



## Review Article

### Current Status of Mango White Scale Insect in Ethiopia: A Review

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#### ABSTRACT

Mango is an important tropical fruit tree widely grown in Ethiopia, which has nutritional and economic benefits. However, currently, a new and recently introduced mango white scale becomes the devastating insect pests by affecting the mango tree and bringing the plant out of the production in different parts of the country. According to assessment reports indicated in Ethiopia, the white mango scale was identified as new, fast-spreading and devastating insect pest, which causes a premature leaf drop, twigs and branches dieback, fruit stunt and distortion, and premature fruit drop that seriously affects the quality and quantity of mango yield. The insect pest was primarily introduced to the country by a private farm 'Green Focus Ethiopia' and had introduced an infected new cultivar called 'Alphanso' from India, which was planted at Lako in Guto Gida Woreda of East Wollega zone of Oromia region, Western Ethiopia. Due to the poor internal quarantine systems, the insect pest was distributed and invaded the mango trees in the south, southwestern, northern (Tigray) and central rift valley areas of the country. Because of its recent history of introduction, the management option of the insect pest didn't understand well among the growers and no appropriate way of controlling mechanisms was developed. However, the cultural practices like smoking under mango tree and pruning of infested branches were some practices done by growers to reduce the insect pest infestations. In addition, the chemical screening trials were reported to alleviate the potential effects of insect pest. Currently, farmers, researchers and other stakeholders have been working together to come up with the solutions to tackle the fast-spreading status of the insect pests. Therefore, this review paper mainly discusses the status of white mango scale insect and its available optional management strategies in Ethiopia.

**Key words:** Controlling system; Cultural practices; Infestation; Quarantine

#### INTRODUCTION

Mango (*Mangifera indica L.*) is native to the south Asia countries which more likely in the Burma-Malaysia region from where it was distributed to the worldwide and become one of the most cultivated fruit crops in the tropical and subtropical world (Babege *et al.*, 2017). Mango is widely consumed as fresh fruit and the ripe fruit is eaten for dessert, candied or used for making juices, jams and other preserves (Hussen and Yimer, 2013). Apart from its nutritional benefits, mango has also an economic advantage for the rural smallholder growers and traders being as a source of income generation, sources of employment and food security, which considered as a king of fruits (Asif *et al.*, 2002).

In Ethiopia, mango is widely produced in western and eastern parts of Oromia, southern people's nation and nationalities, benishangul gumuz, Gambella and Amhara regional states (Yigzaw *et al.*, 2014). The suitable climate condition required for mango growth and development varies from the sub-humid equatorial to sub-arid frost-free

subtropics due to its ease of adaptability and propagation methods. Mango can be reproduced conventionally by sexual and vegetatively by asexual (grafting, budding, and layering) propagation methods. According to Asif *et al.* (2002) reported on the sexual propagation of mango, the crop naturally contains the proportional male and hermaphrodite types on the flowers that vary among panicles, trees and cultivar types for easily pollination purposes.

However, the current mango production and productivities in Ethiopia has been influenced by various biotic and abiotic factors. The diseases and insect pests are one of biotic stresses which could brings several problems by suffering the fruit trees and can causes a fruit rot, tree dieback, anthracnose attack, malformation of the fruit, necrosis of the leaf, spots on fruit and leaf, and mildew attack on the inflorescence (Wafaa *et al.*, 2014). Furthermore, many authors have been reported on insect pest problems of mango production from different parts of Ethiopia (Daneel *et al.*, 2009; Urías-López *et al.*, 2010; Ayalew *et al.*, 2015; Djirata *et al.*, 2016). According to the

assessment reports in the country, one of the becoming important biotic factors, which have been affecting the mango production, is white mango scale insect pest problem. The authors reported that the mango fruit production has greatly challenged by this insect pest in different growing areas of eastern and western parts of Ethiopia (Getahun *et al.*, 2015; Massebo and Tefera, 2015). The white mango scale insect is very important and recently reported, and fast emerging mango pest around the mango producing parts of Ethiopia. According to Fita (2014) was reported, the mango tree has been suffered a lot by this insect pest problem at all the developmental stages of the crop and by now, it is becoming the most important limiting factor of mango producing areas which mostly observed in western and southwestern parts. According to Fita (2014) reported, the insect pest causes a premature leaf drop, dieback of twigs and branches, stunting and distortion of the fruit, and premature fruit drop are among of the problem seriously affects the qualities and quantities of the fruit tree yields. As the results of mango white scale insect are a new, devastating and fast spreading pest of mango in the country, it needs a great concern and urgent solution before eradicating the diversified of available fruit trees in the potential production areas of the country. Therefore, the main aim of this review is to assess the currently available information on the status of mango white scale insect in the country for further understanding and information provision, which will be used for the developments of appropriate control measures.

