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First Record of Okra leafhopper, *Amrasca biguttula biguttula* Ishida on Okra in Iraq

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Okra , *Ablemoschus esculents* is one of the popular vegetable crops in Iraq, Many insects pests infest this crop from germination up to harvesting. Recently , okra leafhopper have become as serious pest of okra , There were no any detailed studies about it in Iraq . Identification , biology and seasonal incidence of okra leafhopper were conducted at the College of Agriculture , Baghdad .Okra leafhopper were identified as, *Amrasca biguttala biguttala* Ishida (Cicadellidae : Homoptera) which considered to be a new record on okra crop and some others secondary host plants including ,eggplant *Solanum melongena* ,pepper , *Capsicum annum* ,Cow pea ,and Mallow , *Malva parviflora* L. In Iraq. Leafhopper had 5 nymphal instars ,Total nymphal period ranged between 6.66-9.33 days with an average of 8.0 days .Adult longevity ranged from 15-19 days with an average of 17 days , Sex ratio were(1.2 M :1.0 F) in favor of males . Okra leaf hopper population varies in different dates through tout the season , Population remained below 2 leafhopper /leaf for about 50 days after emergence , Then numbers started to increase gradually during June reaching maximum two peaks of 16 and 14 leafhopper /leaf during the end of June and through tout the month of October respectively . Then population decreased gradually to less than 2 leafhopper /leaf during December. Incidence of leafhopper increased with age of the crop, generally in vegetative crop population less than in flowering and maturity. Totals numbers of leafhopper/plant were 30, 85, and 155 for 7, 11 and 22 weeks old okra plants. The highest numbers of leafhopper were recorded in middle leaves numbers 5 to 9 which ranged between 6-19 leafhopper/leaf while less numbers recorded on lower and upper leaves.

Keywords: *Amrasca biguttala biguttala*, Okra leafhopper, Seasonal incidence ,Okra , Iraq

Introduction

Okra, *Amblemoschus esculentus* L. is one of the popular vegetable crops grown in Iraq. Okra crop is susceptible from early stages to maturity to insect pests, as high as 72 species of insects have been recorded on okra (Srinivasa and Rajendran, 2003). Okra leafhopper, *Amrasca biguttula biguttula* is considered the most destructive sucking pest of this crop (Dhandapani *et al*., 2003). *A. biguttula biguttula* Ishida has become increasingly severe pest of vegetables, as well as some agronomic crops and ormental plants (Iqbal *et al*., 2012).Okra is the most suitable host for the

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survival and feeding of its nymph(Sharma and Singh, 2002) . *A. biguttula biguttula* causes damage right from seedlings to the fruit setting stage, resulting in a loss of 50-63.41 % in yield (Bindra and Mahal, 1981; Sharma and Sharma, 2001). Furthermore, leafhopper attack caused a reduction of 49.8% and 45.1% in plant height and numbers of leaves respectively (Rawat and Sadu,1973).

Nymph and adults suck plant sap mainly from lower surface of leaves causing a phototoxic symptom's known as "hopper burn". Infested leaves curl upward an edges and develop brown dead spots with a yellow halo at the edge of the leaves, severely affected leaves may desiccate and fall off (Schreiner, 2000). This symptoms gradually affecting plant growth and cause reduction in fruit numbers and yield (Jayasima *et al*., 2012; Jayarao, *et al*., 2015).

The female lay about 16-20 yellowish eggs ,hatch in 4-11 days, Nymphs are greenish yellow .The nymphal period last about 7 days in summer and 21 days in winter . Adults are greenish yellow ,wedge shaped with a pair of black spots on vertex and a black spot on each of the forewing .(Atwal,1990 ; Solangi, *et al*.,2013) In India Jayasimha ,*et al.* (2012) reported that the highest incidence (16.44 leafhopper / plant) was observed during March , While the lowest (0.25 leafhopper / plant) was observed during December . This study have been conducted to estimate the incidence (seasonal abundance) and some aspects of biology and nature of damage caused by this species on okra crop.

