Short note [Nota corta]

# First report of the pepper thrips *Thrips parvispinus* (Karny) in Costa Rica†

# [Primer reporte del trips del pimiento *Thrips parvispinus* (Karny) en Costa Rica]

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## SUMMARY

**Background:** The accidental invasive insects pose a growing threat to agricultural productivity and food security worldwide. **Objective:** To report for the first time the pepper thrips *Thrips parvispinus* in Costa Rica. **Methodology:** Specimens were collected from May to October 2024 in commercial crops *Capsicum annuum, Citrus sinensis, Coriandrum sativum, Cucumis sativus,* and ornamental *Croton* spp. in the western region of the country, encompassing both protected environments and greenhouses. The thrips identification was carried out using external morphological characteristics and partial sequencing of the mitochondrial cytochrome c oxidase subunit I (COI) gene. **Results:** Morphological and molecular analyses confirmed the species identity of *T. parvispinus*. **Implications:** The observed damage included feeding scars on young leaves, margin curling, necrosis of foliar tissue, and floral deformation; with relevant implications for the health of these crops in Costa Rica. **Conclusion:** The detection of this invasive species represents a phytosanitary concern in Central America and underscores the necessity for continuous monitoring and implementation of effective insect management strategies throughout the region.
**Key words:** invasive species; crop thrips; taxonomic identification; plant health; exotic species.

## RESUMEN

**Antecedentes:** La introducción de especies de insectos invasivas conlleva una constante preocupación en la agricultura y la seguridad alimentaria mundial. **Objetivo:** Reportar por primera vez la presencia de el trips del pimiento *Thrips parvispinus* en Costa Rica. **Metodología:** Los muestreos de especímenes se realizaron entre mayo y octubre de 2024 en cultivos comerciales de *Capsicum annuum*, *Citrus sinensis*, *Coriandrum sativum, Cucumis sativus* y *Croton* spp., incluyendo ambientes protegidos e invernaderos. La identificación de los especímenes se llevó a cabo mediante análisis de morfología externa, complementados con secuenciación parcial del gen mitocondrial COI. **Resultados:** Los análisis morfológicos y moleculares confirmaron la identidad de la especie *Thrips parvispinus*. **Implicaciones:** Se documentaron daños típicos de alimentación de los insectos hacia hojas jóvenes, enrollamiento de márgenes, necrosis en láminas foliares y afectación floral, lo que podría tener consecuencias para la sanidad vegetal

† S*ubmitted May 14, 2025 – Accepted July 28, 2025.* http://doi.org/10.56369/tsaes.6334

ISSN: 1870-0462.
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de dichos cultivos en Costa Rica. **Conclusión:** Este hallazgo constituye una alerta fitosanitaria para la región centroamericana, dada la capacidad invasiva de esta especie. Su presencia refuerza la necesidad de monitoreo constante y de correctas medidas fitosanitarias en los países de América.
**Palabras clave:** especies invasoras; trips en cultivos; identificación taxonómica; fitosanidad; especie exótica.

## INTRODUCTION

Insects of the order Thysanoptera, commonly referred to as thrips, constitute a significant group due to their impact on a wide array of crops, either through direct physical damage or by transmitting viruses that adversely affect agricultural yields (Lewis, 1997; Maris *et al.*, 2003; Mouden *et al.*, 2017). Species in the genus *Thrips* are notable for their remarkable diversity and frequent occurrences in global phytosanitary records (Bragard *et al.*, 2019; Díaz-Montano *et al.*, 2011; He *et al.*, 2020). This genus is present in all continents except Antarctica, with the highest incidence in places located between 30° N and 60° N. However, their presence diminishes at higher elevations and in environments with limited floral availability (Gentile and Bailey, 1968). Generally, *Thrips* species are phytophagous (Nakahara, 1994), typically measuring no more than 5 mm in length (Hulagappa *et al.*, 2022; Hutasoit *et al.*, 2019), and exhibiting cryptic behavior (Morse and Hoddle, 2006), which has facilitated their global dispersal (Lewis, 1997).

Research on the genus *Thrips* in the Americas is limited, with most distributional data originating from the northern part of the continent (Nakahara, 1994). However, this information is less comprehensive than that available from Europe, as many species reported in the Americas have Holarctic European origins (Monteiro *et al.*, 2001; Mound and Marullo, 1996). Nakahara (1994) documented 62 *Thrips* species in North America, 43 of which are endemic. In contrast, only a few species are known from the Neotropical region, most of which have been introduced (Mound and Marullo, 1996). Three species have been identified in Argentina (De Borbón, 2008), four in Brazil (Cavalleri and Gonçalves, 2022; Monteiro *et al.*, 2001), and several in Colombia (Ebratt-Ravelo *et al.*, 2024), whereas nine species have been recorded in Central America (Goldarazena *et al.*, 2012; Mound and Marullo, 1996).