**Overview of Mango (*Mangifera indica* L.) production status in Ethiopia:** Mango is also a largely produced fruit tree in Ethiopia and has been used as sources of income generation, employment purpose and food security (Ettisa *et al.*, 2006). According to CSA (2014) report, from 2003/4 to 2013/14 production period, both its area coverage and amounts of total production has increased by 208.4% and 247% respectively. Despite to this trend of production increment in the last one decade, its productivity was very low, 7 tons per hectare and Ethiopia has produced only 72,187 tons fresh mango fruit in 2013/14 compared to other producing countries due to the lack of improved cultivars, diseases and insect pest infestation and other production constraints. In addition to this nowadays, the mango white scale is the newly emerging insect pests, which devastating the mango tree and can have the ability to reduce the crop production and productivity, is become the challenging problem in mango growing areas of the country. These might be due to availability of favorable climatic conditions for a newly emerged potential insect's pests, absence or poor quarantine systems of the country, lack of resistance cultivar against to insect pest and the growth habit of the crop that is conducive to live on and lack of appropriate control methods of insect pests.

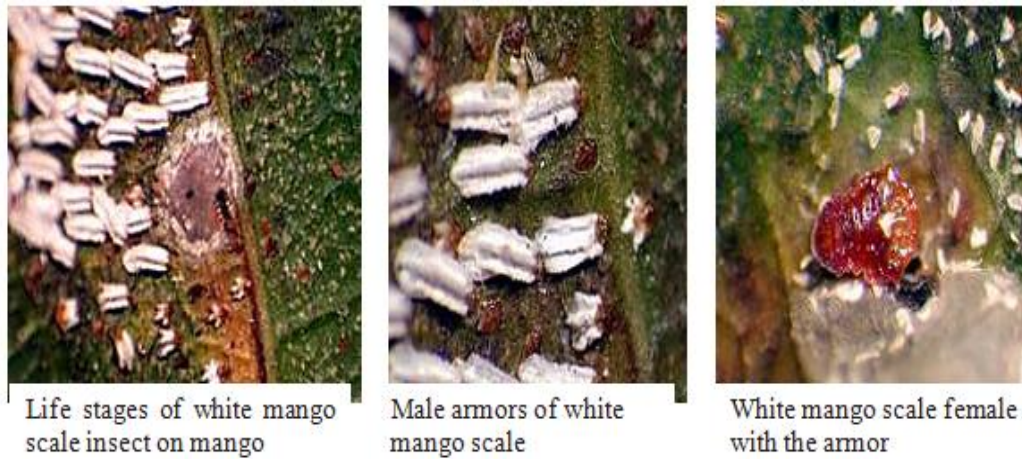
**Description of white mango scale and its status in Ethiopia:** White mango scale, *Aulacaspis tubercularis*, is a Hemiptera insect of the family Diaspididae which characterized by having a piercing and sucking mouthpart. This insect pest can be reproduced from five to six generations per year, at a maximum day time temperature of 26°C and at night-time minimum temperature of 13°C (Bautista-Rosales *et al.*, 2013). The influences of this insect

pest were reported in many mangoes producing and exporting countries of the world like in Mexico (Bautista-Rosales *et al.*, 2013), India and Egypt (Abo-Shanab, 2012; Wafaa *et al.*, 2014). The spreading route of mango white scale is mainly through transportation of infested planting materials, from the infested area to healthy places and widened its scope becoming as a potential pest in many mango-producing countries of Africa, North and South America continents and the Caribbean Islands (El-Metwally *et al.*, 2011).

Due to serious damage it causes to the mango fruit tree, different studies were conducted to identify the mango white scale with their environmental interaction in mango growing areas and the problem it causes and the best controlling practices to tackle its fast spreading status. According to Bautista-Rosales *et al.* (2013) reported on their interaction with the environmental conditions showed that males of white mango scale make groups in colonies in the lower tree canopies while the females are isolated and more homogeneously distributed in the whole plant parts with the tendency to migrate to the lower canopy parts during the warm temperature conditions (Fig.1). Therefore, the white mango white scale insect has a significant positive relationship with the daily average temperature for their fast reproduction and infestation of mango trees (Abo-Shanab, 2012) since mango is one of the tropical tree fruits, which requires a warmer temperature for its optimum yield bearing.

