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Status of Mango Fruit Infestation at Home Garden in Mymensingh, Bangladesh

Ahasan Ullah Khan[1&2*], Md Abdur Razzak Choudhury[1], Shofiul Azam Tarapder[3], Abu Rashed Md. Maukeeb[4] and Israt Jahan Ema[5]

[1]Department of Entomology, [2]Climate-Smart Agriculture Lab, Department of Agroforestry and Environmental Science, [3]Department of Agronomy and Haor Agriculture, [5]Department of Plant Pathology and Seed Science, Faculty of Agriculture, Sylhet Agricultural University, Sylhet 3100, Bangladesh

[4]Department of Agricultural Chemistry, Faculty of Agriculture, Khulna Agricultural University, Khulna-9100, Bangladesh

*Corresponding Author E-mail: ahasanullahsau@gmail.com

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ABSTRACT

The study was undertaken to determine the insect infestation in mango fruit in the farmers' field of Uchalhila, Ishwargonj, Mymensingh, Bangladesh, during the period of months March to July 2020 under natural condition. Visual searching method followed for identifying the infested and healthy mango fruit. The total healthy and infested (14.86%; 22 out of 148) and (85.13%; 126 out of 148), respectively in mango fruit. The healthy and infested ranged (0.00-3.33%) and (66.67-93.33%), respectively in mango fruit. The insects viz thrips, stone weevil, and fruit borer (0.00-33.33) %, (33.33-73.33) and (23.33-46.67) % in this study, respectively. In the rural area of Bangladesh, they are not using any fertilizer, insecticides to manage the constraints in mango production. Specific study plans are needed in the rural area of Bangladesh to minimize insect infestation with bio-rational insecticides.

Keywords: *Mangifera indica, Healthy, Infested, Fruit, Insect.*

INTRODUCTION

The mango (*Mangifera indica* L.) is a national fruit tree of Bangladesh which is a very important and popular fruit in the world. It is also considered a national fruit of India, Pakistan, and the Philippines. It is under the family of Anacardiaceae. It is believed to have originated in South Asia or the Malayan archipelago (Salunkhe & Desai, 1984). The total area under mango cultivation in Bangladesh is 109584 acres, the total production is 11,65,804 metric tons and it occupied 25.22% of the garden area under fruits during 2017-18 (BBS, 2019). It is commonly cultivated in many tropical and subtropical regions (FAO, 2012) and grown in a significant acreage after jackfruit and banana fruit in Bangladesh. In the world mango ranks as the fifth most consumed fruit after citrus, banana, grapes, and apple.

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About 250 varieties of mangoes are grown in Bangladesh and terms of total production, Bangladesh ranks eight (10,47,850 tones) among the worldwide production (Shafique, 2006; & FAOSTAT, 2013). The world's top ten mango growing countries are India, China, Thailand, Pakistan, Mexico, Indonesia, Brazil, Bangladesh, Philippines, and Nigeria (FAOSTAT, 2013).

Mango is known as 'king of all fruits' in the world and it contain some special characters viz pleasant aroma, eye-catching color, and wonderful taste with typical nutritive values, and these qualities make this fruit one of the unique items in the world market (Malik et al., 2018; & Shahjahan et al., 1994). About 200g fruit is the daily requirement whereas 78g fruit is available per person in Bangladesh (BBS, 2017; & Sultana et al., 2018). It is known for its high content of sugar, protein, fats, salts, vitamin (A and C), minerals, and also has iron, potassium, calcium, or small quantities of protein (Tharanathan et al., 2006; & Nabil et al., 2012). It helps in balancing the human diet by providing about 64-86 calories per 100 grams of ripe fruits (Rathore et al., 2007). The ripe mango pulp contains 16.9% carbohydrate (Salunkhe & Desai, 1984). Gopalan et al. 1989 observed that the per 100 g ripe mango contains moisture, protein, fat, minerals, crude fiber, carbohydrates, energy, calcium, phosphorus, and iron (81g, 0.6g, 0.4g, 0.4g, 0.7g, 16.9 g, 74 kcal., 14 mg, 16 mg, 1.3 mg), respectively. It is also used as animal feeds, poultry diets, in Ethnopharmacology, and various chemical industries in different parts of the world (Wauthoz et al., 2007; Kayode & Sani, 2008; & Nwinuka et al., 2008). As its nutritious value mango fruit, export-import business in the world and on generates foreign currency (www.unctad.org).