Globally, several *Thrips* species are recognized as significant agricultural pests, including *Thrips tabaci*, *Thrips palmi*, and *Thrips parvispinus* (Bragard *et al.*, 2019; Díaz-Montano *et al.*, 2011; Hulagappa *et al.*, 2022). *Thrips parvispinus* was first collected and described from the flowers of *Trichosanthes tricuspidata* in Thailand and Vietnam (Karny, 1922). This polyphagous species measures 0.8 to 1.2 mm in length, with adults typically exhibiting yellow to light brown coloration and darker-tinted wings (Pavithran *et al.*, 2024). Native to Southeast Asia, *T. parvispinus* has emerged as a serious pest in India and Indonesia, particularly affecting *Capsicum annuum* (sweet pepper or chili) crops (Gleason *et al.*, 2023; Hulagappa *et al.*, 2022; Tyagi *et al.*, 2015). In Europe, it was first detected in Greece in 1998 (Mound and Collins, 2000) and was recorded in northern Australia in 2005 (Mound and Masumoto, 2005). Additionally, it was reported in Spain in 2017 (Pijnakker, 2023), France in 2018 (European Food Safety Authority, 2019), the Netherlands in 2019 (National Plant Protection Organization of the Netherlands, 2019), Germany in 2021, and Belgium in 2022 (Pijnakker, 2023). In the Americas, *T. parvispinus* was first detected in Barbados (Seal *et al.*, 2023); however, in continental North America, it was first reported in Florida in 2020, causing damage to ornamental plants (Soto-Adames, 2020), then it was confirmed in Canada in 2023 (Gleason *et al.*, 2023) and recently, was recorded in Sinaloa, México (Payán-Arzapalo, 2025).

In recent years, the arrival of invasive thrips species in Costa Rica, such as *Megalurothrips usitatus*, has been documented (Rodríguez-Arrieta *et al.*, 2023). Prior to this report, there were no records of *T. parvispinus* in Costa Rica. This study is the first to document the occurrence of this species in association with commercially important crops in this country.

## MATERIAL AND METHODS

### Sampling

Thrips specimens were collected from various locations in Alajuela province: Sarchí, San Pedro (10°06'41.7"N, 84°19'58.8"W; May 2nd, 2024) in a protected *Capsicum annuum* (chili pepper) cultivation environment; San Carlos, Muelle (10°27'55.6"N, 84°27'38.8"W; August 20, 2024) in a greenhouse with *Citrus sinensis* (orange); Zarcero, Brisas (10°13'45.7"N, 84°23'44.4"W; September 1st, 2024) in a greenhouse with *C. annuum*; San Ramón, Bajo Rodríguez (10°18'25.1"N 84°31'55.4"W; September 26, 2024) in an open field with *Croton* sp. and Bajo Zúñiga (10°08′20.3"N, 84°29′53.1"W; September 9, 2024) in an open field with *C. annuum*, *Cucumis sativus* (cucumber) and *Coriandrum sativum* (coriander); Palmares (10°03'38.6"N, 84°26'17.7"W; October 9, 2024) in a greenhouse with *C. annuum*. The elevation at the collection sites ranged from 200 m a.s.l. in San Carlos, Muelle, to 1,000–1,500 m a.s.l. in Sarchí, Zarcero, Palmares, and San Ramón. ArcGIS Maps (Esri, 2024) were used to illustrate these locations (Figure 1). A total of 318 adult and both sexes specimens were sampled and collected directly from the host plants (53 specimens per location) that were carried out to the laboratory stored in 90% of ethylic alcohol in glass test tubes with cap.

**Light Microscopy**

Thrips specimens were identified at the Centro de Investigación en Estructuras Microscópicas (CIEMic), Universidad de Costa Rica (UCR), using conventional light microscopy with a Zeiss® Axiolab microscope at magnifications ranging from 5X to 63X. Specimens were prepared and cleared following the standard mounting techniques described by Mound and Marullo (1996), and taxonomic identification using the morphological keys provided by Mound and Masumoto (2005). Post-processing of the images was performed with HeliconFocus version 8.2.6 (HeliconSoft, 2022) with depth map stacking, and final composition of the figures was completed in Photoshop version 25 (Adobe Inc., 2024). Voucher specimens were deposited in the Thysanoptera Collection at CIEMic-UCR.

**DNA Extraction, Sequencing, and Genetic Inference**

Genomic DNA was extracted using the DNeasy Blood and Tissue Kit (QIAGEN®) following the manufacturer's instructions. A partial fragment of the mitochondrial cytochrome c oxidase subunit I (COI) gene was amplified using the primers LCO1490 (5'-GGTCAACAAATCATAAAGATATTGG-3') and HCO2198 (5'-TAAACTTCAGGGTGACCAAAAAATCA-3') (Folmer *et al.*, 1994). PCR reactions were carried out in 25 µl volumes containing 3–50 ng of DNA (1–2 µl), 0.25 µl of Taq DNA polymerase (DreamTaq, Thermo Scientific, 5 U/µl), 2.5 µl of DreamTaq Buffer (10X), 2.5 µl of dNTP mix (10 mM each), and 1.25 µl of each primer (10 µM). The thermal cycling profile consisted of an initial denaturation at 95°C for 1 min, followed by 35 cycles of denaturation at 95°C for 1 min, annealing at 58°C for 1 min, extension at 60°C for 1 min, and a final extension at 72°C for 10 min. The PCR products were purified and sequenced by Macrogen, Inc. (Seoul, South Korea) using the same primers used for amplification. Complementary strands were assembled and edited using BioEdit v7.2.5. Sequence alignment was performed using MUSCLE in MEGA v.11.0.13 (Tamura *et al.*, 2021) with sequences of 570 bp. Phylogenetic analysis was conducted using the Maximum Likelihood (ML) method within the same software. Branch support was assessed through bootstrap analysis with 1,000 replicates, and the Kimura 2-parameter (K2P) nucleotide substitution model was applied. Sequences from specimens collected in Costa Rica were deposited in GenBank (NCBI, National Center for Biotechnology Information) under accession numbers PQ624786, PQ624787, PQ624788, PQ624789, PQ624790, and PV335501.

