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# Incidence and Occurrence of African Citrus Psyllid a Vector of Greening Disease in Citrus Orchards in Tanzania

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## ABSTRACT

*Trioza erytreae* (Del Guercio) (Hemiptera: Triozidae), is one of the important pest with the significance of its ability to transmit African citrus greening disease pathogen '*Candidatus*' Liberibacter africanus in citrus growing areas in Tanzania. Citrus greening is caused by a phloem-limited bacterium which can be detected through molecular characterization. Citrus production in Tanzania is mostly grown in Morogoro, Tanga, Dar es salam, Kilimanjaro, Mbeya, Mtwara and Arusha regions. A survey was carried out in Morogoro (Langali village situated in Mgeta villge), Tanga region (Amani and Lushoto), Kilimanjaro and Arusha (Tengeru) regions from 18/02/2016 to 25/01/2016 to detect presence or absence of African Citrus Psyllid. Random sampling of plant leaves, twigs was carried out following geographical position using a quadrat of $1m^2$. Number of twigs, twigs infested from each quadrat whereby destructive sampling of one infested leaf sample was used to estimate abundance of psyllid nymphs. Old leaves were used for estimate level of infestation. During survey period adult psyllid were not estimated because there was no young flush. Leaves and root samples were also collected for confirmation of presence or absent greening disease from surveyed areas. Specimen collected was preserved in 99 % ethyl alcohol for molecular characterization at International Center for Insect Physiology and Ecology (ICIPE) in Nairobi. The results showed that elevation from 0-450 meters above sea level there was no incidence of psyllid infestation. Furthermore, the results showed that Psyllid infestation was observed to be high from 500 -1600 meters above sea level. Statistically there were no significant differences between abundance of psyllid and altitude. Probably lack of new flush leaves was related to low population of psyllid in surveyed areas. Differences between total number of twigs and infested one differ significantly (P=0.003). Regular monitoring is needed to develop area wide Integrated Pest Management (IPM) measures for the target pest.

**Keywords:** Psyllid *Trioza erytreae* , citrus leaves, orchards, Tanzania

## INTRODUCTION

Citrus greening disease (CGD) *Trioza erytreae* is one of the serious problems in highland areas in Tanzania and other parts of the world (Bove´ 2006). The disease is transmitted by psyllid and it was reported for the first time in 1990 (Swai, 1992). The population of *T.erytreae* is correlated with the flushing rhythm of the citrus host (CABI/EPPO/CABI, 1997).

Citrus production in Tanzania is mostly grown in Morogoro, Tanga, Dar es salam, Kilimanjaro, Mtwara, Mbeya and Arusha regions. Citrus orchards in most cases is cultivated as a mono culture or intercropped with other annual and perennial crops. Poor agronomic practices including crop neglect in citrus orchards growing areas has been reported to create problems in managing the citrus psyllid and other pests of economic importance in citrus production. Poor crop management in citrus growing areas serve as refugia for citrus pests thus increase costs of production.

Greening disease caused by *C. liberibacter* is phloem-limited bacteria responsible for citrus greening (Huanglongbing-HLB) disease (Halbert and Manjunath 2004, Hung et al. 2004). Apart from the Psyllid vector the disease can be transmitted to other areas through infested plant materials (Regmi, 1982; Van den Berg and Deacon, 1988). The incidence of the disease is high in areas where source of planting materials is from disease areas. Infested trees normally yield poor when compared with health trees from disease free areas *ie* low altitude areas (Catling, 1970). Establishment of citrus

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seedling as source of planting materials from disease free areas can ensure transmitting eggs or nymphs to new disease free areas (OEPP/EPPO, 1990).