Despite being a prospective crop, the high incidence of insects is one of the main factors for the reduction of yield and quality of mango fruit. About 400 species of insects are known to infest fruit in different parts of the world (Patel et al., 2004). Out of which 87 are fruit feeders, 127 are foliage feeders, 36 feeds on the inflorescence, 33 inhabit buds, and 25 feeds on branches and the trunk (Kapadia, 2003). Those insects are varied in different reason and common major insects are thrips (*Frankliniella occidentalis* Pergande), fruit borer (*Citripestis eutraphera* Meyrick), stone weevil (*Sternochetus mangiferae* Fab.), scale insects (*Aspidiotus destructor* Signoret), fruit fly (*Bactrocera invadens* Drew, Tsuruta and White), mealybug (*Drosicha mangiferae*), Leaf Webbers (*Orthaga euadrusalis* Walker), gall midges (*Erosomya indica* Grover), Mango shoot gall psylla (*Apsylla cistellata* Buckton), mite (*Eriophyes mangiferae* Sayed) and so on. The thrips, fruit borer, stone weevil, and scale insects are very destructive stages in mango fruit. Belon, 2007 noted that the previously mentioned species cause economic damage at different physiological stages in the mango plants and fruits. The sucking pests were damaged (20-44) % in the mango fruit where 95% loss in mango production for all insect pests of mango in Ethiopia (Duressa, 2018). In Bangladesh, there is little information about mango infestation. By considering the above points, the present study was undertaken to collect information about the major insect pests of mango fruits in Bangladesh.

MATERIALS AND METHODS

The experiments were conducted to achieve the objective of the study. The materials and methods are separately presented in the following parameter.

Study location and period: The experiment was conducted at the farmers' home garden of Uchalhila, Ishwargonj, Mymensingh, Bangladesh, during the period of months March to July 2020.

Design of the study and the mango plants: This experiment was set up in a farmer's home garden where the experiment set as Randomized Complete Block Design (RCBD) with three replications. In the garden fifteen plants and nine mango plants carried fruits in 2020. Among the nine plants of mango, one mango plant was 41 years old and name misty amm (Local name); one mango plant was 15 years old and name chokka amm (Local name); one mango plant was 12 years old and

rasun amm (Local name) and others six mango plant were 7 years old and name fazli amm. Mature fruits of mango collected from plants and visual eye searching to identify the insects and also matching from google pictures. Maturity was refereed by the grower's recommendation.

Data collection: Healthy and infested mango fruit were collected by the visual searching method. After collection, count the total number and identify healthy or infested mango. The visual eye searching method was also followed for the infestation of insects. All the data collection under the natural condition and the farmers never use any insecticides and fertilizer in the mango plant. They watered in the plant every day. They also never follow the pruning and training method in the home garden.

Equation: Percentage of healthy, infestation, thrips, stone weevil and fruit borer were observed in the farmers' field calculated in percent using the following formula:

$$\text{Healthy (\%)} = \frac{\text{Healthy fruit}}{\text{Total fruit}} \text{x } 100$$

$$\text{Infestation (\%)} = \frac{\text{Infetated fruit}}{\text{Total fruit}} \text{x } 100$$

$$\text{Insects (\%)} = \frac{\text{Insects infested fruit}}{\text{Total fruit}} \text{ x } 100$$

Data analysis: All the collected data were rechecked, coded, and entered into a database using Microsoft Excel 2016, and R software. The distributed data was used to determine the percentage of healthy and infested fruits in the home garden under natural condition. Statistical significance was accepted at $p<0.05$.

RESULTS

Percentage of healthy and infested mango

In the case of healthy mango fruit: The percentage of healthy fruit in mango plants significantly differed at 0.05% level (Figure 1). The range of healthy fruit (0.00-3.33%) in 2020. The highest healthy fruit observed in 33.33% on 15 July, followed by 26.67% on 3 July, 20.00% on 6 and 9 July, 13.33 % on 28 and 31 May, 7.96% on 15 May, 6.67% on 12 and 18 July, respectively and the lowest percentage of healthy fruit observed 0.00% on 21 July 2020 under natural condition.

In the case of infested mango fruit: The percentage of infested fruit in mango plants significantly differed at 0.05% level (Figure 1). The range of infested fruit was varied from (66.67-93.33%) during 2020. The highest infested fruit observed in 93.33% on 12 and 18 July, followed by 92.31% on 25 May, 86.67% on 28 May, 80.00 % on 31 May, 6 and 9 July, 73.33% on 3 July, respectively, and the lowest percentage of infested fruit observed 66.67% on 15 July 2020 under natural condition.