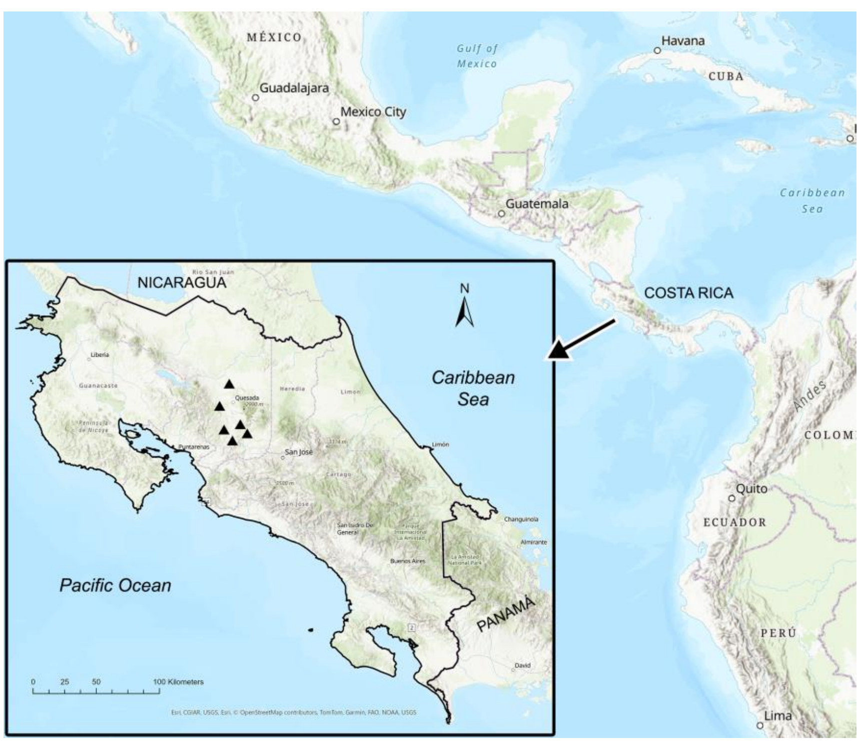


**Figure 1. Locations reporting the first detection of *Thrips parvispinus* in Costa Rica, Central America.**

## RESULTS AND DISCUSSION

At all locations, many of the specimens collected were female *Thrips parvispinus* (282 females and 36 males). The body coloration of these specimens was light brown on the head and thorax, in contrast to the dark brown on the abdomen (Figure 2A). This coloration exhibits variability in tone across different body sections; specifically, segments III and the basal halves of segments IV–V of the antennae are lighter in color (Figure 2B). Like other members of the genus *Thrips*, this species is characterized by seven-segmented antennae with bifurcated sensoria on segments III and IV, absence of ocellar seta I (Figure 2C), and two pairs of long posteroangular setae on the prothorax (Figure 2D). Abdominal sternites III–VI possess ten discal setae, whereas sternite VII lacks these setae (Figure 2E). The forewings are shaded in the distal three-quarters and remain clear only at the base. Morphologically, *T. parvispinus* resembles *T. orientalis*, particularly because of the complete row of setae along the first forewing vein (Figure 2F), a feature that is uncommon among other species in this genus. In contrast, *T. orientalis* exhibits uniformly light brown forewings and possesses fewer discal setae (seven or fewer) on abdominal sternites III–VI.

