



Seasonal Incidence of Citrus Trunk Borer (*Anoplophora versteegi* Ritsema) on Khasi Mandarin in Arunachal Pradesh

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ABSTRACT

The adults of citrus trunk borer first appeared in the third week March to second week of April. Female beetles appeared earlier than male. The beetle population reached the peak on first to third week of May, after which the population declined and completely disappeared from the orchard from the fourth week of July to second week of August. The number of female beetles was found to be outnumbered the male sex during this population growth phase and the number of male beetles /plant was found to be more than females during population declining phase. Adult beetle population of citrus trunk borer was negatively correlated with minimum temperature and positively correlated with bright sunshine hours and wind speed. The studies further showed that gradual rise in winter minimum temperature increased the beetle population and further rise in summer minimum temperature declined the beetle population.

Keywords: Trunk borer, citrus, seasonal incidence

India ranks sixth in the production of citrus fruit in the world. Other major citrus producing countries are Spain, USA, Israel, Morocco, South Africa, Japan, Brazil, Turkey and Cuba (Pedapati and Tiwari, 2014). While priorities being fixed for introduction of fruit crops in India, there is need to introduce suitable fruits germplasms having resistance to the potential insect pests, since they are posing problems and becoming limiting factors for successful production (Singh, 2007 and Singh et al., 2005). It occupies third position after mango and banana in the production of fruits in India. Citrus fruits originated in the tropical and sub-tropical regions of South East Asia, particularly India and China. North East India is the native place of many citrus species. Orange is rich in vitamin C, A, B and phosphorus (Singh and Singh, 2015). Orange (*Citrus reticulata*) is one of the most important commercial fruit crop in North East region. Oranges are mostly grown in the states of Maharashtra, Madhya Pradesh, Tamil Nadu, Assam, Orissa, West Bengal, Rajasthan, Nagaland, Mizoram, and Arunachal Pradesh. Orange is Khasi mandarin is most popular variety in NEH region. In NEH region covering of 57.2 thousand ha, with production of 300.7 thousand tones. Khasi mandarin (*Citrus reticulata* Blanco) is a high quality mandarin variety that covers the largest area in the entire

North-eastern region. This important commercial fruit crop is attacked by various insect pests, of which citrus trunk borer, *Anoplophora versteegi* Ritsema (Coleoptera: Cerambycidae) is the most serious one and responsible for citrus decline in north eastern region. Azad Thakur and Shylesha (1996) found 60-80 per cent damage to Khasi mandarin plants due to the citrus trunk borer in Meghalaya. Considering the seriousness of its problem the present investigation was carried out to study the seasonal incidence of the adult beetle on Khasi mandarin in relation to weather condition. Shylesha et al. (2006) also suggested integrated management of insect-pests for the North Eastern Region of India.

The present investigation entitled Impact of Front Line Demonstration on fruit size, yield, fruit quality and contributing traits in orange (*Citrus reticulata*) was carried out at four former field along with Research Farm of the Krishi Vigyan Kendra, Pampoli, East Kameng, Arunachal Pradesh during 2012 and 2013. Seasonal incidence of adult *A. versteegi* was studied in the former field as well as Krishi Vigyan Kendra form. On each sampling occasion, ten randomly selected citrus plants jerked suddenly. Adult beetles fallen Arunachal during March to August in 2012 and 2013. The presence of adult beetle on Khasi mandarin plants was recorded at weekly intervals. On the ground in a sudden jerk

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of the mandarin plant were counted. The counting of adult beetles numbers was initiated from first week of March and continued till the collapse of field population. The counting was done *in situ*. The number of adult beetles per plants was correlated with meteorological parameters *viz.*, maximum and minimum temperature and relative humidity, rainfall, number of rainy days, bright sunshine hours and wind speed during the period of experiment.

The appearance of adult beetle on Khasi mandarin plants was first recorded on 16th March, 2012 and 9th April, 2013 with an average population level of 0.01 beetles/plant in both the year (Table 1 and 2). Female beetles of citrus trunk borer appeared earlier than male. Han *et al.* (2007) also reported that the female beetles of pine sawyer (*Monochamus ltuarius*) emerged slightly earlier than males similar to the present findings. The appearance of male beetle was first noticed on 6th April, 2012 and on 23rd April, 2013, when sex ratio (female: male) was 1: 0.33 and 1: 0.50, respectively (Table 1 and 2).

The beetle population of citrus trunk borer gradually increased in successive weekly counts and reached the

Table 1: Seasonal incidence of *Anoplophora versteegi* adults during 2012

Date of observation	Number of Adult beetles/plant			Sex ratio (Female: Male)
	Female	Male	Total	
16.3.12	0.1	0	0.1	1:0
23.3.12	0.2	0	0.2	1:0
30.3.12	0.3	0	0.3	1:0
06.4.12	0.6	0.2	0.8	1: 0.33
13.4.12	0.7	0.1	0.8	1: 0.14
20.4.12	0.5	0.2	0.7	1: 0.40
27.4.12	0.5	0.4	0.9	1: 0.80
04.5.12	0.7	0.2	0.9	1: 0.29
11.5.12	0.9	0.1	1	1: 0.11
18.5.12	0.9	0.4	1.3	1: 0.44
25.5.12	0.8	0.4	1.2	1: 0.50
01.6.12	0.5	0.4	0.9	1: 0.80
08.6.12	0.4	0.3	0.7	1: 0.75
15.6.12	0.2	0.4	0.6	1: 2.00
22.6.12	0.2	0.3	0.5	1: 1.50
29.6.12	0.1	0.2	0.3	1: 2.00
06.7.12	0.1	0.2	0.3	1: 2.00
13.7.12	0.1	0.1	0.2	1: 1.00
20.7.12	0.1	0.1	0.2	1: 1.00
27.7.12	0.1	0.1	0.2	1: 1.00
03.8.12	0	0.1	0.1	0: 1.00
10.8.12	0	0	0	-

