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A study on pest complex of *Persea bombycina* (King Ex Hook. F.) kosterm. with special reference to *Myzus persicae* sulzer

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Abstract
A study was conducted for monitoring the insect pests infesting Som plants, *Persea bombycina* Kost. Planted in the botanical garden of the Department of Life Sciences, Dibrugarh University from February 2018 to June 2018. Altogether 25 genera of insects including 12 natural control agents were recorded by using different trapping methods. Density of *Myzus persicae* Sulzer and ants on *P. bombycina* were also evaluated throughout the study. It was found that high degree of correlation existed in between ant density with respect to aphid density. The overall finding showed that the primary host plant of muga silk worm, *Antheraea assamensis* Helfer though harbors a good numbers of insect pests including gall insect, leaf miner, and stem borer, in the particular study area *M. persicae* was more abundant and might be acting as a major pest.

Keywords: som, *Myzus persicae*, botanical garden, correlation, aphid

Introduction
The state of Assam located in Northeast India (25.570N, 93.25^{0}E) is endowed with the environment suitable for three varieties of silk producing insects Eri, Muga and Mulberry. The Muga silk, which is one of the rarest silk in the world, is endemic to this north eastern part of India, particularly Assam. This silk is mainly obtained from multivoltine, semi-domesticated silkworm, *Antheraea assamensis* Helfer which primarily feed on leaves of Som plant, *Persea bombycina* Kostermans [1]. But Som plants harbor great number of insects some of which act pests for the plant. A pest can be defined as an organism which exerts harmful effect on man and his property to a considerable extent. Insects are classified as pests when they are enough to prevent economic increment. The infestation by major pests are likely to reduce nutritional quality of the plant and thereby indirectly contribute towards reducing the production of good quality silk. The recorded insect on *P. bombycina* plants include gall insect (*Aspondylia* sp.), stem borer (*Zeuzera indica*), leaf defoliating beetle (*Apogonia* spp.), leaf miner (*Phytomyza* sp.), aphids and red tree ant (*Oecophylla smaragdina*) [2]. As the larvae of *A. assamensis* are reared in field under outdoor condition, its yield is affected by the nutritional quality of the host plant which in turn is dependent on pest infestation status of the plants. Literature on insect pest complex of *P. bombycina* is scanty. Aphids (Hemiptera) cause serious damage to many agricultural crops by building high population density through removal of plant nutrients and enough sap causing withering and death of the plants [3,4,5]. Although most of the aphid species are highly specialized to few host plants, some are polyphagous. For example, *Myzus persicae* Sulzer is an example of polyphagous insect pest which can destroy more than 400 plant species, most importantly dicotyledons [3].By identifying pest complex and determining the status of different pests of *P. bombycina* of *A. assamensis* will definitely help to design a powerful pest management strategy so that the muga silkworms donot suffer from nutritional insufficiency. Very little work has so far been done on the aspect. Keeping this view in the mind, the present investigation was designed to identify the insect complex of *P. bombycina* and study the density of *M. persicae* which is observed to infest tender shoots of the plant regularly.

Materials and Methods
Study area: The present study was conducted for monitoring the insect pests infesting Som (*P. bombycina*) plants planted in the botanical garden of the Department of Life Sciences, Dibrugarh University from February 2018 to June 2018. The plantation area covers an area of 100 square meters with 25 Som plants in 5×5 (Meters) spacing. Observations on the incidence of pest infestation were made at weekly intervals by using different trapping methods. The species, natures of the attack, total number were recorded.

Trapping and monitoring of insects pest complex
For trapping and monitoring of insect pest complex, the following six different trapping methods were applied.

Sticky Trap: Commercially available sticky yellow papers were hanged /clipped on the branches as well as the base of plants with the help of wire. Size of the sticky trap was 8*8=64 inch^2. After 10 days the traps were removed and new sticky traps were fixed in a similar manner.

Fluorescent lamp trap: Large funnel was placed on a water-containing beaker and the whole set was hanged in different branches and base of the plants. The fluorescent lamp was suspended just above the funnel. Insects being attracted into the fluorescent light fell down the funnel and got trapped. The next morning, the beaker was replaced with new one.

Tungstent filament bulb trap: This type of trapping procedure is similar to the Fluorescent lamp trapping described above. But instead of a fluorescent lamp, tungsten filament bulbs were used.

Light + yellow sticky trap: This type of trapping is a combination of two trapping methods, sticky trap and light trap. In this method, bulbs were fixed in the branches and base of the plants. Commercially available sticky yellow papers (Dimension - 8*8=64 inch^2) were hanged /clipped on the branches sounding the light source (Fig.2A). Every week, the sticky papers were removed and new sticky traps were fixed in a similar manner. The sticky papers were kept for insect pest identification.

