Investigation note

Effect of phytosanitary pruning in populations of *Aulacaspis tubercularis* Newstead (Hemiptera: Diaspididae) and its natural enemies

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Abstract

The mango white scale (EBM), *Aulacaspis tubercularis* Newstead (Hemiptera: Diaspididae), is a pest that damages foliage and decreases the commercial value of mango fruits. Phytosanitary pruning is a cultural practice that can help reduce EBM populations in mango orchards. The objective of this work was to evaluate the impact of phytosanitary prunings in EBM populations and their natural enemies in a mango orchard Ataulfo, in Chiapas, Mexico. The phytosanitary pruning was done after the mango harvest (month of May) and its impact on EBM between December 2013 and May 2014 was evaluated, a period considered to be the one with the highest abundance of EBM populations in Chiapas. It was found that the abundance of colonies and total of scales (females + colonies) was lower in trees with phytosanitary prunings compared to mango trees without pruning. The natural enemies that were observed in trees with pruning and without pruning were identified as *Ceraeochrysa* sp., *Azya* sp. and *Pentilia* sp. No significant differences were detected in the abundance of natural enemies between mango trees with and without phytosanitary pruning.

Keywords: *Aulacaspis tubercularis*, phytosanitary pruning, predators.

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The mango is one of the fruits of greater export and consumption worldwide. This crop occupies the fourth place in terms of surface of fruit trees planted in Mexico, after coffee, orange and banana, with an area of 115 963 ha (SIAP, 2013). This fruit is one of the products with the highest economic export potential and represents for Mexico an important source of foreign currency, after agricultural products such as coffee and oranges (SIAP, 2013). Chiapas is the state that occupies the fourth national place as mango producer, with a contribution of 18% of the production in an area of 34 728.07 ha, of which, 73% are cultivated with Ataulfo mango, 8% with manililla, 1% with creole and 18% with other cultivars (SIAP, 2016, 2017).

The cultivation of mango in Chiapas is affected by different pests and diseases, among which an emerging plague of quarantine importance is the white mango scale (EBM) *Aulacaspis tubercularis* Newstead (Hemiptera: Diaspididae) (López-Guillen and Urias-López, 2014). This pest occurs in almost all mango orchards in the state of Chiapas and can aesthetically damage up to 33% of the fruits (López-Guillen *et al*., 2017), so control measures must be applied to reduce their populations. The control of this plague in the country is carried out through insecticides, mineral oils and detergents (Urias-López *et al*., 2013). However, it is necessary to design control strategies that are more friendly to the environment and the populations of natural enemies.

Pruning is an essential practice to maintain productivity in mango orchards, it is carried out with the purpose of stimulating the production and quality of the fruits, facilitating the agronomic management, maintaining an appropriate size of the trees, increasing the incidence of sun rays in the fruit and eliminate branches damaged by pests and diseases (Vázquez *et al*., 2009; De Souza Rodrigues *et al*., 2013). Recently, Pérez *et al*. (2016) determined that pruning in mango trees, in combination with detergent application, decreases EBM populations in Nayarit, Mexico. However, it is not recommended to generalize and extrapolate the positive effect of pruning in other agroecological conditions, because the growth and behavior of trees is not the same (Vazquez *et al*., 2009). The objective of this work was to evaluate the impact of phytosanitary prunings in EBM populations and their natural enemies in a mango orchard Ataulfo, in Chiapas, Mexico.

The evaluation of the effect of phytosanitary prunings in the EBM population was performed on mango trees of the Ataulfo cultivar, at the La Norteña Experimental Site of the INIFAP, municipality of Tapachula, Chiapas, Mexico (14° 45' 31.7" north latitude; 92° 23' 8.4" west longitude, 22 m), with humid warm climate [Af(m)] according to the classification of García (2004). The plantation was 15 years old when work began, with a distance between trees of 15 x 15 m. The phytosanitary prunings were made in May 2013 and consisted of eliminating after the harvest dry branches, broken and damaged by pests and diseases; likewise, pacifiers, dry floral rachis and thinning of the tree crown were eliminated (approximately 40 cm of blunting in apical buds). Five mango trees with pruning and five without phytosanitary pruning (control) were randomly selected, with similar size, age and appearance, in which four oriented branches were marked in each cardinal point.