Materials and Methods

Identification, Nymphal period and adult longevity

Adults of okra leafhopper was collected from okra field and from infested okra plants raised in the nursery by sweeping net. Adult's specimens was labelled and sent to the Iraqi Natural History Museum, Baghdad for identification.

Adults of the okra leafhopper were released in potted okra plants (Batra variety) covered with cages (1.0 m height x 2.0 m long) and maintained in rearing cages and used as a colony source of the leaf hopper for the biological studies. The details of each instar of okra leafhopper can be distinguished according to Jayarao *et al.,* (2015) as the following:

1. The newly hatched first instar nymph was transparent and yellowish color 2.Second pads along the posterior side of meso and metathorax. 3. Third instar nymph was yellowish green in color with small wing pads .4.Fourth instar was yellowish green in color with increase size of wing pads. 5. Fifth instar nymph was greenish yellow in color and eyes were prominent and whitish in color with enlarged wing pads reaching up to 9^{th} abdominal segment having black dot on each near the base.

A glass petri dishes (15x3) cm with filter paper on it base were used to study the nymphal period and adult longevity under the laboratory conditions at 25 -30 C° and60-70% Relative Humidity (RH) according to jayarao *et al*. (2015). 10 newly hatched first instar nymphs from the culture colony were carefully transferred to each of the 12 glass petri dishes with fresh okra leaf on it base for feeding nymphs, Petri dishes were observed daily and new okra leaves were supplied every 2-3 days. CRD experiment with 4 replications (3 petri dishes / replicate). Nmphal period from the first instar nymph to the fully developed fifth instar nymph was recorded for each of the 4 replicates and the mean was used as nymphal period. The duration of the adult leaf hopper (longevity) from the fifth instar to their death and sex ratio was recorded. The whole study was repeated 3 times and the means of each experiment were recorded in order to confirm the consistency in results.

Field Experiments

Field experiments were conducted at the experimental station of the college of Agriculture, Baghdad in a randomized complete block design with three replication. Okra seeds of the local variety " Batra "was raised in rows measuring 3 M with spacing of 75 x 30 cm between rows and plants respectively . Each treatment consisted from 9 rows .Okra seeds was sown on April, 1, 2016, using appropriate agronomic practices (Al-Kafagi and Al-Mukhtar, 1989). Three plant were randomly selected in each replicate, 3 leaves (top, middle and lower) were randomly selected from each plant and number of leafhoppers/leaf were determined. (Mahmood *et al*., 1988, Latif *et al.*, 2015) Okra leafhopper sampling was carried out at regular intervals from germination to the end of the season.

Leafhopper nymphs and adults were estimated by cutting 3 leaves randomly selected from 3 plants for each replicate and placed in a labeled polyethylene bags. Samples were put in freezer for about 30 minutes to immobilize leafhopper movement before counting numbers by using a magnifying lens(2x)(Al-karboli and Al-Anbaki, 2014)

Results and Discussions

Specimens of the okra leafhopper was identified by a specialist in the Iraqi Natural History Museum as *Amrasca biguttula bigutulla* Ishida which considered to be a new record on okra in Iraq. Also okra leafhopper was collected from other secondary host plant including eggplant, *Solanum melongena* L., pepper, *Capsicum annum L.*,and cowpea . It was observed from this study that the leafhopper *A. biguttula* bigutulla moves to feed on Mallow, *Malva parviflora* L.(Malvaceae) at the end of the season and the death of okra plants in the field.

Leafhopper females prefer to lay eggs in the leaf tissue mainly on midrib and other veins. Before hatching a pair of brownish red eyes appeared near the anterior end of the egg, during the development period, the nymph molted 4 times and the leafhopper had 5 nymphal instars (Jayarao *et al*., 2015). Results in Table 1 indicated that total nymphal period of leafhopper ranged from 6.66 to 9.33 days with an average of 8.0 days. The total nymphal period is slightly different from the results obtained by Jayarao *et al*., (2015) who obtained a range of 6.0-10.50 days with an average of 8.0± 0.5 days and Jayasimha *et al*., (2012) who obtained a range of (4.5 - 9.5) days with an average of 7.28+-1.27 days. Also this results is in confirmation with the results of Sharma and Sharma (1997) and Bhalani and Patel (1981) who reported an average of 7.30 and 7.0 days respectively.

