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Review Article

White Mango Scale: A Threat to Mango Production in Ethiopia

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Abstract: There are different species of insects and diseases that contribute to low yield of mango tree throughout its stages of development. Fruit flies, red-banded thrips, mango tip borer, scales, seed weevil, anthracnose, bacterial black spot and powdery mildew are some of the biotic constraints for mango production. This review was intended to collect research works on white mango scale with special focus on research works done in Ethiopia. Different findings of research works on the insect were carefully studied. The scale insect, white mango scale *Aulacaspis tubercularis*, is agriculturally important scale insect of mango tree. Taxonomically, the insect is a sucking scale insect found in order Hemiptera. White mango scale has different scientific names with its preferred scientific name *Aulacaspis tubercularis* Newstead and common English name white mango scale. The insect was recorded in Ethiopia for the first time in 2010 in western part of the country since which it fastly spread locally within the country. Economically, reports indicate that the white mango scale can cause total rejection of mango fruit. Even though biological, cultural and chemical management options exist, quarantine is the best management option existed so far limiting the distribution of the insect. The research works indicate that many of the existing management options for white mango scale are spraying insecticides with few integrated pest management options. Quarantining the insect is the management method recommended in many cases. With the current status of the insect, mango farm in Ethiopia will be out of production due to this insect unless the insect is managed. Generally, the current reports revealed that mango production in Ethiopia will be under serious threat which can even destroy total mango production in the future.

Keywords: White Mango Scale, *Aulacaspis tubercularis*, Mango

1. Introduction

There are different species of insects and diseases that contribute to low yield of mango tree throughout its stages of development. Fruit flies, red-banded thrips, mango tip borer, scales, seed weevil, anthracnose, bacterial black spot and powdery mildew are some of the biotic constraints of mango production [1-4]. Of these, insect pests such as fruit flies, mango seed weevils, mites, thrips, mealybugs, and scale insects are common in Ethiopia [5].

The scale insect, white mango scale *Aulacaspis tubercularis*, is agriculturally important scale insect of mango tree. Taxonomically, the insect is a sucking scale insect found in order Hemiptera [6]. The insect is a serious insect pest of mango across the mango producing parts of the world. A report in Abo-shanab [7] indicates that the insect was a significant problem in Egypt. Reports indicate that white mango scale was a major problem in countries such as South Africa, Pakistan and Australia [8-10]. Until the first report of the insect in Ethiopia in 2010, it was not known as an insect pest of mango in the country [2, 11-13]. National sample survey reports indicate that there is a yield reduction of mango in Ethiopia since the first occurrence of the insect, for instance, 87.39 $Qt.h^{a-1}$ could be harvested during the early occurrence of the insect [14] but currently 64.4 $Qt.h^{a-1}$ [15]. FAOSTAT [16] also indicates a general decline in mango yield since the occurrence of the white mango scale (Figure 1). This paper is therefore aimed at reviewing research works conducted so far

on the insect.