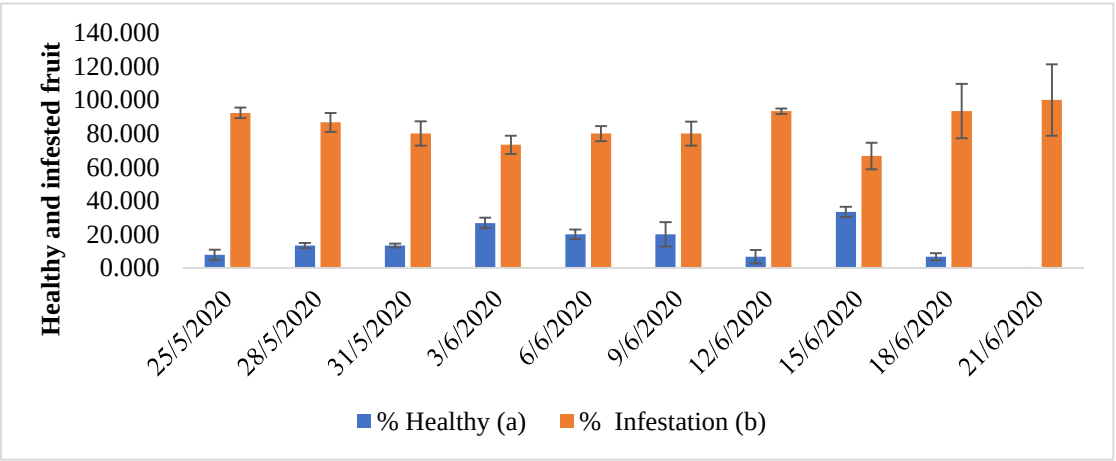

Fig. 1: Percentage of healthy and infested mango in 2020 (where CV_a=11.09%, CV_b=16.12%, Significance at 5% level)

Total percentage of healthy and infested mango

The total healthy mango 14.86% (22 out of 148) and total infested mango 85.13% (126 out of 148) during 2020 under natural conditions (Figure 2).

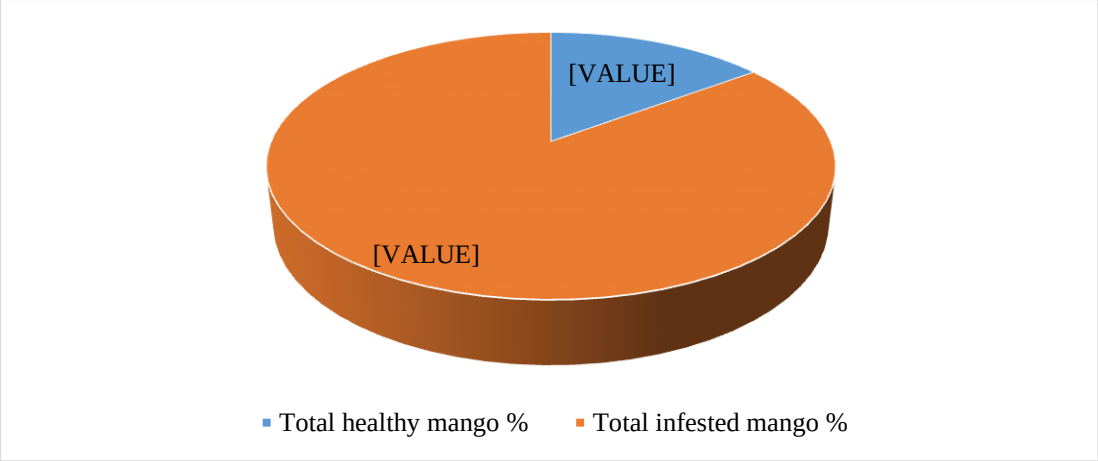

Fig. 2: Total healthy and infestation of mango during 2020

Percentage of infested mango fruit by different insects

In the case of thrips: The percentage of infested mango fruit by thrips significantly differed at 0.05% level (Figure 3 and 5). The range was observed (0.00-33.33) % in 2020. The highest thrips infested fruit 33.33% on 6 July followed by 26.67% on 3 July, 23.07% on 25 May, 20.00% on 9 July, 13.33% on 28 May and 15 July, 6.67% on 31 May and 21 July and the lowest trips infested fruit 0.00% on 12 and 18 July during the study period.