In each branch the second to last vegetative flow (outbreak) was sampled, of which two leaves of the middle part of the shoot were marked, a leaf located in the interior and another one in the outside of the bud, with which a total of eight leaves were had per tree at each sampling

date and according to the methodology proposed by Urias-López *et al*. (2010). The sampling was carried out every two weeks between December 2013 and May 2014, just when the highest EBM populations were presented, according to Lopez-Guillen and Urias-López (2014). In each sampling, the number of colonies, females and total number of scales (colonies + females) present in the upper and lower leaves, both of the trees with pruning and without pruning, the latter considered as a control, was recorded. In the case of natural enemies, sampling was done on the same trees and branches of the scale sampling, with the difference that the number and species of natural enemy was recorded.

The data of the populations of EBM and the total of natural enemies in both trees with pruning and without pruning, were analyzed through an analysis of variance, in random blocks and the comparison of means was made by Tukey test (α= 0.05). The statistical analyzes were made with the computer program SAS Institute (2009). The response variables that were considered were number of females, colonies, total of scales and total of natural enemies present in the foliage.

The number of colonies and total (colonies + females) per leaf of EBM in the trees with and without phytosanitary pruning's were significantly different ($p \leq 0.05$) in almost all the dates, whereas, in the number of females per leaf they were not presented significant differences ($p \geq 0.05$). Trees with phytosanitary prunings had lower EBM abundance (Figure 1A and 1B). The highest abundance of EBM in mango trees with and without pruning was observed between February and March. The effect of pruning on mango trees of the Ataulfo variety to reduce EBM populations was also observed by Pérez *et al*. (2016) in Tepic, Nayarit, who found that pruning in combination with detergents decreased EBM populations. However, in Chiapas, unlike the work developed in Tepic, Nayarit, it was found that pruning alone reduced EBM populations.

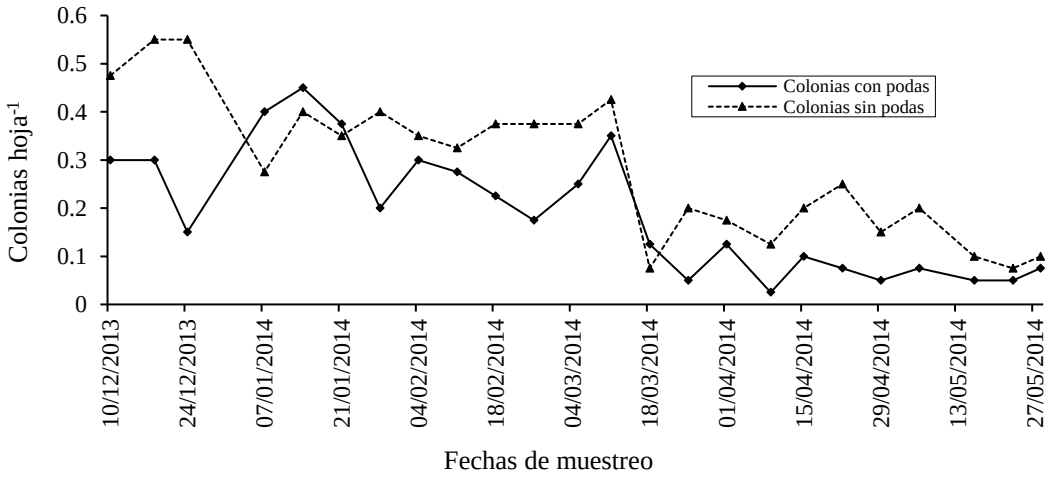

Figure 1A. Monthly average of EBM colonies per leaf in Ataulfo mango with pruning and without phytosanitary pruning. La Norteña Experimental Site, Tapachula, Chiapas from December 2013 to May 2014.