The objective of this report was to document presence or absence of citrus psyllid under different altitudes in Tanzania. Simple population estimate of *T. erytreae* is needed to all citrus growers in Tanzania and neighboring countries aiming at identifying suitable Integrated Pest Management (IPM) program for the controlling citrus psyllid (Hall and Albrigo 2007, Setamou et al. 2008). The information on citrus Psyllid will assist different scientists to undertake various studies on population dynamics in relation to the presence of the HLB disease in citrus growing areas in Tanzania.

## MATERIALS & METHODS

Estimate of Population abundance of the greening vector were studied in Morogoro (Langali and Morogoro urban), Tanga (Amani and Lushoto), Kilimanjaro and Arusha (Tengeru). Transect sampling was used whereby a quadrat of $1m^2$ was used to estimate psyllid nymphs abundance. During data collection four readings from each geographical location were used for data collection. One leaf sample from each quadrat was used for data collection *ie* population estimate. Other information collected was based on the following total number of twigs from each quadrat and total number of twigs infested.

### Description of the Area That was Surveyed

The delimiting survey was carried out in Morogoro region (Matombo, Langali ). Tanga (Amani Lushoto) Kilimanjaro (Mferejini) and Arusha region (Tengeru).

### Identification of the Surveyed Areas

The identified villages were those grow citrus, easily accessible whereby extension officers were involved directly to identify suitable sampling sites. A delimiting survey involves looking at a pest infestation on citrus orchards from young leaves, old plant leaves and twigs. The information collected will be updated regularly and data becomes available for various uses. The delimiting survey was carried out with emphasis on Citrus psyllid in different citrus production areas in Tanzania.

## DATA COLLECTION

Number of psyllids nymphs was enumerated through destruction of one leaf from each quadrat following geographical positioning. Geographical location (GPS coordinates), name of the land owner, collector name date of collection, number of twigs observed, total number of twigs infested, number of nymphs sampled per leaf from each quadrat.

### General Data Analysis

Mean number of infested twigs from the total sampled twigs observed during sampling were compared using a *t*-test and correlation (Iwao & Kuno.1968).

## RESULTS

**Table1:** *Information on the Psyllid from selected citrus orchards in Morogoro, Tanga, Kilimanjaro and Arusha regions.*

| Date | Place | Latitude and Longitude | Altitude (m) | Total number of twigs | Number of infested twigs | Number of galls/nymphs per leaf |
|---|---|---|---|---|---|---|
| 17/11/2015 | Morogoro | | | | | |
| | Fulwe | S07° 37' and E039° 03' | 151 | 0 | 0 | 0 |
| | Morogoro –Kireka A | S06° 51' and E037° 40' | 628 | 1 | 1 | 35 ± 18 |
| 21/01/2016 | Morogoro- Mikongeni | S06° 54' and E037° 34' | 596 | 55 | 0 | 0 |
| | Morogoro-Nyandira | S07° 05' and E037° 34' | 1649 | 49 | 4 | 49 ±4 |
| | Morogoro –Langali | S07° 03' and E037° 03' | 1235 | 46 | 18 | 313 ± 78 |
| | Tanga-Kwabastola | S05° 14' and E038° 42' | 266 | 27 | 0 | 0 |
| | Kisiwani | S05 ° 06' E038° 40' | 473 | 212 | 4 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Zigi-botanical garden | S 05° 06' E038° 38' | 488 | 29 | 7 | 30 ± 8 |
| | Amani-residential area | S05 ° 78' E038 ° 38' | 891 | 60 | 8 | 60 ± 2 |
| | Lukungwi | S05 ° 06' E038 ° 37' | 887 | 0 | 0 | 0 |
| | Bumbuli | S04 ° 53' E038 ° 18' | 704 | 214 | 0 | 0 |
| | Soni | S04 ° 50' E038 ° 22' | 1238 | 24 | 0 | 0 |
| | Jejetu | S04 ° 47' E038 ° 18' | 1450 | 60 | 15 | 60 ±7 |
| | Magamba | S03 ° 22' E036 ° 47' | 1641 | 28 | 5 | 28±4 |
| | Korogwe/Makuyuni | S05 ° 01' E036 ° 19' | 412 | 0 | 0 | 0 |
| | Moshi-Kindi | S03 ° 20' E037 ° 17' | 773 | 91 | 2 | 61 ±11 |
| | Arusha-Kwesadala | S03 ° 23' E037 ° 01' | 953 | 47 | 0 | 0 |
| | Usa River | S03 ° 22' E036 ° 50' | 1223 | 34 | 0 | 0 |
| | Arumeru/Tengeru | S03 ° 22' E036 ° 47' | 1317 | 17 | 3 | 17 ±2 |
| | Meru kibaoini | S03 ° 22' E037 ° 01' | 942 | 0 | 0 | 0 |
| 25/01/2016 | Hedaru/Same | S04 ° 29' E037 ° 54' | 669 | 0 | 0 | 0 |