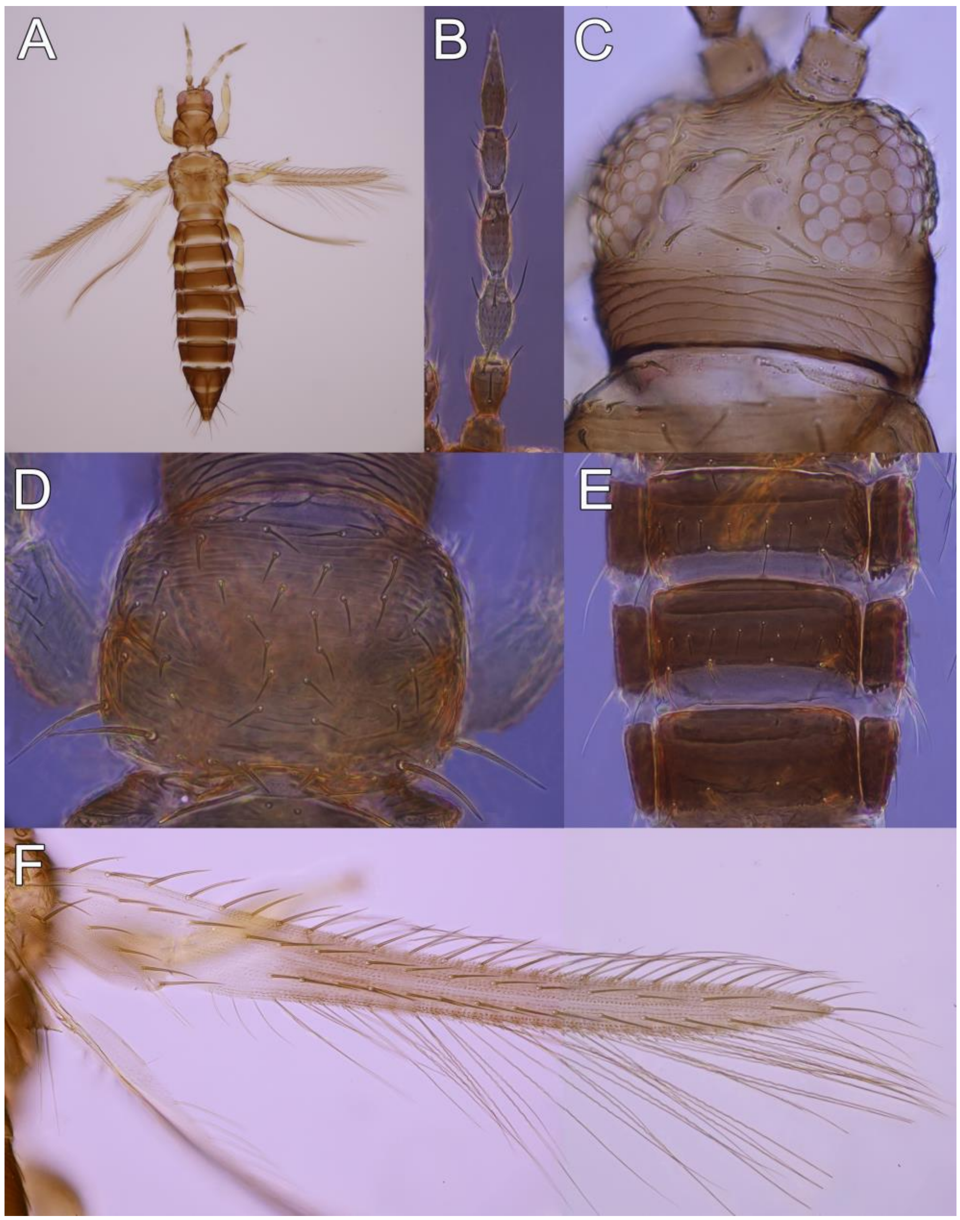


**Figure 2. External morphology of the species *Thrips parvispinus*. (A) Macropterous female; (B) seven-segmented antenna; (C) head lacking ocellar setae I; (D) prothorax with long posteroangular setae; (E) abdominal sternites V–VII; (F) forewing with a complete row of setae along the first vein.**

Visual damage was observed in young host plant leaves, where leaf margins exhibited curling and deformation or even senescence of new shoots (Figs. 3A, 3B). This thrips was found on both sides of the leaf (Figure 3C) and throughout the plant; however, damage was most evident on the abaxial leaf, where discoloration, necrotic spots, and epidermal destruction were observed (Figs. 3D, 3E). *T. parvispinus* was also observed in the plant flowers (Figure 3F).

Phylogenetic analysis confirmed the morphological identification and validated the species identity through COI gene sequences compared to the NCBI database (Figure 4). The resulting phylogenetic tree revealed the formation of two clades, demonstrating a clear separation between *T. parvispinus* and other *Thrips* species such as *T. orientalis* and *T. palmi*. Additionally, the subdivision within the *T. parvispinus* clade indicates a degree of geographic structuring among haplotypes, with genetic similarities observed in sequences from India and Indonesia, whereas sequences from Costa Rica and the United States appeared to share a common haplotype (Ahmed *et al.*, 2024).