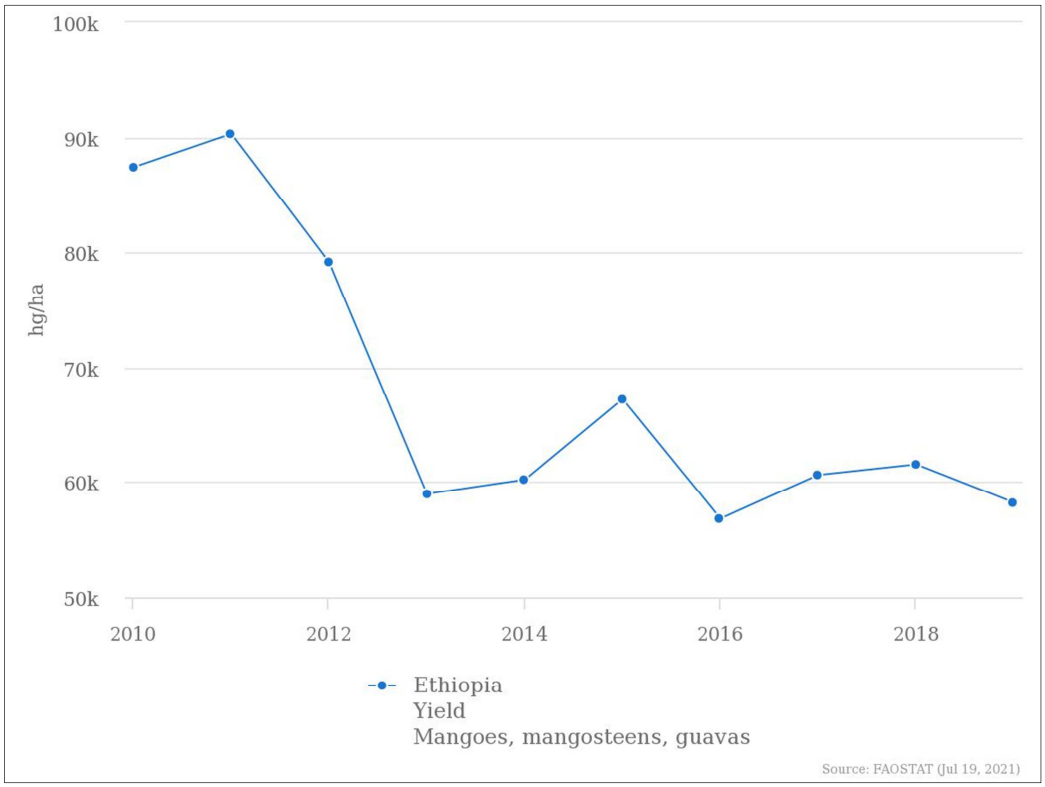

Figure 1. *FAOSTAT reports of mangoes and guavas yield over ten years in Ethiopia.*

2. Discussions

2.1. The White Mango Scale Insect: Biology and Taxonomy

Bautista-Rosales et al. [17] and Miller and Davidson [18] reported that white mango scale had five to six generations per year which was highly influenced by temperature. They also reported that females could lay 80-200 eggs depending on temperature which it hatches nymphs after a week. The nymphs feed on plant tissues and reproduce on them [19, 20].

White mango scale insect is known by different scientific names such as *Aulacaspis cinnamomi* Newstead, *Aulacaspis cinnamomi mangiferae* Newstead, *Aulacaspis mangiferae* MacGillivray, *Diapis mangiferae* Newstead, Ramakrishna Ayyar, *Diaspis cinnamomi, Diaspis cinnamomi mangiferae* Newstead and Diaspis tubercularis Newstead. However, its common English name is white mango scale in many regions and scientifically called *Aulacaspis tubercularis* Newstead [21].

2.2. Local Distribution

White mango scale is a tropical insect species assumed to have originated in Asia [7]. The insect is reported distributing all over the world feeding on more than 40 plant species [17, 22]. In Ethiopia, the insect white mango scale was reported in a private mango farm established in an area called 'Anger Gutin' where an Indian agro industry called 'Green Focus Ethiopia' grew mango plantations. It was since that the insect has spread to bordering districts of Diga, Ghimbi, Gobu Seyo, and Mana Sibu [2, 23, 24]. Reports showed that the private farm planted its own variety called 'Alphanso' which later on confirmed that the insect was from this introduced variety [6, 11]. The insect was then distributed to south-western, central, and northern parts of Ethiopia, far from its original report mainly through infested mango fruits [13, 25].

2.3. Population Dynamics and Economic Importance

A study conducted in western Ethiopia found that the population of white mango scale reaches a peak in April and May [26]. The same study also reported that there was a fluctuations in eggs numbers, crawlers and sessile stages across the study months (June 2013 to May 2014). Another survey conducted in southwest Ethiopia also indicates that the insect had distributed in the areas with its peak population density in April and May [27]. These studies also found that the prevailing weather conditions in the months significantly influenced the population density.

