Li, Y., & Liu, Y. (2017). Identification of *Taeniothrips eucharii* (Thysanoptera: Thripidae) as a Vector of Hippeastrum chlorotic ringspot virus in Southern China. *Plant Disease, 101*(9), 1597-1600. https://doi.org/10.1094/PDIS-01-17-0045-RE

Yuki, V. A., Rezende, J. A. M., Kitajima, E. W., Barroso, P. A. V, Kuniyuki, H., Groppo, G. A., & Pavan, M. A. (2000). Occurrence, Distribution, and Relative Incidence of Five Viruses Infecting Cucurbits in the State of São Paulo, Brazil. *Plant Disease, 84*(5), 516-520. https://doi.org/10.1094/pdis.2000.84.5.516

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