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# SURVEY AND IDENTIFICATION OF MAJOR INSECTS PESTS OF COTTON IN BANGLADESH

**Md. Abdul Ahad[1], M.N. Rasel[1] and H.M. Syfullah Azad[2]**

## ABSTRACT

'Survey and identification of major insect pests of cotton in Bangladesh was under taken during the cropping season 2007-2008' in the farm of 'Cotton Development Board' Sadarpur, Dinajpur. In addition, consultation and discussion with cotton-scientists, cotton-farmers, annual report of 'Cotton Development Board' (2003-2008) was made. Data of field observation, hand picking of woman labour of 'Cotton Development Board', the molasses trap and pheromone trap indicated that American bollworm, spotted bollworm, armyworm (was an arising major pest); jassid, aphid, white fly, cotton stainer (in hilly cotton*)* were found as major pest of cotton; On the other hand pink bollworm, spiny bollworm, cotton leaf roller, cutworm, semilooper, thrips and red mite were considered as minor pests.
*Key words: Cotton, survey, major pest*

## INTRODUCTION

Cotton (*Grosypiam spp*.) is considered as a major agricultural crop (Jiskani and Wagan, 2001) and is known as the silver fiber (Menon and Chang, 2007). Cotton is cultivated else where as fiber and oil crop (Mallah, 1997). It grows in more than 60 countries of the world and a major crop of African tropics, Australia, China, Egypt, India, Mexico, Pakistan, Soviet Union, Sudan, United States, and warmer regions of Central and South America (Jiskani and Wagar, 2001). Two types of cotton, viz; American cotton (*Gossypium hirsutum* L.) and deshi cotton (*G. arboreum* L.) are commonly grown in the Indian sub-cotinent (Singh and Lal, 1984; Atwal and Dhalaiwal, 2005). These two species of cotton are also grown in Bangladesh but *Gossypium arboreum* L. is known as the hilly cotton (CBD, 2008) in Bangladesh. Cotton is a very sensitive crop in terms of pest complex. It is attacked by the different pests from germination upto final picking stage (Borah, 1995). There are 162 species of insect pests have been recorded, among them only 15 species may be cosidered as the major due to their occurrences and damages (Atwal and Dhalaiwal, 2005; Bohmfalk *et al.*, 1996). In Pakistan this crop is attacked by 145 species of insect and mite pests (Haque, 1994). The cotton production reduces by 16.50 % (Baloch *et.al.* , 2001), 20 to 70%, due to the serious attack of insect pests (Menon and Chang, 2007). It is impossible to establish cotton plants, due to infestation of cotton jassid, *Amrasca devastans* (Dist.) without insecticide sprays against this pest (EI-Tom, 1987 and Ali, 1992).

So, insect pest is a serious problem for the cultivation of cotton that may cause lower yield. However, there is a debate of considering these insects as major or minor. Alam *et al.* (1964) listed the spotted bollworm, *Earias vittella (F.),* the spiny bollworm, *E. insulana* Boise and the pink bollworm, *Pectinophora gossypiella* (Saund.) as the major insect pests of cotton in Bangladesh, while Bohlen (1984) mentioned the spotted bollworm, pink bollworm and the American bollworm, *Heliothis armigera* (Hubn.) as the major insect pests of cotton in Bangladesh at the same time as, El-Tom (1987) recorded only the spotted bollworm as the major pest and the American bollworm as a minor pest of cotton in Bangladesh. He did not found any infestation of pink bollworm and spiny bollworm in Bangladesh. A thorough understanding of feature of insect pest can help in forecasting of any outbreaks of insect pests and to develop integrated control approaches to combat these of pests for of cotton (Jayanthi *et al.* 1993). In order to develop economically feasible, ecologically sound and socially acceptable pest management strategies, detail information of the pest complex, and the status are of great importance (Chowdury *et al*, 1986, Jayanthi *et al*. 1993, Bijjur and Verma, 1995). An economically sound pest management is necessary for combating the major pest of cotton. So, for any successful crop production it is

[1]Department of Entomology, Hajee Mohammad Danesh Science and Technology University, Dinajpur 5200. [2]Regional Cotton Research, Training and Seed Multiplication Farm, Sadarpur, Dinajpur.

necessary to know which insect pest are the major pests of a crop. Therefore, a study was under taken to survey and identify the status of major insect pests of cotton in Bangladesh.