Table 2: Seasonal incidence of *Anoplophora versteegi* adults during 2013

Date of observation	Number of adult beetles/ plant			Sex ratio (Female: Male)
	Female	Male	Total	
09-04-2013	0.1	0	0.1	1:0
16-04-2013	0.2	0	0.2	1:0
23-04-2013	0.4	0.2	0.6	1:0.50
30-04-2013	0.7	0.4	1.1	1: 0.57
07-05-2013	0.8	0.8	1.6	1: 1.00
14-05-2013	0.7	0.6	1.3	1: 0.86
21-05-2013	0.6	0.6	1.2	1: 1.00
28-05-2013	0.5	0.4	0.9	1: 0.80
04-06-2013	0.3	0.4	0.7	1: 1.33
11-06-2013	0.2	0.4	0.6	1: 2.00
18-06-2013	0.2	0.3	0.5	1: 1.50
25-06-2013	0.1	0.2	0.3	1: 2.00
02-07-2013	0.1	0.1	0.2	1: 1.00
09-07-2013	0.1	0.1	0.2	1: 1.00
16-07-2013	0	0.1	0.1	0: 1.00
23-07-2013	0	0	0	-
30-07-2013	0	0	0	-

peak population of 1.3 beetles /plant on 18th May in the year 2012 and 1.6 beetles /plant on 7th May during 2013. Thereafter, beetle population declined and totally disappeared from the orchard from the fourth week of July to second week of August. The female beetles outnumbered the male during this population growth phase. However, the number of male beetles /plant was found to be more than females during population declining phase. The number of male beetles/plant was found to be more than females on 15th June, 2012 onwards till 6th July, 2012 and the sex ratio (Female : Male) varied from 1:1.5 to 1: 2.0 during that period. Similarly, male beetle was found to outnumber the female beetle from 4th June to 25th June in the year 2013 and sex ratio (Female: Male) varied from 1:1.50 to 1: 2.00. Thereafter, beetle population was found to maintain a sex ratio of 1: 1 for next three consecutive weeks in the year 2012 and two consecutive weeks in the year (Table 2).

Shukla and Gangwar (1989) observed the appearance adult trunk borer in the last week of March to second week of April in the state of Arunachal Pradesh. However, Azad Thakur and Shylesha (1996) recorded the beetle emergence from the last week of March to end of September where more than ninety per cent of

the beetles emerged during the period of first week of April to end of August. Padmanaban and Rai (2001) observed the beetle emergence at Basar, Arunachal Pradesh from last week of April to fourth week of June. The variation in the emergence might be due to the favorable weather prevailing during the period of adult emergence. The beetle population of citrus trunk borer during weekly intervals when examined critically in relation to meteorological parameters revealed that the adult beetles appeared in the Khasi mandarin orchard when weekly averages of maximum and minimum temperature were above 25.87 and 11.86°C, respectively and there was sudden fall of average morning and evening relative humidity. Beetle population was negatively correlated with the minimum temperature (Table 3) and showed significant impact on beetle population in the year 2013.

Table 3: Correlation co-efficient between adult beetle population and weather parameters during 2012 and 2013.

Weather Parameters	Correlation co-efficient (r)	
	2012	2013
Maximum temperature (°C)	-0.06	-0.10
Minimum temperature (°C)	-0.27	-0.72*
Morning Relative humidity (%)	-0.37	-0.18
Evening Relative humidity (%)	-0.04	-0.17
Rainfall (mm)	-0.26	-0.24
Number of rainy days /weekly	-0.03	-0.03
Sun shine hours (Hours)	0.38	0.29
Wind speed (km/hour)	0.41	0.19

The studies further showed that gradual rise in winter minimum temperature increased the beetle population and further rise in summer minimum temperature declined the beetle population. In the present study, the population reached its peak on 18th May, 2012 and 7th May, 2013 when average maximum temperature ranged from 25.41 to 29.96°C and 27.79 to 32.61°C, respectively during ascending phase of population growth and minimum temperature from 12.84 to 18.27°C and 15.19 to 19.93°C, respectively. Padmanaban and Rai (2001) observed the b temperature varied from 15.3°C to 26.5°C. Beetle emergence from last week of April to fourth week of June at Basar, Arunachal Pradesh when the maximum, It is evident that the emergence of adult was associated with the initiation of rainfall. Delay in initiation of rainfall delayed in emergence of trunk borer beetle in the year 2012. Heavy daily rainfall from third week of May onwards caused decline in beetle

population. Padmanaban and Rai (2001) also reported the emergence of citrus trunk borer beetle when rain fall and number of rainy days/month varied from 64.5 to 105 mm and 5 to 7 days, respectively. Adult beetle population of citrus trunk borer was positively correlated with bright sunshine hours and wind speed (Table 3). According to Azad Thakur and Shylesha (1996) emergence occurred during bright sunshine hours of the day and beetles remained active under bright sunshine conditions similar to the present findings.

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