Hand picking: Medium-to-large sized insects were picked up by hands using forceps and brushes. Then collected insect specimens were kept in plastic bottles for identification.

Identification and preservation

After collection of different insect complex, samples were stored in 100% ethanol for future reference. Identification was done under binocular microscope (Dewinter) based on numerous taxonomic identification keys following Imms [6], Jonathan and Kulkarni [7], Triplohorn and Johnson [8].

Estimation of total number of *Myzus persicae*

Five infested Som (*P. bombycina*) plants were selected and from each plant, 3 different branches were chosen. Then visual counting of aphids was done by counting total number of different stages of peach aphid, *viz*. 1stinstar, 2ndinstar, 3rdinstar, 4th instar, winged adult and wingless adult in 1cm long infested leaf. After counting of different stages of aphid in 1cm length of infested leaf, the total number of each stage (1st - 4th instars, adult winged, adult wingless) were counted by multiplying the total length of the infested leaf with a total number of aphids of each stage. In this way, total aphid populations were counted for each branch of the five plants.

Calculation and data analysis

Total count of each stage: The total count of different stages of aphids were calculated using the following formula-

Total number of a particular stage of aphid of an infested leaf in 1cm × Length of the infested leaf

Estimation of density

Density for each stage of *M. persicae* was calculated by taking the formula,

$D = S/B$ where D is the density of particular stage of aphid, S is the total number of aphid of a particular stage and B is the unit area which is the total number of branches considered. Here, total number of branch considered (B) =15. Similarly density of ants were also recorded

Statistical analysis

Correlation: Pearsons' Correlation test was performed to find out the relationship between density of aphids and ants in different Som plants using Microsoft office excel 2013.

ANOVA: One way ANOVA was performed to find out the significant difference of density of aphids in different plants undertaken at P = 0.05 taking a null hypothesis that no significant difference of aphid density was found in different plants. One way ANOVA was calculated using SPSS 2017.

Results

Identification of pest and natural enemies

Altogether 25 genera of insects belonging to 10 families of four orders were recorded (Table 1). The order Hemiptera contained highest numbers of families *viz*. Aphididae, Cicadellidae, Coreidae and Rhopalidae, followed by the order Coleoptera with 3 families (Chrysomelidae, Scarabaeidae and Coccinellidae), Diptera with 2 families (Cecidomyiidae, Agromyzidae) and Hymenopter with only one family (Formicidae). Taxonomic positions of each species are described in Table1. Two aphid species, *Myzus persicae* and *Phyllapis* species were found in abundance as compared to the other pests. Ten natural enemies *viz*. *Coccinella transversalis*, *Coccinella septempunctata*, *Anisolemnia dilata*, *Diomus notescens*, *Chilocorus nigritus*, *Chilocorus circumdatus*, *Miscraspis univattata*, *Miscraspis discolor*, *Harmonia dimidiata*, *Phrynocaria unicolor* on aphid species *Phyllaphis* sp. and *Myzus persicae* were recorded from the study area.

Estimation of green peach aphids, *Myzus persicae* population

Altogether six different stages of green peach aphids were recorded during the monitoring of aphid population in Som rearing area. They were 1st- 4th instar nymph, winged adult and wingless adult. A total of 7436 individuals of green peach aphid was recorded during the survey period. The highest count was recorded in 1st instar nymph with 2193 individuals (29.47% of the total count) and winged adult showed the lowest count with 479 (6.44% of the total count) individuals listed in table 2. In case of infested plant, highest infestation by green peach aphid was recorded in Plant 2 with 2299 (30.91% of the total count) of aphids. On the contrary plant 1 showed lowest number of aphid count (1100 individuals) with only 14.79% of the total infested aphid count (Table 2).

The density of different stages of green peach aphids was listed in table 3, 4 and 5. The highest density was recorded in plant 2 during 1st instar nymphal stage with 54.13 individuals/branch (37.02% of the total density) and in winged adult with 12.27 individuals/branch. Accordingly, the average highest density of aphids per plant was recorded in Plant 2 with 153.27(31.27% of the total count) number of aphid. On contrary, plant 1 showed the lowest number of aphid density with only 14.96% of the total infested aphid density (Table 3).

The density of ants in aphid infested Som plant ranged from 4.9 ants/ branch to 20.26 ants/ branch (Table 6). The highest density was found in plant 2 which was found directly proportional to the density of aphid. The lowest value of ant density was found in plant 1. The Pearson's correlation coefficient value was 0.896 at 0.05 level of significance.