## MATERIALS AND METHODS

**Collection of data from the cotton scientists of 'Cotton Development Board'(CDB):** Data were taken from the cotton scientists of 'Cotton Development Board' (Dinajpur, Rangpur, Bogra, Rajshai, Jhenadaha, Jagadashpur, Sreepur, Khamarbari -Dhaka, and Bandarban) when they appear to participate '2 days 'External Annual Review' (on 27-05-08 to 28-05-08) meeting at Khamar Bari, Dhaka. A pre-tested questioner were supplied to them to comment on the -American bollworm, spotted bollworm, pink bollworm, spiny bollworm, cotton leaf roller, cutworm, cotton semilooper, armyworm, jassid, aphid, white fly, cotton stainer, thrips, and red mite are major, (infest the crop every year and damage significant amount) or minor (infest the crop every year and damage not appreciable amount) or sporadic (infest the crop not every year and but damage appreciable amount) and compile in a table as percent.

**Collection of data from the cotton farmers:** Data were taken from the farmers of Thakurgaon, Dinajpur, Rangpur, Gaibandha and Kurigram when they were participating 7 days training entitled - "A Training on Modern Technology Transfers for Cotton Cultivation" (03-01-09 to 10-01-09) at the 'Regional Cotton Research, Training and Seed Multiplication Farm, Sadarpur, Dinajpur'. There were 140 Farmers but data were taken randomly from 121 farmers, the questioner used for cotton-scientists also used for the cotton-farmers. A colour photograph of insect pest and their nature of damage showed to the farmers and also explain and asked them whether the pests are major or minor or sporadic and compiled in a table as percentage.

**Collection of data (reviewed) from Annual Research Report of 'Cotton Development Board':** Incidence of insect pest during the last 5 years (2003-2008) were collected from the 'Annual Research Report' of 'Cotton Development Board' and compiled in a table as percent.

**Field observation Study:** The experiment was conducted at the Regional Cotton Research, Training and Seed Multiplication Farm, Sadarpur, Dinajpur during August 2008 to January 2009. The experiment was conducted in the randomized complete block design (RCBD) with 3 replications. The plot size was 5.4m x 5m. The spacing between block to block and plot to plot was 1.5 and 1m, respectively and walkway was 2m. Seeds were sown in rows on the 3$^{rd}$ August 2008; at the rate of 15 kg/ha. A distance of 45 cm from plant to plant and row to row was 90 cm, depth 1 to 1.5 cm of the soil and these were covered with loose soil. A popular variety (CB-10) was used in this experiment. Application of fertilizers and intercultural operations such as mulching, weeding, irrigation etc were done as recommended for cotton crop in Bangladesh. Counts of insect pests were done after 2 weeks of days after seeding. In each replication 5 plants were selected randomly for the examination. Scouting was done once in a week. The scouting plants were selected along in a zigzag method throughout the field, so that a representative sample was obtained.

**Collection data through hand picking:** Daily 100 women picked cotton pests from 34 ha of land in the 'Regional Cotton Research, Training and Seed Multiplication Farm', Sadarpur, Dinajpur. They collected cotton pests in bottle containing of pond water. Every 4 hours the bottle was filling up by the insect pest so, they change it. These insects were counted continuously for 10 days without interval (10-10-08 to19-10-08).

**Collection of data using trap:**

**a) Preparation of molasses trap:** Small earthen pot was placed in three split bamboo sticks located at the center of the plot at a height of 50 cm above the ground level. Molasses with insecticides (3gm Asataf 85 WP + 100 g molasses) was placed in this pot. Another flat and bigger earthen pot was placed 20 cm above the bait container as the hood to protect the bait material from the sun and the rain. The bait materials were changed after 15 days.

