New report of the exotic species *Megalurothrips usitatus* (Thysanoptera: Thripidae) infesting three commercial legumes in Nayarit, Mexico

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Legumes (Fabaceae) historically have been a major component in the standard Mexican diet (9.9 kg yr^{-1} per capita), and their cultivation is crucial in sustaining small and medium-scale growers (SADER 2020). The common bean (*Phaseolus vulgaris* L.; Fabaceae) is the second most important crop in terms of acreage after corn, with 1,711,962 ha in 2020; in addition its cultivation generates employment and substantial revenue (1.3% Gross Domestic Product [GDP] on average) to the country (SIAP 2020). Likewise, jicama or yam bean (*Pachyrhizus erosus* [L.] Urb.; Fabaceae) is an important leguminous crop in Mexico. With roughly 18,654 planted ha during 2019, the production yielded 7,889 tons (SIAP 2019). *Pachyrhizus erosus* is highly valued in local diets as an inexpensive and energy-rich food (Noman et al. 2007). In Mexico, the cowpea (*Vigna unguiculata* subsp. *sesquipedalis* [L.] Walp.; Fabaceae) is appreciated among small-scale growers because of its nutritious pods and adaptability to either dry or humid environments (Morales-Morales et al. 2019). In Nayarit State, farmers grow common bean (78, 265 ha) (SIAP 2020), jicama (2,408 ha) (SIAP 2019), and cowpeas (about 300 ha in 2020). However, the status of some pests attacking these crops remains unclear.

Among the common pests affecting the above-mentioned species grown in Nayarit are green leafhoppers (*Empoasca kraemeri* Ross & Moore; Hemiptera: Cicadellidae), whiteflies (*Bemisia tabaci* Gennadius; Hemiptera: Aleyrodidae), cucurbit beetles (*Diabrotica* spp. Chevrolat in Dejean; Coleoptera: Chrysomelidae), and thrips (*Frankliniella* spp. Kamy; Thysanoptera: Thripidae) (Agenda Técnica Agrícola Nayarit 2015). Growers invest significant resources every yr to control these insects. In 2021 on the coastal plain of Nayarit, unusual thrips damage was reported by growers on common beans (leaves and flowers), cowpeas (inflorescences and pods), and jicama (flowers). This study aimed to identify and document thrips species associated with the above-mentioned crops, and to develop possible management guidelines.

The thrips infestation reported in 2021 on common beans, cowpeas, and jicama was assumed to be caused by common thrips pests in the region (i.e., *Frankliniella* spp., *Caliothrips phaseoli* Hood; Thysanoptera: Thripidae). We collected 2,811 samples in a simple sampling carried out on 7 Feb 2022 from the 3 legume species mentioned above when the thrips damage was severe, especially in common beans and cowpeas. Samples were collected from 2 localities of Santiago Ixcuintla, Nayarit, where the first reports of high populations of the insect were documented. Each sample consisted of a fully developed inflorescence randomly sampled. The number of inflorescences collected varied depending on the available material given the phenological stage (close to harvesting date).

Thrips specimens obtained from the sampled inflorescences were preserved in 70% ethanol for subsequent separation and quantification in the Laboratory of Agricultural Parasitology at the Autonomous University of Nayarit, Tepic, Nayarit, Mexico, using a stereomicroscope (VELAB™ VE-S5, Mexico City, Mexico). About 10% of adult thrips from each crop were prepared for identification following the protocol proposed by Johansen-Naime and Mojica (1997). Identification was conducted under a compound microscope (LABOMED® CxL, Hicksville, New York, USA), using the taxonomic keys of Mound & Kibby (1998), Hoddle et al. (2012), and Oz Thrips (2022). Finally, the species was corroborated by Alexander Rodríguez Arrieta (specialist in Thysanoptera at the University of Costa Rica, San José, Costa Rica). Specimens were deposited in the insect collection of the Laboratory of Agricultural Parasitology, Autonomous University of Nayarit, Tepic, Nayarit, Mexico.

A total of 2,811 thrips individuals from all stages (larvae, pupae, and adults) were obtained from the inflorescences. Of these, 1,643 (58.4%) were obtained from 20 inflorescences of jicama, 822 (29.3%) from 58 inflorescences of cowpeas, and 346 (12.3%) from 24 inflorescences of common bean. The identified species corresponded to *Megalurothrips usitatus* Bagnall (Thysanoptera: Thripidae), commonly known as bean

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flower thrips or Asian bean thrips. The species *Frankliniella* spp. (63 specimens), *C. phaseoli* (18 specimens) also were detected in common beans inflorescences but in lesser proportion.