Table 1: List of recorded insect fauna and their taxonomic positions

Phylum	Sub-phylum	Class	Order	Family	Genus	Species
Arthropoda	Hexapoda	Insecta	Hemiptera	Aphididae	*Myzus*	*persicae*
					Phyllaphis	sp.
				Cicadellidae	*Cofana*	*spectra*
					Bothrogonia	*addita*
					Cicadella	spp.
					Amritodus	spp.
				Coreidae	*Acanthocephala*	*terminalis*
				Rhopalidae	*Corizus*	*hyoscyami*
			Coleoptera	Chrysomelidae	*Charidotella*	*sexpunctata*
				Scarabaeidae	*Apogonia*	spp.
					Anisolemnia	*dilatata*
				Coccinellidae	*Coccinella*	*transversalis*
					Coccinella	*septempunctata*
					Harmonia	*dimidiata*
					Phrynocaria	*unicolor*
					Chilocorus	*circumdatus*
					Diomus	*notescens*
					Miscraspis	*univattata*
					Chilocorus	*nigritus*
					Miscraspis	*discolor*
			Hymenoptera	Formicidae	*Oecophylla*	*smaragdina*
					Red ant	sp.
					Black ant	sp.
			Diptera	Cecidomyiidae	*Aspondylia*	sp.
				Agromyzidae	*Phytomyza*	sp.

Table 2: Count of different stages of green peach aphid in different plants

Plants	Nymph (Instar)				Adults		Total
	1st	2nd	3rd	4th	Winged	Wingless	
Plant 1	434	300	139	91	61	75	1100
Plant 2	812	472	414	239	184	178	2299
Plant 3	385	392	337	287	102	150	1653
Plant 4	298	297	265	157	67	102	1182
Plant 5	264	278	253	150	65	98	1117
Total	2193	1739	1408	924	479	603	7436

Table 3: Density (Per branch) of green peach aphid in different plants

Plants	Nymphs (Instars)				Adults		Total
	1st	2nd	3rd	4th	Winged	Wingless	
Plant 1	28.93	20	9.27	6.07	4.07	5	73.33
Plant 2	54.13	31.47	27.6	15.93	12.27	11.87	153.27
Plant 3	25.67	26.13	22.47	19.13	6.8	10	110.2
Plant 4	19.87	19.8	17.67	10.47	4.47	6.8	78.8
Plant 5	17.6	18.53	16.87	10	4.33	6.53	74.47
Total	146.2	115.93	93.88	61.6	31.94	40.2	490.07

Table 4: Average density of different morphs of green peach aphid in studied Som plants

Groups	*Count*	*Sum*	*Average*	F	P-value	F critical
1st instar	5	146.2	29.24±14.62	7.17	0.0003	2.62
2nd instar	5	115.93	23.18±5.49			
3rd instar	5	93.88	18.77±6.83			
4th instar	5	61.6	12.32±5.17			
Winged	5	31.94	6.38±3.46			
Wingless	5	40.2	8.04±2.80			

Table 5: Average density of total green peach aphid population per plant

Groups	*Count*	*Sum*	*Average*	F	P-value	F critical
Plant 1	6	73.34	12.22±10.04	1.92	0.14	2.75
Plant 2	6	153.27	25.54±16.20			
Plant 3	6	110.2	18.36±8.18			
Plant 4	6	79.08	13.18±6.82			
Plant 5	6	73.86	12.31±6.16			

Table 6: Density of ants in different Som plant during study

Ant density	Som plant				
	Plant 1	Plant 2	Plant 3	Plant 4	Plant 5
	4.9	20.46	17.47	8.35	5.89

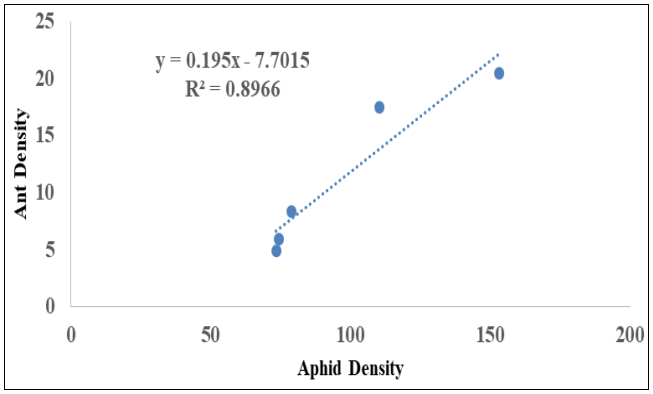

Fig 1: Correlation between ant densities with respect to aphid density

Fig 2: A- Set up of light and yellow sticky traps in the study area B- Ant -Aphid mutualism C- *Myzus persicae* infested leaves of *Persia bombycina* D- *Harmonia dimidiata* E-*Cheilomenes sexmaculata* F- *Chilocorus nigritus*