**b) Preparation of pheromone trap:** A triangular pore (each arm 7 cm) was made one side of a rejected soybean oil plastic bottle (30 cm height and 15 cm wide) and another pore was also made to the opposite site of the bottle. The pheromone band was hanged with the help of a thread (15 cm length) from the inner portion of the mouth of the bottle. Soap water was also put in the bottom of the bottle for the killing of the dropping moths.

There were 25 molasses traps and 25 pheromone traps (each trap was in 4 decimal of land) in the CDB farm, Sadarpur, Dinajpur for the collection and destruction of Armyworm (*Spodoptera litura)* and male American bollworm *(Helicoverpa armigera)* moth. Data were taken every day from those trap and calculated total no. of moths caught in 7 days with 25 traps and average no. of moths caught /day /trap.

## RESULTS AND DISCUSSIONS

**Comment of cotton-scientists:** According to comment of cotton scientist's - American bollworm, spotted bollworm, armyworm, jassid, aphid, white fly, and cotton stainer (in hilly cotton*)* were major insect pest of cotton as reported by 91.30%, 91.30%, 52.17% , 95.65%, 69.57%, 52.17%, and 82.61% of scientists, respectively ; on the other hand the pink bollworm, spiny bollworm, cotton leaf roller, cutworm, cotton smilooper, thrips, red mite were considered minor insect pests as reported by 52.17%, 65.22%, 78.26%, 73.92%, 69.56%, 91.30%, and 73.91% scientists, respectively (Table-1).

Table 1. Comment of 30 cotton scientists on the status of cotton pests during the period of 27-05-08 to 28-05-08

| Types and names of the pest | Comments by cotton scientists (%) | | | | |
|---|---|---|---|---|---|
| | Major pests | Minor pests | Sporadic pests | No comment | Not found |
| **Chewing pests** | | | | | |
| 1.American bollworm (*Helicoverpa armigera*) | 91.30 | 4.35 | 4.35 | - | - |
| 2. Pink bollworm (*Pectinophora gossypiella*). | 13.04 | 52.17 | 17.39 | - | 17.39 |
| 3. Spotted bollworm (*Earias vitella*) | 91.30 | 8.70 | - | - | - |
| 4. Spiny bollworm (*Earias insulana*) | 4.35 | 65.22 | 8.70 | 21.74 | - |
| 5. Cotton leaf roller (*Sylepta degorata*) | 13.04 | 78.26 | 8.70 | - | - |
| 6. Armyworm (*Spodoptera litura)* | 52.17 | 30.44 | 17.39 | - | - |
| 7. Cutworm (*Agrotis ipsolon)* | - | 73.92 | 13.04 | 13.04 | |
| 8. Cotton Semilooper *(Trichoplusia ni*) | - | 69.56 | 17.40 | 13.04 | |
| **Sucking pests** | | | | | |
| 9. Jassid (*Amrasca biguttula)* | 95.65 | - | - | 4.35 | - |
| 10. Cotton stainer (*Dysdercus cingulatus*) | *82.61 | **82.61 | 17.39 | - | - |
| 11. Aphid (*Aphis gossypii*) | 69.57 | 30.43 | - | - | - |
| 12. White fly (*Bemisia tabaci*) | 52.17 | 30.43 | 17.39 | - | - |
| 13. Thrips (*Thrips tabaci*) | - | 91.30 | 4.35 | 4.35 | - |
| 14. Red mite (*Tetranychus* spp) | - | 73.91 | 17.39 | 8.70 | - |

*major in hill cotton but minor in non-hill cotton, **minor in non-hill cotton

**Comment of cotton-farmers:**

According to comment of cotton farmers - American bollworm, spotted bollworm, armyworm, jassid, aphid, white fly and were major pest of cotton opined by 79.17%, 87.75%, 77.08%, 93.75%, 60.00%, and 66.67% cotton farmers, respectively; while- the pink bollworm, spiny bollworm, cotton leaf roller, cutworm, cotton semilooper, thrips, red mite were considered as minor pests opined by 25.00%, 65.22%, 41.67%, 47.92%, 33.336%, 43.04% and 41.67% cotton farmers, respectively (Table-2).