This is the first record of the presence of *M. usitatus* in Mexico. In addition, jicama is a new host record for this thrips species. *Megalurothrips usitatus* is native to Asia where it is widespread and commonly found on Fabaceae (Chen 1980; Fan et al. 2013; Tang et al. 2015; Soto-Adames 2020). However, recently it has been reported in the Americas, specifically in Miami-Dade County, USA (Soto-Adames 2020) and Cuba attacking *P. vulgaris* (Elizondo-Silva et al. 2021; Urdanivia 2021).

In 2022, we found *M. usitatus* in high abundance causing severe damage to jicama, common bean, and green bean crops. This thrips species is a well-known pest of some legumes in Asia (Chen 1980; Chang 1987, 1989; Mound & Walker 1987; Palmer 1987; Tang et al. 2015; Soto-Adames 2020; Elizondo-Silva et al. 2021; Urdanivia 2021). In China, *M. usitatus* has been reported causing severe economic losses in common beans (*P. vulgaris*), cowpeas (*V. unguiculata*), peas (*Pisum sativum* L.; Fabaceae), and lima beans (*Phaseolus limensis* Macf.; Fabaceae) (Chen 1980; Chang 1987, 1989; Fan et al. 2013; Tang et al. 2015). In Taiwan, yield losses in peanut (*Arachis hypogaea* L.; Fabaceae) can be up to 30% (Chen 1980), and severe damage to common beans has been reported in Cuba (Elizondo-Silva et al. 2021; Urdanivia 2021).

The estimated loss by the attacks of *M. usitatus* on cowpea was close to 60% (grower's personal communication). Damages on this legume principally were malformations and scarring of tissues (flowers, inflorescences, pods, and green beans) during feeding (Fig. 1). The brown staining at the base of the pods (Fig. 1F) presumably is the result of initial feeding. In highly infested plants, the pods twisted and turned dark brown (Fig. 1D). Such damage is consistent with a previous report on common beans by Elizondo-Silva et al. (2021) indicating that injuries depend principally on the phenological stage of the plants. For example, in young plants, these thrips can cause a delay in growth, poor development, and leaf deformation, whereas in older plants, chlorotic spots, wrinkling, leaf burns, and necrosis of the leaflet veins usually are present. Likewise, Soto-Adames (2020) reported that both larvae and adults can damage flowers, leaves, and pods of legumes. However, Tang et al. (2015) observed that the flowering stage is the most vulnerable to receive attacks from this pest.

Although high populations of *M. usitatus* were documented in jicama flowers (163 specimens per flower cluster), there was no evidence of serious damage on jicama inflorescences, but further monitoring programs are important (Soto-Adames 2020), especially since the presence of larvae and pupae of this thrips was evident, which could suggest its ability to reproduce successfully in this crop.

The common bean is the preferred host plant for *M. usitatus*, although there are several reports of damage on other Fabaceae crops such as peanuts (*A. hypogaea*), soybeans (*Glycine max* [L.] Merr.; Fabaceae), pigeon peas (*Cajanus cajan* [L.] Millsp.; Fabaceae), lima beans (*Phaseolus lunatus* L.; Fabaceae; and *P. limensis* Macf.), peas (*P. sativum* L.). There are reports of *M. usitatus* attacking potato (*Ipomoea batatas* [L.] Lam.; Convolvulaceae) (Chen 1980; Chang 1987; Tang et al. 2015, 2016; Soto-Adames 2020; Elizondo-Silva et al. 2021; Urdanivia 2021).

The population control of *M. usitatus* in both native and exotic locations is based largely on chemical insecticides, but with low effectiveness, which is attributed to the fact that thrips remain protected inside flowers (Liu et al. 2018) and their short life cycle (about 9–10 d at 24 °C), and thus multiple generations per year increase the probability of resistance to active ingredients (Tang et al. 2015). In this work, producers used broad-spectrum chemical insecticides (e.g., cypermethrin, alpha-cypermethrin, zeta-cypermethrin, malathion, methoxyfenozide, and spinetoram, among others), and some insecticides of natural origin (spinosad and spinoteram) to control *M. usitatus*. However, it seems that other factors (as mentioned by Liu et al. 2018 and Tang et al. 2015) interfered with the control of this thrips species.