The damage of white mango scale is through chlorotic spots development which reduces the quality of the fruit for market; not direct damage to the internal part of the fruit; such quality reduction usually results in the rejection of the product in the market [20, 30, 31]. In a study conducted to investigate the infestation level of the insect during fruit development, highest level of infestation was at the yellow stage than the green and pre-yellow fruit development stage with a significantly higher number of the insects on the upper surface of the leaves [24, 26]. The authors also found that the female white mango scales infest more than the males and, the level

of infestation by females was found to vary among the stages of fruit development. The same study found that male white mango scales infest the ripening fruits to green fruits.

Rehmat et al. [28] as cited by Juárez-Hernández et al. [29] reported that mango growth is severely affected by the insect in the nursery. A color change from pale green to yellow is a common characteristics of infested leaves [18]. Bakry and Tolba [32] also reported significant yield loss from high population density and incidence of the insect in Egypt.

3. Management Options of White Mango Scale

3.1. Biological Control

The ectoparasitoid, *Aphyti schionaspis* (Ren) was known to parasitize the insect in most of the mango-producing areas [31]. Predators such as ladybird beetles, green lacewings, *Chilocorus bipustulatus* and *Scymnussyriacus marseul* and, parasitoids such as *Aphytis mytilaspidis* and *Encarsia citrine* (Craw) were reported to manage the insect [6, 7].

3.2. Cultural Control

Evaluation of pre-harvest bagging for the control of white mango scale and fruits quality indicated that pre-harvest bagging was effective in controlling the insect and thereby found to improve the quality of mango fruits [33].

3.3. Chemical Control

Diazinon and Dimethoate were found to reduce pest damage [6]. Maximum population reduction with Folimat 500 SL was attained [34]. "Integrated use of the systemic soil drenching insecticide and management can significantly reduce the White mango scale life stages on infested mango trees indicating that it is a promising approach to the control of the White mango scale" [35].

3.4. Quarantine

Conducting national delimiting surveys, establishing and strengthening quarantine facilities, enforcing laws prohibiting interstates movements of mango fruits and planting materials, building the capacity of plant health clinics, and applying bio rational and recommended soft insecticides are among the currently recommended management options [36].

4. Conclusion

The white mango scale, *A. tubercularis*, became a serious insect pest of mango in Ethiopia a decade ago. Mango producers have faced a big economic loss since the first report of the insect in Ethiopia. Mango growers are losing huge production. Mango farm in Ethiopia is almost out of production due to the newly introduced insect, the white mango scale. Biological, cultural and chemical management practices have been tested to manage/control white mango scale. However, there is no effective management practices in the country. White mango scale is highly spreading within the country through infested mango fruits and seedlings. So, unless an immediate solution will be given, the current reports indicate that mango production in Ethiopia will be under serious threat which can even destroy total mango production in the future.

Conflict of Interest

The authors declare that they have no competing interests.

References

[1] Nofal, M. and Hagga, W. M., 2006. Integrated management of Powdery Mildew of Mango in Egypt. Crop protection; 25 (5), 480-486.

[2] Temesgen, F., 2014. White Mango Scale, *Aulacaspis tubercularis*, Distribution, and Severity Status in East and West Wollega Zones, Western Ethiopia. Sci. Technol. Arts Res. J. 3 (3): 01-10.

[3] Nankinga, C. M., Isabirye, B. E., Muyinza, H., Rwomushana, I., Stevenson, P. C., Mayamba, A., Aool, W., and Akol, A. M., 2014. Fruit fly infestation in mango: A threat to the Horticultural sector in Uganda. Uganda Journal of Agricultural Sciences, 15 (1): 1-14.

[4] Dan, A., Baron, A., Emmanuel, O., and Dickson, E., 2016. Assessment of Mango Pests, Diseases and Orchard Management Practices in West Nile Zone of Uganda.

[5] Chala, A., Getahun, M., Alemayehu, S. and Tadesse, M., 2014. Survey of mango anthracnose in southern Ethiopia and in-vitro screening of some essential oils against *Colletotrichum gloeosporioides*. International Journal of Fruit Science; 14: 157-173.