Table 2. Comments of 121 cotton farmers on the status of cotton pests from 03-01-09 to 10-01-09

| Types and names of the pest | Comments by cotton farmers (%) | | | | |
|---|---|---|---|---|---|
| | Major pests | Minor pests | Sporadic pests | No comment | Not found |
| Chewing pests | | | | | |
| 1.American bollworm (*Helicoverpa armigera*) | 79.17 | 20.83 | - | - | - |
| 2. Pink bollworm (*Pectinophora gossypiella*). | 14.58 | 25 | 16.67 | 6.25 | 37.05 |
| 3. Spotted bollworm (*Earias vitella*) | 87.75 | 6.25 | 6.00 | - | - |
| 4. Spiny bollworm (*Earias insulana*) | 4.35 | 65.22 | 8.70 | 21.74 | - |
| 5. Cotton leaf roller (*Sylepta degorata*) | 12.25 | 41.67 | 28.33 | 17.75 | - |
| 6. Armyworm (*Spodoptera litura)* | 77.08 | 22.92 | - | - | - |
| 7. Cutworm (*Agrotis ipsolon)* | 18.75 | 47.92 | 8.33 | - | 25.00 |
| 8. Cotton Semilooper *(Trichoplusia ni*) | - | 33.33 | 13.68 | 21.74 | 31.25 |
| Sucking pests | | | | | |
| 9. Jassid (*Amrasca biguttula)* | 93.75 | - | - | 6.25 | - |
| 10. Cotton stainer (*Dysdercus cingulatus*) | 14.58 | 41.67 | | 18.75 | 25.00 |
| 11. Aphid (*Aphis gossypii*) | 60.00 | 31.67 | - | 8.33 | - |
| 12. White fly (*Bemisia tabaci*) | 66.67 | 14.58 | - | - | - |
| 13. Thrips (*Thrips tabaci*) | 16.67 | 43.40 | 4.35 | 4.35 | 31.25 |
| 14. Red mite (*Tetranychus* spp) | 27.08 | 41.67 | - | 12.50 | 18.75 |

**Collection of data (reviewed) from Annual Research Report of 'Cotton Development Board':** Reviewed of last five years annual report (2003 to 2008) of 'Cotton Development Board' showed that cotton scientists controlled and recorded the data on the pest - American bollworm, Spotted bollworm, armyworm (sometimes), Jassid, Aphid and white fly (sometimes) and the recorded data of these pest were very close to their "economic threshold levels" (Table-1 and Table -2). They have to apply of insecticide, which reduce the number of pest. So, it indicates that these insect pests are major. This information is also supported the reports of the cotton scientists and comments of cotton farmers (Table-7 and 8).

Table-3. Incidence of sucking pest at 3 locations during 2003 to 2008 as indicated in the 'Annual Research Report' of Cotton Development Board, after application of insecticides or farmer practices.

| Years | Sadarpur | | | Jagadispur | | | Sreepur | | |
|---|---|---|---|---|---|---|---|---|---|
| | Aphid grade | No. of Jassid nymph/plant | No. of Whitefly /plant | Aphid grade/ plant | No. of Jassid nymph /plant | No. of Whitefly/plant | Aphid grade | No. of Jassid nymph/ plant | No. of Whitefly/plant |
| 1. 2003-04 (p.67,62) | 1.10 | 0.21 | - | 0.37 | 0.65 | - | 0.20 | 0.78 | - |
| 2. 2004-05 (p.73) | 1.45 | 1.25 | - | 1.49 | 1.42 | - | 1.35 | 1.57 | - |
| 3. 2005-06 (p.69) | 1.18 | 0.24 | 0.24 | 1.40 | 0.03 | 0.19 | 0.18 | 0.80 | 1.48 |
| 4. 2006-07 (p.55) | 1.10 | 0.40 | 0.91 | 0.75 | 1.07 | 0.39 | 0.54 | 1.36 | 0.18 |
| 2007-08 | 1.75 | 2.22 | 5.17 | - | - | - | - | - | - |
| Mean | 1.32 | 0.86 | 1.23 | 0.80 | 0.63 | 0.12 | 0.45 | 0.90 | 0.33 |