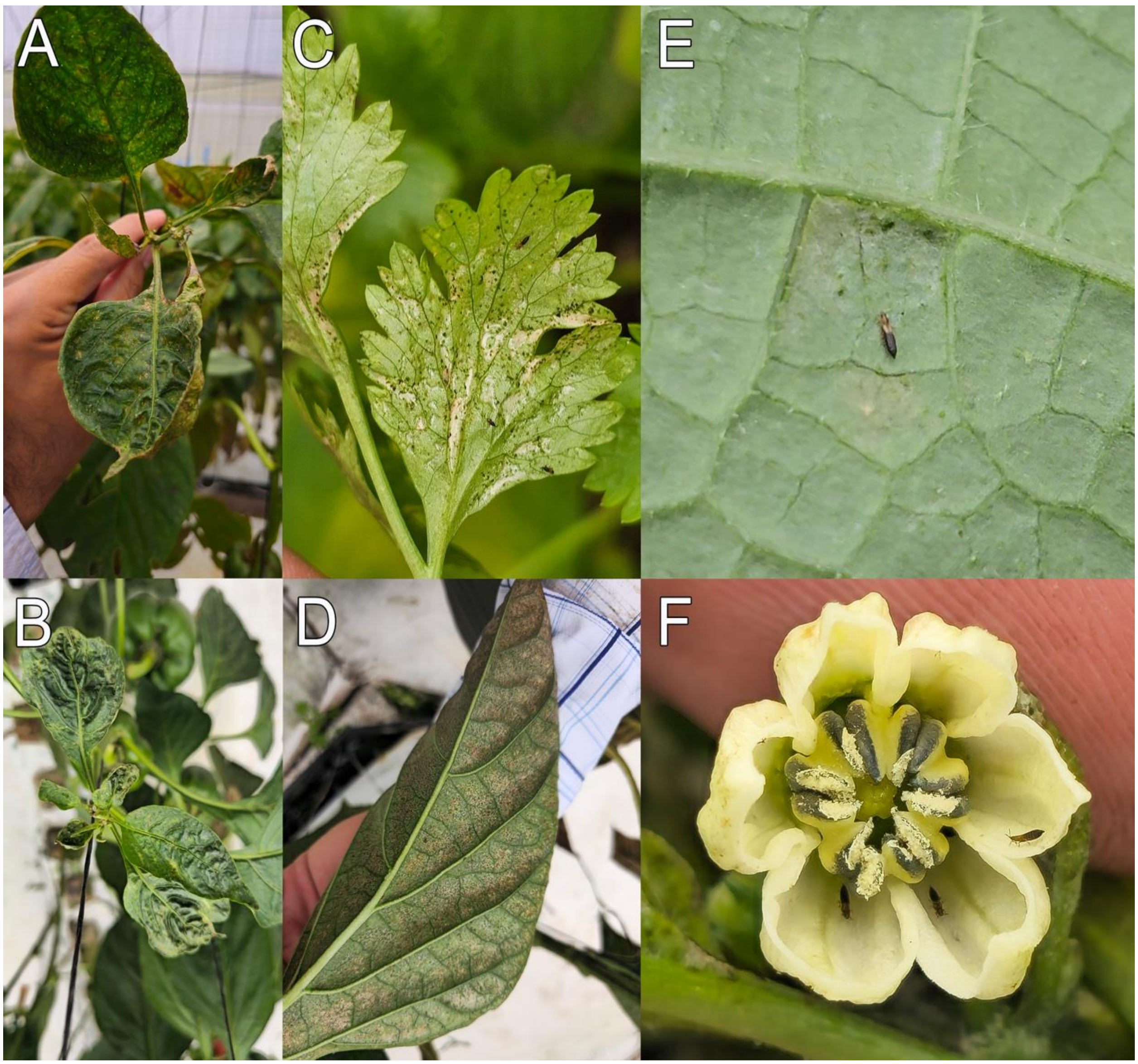


**Figure 3. Damage inflicted by *Thrips parvispinus* on host plants. (A, B) Leaf curling and deformation of new shoots in *C. annuum*; (C) feeding activity observed on the leaf surface of *C. sativum*; (D) mature leaves displaying extensive abaxial tissue destruction in *C. annuum*; (E) feeding damage evident on the abaxial leaf surface in *C. sativum*; and (F) presence of the species on the flowers of *C. annuum*.**

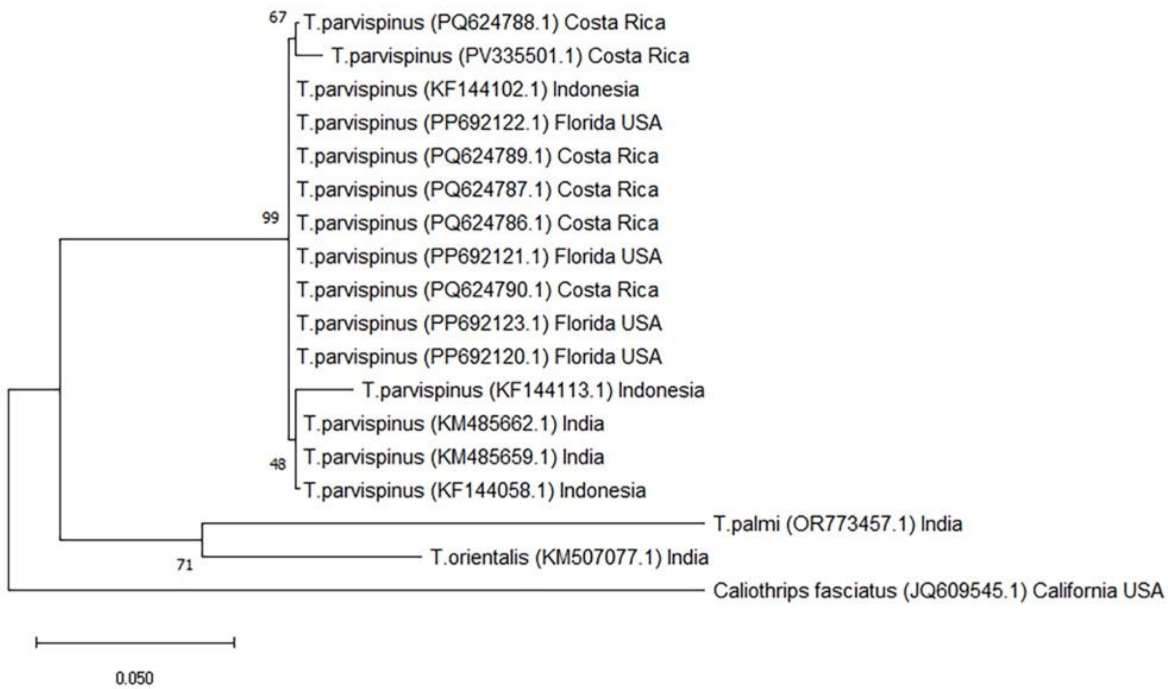


**Figure 4. Phylogenetic relationships of *T. parvispinus* from Costa Rica. Maximum Likelihood tree constructed from partial COI gene sequence alignments. Bootstrap support based on 1,000 replicates was calculated using the Kimura 2-parameter model. Accession JQ609545.1, designated as *Caliothrips indicus* from California (U.S.A.), served as the outgroup.**

