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The banana rust mite, *Phyllocoptruta musae* Keifer (Eriophyidae), an invasive mite in the Caribbean presenting an unusual sexual behavior*

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The banana rust mite, *Phyllocoptruta musae* Keifer, 1955 (Eriophyidae), was observed for the first time in the Caribbean in 2020, in Dominican Republic, in the Línea Noroeste region, Valverde and Monte Cristi provinces, infesting *Musa acuminata* plantations (Gran Enano and Williams hybrids) (Gómez-Moya *et al.,* 2021). This eriophyid mite was described from Queensland, Australia on *Musa* x *paradisiaca* L. (Keifer, 1955). In the Eastern Hemisphere, besides Australia *P. musae* had been reported from China, in the autonomous region of Guangxi Zhuang; on Hainan Island, and in Thailand (Li *et al.,* 2007; Tan *et al.,* 2014; Chandrapatya *et al*., 2016; Amrine & de Lillo, personnal communication). In Australia infestations were reported causing fruit spotting (Keifer, 1955).

When reported in the Caribbean in 2020 population explosions were already occurring (personnal communication Eng. Dionicio Campos, Antonio Bonilla's farm, El Charco). During the last two years, the banana rust mite expanded its distribution in Linea Noroeste, where it was also observed in the province of Santiago. It is possible that currently this mite presents a wider distribution along the island. Numerous colonies were found on the flag leaf and brown and chlorotic streaks were observed on the bundle of young leaves when there were high populations on the underside; also, brown spots were observed on young leaves, as well as rachis and pseudostem (Gómez-Moya *et al.,* 2021). Attacked leaves seem to have darkened marginal patches at the distal portion contacting the younger leaves, but it is unclear how much of that could be due to other causes. Besides, spots at the base of young leaves, growers have associated it with damage caused by *P. musae* (Figure 1). These fusiform eriophyid mites are noticeable by their relatively large size (around 230µm) (Keifer, 1955) and by aggregation, forming elongate yellowish bands (Figure 2). Up to now in Dominican Republic infestations have been observed just on *M. acuminata*; no infestations have been observed on others Musaceae.

An unsual sexual behavior was observed on the banana rust mite colonies. Apparently, the mite shows behavior similar to Tetranychidae in relation to sexual courtship and competition between two or more males to mate with a certain female. Tetranychid mites exhibit precopulatory behaviour, followed by the actual sperm transfer (Potter

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& Wrensch, 1978; Tien *et al*., 2011; Vacante, 2015). Males of *P. musae* slide their opisthosoma under the sides of the targeted female, as if trying to copulate with quiescent deutonymphs or active females. This behavior, *i.e.* incomplete sex dissociation, is unusual in eriophyid mites, in which the most commonly observed is the complete sex dissociation (also called mate dissociation or non-pairing, in which sperm transfer via spermatophores occurs in total isolation from both conspecifics) (Michalska *et al.,* 2010). Interesting contact between male and female was reported once in other species of *Phyllocoptruta,* the citrus rust mite *P. oleivora* (Ashmead, 1879). Incomplete sex dissociation has been observed in some water mites, in which spermatophore deposition is triggered only by previous contact with females (Proctor, 1992). Very little is known about the banana rust mite biology, especially in relation to its internal reproductive system, sperm transfer.

FIGURE 1. Damage associated with by *P. musae* according to growers. Photos: J. Catuto (Técnico privado) y C.A Gómez Moya.

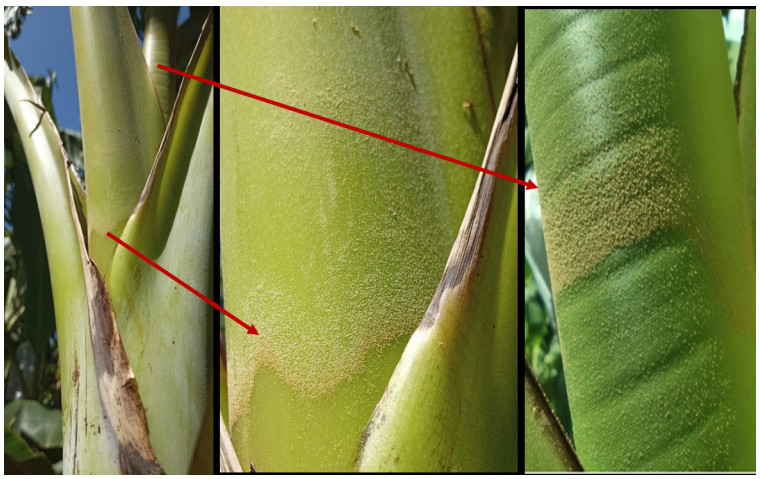

FIGURE 2. *Phyllocoptruta musae Keifer* infesting the flag leaf of a banana plant in the Dominican Republic (photo: Parmenio Taveras).

Care should be taken to prevent introduction of this invasive pest to other banana producing countries in the Neotropics. Still, it may be also present elsewhere, without being detected. Careful searches should be made wherever bananas are grown. This is the first report of the banano rust mite in the Neotropics and even in the Americas. Severe symptoms and high populations of this eriophyid mite observed in Dominican Republic alert to the need of adoption of prevention and control measures to minimize its impact in the whole region, specially in banana production countries.

In order to expand knowledge, a grant was recently obtained through the *Fondo Nacional de Innovación y Desarrollo Científico y Tecnológico (FONDOCYT)*, a dependency of the Ministry of Higher Education, Science

and Technology (MESCYT) of Dominican Republic. In this project it is expected: i) to determine the current distribution of *P. musae* in the Caribbean; ii) determine its economic impact; iii) investigate invasion routes through genetic studies; and iv) study population dynamics in the main infested region (Feliz-Lebrón et al., 2022). They would allow the inference of the route of entry of this mite into the country.

It is not known how *P. musa* was introduced to Dominican Republic, as well as various invasive mites to the Neotropics. In recent years, mites have gained economic importance in most agricultural crops. However, they have not received due attention, compared to other groups of pests, *e.g.*, insects, weeds or diseases. This situation causes concern with the arrival in the Caribbean of mites that constitute phytosanitary risks and that have expanded its distribution in Central and south America; such is the case of *Schizotetranychus hindustanicus* (Hirst, 1924), (Tetranychidae), and *Raoiella indica* Hirst, 1924 (Tenuipalpidae) (Flechtmann & Etienne, 2004; Navia & Masaro, 2010; Navia *et al.,* 2013). Regional measures need to be adopted to minimize dissemination and impact of invasive mites in the Americas.

Keywords: *Musa acuminata*, invasive pest, quarantine, Neotropics, Dominican Republic

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