* 1-10 aphid= grade 1, 11-20 aphid= grade 2

**(Threshold levels:** The critical threshold levels of cotton pests were determined by (Anonymous, 2008) are as follows: (i) jassid -2.0 nymphs/plant (ii) aphid - grade of 1.50 /plant (iii) white fly-4-5

adults /plant (iv) american bollworm -0.25 larva/plant (v) spotted bollworm -0.25 larva /plant, (vi), thrips 8-12/ plant )

Table 4. Incidence of chewing pest at 3 locations during 2003 to 2008 as revealed in the 'Annual Report' of Cotton Development Board', after application of insecticides following farmer practices.

| Years | Sadarpur | | | Jagadispur | | | Sreepur | | |
|---|---|---|---|---|---|---|---|---|---|
| | No. of American bollworm larva/ plant | No. of Spotted bollworm larva/ plant | No. of Army worm larva/plant | No. of American bollworm larva/ plant | No. of Spotted bollworm larva/ plant | No. of Army worm larva/plant | No. of American bollworm larva/ plant | No. of Spotted bollworm larva/ plant | No. of Armyworm/ plant |
| 1. 2003-2004 (pp.66-67) | 0.21 | 0.04 | - | 0.04 | 0.05 | - | 0.22 | 0.21 | - |
| 2. 2004-2005 (p.69) | 1.18 | 0.24 | 0.24 | 1.14 | 0.03 | 0.19 | 0.18 | 0.80 | 1.48 |
| 3. 2005-2006 (p.74) | 0.24 | 0.14 | - | 0.29 | 0.26 | - | 0.19 | 0.20 | - |
| 4. 2006-200 (p.51) | 0.24 | 0.11 | - | 0.21 | 0.23 | - | 0.36 | 0.11 | - |
| **5. 2007-2008 | 0.50 | 0.42 | 0.55 | - | - | - | - | - | - |
| Mean | 0.47 | 0.19 | 0.16 | 0.34 | 0.02 | 0.04 | 0.19 | 0.22 | 0.29 |

**(Threshold levels:** The critical threshold levels of cotton pests were determined by CDB are as follows: (a) jassid -2.0 nymphs/plant (b) aphid - grade of 1.50 /plant (c) white fly 4-5- adults /plant (d) American bollworm -0.25 larva/plant (e) spotted bollworm -0.25 larva /plant)
* 1-10 aphid= grade 1, 11-20 aphid= grade 2

**Collection of data from the field (observation):**
The abundance (mean) of American bollworm, spotted bollworm, jassid, aphid, white fly were 0.37 larva /plant (ET- 0.25 larva /plant), 0. 32 larvae /plant (ET- 0.25 larvae /plant), 2.3 nymphs/plant (ET- 2.0 nymphs/plant), 1.6 grade/plant (ET- 1.50 grade /plant) and 4.27 adults /plant (ET- 4-5 adults /plant), respectively, which crossed their economic threshold (ET); even their weekly abundance were also crossed the ET. So, they were major, while- mean abundance of pink bollworm, spiny bollworm, cotton leaf roller, cutworm, cotton smilooper, thrips and red cotton bug were 0.10, 0.02, 0.16, 0.02, 0.16, 3.42, 0.11 respectively and did not cross the economic threshold, even their weekly abundance were never cross the ET (table -3). So, they were minor pests. Though ET of Armyworm was not determined by the CDB but its abundance, comment of cotton-scientists, cotton-farmers, hand picking data by CBD woman labour, survey through molasses trap and pheromone trap advised that it was an arising major pest of cotton.

