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The Effect of Seasonal Temperature and Relative Humidity on the Infestation of Cotton Mealybug, *Phenacoccus solenopsis* Tinsley, on Tomato in Gezira State, Sudan (2016)

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Abstract— *Cotton mealybug, Phenacoccus solenopsis Tinsley (Hemiptera: Pseudococcidae) is a serious pest of cotton, tomato, eggplant etc. The species is polyphagous and invasive and can attack many other economic crops. A field trial was carried out to study the effect of seasonal temperature and relative humidity on the mean number and infestation level of cotton mealybug on Tomato in Gezira State, Sudan. Tomato seedlings were transplanted into the field on 1st January and 1st August, 2016, respectively. Cultural practices were conducted as recommended by the ARC, Sudan. The infestation level and mean numbers of mealybug and were closely observed through weekly counts in both seasons. Temperature and relative humidity during the study period were provided by ARC, Meteorological Station. The results showed that the infestation level (50–90) and the mean number of cotton mealybug (0-15 insect/15cm) were lower on tomato in January where the temperature ranged between 20 ºc and 25ºc and the (RH) ranged between 30% and 40 %. The infestation level (80%) and the mean number of cotton mealybug (40–100 insects/15cm) were higher on tomato in March where the temperature ranged between 25ºc and 35ºc and the (RH) ranged between 20% and 30 %. The results showed that the infestation level (60–80) and the mean number of cotton mealybug (0-5 insect/15cm) were lower on tomato in August where the temperature ranged between 25 ºc and 30ºc and the (RH) ranged between 70% and 80 %.The infestation level (80-100%) and the mean number of cotton mealybug (40–60 insects/15cm) were higher on tomato in from September to November where the temperature ranged between 35ºc and 40ºc and the (RH) ranged between 40% and 60 %. It concluded that the seasonal temperature and relative humidity could influence the infestation of cotton mealybug on tomato crop.*

Keywords— ***cotton mealybug, Phenacoccus solenopsis (Tinsley), Relative humidity, Temerature, Tomato.***

I. INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.), belonging to family Solanaceae, has become a major world food crop. Tomato is grown commercially in 159 countries and considered is most important vegetable crops for fresh consumption and processing (Abd El-Ghany, 2011).In Sudan, tomato is second to onion among the most important vegetable crops grown, producing about 294 thousand tons of fruits annually representing about27% of the country's total vegetable production (El-Amin and Ali, 2012).Tomato is subjected to infestation with several insect pests that affect the quality and quantity; these are cutworms, aphids, Africa Boll Worm, whiteflies, tomato fruit worms and flea beetles (Ibrahim 2007; Abd El-Ghany 2011). The cotton mealybug, *phenacoccus solenopsis* Tinsley, was recorded as a new pest on tomato (Mohamed *et al*., 2015).*P. solenopsis* belongs to the family Pseudococcidae which is the second largest family of scale insects (Ben-Dov, 2006).It has a wide range of variation in morphological characters, biological adaptations and ecological adjustability (Hodgson *et al*., 2008).The *P. solenopsis* is a major threat to agricultural crop in many tropical and subtropical countries which was found to attack large number of plant species including crops, vegetables, ornamental plants and weeds(Abbas and Wang, 2010). As a result of *P.*

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solenopsis dispersal, reproductive and survival capacity, this invasive pest has the potential to damage or kill native plant species that could be displaced by other more aggressive plant (CABI, 2015). The feeding of mealybug causes yellowing, defoliation, reduced plant growth and finally at sever stage causes plant death (Culik and Gullan, 2005). Mealybug infestation symptoms can be observed on roots forming galls restricting water and nutrient absorption. Besides honeydew excreted by this insect on the leaves and serves as a medium for the growth of sooty mold fungus that reduces photosynthetic abilities (Saeed *et al*., 2007). Therefore, this research was carried out to study the effect of seasonal temperature and relative humidity on the mean number and infestation level of cotton mealybug, *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae), on Tomato in Gezira State, Sudan in 2016.

II. MATERIALS AND METHODS

2.1. Experimental site

This experiment was conducted at the research farm of the Gezira Research Station, Agriculture Research Corporation (ARC), Wad Medani (14 24"N, 33 39"E, 407.0 m above sea level), Sudan during winter and summer seasons of 2016.