Adults were green in color and have prominent black spots on both sides of the median line in the vertex of the head and on other on the apical area of the wing (Fig.2).Adult leafhopper longevity fed on okra leaves ranged from (15-19) days with an average of 17 days . These results correspond to what is referred by Jayasimha *et al*., (2015) who found that mean adult male and female longevity were 16 and 18 days respectively. These results varied from that obtained by Jayasimha *et al*., (2012) who referred that mean male and female longevity were 22.85 and 26.66 days respectively. This variation may be due to change in temperatures and host plant.

Sex ratio indicated male to female ratio of (1.2:1.0) in favor of males. Shivanna *et al*., (2009) reported the male: female sex ratio on cotton as 1:1.22 under laboratory conditions.

Table 1 Some biological aspects of okra leafhopper, *Amrasca biguttula biguttula* on okra.

	Mean (days)	**Range (days)**
Nymphal period	8	(6.66-9.33)
Adult longevity	17	(15-19)
Sex ratio	Male (1.2) : female (1)	

Fig. 1 Life cycle of the leaf hopper, *Amrasca biguttula biguttula*. 1st, 2nd, 3rd, 4th, 5th instars and adult okra leaf hopper. (10x)

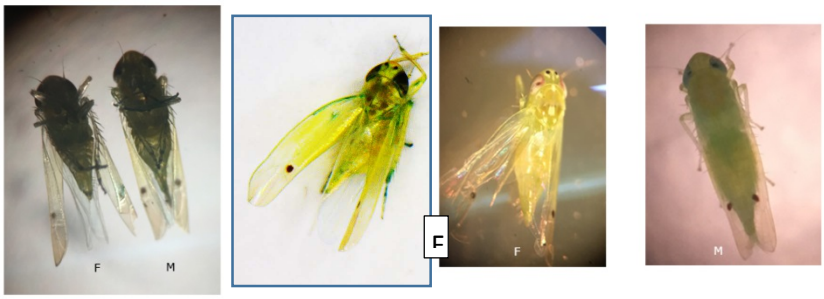

Fig. 2 Female (F) and male (M) of okra leaf hopper, *Amrasca biguttula biguttula*. Ventral View (left) and dorsal view (right). (10x)

Seasonal incidence of the leafhopper, A. biguttula biguttula

The data in Fig. 3 Indicated that the population of leafhopper, *A. biguttula* remained low less than (2 leafhopper/leaf) for about 50 days after emergence of the crop whereas average maximum and minimum temperature were ranged between (23-24)C° and (8-25)C° respectively during April (Fig.1). Maximum and minimum temperatures increased during May, Average maximum and minimum temperature ranged between (31-44)C° and (16-25)C° respectively . Numbers of jassids started to increase gradually during June until it's reached a tremendous and a highest

first peak of a 16 leafhopper/leaf during the end of June and the 3rd week of July with average maximum and minimum temperature range between (45-47)C° and (24-29)C° respectively . The jassid population decreased to about 2 leafhopper /leaf during the period from 21, July to mid of September properly due to the high temperature which reached 50C° and the bad quality of okra plant leaves which severely damaged by the heavy infestation during the first peak of the leafhopper. Leafhopper numbers began to build up gradually from the third week of September to a second peak of about 14 leafhopper /leaf from the 3rd week of September to the 1st week of November. After okra plants died we observed that leafhopper adults moved to feed on Mallow, *Malva parviflora* L. (Malvaceae) for about 2-3 weeks then its disappeared from the field when temperatures fall down to about zero during January. The results revealed that okra leafhopper occurred on the crop from May in low numbers, then numbers and activity increased gradually till the end of the season. Mahmood *et al*. (1990) observed the appearance of the okra leafhopper, *A. bigutulla bigutulla* on okra in Pakistan and reported its activity until the of the crop season .Further, among various environmental factors, the only significant factor of the study were maximum and minimum temperatures on density of the pest.