In the case of stone weevil: The percentage of infested mango fruit by stone weevil significantly differed at 0.05% level (Figure 3 and 5). The range was observed (33.33-73.33) % in 2020. The highest stone weevil infested fruit 73.33% on 12 July followed by 60.00% on 28 May and the lowest stone weevil infested fruit 33.33% on 3 and 6 July during the study period.

In the case of fruit borer: The percentage of infested mango fruit by fruit borer significantly differed at 0.05% level (Figure 3 and 5). The range was observed (23.33-46.67) % in 2020. The highest fruit borer infested fruit 46.67% on 28 and 31 May and 21 July followed by 40.00% on 3,15 and 18 July, 33.33% on 6 July. 26.67% on 9 and 12 July and the lowest fruit borer infested fruit 23.08% on 25 May during the study period.

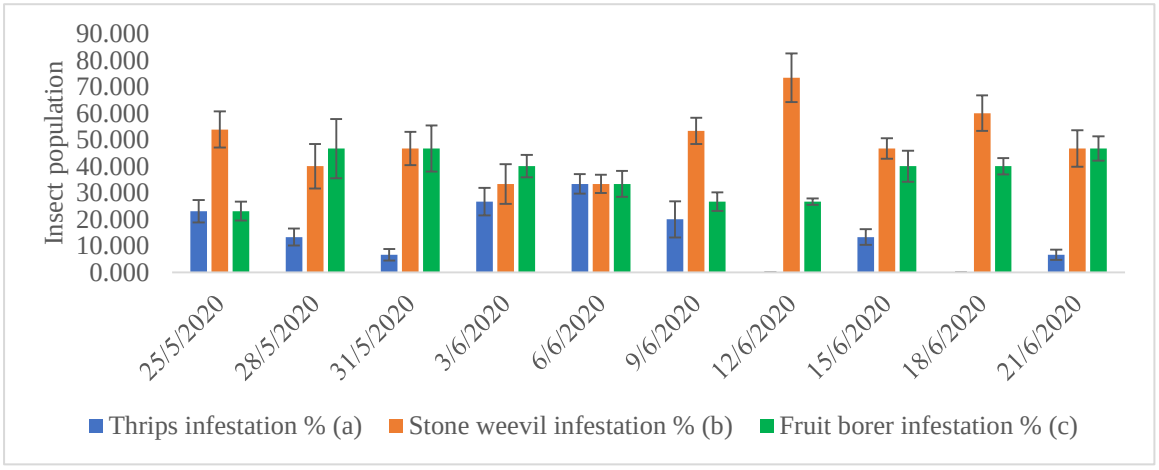

Fig. 3: Mango infestation by different insects during 2020 (where CV $_a$=18.09%, CV $_b$=11.12%, CV $_c$=14.78%, Significance at 5% level)

Total infestation of mango fruit by insects

The lowest infestation found for the thrips and the height infestation found for the stone weevil. The total thrips infested mango fruit 14.86% (21 out of 148) followed by 37.165% (55 out of 148) and 48.65% (72 out of 148) during 2020 under natural conditions (Figure 4).