Table 5. Abundance of different insect pests in research field

| Date | American bollworm larva/plant | Pink bollworm/plant | Spotted bollworm larva/plant | Spiny bollworm/plant | Leaf roller/plant | Army worm/plant | Cut worm/plot | Semi lopper/plant | Red Cotton bug/plant | Jassid nymph/plant | Aphid grade/plant | White fly/plant | Thrips/plant |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 31/08/08 | 0.4267 ab | 0.09000 b | 0.3133b | 0.03667 a | 0.1300 bc | 0.3367cd | 0.0366 a | 0.1400bc | 0.1067ab | 1.167 d | 0.9333 c | 4.167 e | 2.500 efg |
| 07/09/08 | 0.3133 b | 0.09667 b | 0.2733 b | 0.04667 a | 0.1500 bc | 0.3833 bcd | 0.03667 a | 0.1400 bc | 0.09000 ab | 1.183 d | 1.500 abc | 4.617 d | 2.067 fg |
| 14/09/08 | 0.2833 b | 0.1000 b | 0.2800 b | 0.03667 a | 0.1333 bc | 0.3100 d | 0.03667 a | 0.1333 bc | 0.08333 ab | 2.083 c | 1.500 abc | 4.167 e | 2.667 efg |
| 21/09/08 | 0.4167 ab | 0.3700 a | 0.3200 b | 0.04000 a | 0.1667 abc | 0.4000abcd | 0.05000 a | 0.1767 abc | 0.09333 ab | 2.200 c | 1.517 abc | 1.817 h | 3.167 cde |
| 28/09/08 | 0.3667 b | 0.1067 b | 0.2733 b | 0.03000 a | 0.2216 7 ab | 0.5300 ab | 0.03000 a | 0.2167 ab | 0.3567 a | 2.817 b | 1.650 abc | 5.000 c | 3.750 bcd |
| 05/10/08 | 0.4167 ab | 0.08333 b | 0.3667 b | 0.02677 a | 0.2333 a | 0.5000 abc | 0.02667 a | 0.2433 a | 0.09000 ab | 3.050 ab | 1.800 ab | 4.083 e | 4.100 bc |
| 12/10/08 | 0.5500 a | 0.08667 b | 0.5000 a | 0.01267 a | 0.2167 abc | 0.5667 a | 0.01367 a | 0.2067 abc | 0.06000 b | 3.233 a | 2.017 a | 6.000 a | 4.333 b |
| 19/10/08 | 0.2767 b | 0.06000 b | 0.2833 b | 0.00200 00 a | 0.1867 abc | 0.5667 a | 0.001000 a | 0.1867 abc | 0.06000 b | 2.950 ab | 1.877 ab | 5.883 a | 5.750 a |
| 26/10/08 | 0.3433 b | 0.04667 b | 0.3633 ab | 0.01067 a | 0.1333 bc | 0.4500abcd | 0.01067 a | 0.1333 bc | 0.07333 ab | 1.933 c | 1.183 bc | 5.533 b | 4.333 b |
| 02/11/08 | 0.4333 ab | 0.06667 b | 0.3433 ab | 0.00100 00 a | 0.1233 c | 0.3167 d | 0.001000 a | 0.1233 c | 0.08100 ab | 2.767 b | 1.933 ab | 4.167 e | 3.750 bcd |
| 09/11/08 | 0.3600 b | 0.07333 b | 0.2433 b | 0.00100 00 a | 0.1433 bc | 0.3500 cd | 0.001000 a | 0.1533 bc | 0.12000 ab | 1.967 c | 1.850 ab | 3.200 f | 2.950 def |
| 16/11/08 | 0.2700 b | 0.06667 b | 0.2367 b | 0.00100 00 a | 0.1157 c | 0.3333 cd | 0.001000 a | 0.1167 c | 0.09000 ab | 1.833 c | 1.250 abc | 2.567 g | 1.733 g |
| Mean | 0.371 | 0.104 | 0.316 | 0.020 | 0.164 | 0.420 | 0.020 | 0.164 | 0.109 | 2.265 | 1.584 | 4.267 | 3.425 |
| SD | 0.10 | 0.14 | 0.10 | 0.02 | 0.05 | 0.12 | 0.02 | 0.05 | 0.14 | 0.70 | 0.34 | 1.28 | 1.18 |
| SE | 0.02 | 0.02 | 0.02 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.02 | 0.12 | 0.06 | 0.21 | 0.20 |