Previous studies have demonstrated that *T. parvispinus* feeds on approximately 43 plant species from 19 families worldwide (Ataide *et al.*, 2024). In North America, in addition to *Capsicum*, it has been documented in *Gardenia*, *Hoya*, *Anthurium*, and *Mandevilla*, highlighting its significance in agricultural production (Ahmed *et al.*, 2024). The larvae primarily pierce and scrape the abaxial surface of the leaves, extracting cellular sap and resulting in a yellowish to brownish appearance in the affected areas (Thorat *et al.*, 2022). Damage to mature leaves manifests as streaks, leaf curling, or necrotic zones, while newly emerged leaves exhibit drying and wilting (Sridhar *et al.*, 2021). In flowers, adults cause damage by scraping petals and feeding on pollen, which leads to wilting and flower drop, affecting pollination and reducing fruit productivity (Sireesha *et al.*, 2021).

The presence of this species may also be a warning about its potential for viral vectoring in Central America, a phenomenon well documented for *T. parvispinus* in Asia (Rachana *et al.*, 2022). Furthermore, the successful establishment of these invasive species in new regions may result from the exchange of agricultural materials among trading countries coupled with limited phytosanitary measures (Ahmed *et al.*, 2024).

## CONCLUSION

The recent detection of *Thrips parvispinus* in Costa Rica underscores its capacity for range expansion within the Americas, which has previously been reported in the United States, Canada, and Mexico. Its association with commercially important crops confirms its polyphagous nature in both protected and open-field agricultural systems. By identifying the specimens through external morphology and mitochondrial COI gene analysis, we confirmed its identity and detected genetic similarities with previously reported populations in North America, suggesting a potential introduction route linked to regional horticultural trade. This finding serves as a phytosanitary alert for the Central American region and emphasizes the urgent need to implement monitoring programs for invasive thrips.

**Acknowledgements**
We extend our gratitude to the Centro de Investigación y Desarrollo en Agricultura Sostenible para el Trópico Húmedo (CIDASTH) and the Vicerrectoría de Investigación y Extensión (VIE) of the Instituto Tecnológico de Costa Rica (TEC) for their invaluable technical and financial support. We also thank the Laboratorio de Técnicas Moleculares at the Centro de Investigación en Protección de Cultivos (CIPROC) at

the Universidad de Costa Rica for their assistance with the DNA analysis.

**Funding**. This work was supported by the project B8732 "Colección de Thysanoptera" Universidad de Costa Rica and by the Vicerrectoría de Investigación y Extensión, Instituto Tecnológico de Costa Rica.

**Disclosure statement**. The authors declare no potential conflicts of interest.

**Compliance with ethical standards**. The authors confirm that this investigation was conducted under current ethical procedures. No human or animal was used in this study.

**Data availability.** Data are available from the corresponding author upon request. Open and public data is supported by the Universidad Costa Rica and the Instituto Tecnológico de Costa Rica. The results are associated to the thesis dissertation entitled "Identificación y muestreo de una nueva especie de Thysanoptera de importancia agrícola en Costa Rica" by the second author Andrés Barrientos-Castro.

**Author contribution statement (CRediT). J.A. Rodríguez-Arrieta –** Conceptualization, Writing and editing, Funding acquisition, Methodology, Data curation, Validation, Supervision. **A. Barrientos-Castro –** Resources, Methodology, Formal analysis, Visualization. **J. Masís-Arce –** Writing -original draft, Software. **I. Varela-Benavides –** Funding acquisition, Conceptualization, Supervision.

## REFERENCES

Adobe Inc., 2024. *Adobe Photoshop* (Version 25.0) [Computer software]. Adobe Inc. https://www.adobe.com/products/photoshop.html

Ahmed, M.Z., Roberts, J.W., Soto-Adames, F.N., McKenzie, C.L. and Osborne, L.S., 2024. Global invasion of *Thrips parvispinus* (Karny) (Thysanoptera: Thripidae) across three continents associated with its one haplotype. *Journal of Applied Entomology*, pp. 237–247. https://doi.org/10.1111/jen.13376

Ataide, L.M.S., Vargas, G., Velazquez-Hernández, Y., Reyes-Arauz, I., Villamarin, P., Canon, M.A., Yang, X., Riley, S. and Revynthi, A.M., 2024. Efficacy of conventional and biorational insecticides against the invasive pest *Thrips parvispinus* (Thysanoptera: Thripidae) under containment conditions. *Insects*, 15(48), pp. 48. https://doi.org/10.3390/insects15010048

Bragard, C., Dehnen-Schmutz, K., Di Serio, F., Gonthier, P., Jacques, M., Jaques Miret, J.A., Fejer Justesen, A., Magnusson, C.S., Milonas, P., Navas-Cortes, J.A., Parnell, S., Potting, R., Reignault, P.L., Thulke, H., Van der Werf, W., Vicent Civera, A., Yuen, J., Zappalà, L., Malumphy, C., Czwienczek, E. and MacLeod, A., 2019. Pest categorisation of *Thrips palmi*. *EFSA Journal*, 17(2), pp. 5620. https://doi.org/10.2903/j.efsa.2019.5620