[6] Babege, T., Haile, B. and Hailu, A., 2017. Survey on distribution and significance of White Mango scale, *Aulacaspis tubercularis*, in Bench-Maji Zone, Southwest Ethiopia. *Journal of Horticulture and Forestry*; *9* (4), pp. 26-32.

[7] Abo-Shanab, A. S. H., 2012. Suppression of white mango scale, *Aulacaspis tubercularis* (Hemiptera: Diaspididae) on mango trees in El-Beheira Governorate, Egypt. *Egypt. Acad. J. Biolog. Sci*; *5* (3), pp. 43-50.

[8] Pena, J. E., Mohyuddin, A. I. and Wysoki, M., 1997. The current mango pests' management in the tropics and subtropics. Acta Hortic. 455: 812-820.

[9] Joubert, P. H., Daneel, M. S., Grove, T., Pichakum, A., 2000. Progress towards integrated pest management (IPM) on mangoes in South Africa. Acta Horti. 509: 811-817.

[10] Khan, I., Bitani, S., Habib UR., 2016. Effect of gamma irradiation on the mortality and growth inhibition of Aspidiotus destructor (Hemiptera: Diaspdidiae) on mango Florida Entomologist, 99 (2): 125-129.

[11] Mohammed, D., Belay, H. G., Lemma, A., Konjit, F., Seyoum, H. M., Teshome, B., 2012. White mango scale: Anew insect pests of mango in western Ethiopia. Proceedings of the inaugural and third Ethiopian Horticultural Society Conference. Addis Ababa Ethiopia, pp. 257-267.

[12] Tesfaye, H., Solomon, T., Tadele, W., 2014. White Mango Scale Insect's Infestations and Their Implications in Guto Gida and Diga Districts of East Wellega Zone. ABC Res. Alert 2 (2).

[13] Gashawbeza, A., Abiy, F., Birhanu, S., 2015. Appearance and Chemical Control of white mango scale (*Aulacaspis tubercularis*) in Central Rift Valley. Sci. Technol. Arts Res. J. 4 (2): 59-63.

[14] CSA (Central Statistics Agency), 2011. Agricultural sample survey 2010/2011, Volume I: Report on Area and Production of Crops, Addis Ababa, Ethiopia.

[15] CSA (Central Statistics Agency), 2020. Agricultural sample survey 2019/2020, Volume I: Report on Area and Production of Crops, Addis Ababa, Ethiopia.

[16] FAO, 2021. Food and Agriculture Organizations of the United Nations, FAOSTAT Database, Ethiopia. Data of crop production from 2011 to 2019. http://www.fao.org/faostat/en/#compare. Accessed July 2, 2021.

[17] Bautista-Rosales, P. U., Ragazzo-Sánchez, J. A., Calderón-Santoyo, M., Cortéz-Mondaca, E. and Servín-Villegas, R., 2013. *Aulacaspis tubercularis* Newstead in Mango Orchards of Nayarit, Mexico, and Relationship with Environmental and Agronomic Factors. *Southwestern entomologist*, *38* (2), pp. 221-230.

[18] Miller, D. R., and Davidson, J. A., 2005. Armored Scale Insect Pests of Trees and Shrubs (Hemiptera: Diaspididae), Cornell University Press, New York.

[19] Bautista-Martinez, N., 2006. Insectos Plaga: unaguíailustradaparasuidentificación, 1ª. Ed. Colegio de Posgraduados, Texcoco, Edo. de Mex.

[20] Urías-López, M. A., 2006. Principales plagas del mango en Nayarit, pp. 211-234. In V. Vázquez-Valdivia and M. H. Pérez-Barraza (eds.), El Cultivo del Mango: Principios y Tecnología de Producción. INIFAP, Santiago Ixcuintla, Nayarit, México.

[21] CABI, 2021. Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc.

[22] Kondo, T., and. Muñoz-Velasco, J. A., 2009. Nuevosregistrosde Aulacaspis tubercularis Newstead (Hemiptera: Diaspididae) en Colombia y experimentos de transferencia de hospederos. Rev. Asiava. 84: 18-20.