**(Threshold levels:** The critical threshold levels of cotton pests were determined by (Anonymous, 2007-08) are as follows: (i) jassid -2.0 nymphs/plant (ii) aphid - grade of 1.50 /plant (iii) white fly -4-5 adults /plant (iv) American bollworm -0.25 larva/plant (v) spotted bollworm -0.25 larva /plant, (vi), thrips 8-12/ plant )

* 1-10 Aphids = grade 1, 11-20 Aphids = grade 2 (Anonymous, 2007-08)

**Hand picking by CDB woman labour:**

A woman labour picked on an average of 418.20 armyworm larvae, 36.60 American bollworm larvae and 2.7 spotted bollworm larvae in 4 hours (Table-4). Armyworm larvae was caught highest number; perhaps this larvae is a surface feeder, so, it was caught in large number, but American bollworm larvae and spotted bollworm larvae are internal feeder so, difficult to catch it easily and were caught in less number.

Table 6. Hand picking data by CDB labour during the ten days in the month of October, 2008

| Date | Hand picking of insects/ labours/4-hours | | |
|---|---|---|---|
| | Armyworm | American bollworm | Spotted bollworm |
| 10-10-2008 | 144 | 30 | 0 |
| 11-10-2008 | 400 | 50 | 1 |
| 12-10-2008 | 510 | 53 | 10 |
| 13-10-2008 | 503 | 16 | 1 |
| 14-10-2008 | 507 | 16 | 1 |
| 15-10-2008 | 450 | 52 | 5 |
| 16-10-2008 | 376 | 39 | 2 |
| 17-10-2008 | 512 | 25 | 0 |
| 18-10-2008 | 365 | 20 | 3 |
| 19-10-2008 | 415 | 15 | 4 |
| Mean | 418.20 | 36.60 | 2.7 |

**iv) Survey through molasses trap and pheromone trap:**

Total numbers of 7381 armyworm moths were caught by 25 molasses traps and total 40.61 moths were captured by one molasses trap in the whole season (September to November, Table 7). A total number of 2580 male American bollworm moths were caught by 25 pheromone traps and total 14.66 moths were caught by a single pheromone trap in the whole season (October to November). The highest abundance of armyworm moths and American bollworm moths were observed in October Ist and 2nd week; and November Ist and 2nd week (Table 8). So, catching of large number of armyworm moths and male American bollworm moths by molasses trap and pheromone trap, respectively indicate that they were major pests of cotton.

Abou-Elhagag (1998) opined that the important pests of cotton are jassid (*Amrasca bigutulla*), Aphid (*Aphis gossypii*), whitefly (*Bemisia tabaci*), American bollworm (*Helicoverpa armigera*), spotted bollworm (*Earias vittella*), armyworm (*Spodoptera litura*), pink bollworm (*Pectinophora gossypiella*), thrips (*Thrips tabaci*) and red cotton bugs (*Dysdercus cingulatus*), which cause serious damage to cotton by direct feeding plant parts as well as by transmitting various diseases.

This information may be compared with the present results of in Bangladesh. Ali (1992) showed in a study that the spotted bollworm *Earias vittella* and the American bollworm, *Helicoverpa armigera* were the dominant species in Bangladesh but the incidence of pink bollworm (*Pectinophora gossypiella*) was not found during his study period. He reported that the reason of their sudden disappearance from the cotton field was unknown. Thrips (*Thrips tabaci*) is the most common pest of cotton throughout the most temperate region (Klein *et al*., 1986). But in Bangladesh their occurrence is not common as it is a tropical to subtropical country. So, it may not be a major pest of cotton in Bangladesh. Rasel (2007) showed in an experiment that white fly (*Bemisia tabaci*) is a major pest of cotton in Bangladesh. However, Biswas *et al*, (2007) reported that any insect pest may alter its status depending upon the environmental conditions and changing cropping patterns.