Latif *et al*., (2015) reported that the density of jassid, *A. biguttula biguttula* in Pakistan reached their two peaks of 7.75 and 7.0 leafhopper/leaf during the second week of August and the third week of September respectively . Rehman *et al*., (2015)studied incidence and population dynamics of *A. biguttula biguttula* on okra ,their study revealed that the leaf hopper population varies in different dates through the season with maximum population about505 leafhopper/leaf observed in the first week of July,2012 .In India Jayasimha *et al*., (2012)studied the seasonal incidence of the leafhopper, *A. biguttula biguttula* from March, 2007 to march/2008 and record an incidence ranging from 0.25 to 16.44 leafhopper/leaf and found that the leafhopper population had appositive correlation with maximum temperature ,and significant negative decrease in air temperature and the growth of new leaves on okra plants, So a second peak of 14.0 leafhopper was occurred during October . They found that population remained below economic threshold level Then leafhopper began to decrease to reach 7 leafhopper/leaf during the last week of Nov. and decline during December and end of the season ,.

Mahmood *et al*., (1988) studied density variation of okra leafhopper, *A. devastans* (Distant) and for about five weeks after germination of the okra crop, After this period, the population cross over the threshold and remain same till or relation with rain fall, However, relative humidity was non-significant and negative with population. However, the differences in the leafhopper incidence reported by the many researchers mentioned above

and our study might be due to different ecological conditions under which these studies were conducted.

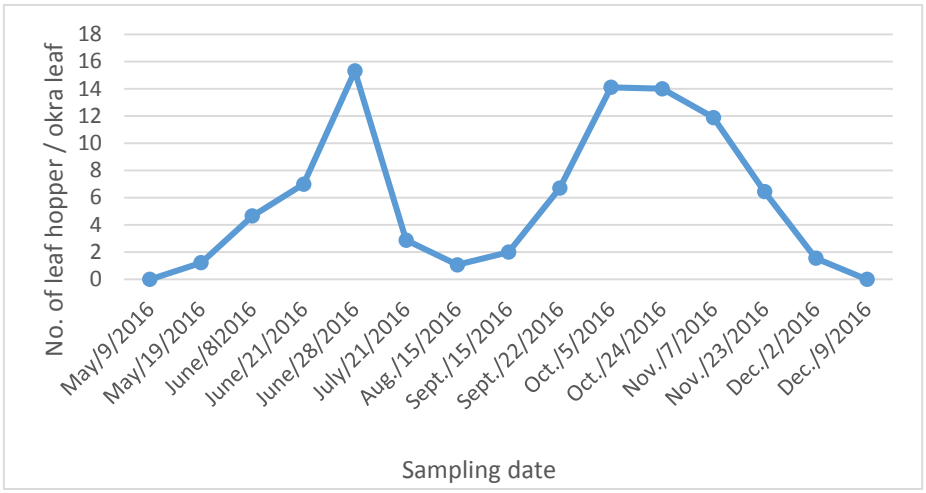

Fig. 3 Seasonal abundance of the okra leaf hopper, *Amrasca biguttula biguttula* Ishida during the growing season 2016 at Al-Jaderyia field / Baghdad.