[23] Temesgen, F., 2011. Distribution, prevalence, and farmers management practices of white mango scale (*Aulacaspis tubercularis* Newstead: Diaspididae) In Wollega, Western Ethiopia. MSc. Thesis, Addis Ababa University, Addis Ababa 92pp.

[24] Ofgaa, D. and Emana, G., 2015. Infestation of *Aulacaspis tubercularis* (Homoptera: Diaspididae) on Mango Fruits at Different Stages of Fruit Development, in Western Ethiopia.

[25] Djirata, O., Getu, E. and Kahuthia-Gathu, R., 2019. A survey of geographical distribution and host range of white mango scale, Aulacaspis tubercularis Newstead (Hemiptera: Diaspididae) in Western Ethiopia. *Journal of Entomology and Nematology*, *11* (5), pp. 59-65.

[26] Djirata, O., Getu, E., and Ruth, K. G., 2018. Population dynamics of white mango scale, Aulacaspis tubercularis Newstead (Hemiptera: Diaspididae) in Western Ethiopia. *African Journal of Agricultural Research*, *13* (31), pp. 1598-1605.

[27] Dinka, T. D., Terefe, T. H., Wendafrash, B. H. and Edosa, T. T., 2019. Distribution and Population Dynamics of the White Mango Scale, Aulacaspis tubercularis in Southwest Ethiopia.

[28] Rehmat, T., Anis, S. B., Khan, M. T., Fatma, J., and Be-gum, S., 2011. Aphelinid parasitoids (Hymenoptera: Chalcidoidea) of armored scale insects (Homoptera: Diaspididae) from India. Biol. Med. 3 (2): 270-281.

[29] Juárez-Hernández, P., Valdez-Carrasco, J., Valdovinos-Ponce, G., Mora-Aguilera, J. A., Otero-Colina, G., Téliz-Ortiz, D., Hernández-Castro, E., Ramírez-Ramírez, I. and González-Hernández, V. A., 2014. Leaf penetration pattern of *Aulacaspis tubercularis* (Hemiptera: Diaspididae) stylet in mango. *Florida entomologist*; *97* (1), pp. 100-107.

[30] Cunningham, I. C., 1991. Common mango scales in Queensland. Acta Hort. 291: 409-412.

[31] Daneel, M. S., and Joubert, P. H., 2009. Biological control of the mango scale *Aulacaspistubercularis* Newstead (Coccidea: Diaspididae) by a parasitoid *Aphytischionaspis* Ren (Hymenoptera: Aphelinidae). Acta Hort. 820: 567-574.

[32] Bakry, M. M. and Tolba, E. F., 2018. Relationship between the population density of the white mango scale insect, Aulacaspis tubercularis (Newstead)(Hemiptera: Diaspididae), and the yield loss of mango trees in Luxor Governorate, Egypt. *Journal of Phytopathology and Pest Management*, pp. 14-28).

[33] Del Pino, M., Bienvenido, C., Wong, M. E., Rodríguez, M. D. C., Boyero, J. R. and Vela, J. M., 2021. Influence of Pre-Harvest Bagging on the Incidence of Aulacaspis tubercularis Newstead (Hemiptera: Diaspididae) and Fruit Quality in Mango. *Insects*, *12* (6), p. 500.

[34] Dako, O. D., 2020. Evaluation of some insecticides against White mango scale, Aulacaspis tubercularis Newstead (Hemiptera: Diaspididae) on mango. *Ethiopian Journal of Sciences and Sustainable Development*, *7* (2), pp. 86-92.

[35] Habtegebriel, B., Melisie, D., Daba, T., Hailu, T. and Azerefegn, F., 2020. Integrated Control of the White Mango Scale Through Tree Management and Soil Drenching with a Systemic Insecticide in Western Ethiopia. *Ethiopian Journal of Agricultural Sciences*, *30* (3), pp. 25-32.

[36] Segenet, K., 2017. Invasive Species and Africa (online), Quarterly e-bulletin, Vol. 7, Issue No. 2, 2017, http://www.icipe.org/system/files.force/icipe.