The white mango scale, *tubercularis* (Hemiptera: Diaspididae) has been first reported in August 2010 in Ethiopia at the western part of the country (Ayalew *et al.*, 2015). Its occurrence story was associated with the establishment of private orchard 'Green Focus Ethiopia, which was introduced an infected new mango cultivar called 'Alphanso' from India that was planted at Lako in Guto Gida Woreda of East Wollega zone of Oromia region, western Ethiopia (Babege *et al.*, 2017). The invasion of this insect pest in this area was devastated the fruit trees and significantly affected the economy of mango growers in the region. Currently, the insect pest is spreading to other mango producing parts of Ethiopia like that of Tigray region (northern), central rift valley areas (Ayalew, 2014; Ayalew *et al.*, 2015) and Bench Maji zone (Babege *et al.*, 2017) due to the absence of strong internal quarantine systems in the country. The mango growers from whole western and southwestern parts are suffering from the problem caused by this potential insect pest, which requires urgent solution because of its adverse effects to the overall plant parts including of the growing seedlings, leaves, and fruits that leads to the yield reduction of the fruit tree (Fig. 2). According to the study of Terefe *et al.* (2014) reported on the effects of mango white scale, the contract agreement signed between farmers from the western part of Oromia region and Et-fruit enterprise was canceled due to the problem this insect pest. Thus, the gained benefit by growing mango trees in the area is becoming decline that particularly affected the economy of the mango growers in the area and generally the whole country. The problem is not yet restricted to the economic losses but also it has resulted in biodiversity and natural resources loss that threatens the mango growers who started changing the affected old mango trees to other crops.

**Status of White Mango Scale Insect Management:** In Ethiopia, the infestation of white mango scale insect was



**Fig. 1:** The life stages of male and female white mango scale insect on mango tree fruit: Source: Hamon, (2002).

recent history and did not well understood. The most smallholder growers are not aware of this insect pest and still, there is no an appropriate control measure has developed even though few farmers are already started using the cultural control measures to reduce the level of insect pest infestations. According to the study of Babege *et al.* (2017) reported that the farmers in Bench-Maji zone were conducted pruning of heavily infested twigs and dense branches to eliminate infestations on limited parts of the plant but unable to eliminate the insect pest from the mango plants. This might be due to the canopy nature of the plant, level of insect pest infestation and climatic conditions of the areas that favor the reproduction system of the insect.

Experiences from countries also showed that there was a beginning of study on the insect pest distribution and its control mechanisms. From their preliminary studies in Ethiopia, Ayalew *et al.* (2015) reported that about 30%-90% mortality rate of white mango scale insect was observed from Movento chemical application against the insect pest. In addition to this, the private mango farm, Green Focus Ethiopia p.l.c, which is responsible for the introduction of white mango scale in the country, was also tried to screen a chemical pesticide to control the insect pests' infestation (Fita, 2014). However, the practice has still never stopped the spreading of insect pest to neighboring mango producing areas. Further, the effectiveness of mineral oil, diver applied by means of a conventional knapsack motor sprayer (600 liters) at the rate of spray/feddan, at mean rate of 20 liters per tree to ensure complete coverage of all parts of the tree was reported against the white mango scale insect at another country (Abo-Shanab, 2012). Furthermore, the experience from Kenya showed that the integrated management systems like pruning and removal of infected plant parts as well as the application of pesticides like Folimat, Actara, Applaud and white oil was used to reduce the pest level on infected mango trees (Djirata *et al.*, 2016). However, using only the chemical pesticides application has negative impacts on the natural enemies, humans and environmental areas and why many authors have neglected to recommend the chemical method only. This because of chemical insecticide has disadvantageous which related to the inability to cover completely the infected mango trees during spray that might be resulted in pesticide resistance.

Beside to the chemical trial against to white mango scale insect, there were promising activities reported to control the insect pest spreading and infestations to mango trees. As a result, Bautista-Rosales *et al.* (2013) were reported using of mango tree pruning method to reduce the white mango insect pest, which was significantly decreased particularly the female white mango scale insects from the fruit trees. Fita (2014) was also reported similar cultural controlling methods which were practiced by Ethiopian farmers like smoking of plant debris under mango tree by using the fallen mango leaves, grasses, weeds, and animal dung within the mango orchard areas has chased the insect pests away from fruit trees. This might be used as a temporary reduction of insect infestation but it should integrate with other suitable control methods for fruitful results.

**Summary and Future Prospects:** To date, the devastating and newly emerged white mango scale insect is becoming the most important problem for mango growers in western and southwestern parts of Ethiopia. It has the ability to destroy the fruit tree by feeding on the plant sap through leaves, branches and fruits that significantly affected the economy of mango producers in the country. Due to the absence of restricted quarantine regulation, the insect pest is widely spreading to the other mango producing areas like the Tigray region (northern) and central rift valley areas of Ethiopia. However, appreciable initiations from government offices, scientific communities and growers were observed to alleviate the series problems caused by this insect pest. Beside to these efforts, different research activities are underway on the identifications and control systems that have including the cultural management systems (smoking of under mango trees, removing of infested and burnt out mango branches) and screenings of suitable chemical control methods. In general, in order to manage the wide spreading of the insect pest, strengthening of the internal quarantine regulatory system and focusing to the integrated pest management options are very important options to tackle the problem before completely spreading to the healthy areas and bringing the mango tree out of the production in the country. Therefore, every stakeholder, scientific communities and government bodies should strive to control this series of insect pest from the mango producing areas of the country.

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