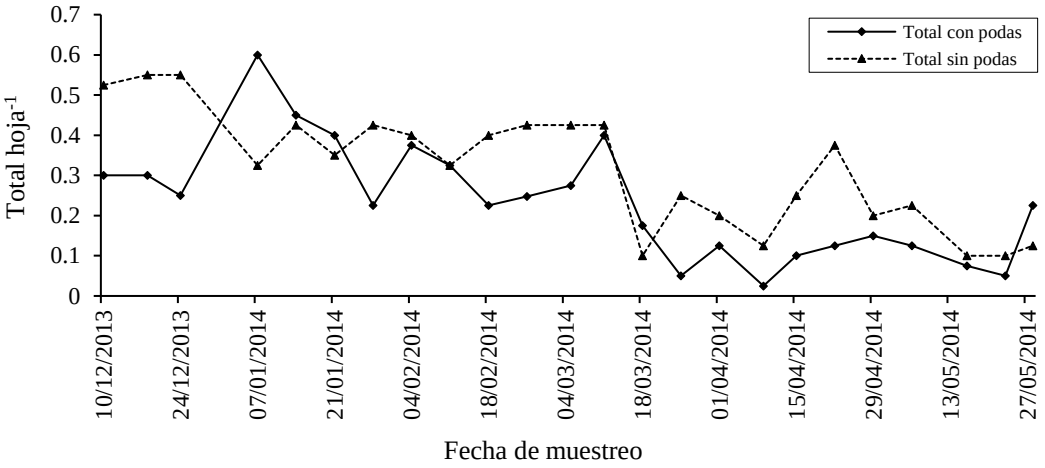

Figure 1B. Monthly average of total EBM (colonies + females) per leaf of mango Ataulfo with pruning and without phytosanitary pruning. La Norteña Experimental Site, Tapachula, Chiapas from December 2013 to May 2014.

The density of EBM in both Chiapas and Nayarit was similar, on average less than 1 colony per leaf. Similarly, Bautista-Rosales *et al*. (2013) found that pruning on mango trees of the Ataulfo variety decreased EBM populations in San Blas, Nayarit.

The natural enemies that were observed in mango trees with and without pruning were predators, they were identified as eggs, larvae and adults of *Ceraeochrysa* sp. (Neuroptera: Chrysopidae), larvae and adults of *Azya* sp. (Coleoptera: Coccinellidae), and larvae and adults of *Pentilia* sp. (Coleoptera: Coccinellidae). It was found that the abundance of natural enemies was significantly different only between sampling dates, but not in the total samples, in mango trees with and without phytosanitary pruning ($p \leq 0.05$). The greatest abundance of predators in trees with and without pruning was observed between February and March 2014, particularly between February 4 and March 18 (Figure 2), just when the highest population density of EBM occurred (Figure 1B).

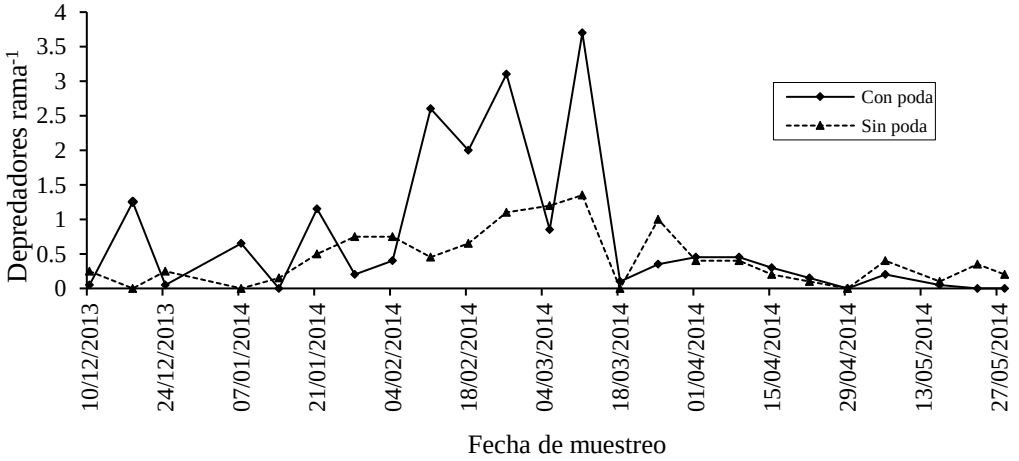

Figure 2. Average number of natural enemies of EBM per branch of mango trees with and without phytosanitary pruning. La Norteña Experimental Site, Tapachula, Chiapas from December 2013 to May 2014.

This is the first work that reports the effect of phytosanitary pruning on the population of natural enemies associated with EBM. Previously, Urias-López and Flores (2005), reported the presence of predators such as *Ceraeochrysa* sp. and other coccinellids, in mango orchards of Nayarit, Mexico, but without evaluating the effect of pruning.

Conclusiones

For the previously discussed, phytosanitary pruning helps to diminish EBM populations in mango trees of Ataulfo cultivar in the Soconusco region of Chiapas. At the same time, this practice tends to increase the populations of predators associated with EBM.

Acknowledgments

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