Immediate actions to control or eradicate this exotic species should be taken by phytosanitary agencies in Mexico to prevent the spread of *M. usitatus*. Special attention should be paid to other legumes grown in the region because the dispersal and population growth of thrips can be rapid under appropriate conditions (Rhainds & Shipp 2003). It is assumed that the thrips present in this region are presumed to come from a highly invasive species found throughout East Asia and that recently was found in the USA (Soto-Adames 2020). Therefore, establishing an emergency phytosanitary surveillance program in the surrounding area should be considered. Along with phytosanitary actions, research on natural enemies is encouraged as an option to control *M. usitatus*; it may become necessary to introduce some of the suggested species from sites of pest origin. In this regard, natural enemies (parasitoids and predators) may help to control this exotic thrips species. In its native range, predatory insects such as *Orius maxidentex* Ghauri, *Orius strigicolli*s (Poppious), and *Orius sauteri* (Poppius) (Hemiptera: Anthocoridae) have been used successfully in the biocontrol of *M. usitatus* (Lee et al. 1991; Men 1999; Tang et al. 2016; Lui et al. 2018). *Orius sauteri* has been recommended as a potential biocontrol agent for *M. usitatus* because its populations can

Fig. 1. (A) Adult female of *Megalurothrips usitatus*; (B) thrips-infested flowers of *Phaseolus vulgaris*; (C) common bean inflorescence infested with thrips; (D) twisted and deformed pods of cowpeas; (E) inflorescence of jicama infested by thrips; (F) brown coloration produced by thrips feeding.

complete their life cycles in fields, and females can consume up to 305 thrips during their lifetime (Tang et al. 2016; Lui et al. 2018).

In conclusion, this work reports for the first time the occurrence of the exotic thrips *M. usitatus* in common beans, jicama, and cowpeas grown in Nayarit, Mexico. Authorities, researchers, extension agents, and growers should work together to prevent the dispersal of this pest, which may infest other economically important legumes. Monitoring the presence of this species in wild legumes may provide meaningful insights of potential dispersion and establishment. Regulatory strategies should consider the mobilization of bioproducts, the evaluation of cultural, genetic, and control alternatives to minimize ecological impacts.

Summary

The bean flower thrips, *Megalurothrips usitatus* (Bagnall) (Thysanoptera: Thripidae) is native from Asia and is a well-known pest of legumes such as common bean (*Phaseolus vulgaris* L.), cowpea (*Vigna unguiculata* [L.] Walp.), pea (*Pisum sativum* L.), and lima bean (*Phaseolus limensis* Macf.) (all Fabaceae). This thrips species has been recorded recently in the Americas (USA and Cuba). Before this study there were no records of *M. usitatus* in Mexico; this work is the first report of *M. usitatus* in Mexico. We found this species attacking common beans, jicama, and cowpeas in Nayarit State. In cowpeas, it reduced production by at least 60%. The highest population was observed in jicama but no evidence of severe damage or yield loss was documented; however, the potential damage on the seed production should be evaluated. Authorities, researchers, extension agents, and growers should work together to prevent the dispersal of this pest, which may infest other economically important legumes. Chances of controlling or eradicating *M. usitatus* in the region are minimal if no effective alternatives are available in the short term.

Key Words: Fabaceae; insect; pest; phytophagous; *Vigna unguiculata*

Sumario

El trips de la flor del frijol, *Megalurothrips usitatus* (Bagnall) (Thysanoptera: Thripidae) es originario de Asia y es una conocida plaga de leguminosas como el frijol común (*Phaseolus vulgaris* L.), el caupí (*Vigna unguiculata* [L.] Walp.), guisante (*Pisum sativum* L.) y frijol lima (*Phaseolus limensis* Macf.) (todas Fabaceae). Esta especie de trips ha sido registrada recientemente en las Américas (EE.UU. y Cuba). Antes de este estudio no había registros de *M. usitatus* en México; este trabajo es el primer reporte de *M. usitatus* en México. Encontramos esta especie atacando frijol común, jícama y caupí en el estado de Nayarit. En caupí, redujo la producción en al menos un 60%. La población más alta se observó en jícama pero no se documentó evidencia de daño severo o pérdida de rendimiento; sin embargo, se debe evaluar el daño potencial sobre la producción de semillas. Las autoridades, investigadores, extensionistas y productores deben trabajar juntos para evitar la dispersión de esta plaga, que puede infestar otras leguminosas económicamente importantes. Las posibilidades de controlar o erradicar *M. usitatus* en la región son mínimas si no se dispone de alternativas eficaces a corto plazo.

Palabras Clave: Fabaceae; insecto; plaga; fitófago; *Vigna unguiculata*

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