Cavalleri, A. and Gonçalves, S.S., 2022. Novos registros e checklist das espécies de Thysanoptera do Pampa Brasileiro. *Entomological Communications*, 4, pp. ec04014. https://doi.org/10.37486/2675-1305.ec04014

De Borbón, C.M., 2008. *Desertathrips chuquiraga* gen. et sp.n. (Thysanoptera, Thripidae) from Argentina. *Zootaxa*, 1751(1), pp. 25–34. https://doi.org/10.11646/zootaxa.1751.1.2

Díaz-Montano, J., Fuchs, M., Nault, B.A., Fail, J. and Shelton, A.M., 2011. Onion thrips (Thysanoptera: Thripidae): A global pest of increasing concern in onion. *Journal of Economic Entomology*, 104(1), pp. 1–13. https://doi.org/10.1603/EC10269

Ebratt-Ravelo, E., Castro-Avila, A. and Goldaracena-Lafuente, A., 2024. Updated checklist of the order Thysanoptera in Colombia. *Zootaxa*, 5489(1), pp. 192–203. https://doi.org/10.11646/zootaxa.5489.1.14

Esri., 2024. *ArcGIS Pro* (Version 3.2.2) [Computer software]. Environmental Systems Research Institute. https://www.esri.com

European Food Safety Authority., 2019. *Emerging risks exchange network (EREN). Minutes of the 21st meeting*. EFSA. https://www.efsa.europa.eu/en/events/event/eren-21st-meeting

Folmer, O., Black, M., Hoeh, W., Lutz, R. and Vrijenhoek, R., 1994. DNA primers for amplification of mitochondrial cytochrome c oxidase subunit I from diverse metazoan invertebrates. *Molecular Marine Biology and Biotechnology*, 3(5), pp. 294–299.

Gentile, A. and Bailey, S.F., 1968. A revision of the genus *Thrips* Linnaeus in the New World with a catalogue of the world species (Thysanoptera: Thripidae). *University of*

*California Publications in Entomology*, 51, pp. 1–92.

Gleason, J.E., Maw, E., Summerfield, A., Jandricic, S.E. and Brunet, B.M.T., 2023. First records of invasive agricultural pests *Thrips parvispinus* (Karny, 1922) and *Thrips setosus* Moulton, 1928 (Thysanoptera: Thripidae) in Canada. *The Journal of the Entomological Society of Ontario*, 154, pp. 1–12. https://journal.lib.uoguelph.ca/index.php/eso/article/view/7528

Goldarazena, A., Gattesco, F., Atencio, R. and Korytowski, C., 2012. An updated checklist of the Thysanoptera of Panama with comments on host associations. *Check List*, 8(6), pp. 1232–1247. https://doi.org/10.15560/8.6.1232

He, Z., Guo, J., Reitz, S.R., Lei, Z. and Wu, S., 2020. A global invasion by the thrip, *Frankliniella occidentalis*: Current virus vector status and its management. *Insect Science*, 27(4), pp. 626–645. https://doi.org/10.1111/1744-7917.12721

HeliconSoft., 2022. *Helicon Focus* (Version 8.0) [Computer software]. HeliconSoft. https://www.heliconsoft.com/heliconsoft-products/helicon-focus/

Hulagappa, T., Baradevanal, G., Surpur, S., Raghavendra, D., Doddachowdappa, S., Shashank, P., Kereyagalahalli-Mallaiah, K. and Bedar, J., 2022. Diagnosis and potential invasion risk of *Thrips parvispinus* under current and future climate change scenarios. *PeerJ*, 10, pp. e13868. https://doi.org/10.7717/peerj.13868

Hutasoit, R.T., Triwidodo, H. and Anwar, R., 2019. The abundance and diversity of thrips (Thysanoptera: Thripidae) on chili (*Capsicum annuum* L.) and cayenne (*Capsicum frutescens* L.) in Bogor. *Jurnal Hama dan Penyakit Tumbuhan Tropika*, 19(1), pp. 33–41. https://doi.org/10.23960/j.hptt.11933-41

Karny, H., 1922. Thysanoptera from Siam and Indo-China. *Journal of the Siam Society*, 16(2), pp. 91–153. https://thesiamsociety.org/wp-content/uploads/2020/02/JSS_016_2b_Karny_ThysanopteraFromSiamAndIndochina.pdf

Lewis, T. (Ed.)., 1997. *Thrips as crop pests*. CAB International.

Maris, P.C., Joosten, N.N., Peters, D. and Goldbach, R.W., 2003. Thrips resistance in pepper and its consequences for the acquisition and inoculation of tomato spotted wilt virus by the western flower thrips. *Phytopathology*, 93(1), pp. 96–101. https://doi.org/10.1094/PHYTO.2003.93.1.96

Monteiro, R.C., Mound, L.A. and Zucchi, R.A., 2001. Espécies de *Thrips* (Thysanoptera: Thripidae) no Brasil. *Neotropical Entomology*, 30(1), pp. 61–63. https://doi.org/10.1590/S1519-566X2001000100010

Morse, J.G. and Hoddle, M.S., 2006. Invasion biology of thrips. *Annual Review of Entomology*, 51(1), pp. 67–89. https://doi.org/10.1146/annurev.ento.51.110104.151044