Table 7. Number of armyworm *(Spodoptera litura)* caught by molasses trap during September, October and November, 2008.

| Date | Month | No. armyworm *(Spodoptera litura)* caught by molasses trap | | |
|---|---|---|---|---|
| | September | Total no. of moth caught in 7 days by 25 traps | Average no. of moth caught /day /25trap | Average no. of moth caught /day /trap |
| 7-9-08 to13-9-08 | 2nd week | 63 | 9 | 0.36 |
| 14-9-08 to 20-9-08 | 3rd week | 184 | 26.29 | 1.05 |
| 21-9-08 to27-9-08 | 4th week | 230 | 32.86 | 1.31 |
| 28-9-08 to 30-9-08 | 3 days | 348 | 49.71 | 1.99 |
| | October | | | |
| 01-10-08 to 07-10-08 | Ist week | 556 | 79.42 | 3.18 |
| 08-10-08 to 14-10-08 | 2nd week | 481 | 68.72 | 2.75 |
| 15-10-08 to 21-10-08 | 3rd week | 311 | 44.42 | 1.78 |
| 22-10-08 to 28-10-08 | 4th week | 165 | 23.57 | 0.94 |
| 29-10-08 to 31-10-08 | 3 days | 91 (3 days) | 45.50 | 1.82 |
| | November | | | |
| 01-11-08 to 07-11-08 | Ist week | 1518 | 216..86 | 8.67 |
| 08-11-08 to 14-11-08 | 2nd week | 1595 | 227.86 | 9.114 |
| 15-11-08 to 21-11-08 | 3rd week | 779 | 111.29 | 4.45 |
| 22-11-08 to 28-11-08 | 4th week | 489 | 69.85 | 2.79 |
| 29-11-08 to 31-11-08 | 2 days | 71 | 10.14 | 0.41 |
| Total | | 7381 | 1015.43 | 40.61 |

Table 8. Number of armyworm *(Spodoptera litura)* caught by molasses trap during September, October and November, 2008.

| Date | Month | No. American bollworm *Helicoverpa armigera* caught by pheromone trap | | |
|---|---|---|---|---|
| | October | Total no. of moth caught in 7 days by 25 traps | Average no. of moth caught /day /25trap | Average no. of moth caught /day /trap |
| 11-10-08 to 17-10-08 | 2nd week | 411 | 58.71 | 2.35 |
| 18-10-08 to 24-10-08 | 3rd week | 71 | 10.14 | 0.29 |
| 25-10-08 to 31-10-0828 | 4th week | 58 | 8.29 | 0.33 |
| | November | | | |
| 01-11-08 to 07-11-08 | Ist week | 1252 | 178.86 | 7.14 |
| 08-11-08 to 14-11-08 | 2nd week | 650 | 92.86 | 3.71 |
| 15-11-08 to 21-11-08 | 3rd week | 102 | 14.86 | 0.59 |
| 22-11-08 to 28-11-08 | 4th week | 33 | 4.71 | 0.19 |
| 29-11-08 to 30-11-08 | last two days of November | 2 days | 1.5 | 0.06 |
| Total | | 2580 | 369.93 | 14.66 |

## CONCLUSION

It may be concluded that the American bollworm, spotted bollworm, armyworm, jassid, aphid, white fly, cotton stainer (in hilly cotton*)* were major pest of cotton.; while pink bollworm, spiny bollworm, cotton leaf roller, cutworm, semilooper, thrips, and red mite were minor pests in Bangladesh. However, with the change of the environmental conditions and cropping patterns any one of the minor insect pest may attain the status of a major pest and vice–versa.

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