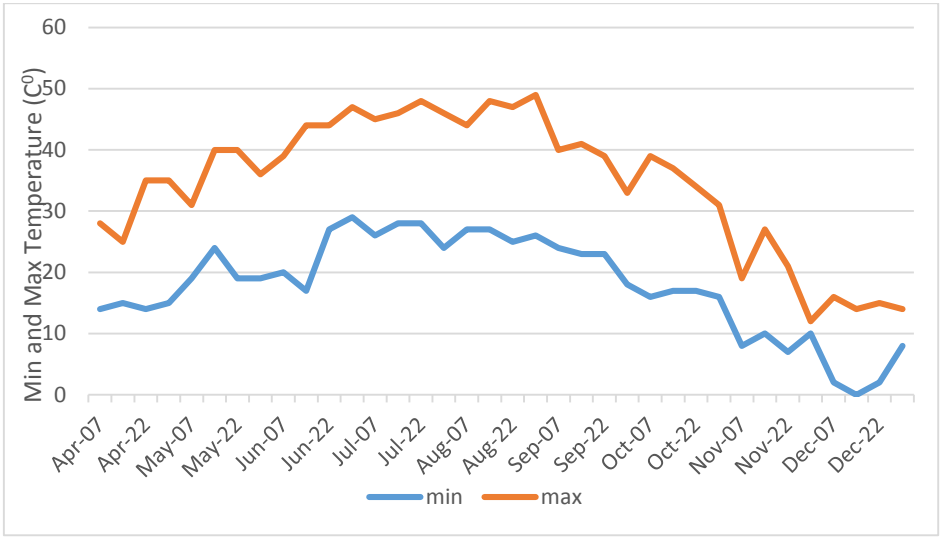

Fig. 4 Minimum and maximum temperature (C^0) recorded during April – December / 2016

Plant age and distribution of okra leafhopper, A. biguttala biguttala on plant leaves

Figure 5 shows the relationship between the crop ages of 7, 11 and 22 weeks old okra plants sown at different dates during the growing season and population of *A. biguttula biguttula*. Total numbers of leafhopper/plant (TNP) were 30, 85 and 155 on 7, 11 and 22 weeks old okra plants respectively. The highest numbers of leafhopper were observed on middle leaves numbers 5,6,7,8 and 9 which ranged between (6-19) leafhopper /leaf, while less numbers were observed on the lower and the upper leaves of okra plants. Senapathi and Khan(1978)found that okra plants at the age of 7-14 succumbed to attack by the leafhopper more(5.18 to 8.39) leafhopper per 100 cm^2 leaf area)than its growth stage and the highest population was recorded on 8 weeks old plants In general, it was observed that the incidence of leafhopper increased with age of the crop. Generally in the vegetative crop, we found that population comparatively less than in flowering and maturity of the crop. These results are consistent with those of Singh *et al*. (2013) who observed that the incidence of okra leafhopper increased with the age of the crop, this may be due to the thinner veins of early stage crop, which further developed into a thicker vein and then favored more numbers of leafhoppers on leaf. Also, Agsaoay and Briones (2012) concluded that population levels *of A. biguttula biguttula* was correlated with age of the plant and temperature. Ragumoorthi and Kumar (2000) also proposed as the age of the plant increase, increase in in the size of leaf lamina, decreases the hair density and increases the population of leafhopper.

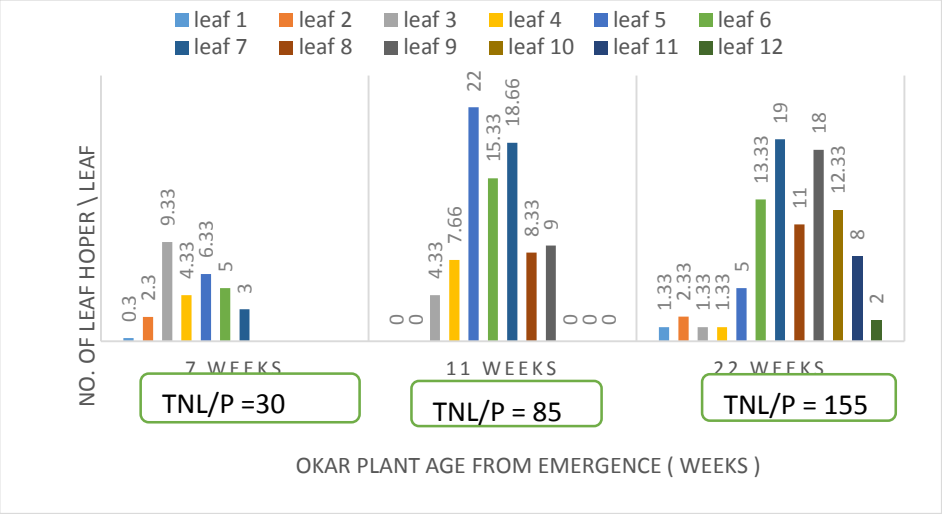

Fig. 5 Relationship between okra plant age and distribution of okra leaf hopper, *A. biguttula biguttula* on plant leaves.
*TNL/P: Total no. of leaf hopper / plant

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