Mound, L.A. and Collins, D.W., 2000. A Southeast Asian pest species newly recorded from Europe: *Thrips parvispinus* (Thysanoptera: Thripidae), its confused identity and potential quarantine significance. *European Journal of Entomology*, 97(2), pp. 197–200. https://doi.org/10.14411/eje.2000.037

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

Mound, L.A. and Masumoto, M., 2005. The genus *Thrips* (Thysanoptera, Thripidae) in Australia, New Caledonia and New Zealand. *Zootaxa*, 1020(1), pp. 1–64. https://doi.org/10.11646/zootaxa.1020.1.1

Mouden, S., Sarmiento, K.F., Klinkhamer, P.G. and Leiss, K.A., 2017. Integrated pest management in western flower thrips: Past, present and future. *Pest Management Science*, 73(5), pp. 813–822. https://doi.org/10.1002/ps.4531

Nakahara, S., 1994. The genus *Thrips* Linnaeus (Thysanoptera: Thripidae) of the New World (No. 1822; U.S. Dep. Agric. Tech. Bull.). U.S. Department of Agriculture.

National Center for Biotechnology Information., 2025. *NCBI Database* [Online]. National Library of Medicine. https://www.ncbi.nlm.nih.gov/

National Plant Protection Organization of the Netherlands., 2019. *Thrips parvispinus*. Netherlands Food and Consumer Product Safety Authority, Ministry of Economic Affairs. https://pra.eppo.int/pra/edad9941-1011-4661-ba82-aa85dab26c8e

Payán-Arzapalo, M.A., Infante, F., Ortiz, J.A., Suárez-Hernández, H., López-Cuén, P.I., Delgado-Pacheco, V., Gastélum-Acosta, W.E., Yáñez-Juárez, M.G. and Estrada-Acosta, M.D., 2025. A new invasive pest in Mexico: the presence of *Thrips parvispinus* (Thysanoptera: Thripidae) in chili pepper fields. *Florida Entomologist*, 108(1), pp. 1–6. https://doi.org/10.1515/flaent-2025-0001

Pavithran, S., Vishnu, M. and Naveen, M., 2024. Overview of invasive species, *Thrips parvispinus* (Karny) and its management strategies. *GreenariA*, 2(9), pp. 150–153.

Pijnakker, J., 2023. *Thrips parvispinus* (tobacco thrips). *CABI Compendium*, 53744. https://doi.org/10.1079/cabicompendium.53744

Rachana, R., Poorani, J. and Ramamurthy, V.V., 2022. Invasive pest, *Thrips parvispinus* (Karny) (Thysanoptera: Thripidae) – A looming threat to Indian agriculture. *Current Science*, 122(2), pp. 211–213. https://doi.org/10.18520/cs/v122/i2/211-213

Rodríguez-Arrieta, J.A., Chaves-Barrantes, N.F., Hernández-Fonseca, J.C. and González-Herrera, A., 2023. First report of common bean flower thrips *Megalurothrips usitatus* Bagnall in Costa Rica. *Tropical and Subtropical Agroecosystems*, 26(2), pp.037. https://doi.org/10.56369/tsaes.4521

Seal, D., Khan, R., Osborne, L. and Gibbs, I., 2023. *Thrips parvispinus* (Karny, 1922) (Insecta: Thysanoptera: Thripidae): A new invasive pest. IN1407, pp. 1–6. https://doi.org/10.32473/edis-IN1407-2023

Sireesha, K., Prasanna, B.V.L., Vijaya-Lakshmi, T. and Reddy, R.V.S.K., 2021. Outbreak of invasive thrips species *Thrips parvispinus* in chilli growing areas of Andhra Pradesh. *Insect Environment*, 24(4), pp. 514–519. https://img1.wsimg.com/blobby/go/e32c3452-4e91-4d33-bdd5-d2fe34246a6c/downloads/9.%20K.%20Sireesha.pdf?ver=1659795704729

Soto-Adames, F.N., 2020. *Thrips parvispinus* (Karny). Florida Department of Agriculture and Consumer Services, Division of Plant Industry. No. P-01926; pp. 1–3.

Sridhar, V., Sree-Chandana, P. and Rachana, R.R., 2021. Global status of *Thrips parvispinus* (Karny, 1922), an invasive pest. *The Journal of Research PJTSAU*, 49(4). https://epubs.icar.org.in/index.php/TJRP/article/view/123201

Tamura, K., Stecher, G. and Kumar, S., 2021. MEGA11: Molecular evolutionary genetics analysis version 11. *Molecular Biology and Evolution*, 38(7), pp. 3022–3027. https://doi.org/10.1093/molbev/msab120

Thorat, S.S., Sisodiya, D.B. and Gangwar, R.K., 2022. Invasive thrips, *Thrips parvispinus* (Karny), an invasive threat: A review. *Environment and Ecology*, 40(4A), pp. 2170–2175. https://environmentandecology.com/wp-content/uploads/2024/07/MS4-4.pdf

Tyagi, K., Kumar, V., Singha, D. and Chakraborty, R., 2015. Morphological and DNA barcoding evidence for invasive pest thrips, *Thrips parvispinus* (Thripidae: Thysanoptera), newly recorded from India. *Journal of Insect Science*, 15(1), pp. 105. https://doi.org/10.1093/jisesa/iev087