2.2. Materials

Certified seeds of tomato, cv. B_2 86 that have a germination percentage of 95-100% and purity of 100% were obtained from the central market of Wed Medani City, Gezira State, Sudan.

2.3. Methods

The experiment was conducted in an area of 0.21 ha (0.5 feddan). The soil was plowed by heavy tillage and then light tillage and the soil was settled and flattened. The soil was cut to ten plots and each plot length 10 meters and width 160 cm. Tomato seeds were grown in the nursery and then transferred to the field. Tomato seeds were grown in the nursery and then transferred to the field. Tomato seedlings were planted along each side of the plot by two plants in each hole. The distance between each hole was 25 cm. Tomato seedlings were planted in the winter and summer seasons on 1st January and 1st August, 2016, respectively. Cultural practices were conducted as recommended by the ARC, Sudan.

2.4. Data collection

Infestation level of cotton mealybug

To determine the infestation level of cotton mealybug (ILCM), from 10 plots, 20 tomato plants were selected, with one plant randomly selected from each side of the plot. The level of infestation was determined weekly using the following Abbot's formula.

$$\text{Percent Infestation} = \frac{Numberofinfestedplant}{Totalnumberofplantexamined} \times 100$$

Mean number of cotton mealybug

To estimate the mean number of cotton mealybug (MNCM), from 10 plots, 20 tomato plants were selected, with one plant randomly selected from each side of the plot. The medium of the stem of the plant was selected at a distance of 15 cm, examined, then numbers of mealybug were counted and recorded weekly.

Meteorological data

Temperature was provided per week and relative humidity (RH) per month during the study period by ARC, Meteorological Station, Wad Medani, Sudan.

2.5. Statistical analysis

Collected data was subjected to descriptive analysis using Microsoft excel.

III. RESULTS AND DISCUSSIONS

1. Effect of temperature on infestation level and mean number of cotton mealybug on tomato, winter season, 2016

Figure (1) shows that the mean number of cotton mealybug (MNCM) and the infestation level (ILCM) were low (0-15 insect/15cm) and (50-90%), respectively during January where the mean temperature ranged between 20–25ºC and began to increase during March (40-100 insect/15cm) and (80%), respectively where the mean temperature ranged between 25-35ºc.

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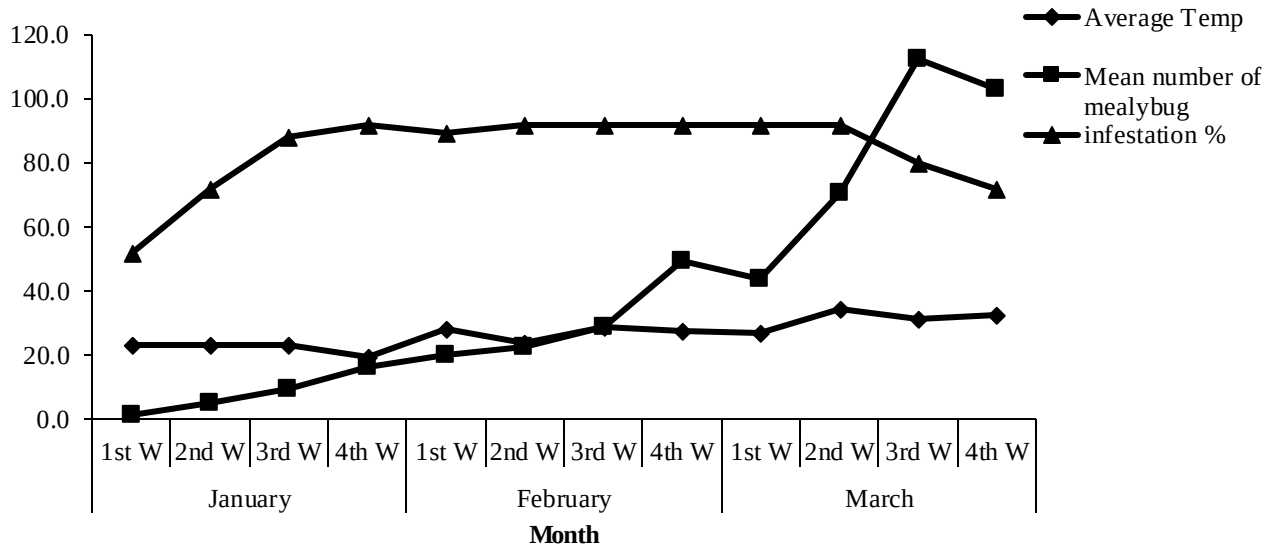