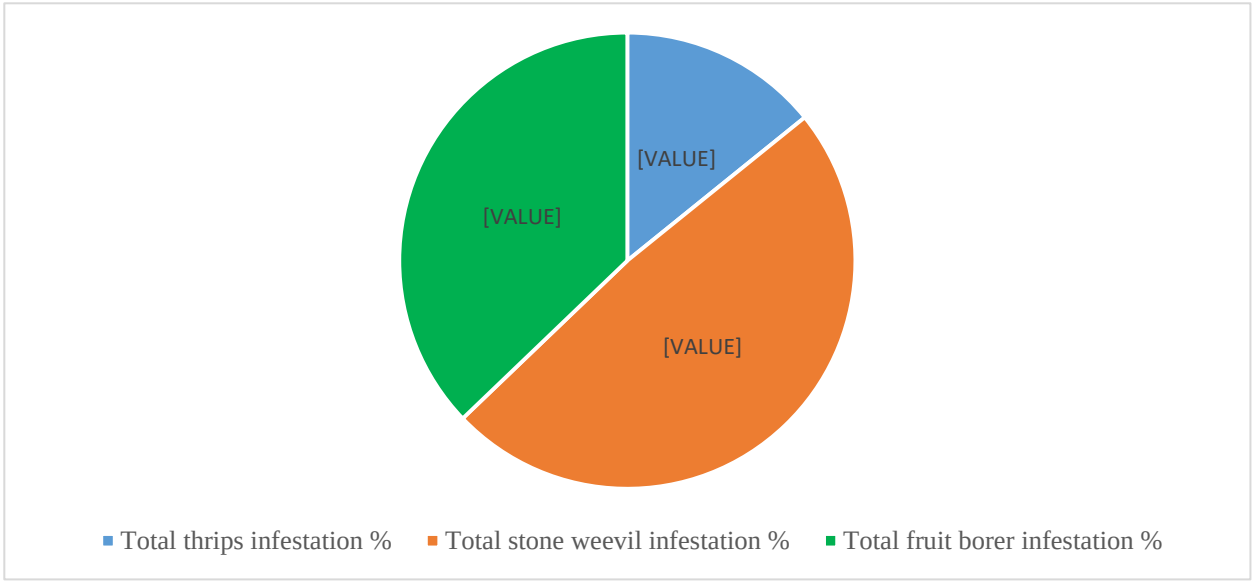

Fig. 4: Total infestation of mango by insects during 2020

Fig. 5: Insect infestation symptoms (Thrips, stone weevil and fruit borer)

DISCUSSION

Insects are one of the most important limiting factors of mango fruits. The insects reduced the quality of mango fruit and ultimately reduced the market value in the world market. The percentage of healthy and infested fruit in mango plants significantly differed at 0.05% level (Figure 1). The highest healthy fruit observed was 33.33% on 15 July and the lowest percentage of healthy fruit observed 0.00% on 21 July 2020 under natural conditions. The highest infested fruit was observed in 93.33% on 12 and 18 July and the lowest percentage of infested fruit observed 66.67% on 15 July 2020 under natural conditions. Similar results were observed by Chowdhury and Rahim, 2009 and the range of healthy fruit was obtained (8.50-86%) from control treatment at 60 DAFS. The percentage of infested mango fruit by thrips, stone weevil, and fruit borer significantly differed at 0.05% level (Figure 3). The highest thrips infested fruit 33.33% on 6 July and the lowest trips infested fruit 0.00% on 12 and 18 July during the study period. Thrips are sucking insects that colonize the leaves, inflorescence, fruit, and new flush (Pena et al., 2002). Mango thrips feed on petals, anthers, pollen and floral nectarines, resulting in the discoloration and malformation of panicles (Pena et al., 2002). Apart from weakening the inflorescence and reducing fruit sets, thrips cause serious bronzing of the fruit surface due to the presence of air in emptied cell cavities. This effect is very pronounced in mature fruits (Lewis, 1973) and renders these fruits unsuitable for fresh marketing (Dennill & Erasmus 1992; Grove et al., 2000; Nault et al., 2003; & Rai et al., 2020). White mango scale is a hard scale insect which is reported to have damaged mango in various mango growing countries (Germain et al., 2010; Abo-Shanab, 2012; Djirata et al., 2016; & Thakor, 2019). The highest stone weevil infested fruit 73.33% on 12 July and the lowest stone weevil infested fruit 33.33% on 3 and 6 July during the study period. Similar results were observed by (Verghese, 2000; & Follett, 2002). This study noted that the stone weevil infestation could increase fruit drop in mango during early fruit development and infestation ranged from 50% to 70% in susceptible varieties. The highest fruit borer infested fruit 46.67% on 28 and 31 May and 21 July and the lowest fruit borer infested fruit 23.08% on 25 May during the study period. This result supported the experiment of Sujatha and Zaheeruddin, 2002 and the study noted that 10–52% damage of fruits from pin-headed stage to full maturity of West Bengal and Andhra Pradesh, India. Considering the above points, the mango fruit infestation is effect on economic status in the mango market and the infestation symptoms reduce the market value of mango fruits. So, there is need for immediate identification and appropriate policy directions to reduce the infestation of mango fruits in the farmers home garden. The botanical, bio-rational and microbial pesticides are very effective, suitable and viable tool for managing mango fruit insect pests in home garden.

CONCLUSION

Our study is based on monitoring different insect populations of mango fruit in farmer home gardens. Three fruit insects such as thrips, stone weevil and fruit borer and their infestation rate in the mango fruit. In Bangladesh, they need a suitable method to minimize the insect population in rural farmers' gardens. Specific study plans in the future will be undertaken in a bio-rational treatment way and will observe biological cycles, their ecology, their relationships with temperature.

Author Contributions: AUK was planned, structured, wrote, and revised the manuscript thoroughly. MARC, SAT, ARMM and IJE contributed to the help in writing and revision of the manuscript.

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