Table 1 shows the results of the survey from the selected areas. Greening symptoms or infestation were recorded in all districts. The result revealed that citrus Psyllid nymphs was more abundant from Morogoro region 313±78 individuals at 1,235 msl**,** 60 ± 17 individuals from Tanga in Lushoto 1,450msl, 17± 2 individuals from Arumeru in Arusha region 1,317 msl, 35± 18 individuals were recorded at 628msl and 30± 8 individuals were recorded at 488msl. Simple correlation showed no significant differences between psyllid abundance and altitude (P=0.08). Furthermore, differences between total number of sampled twigs differ significantly with infested twigs (P<0.003) (Table 1).

**Figure1:** *Severely infested citrus at Lushoto (Tanga region) 1,641m above sea level*

## DISCUSION

The survey revealed that greening diseased trees were stunted, sparse foliage, very short twigs with narrow leaves characterized with yellowish colored leaves similar to Zinc deficiency. Mottled leaves and fruits with aborted seeds provide good indication of greening disease in all surveyed areas. In high disease infestation areas presence of young yellow shoots were related to Zinc deficiency symptoms (Swai, 1992). Furthermore, infested leaves with *T. erytreae*, pit galls were observed on the upper and lower surface of citrus plant (Figure 1). During survey period it was observed that there was no flushing from one region to another probably this was due to variety, plant age and season (Knapp et al. 1995). According to farmers experience no treatment of the disease as the disease cause die back of twigs, decay of roots, loss of plant vigor followed by death. Furthermore, the results of African citrus Psyllid nymphs abundance from selected citrus growing areas were analyzed using paired *t*-test of mean from total number of sampled twigs and infested one the results revealed that there was significant differences ($P<0.05$)(Table 1). High number of psyllid nymphs in high altitude areas was an indicator that the insect can breed and feed on citrus and cause significant crop loss in citrus growing areas (Hall, 2005). Direct sampling of twigs showed that distribution of citrus psyllid nymphs was widely distributed in high altitude above 500 msl. Furthermore, age of the leaves was observed to have an effect on Citrus psyllid population as the pest prefers young leaves for feeding and breeding (Halbert and Manjunath, (2004; Hall et al. 2013a). Few adult psyllid was observed on citrus twigs and leaves at Magamba village in Lushoto. Furthermore, lack of regular monitoring systems and good phytosanitary regulations, has lead to wide spread of the pest in high altitude and results into low benefits accrued from citrus investment.

## CONCLUSION

There should be focus on the community awareness to citrus growers for proper management of citrus psyllid, use of appropriate safety precautions with pesticide ie organic products. There is therefore the need to carefully study how existing control practices can be improved upon, where necessary to enhance their effectiveness in citrus psyllid suppression in citrus growing areas (Ekesi and Billah, 2006). During flush period citrus growers can sample few trees from his orchard to estimate population levels before applying any control measures (Setamou et al. 2008). There is therefore an urgent need to train farmers and extension officers on area wide programme for sustainable control measures of citrus psyllid in Tanzania and neighboring countries.

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