Fig. 1. Effect of temperature on infestation level and mean number of cotton mealybug on tomato, winter season, 2016

2. Effect of temperature on infestation level and mean number of cotton mealybug on tomato, summer season, 2016

Figure (2) shows that the (MNCM) and (ILCM) were low (0-5 insect/15cm) and (60-80%) respectively on tomato during Augusts where the temperature ranged between 25-30ºc and began to increase during September and reach the peak (40-60insect/15cm) and (80-100%), respectively during late October and mid-November where the temperature ranged between 35-40ºc.

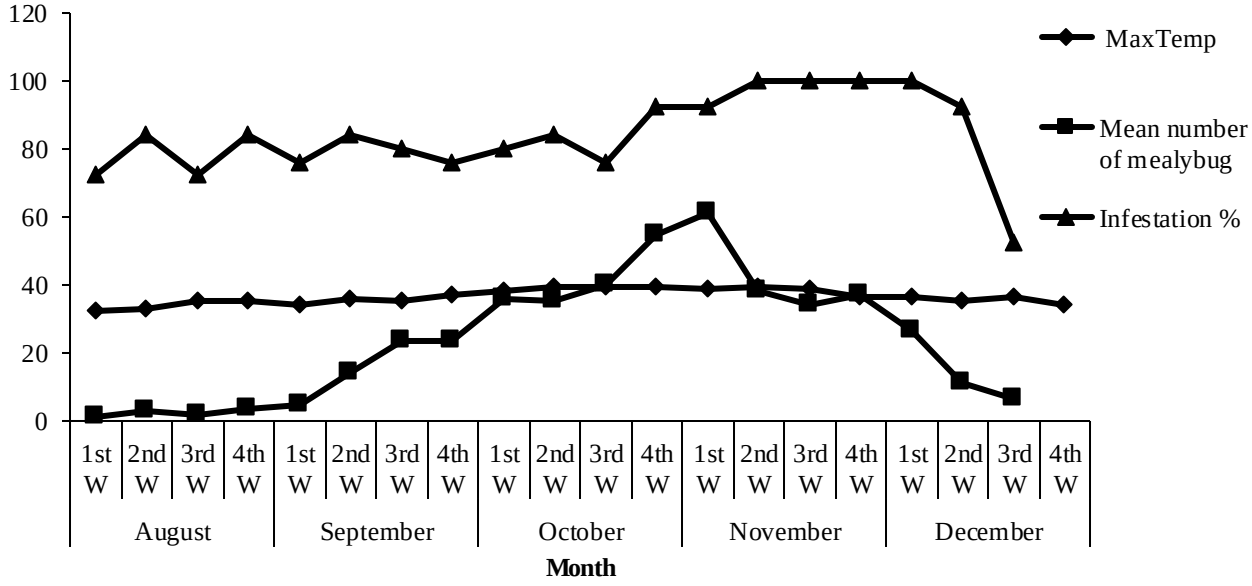

Fig. 2.Effect of temperature on infestation level and mean number of cotton mealybug on tomato, summer season, 2016

3. Effect of relative humidity on infestation level and mean number of cotton mealybug on tomato, winter, 2016

Figure (3 and 4) show that the relative humidity (RH) have negative effect on both (MNCM) and (ILCM) on tomato. Figure (3) shows that the (MNCM) and (ILCM) were high (75-80insect/15cm), and (80-90%) respectively in March, where the (RH) ranged between 20-30% and low (0-10 insect/15cm) and (60-70%) respectively in January, where the (RH) ranged between 30-40%.

4. Effect of relative humidity on infestation level and mean number of cotton mealybug on tomato, summer season, 2016

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Figure (4) shows that, the (MNCM) and (ILCM) were low (0 -5 insect/15cm) and (70%) respectively in August where the (RH) was 70-80% and high (40-50 insect/15cm) and (80-100%) respectively during October and November where the (RH) ranged between (40-60%).

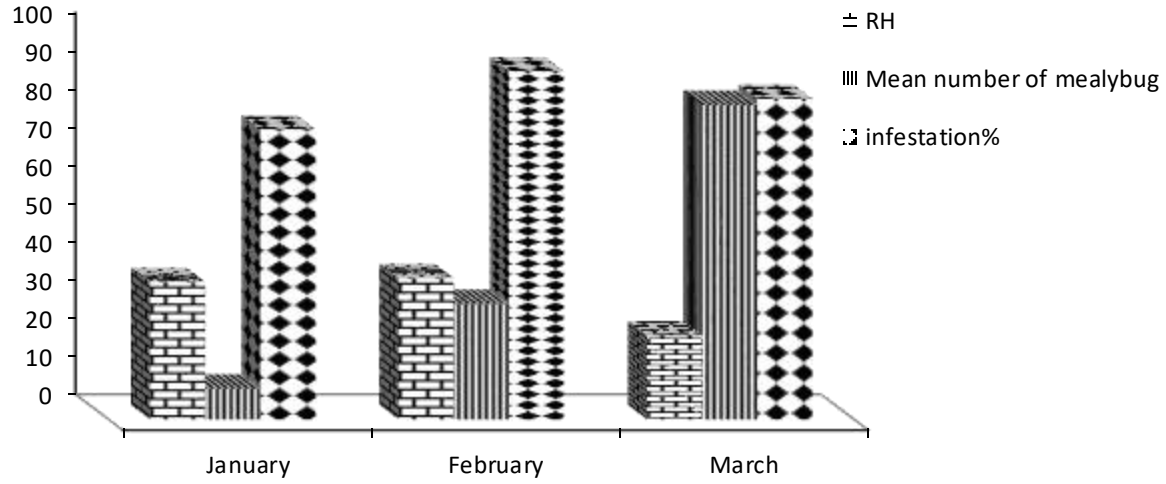

Fig. 3.Effect of relative humidity on infestation level and mean number of cotton mealybug on tomato, winter season, 2016

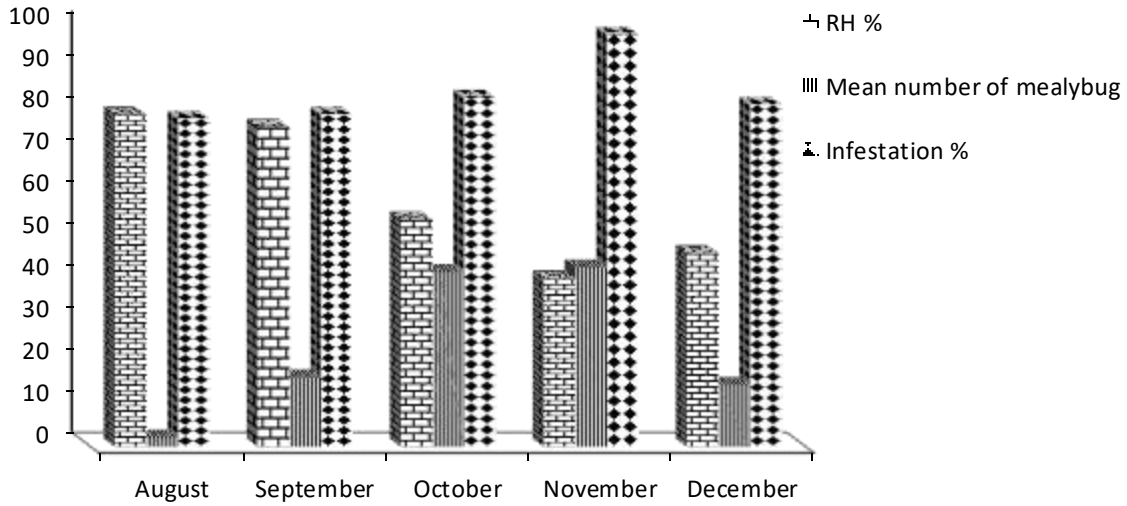

Fig. 4.Effect ofrelative humidity on infestation level and mean number of cotton mealybug on tomato, summer season, 2016

IV. CONCLUSION

The infestation level and mean number of cotton mealybug reach the peak on tomato during March, October and November where the temperature was high (25-40ºc) and the RH was low (20-40%) and low during January and August where the temperature was low (20-25ºc) and the RH was high (40-80%). Hence, the chemical control if needed should be carried out in early January and early September to avoid cotton mealybug to reach the ETL.

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