Discussion

The results presented from the study have revealed presence of 25 genera of insects on *P. bombycina* consisting of pest, predator and mutualists which reflects presence of multitrophic interaction in the ecosystem of the habitat containing different host plants of *A. assamensis*. Several of the insects are known pests of other plants. Insects like *Cicadella viridis*, *Cofana spectra*, *C. unimaculata* are known to infest paddy [9, 10], *Amritodus atiksoni* infests mango [11], *Charidotella sexpunctata* infests pumpkin [12], *Phytomyza* infests plants under brassicacae family [13], *Corizus* infests pumpkin and squash[14], *Apogonia* infests mango, cloves, tea, cocoa [13, 15] and *Myzus persicae* infests tomato, potato, tobacco etc [13]. The study has reflected that a detailed study is required to determine the pest status of the herbivorus insects harboured by the *P. bombycina* and their influence on nutritional quality of the plant which influence the muga silk productivity. Further we also recorded insect predators belonging to Coccinelidae family which included two coccinelids, *Cheilomenes sexmaculata*, *Chilocorus nigritus* not reported earlier from the seri ecosystem. The predatory coccinelids can be explored for controlling the pests in seri ecosystem as natural control agents.

In the present study, the abundance of aphids was found to be the highest among all. They compete with the resources of early instar silk worm larvae who feed on the tender shoots. However, the effect is not only limited to the tender shoots as they suck the cell sap and influence the overall quality of the plant. Aphids reproduce by both sexual and asexual way of reproduction. Variation in the population is associated with the sexual phase and high fecundity is associated with the asexual way of reproduction. Because of high asexual reproductive potential, population of aphid is often greater than the insects having biological control potency. The aphid population in the present study comprised the atate, wingless and adults. It was observed that the abundance and density of apterous (Wingless) was greater than the alates (Winged) forms (Table 4) along with the high abundance of the nymphal stages. This might be due to movement of the alates to newer host plants which might be due to its instinct to avoid overcrowding or predatory insects [16]. The present study also revealed difference in aphid population among different plants. Difference in aphid abundance and density in different plants may be due to the quality of plant chemicals. Positive correlation between the nitrogen content and the aphid count on the top leaves has been reported in other studies [17, 18]. Further the aphid consuming coccinelid beetles may also play important role in population density of the aphids. In an unpublished study of our laboratory we recorded positive correlation between aphid population and coccinelid beetles. In the present study we also recorded the ant population comprising both red and black ant and found ant density to be positively correlated with the aphid density. Aphid-ant interaction is one the best uncomplicated example of mutualism [19]. Aphids are protected by the ants and in return ants receive nutritious honeydew which they utilize in growth. Ants also help aphids to clean honeydew residue from the aphid colony, thus promoting a pathogen free healthy aphid colony. The black ants are harmful for the silk worms reared on *P. bombcina* as they disturb the late instar silkworms by crawling over their body, and can kill the early instar larvae and thus act as pest of the silkworms. The predatory ants like Weaver ant, *Oecophylla smaragdina* were observed also to carry the early instar silkworm to their nest probably to be used as food for the youngs in the colony.

Conclusion

The present study revealed that the primary host plant of *A. assamensis* harbors a good number of insects which includes pests and natural control agents. This was a pilot study carried out to record the density of *M. persicae* and ants on *P. bombycina* and it is concluded that *M. persicae* may serve as a major pest of *P. bombycina*. However further research is required to establish it.

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Authors Contribution

DSB is responsible for the concept, design of experiment, analysis and editing of the write up. DD is responsible for carrying out the experiment, analysis and the write up.

References

1. Choudhury SN. Muga Silk Industry, Directorate of Sericulture and Weaving, Govt. of Assam, Gauhati, Assam, India, 1981, 1-33.
2. Borgohain A. Different insect pests in muga host plant Som *(Persea bombycina*) ecosystem. International journal of development research. 2015; 5(7):4895-4896.
3. Jawale C. Agriculture Entomology and Pest Pesticides, Anchor Academic Publishing, Hamburg, 2016, 5.
4. Jaouannet M, Rodriguez PA, Thorpe P, Lenoir CJ, MacLeod R, Escudero-Martinez C, Bos JI. Plant immunity in plant-aphid interactions. Frontiers in Plant Science. 2014; 5:663.

5. Sorensen JT. Aphids. In: Resh VH, Carde RT (eds) Encyclopedia of insects, Elsevier, Burlington, 2009, 27-31.
6. Imms AD. A general text-book of entomology, including the anatomy, physiology, development and classification of insects. Methuen& Co. Ltd, London, England, 1948.
7. Jonathan JK, Kulkarni PP, Tikader BK. Manual: Collection, Preservation, and Identification of Insects and Mites of Economic importance, 1986, 1-307.
8. Johnson NF Triplohorn CA. Borror and DeLong's Introduction to the study of Insects. Belmont, CA: Thompson Brooks/ Cole, 2005, 268-554.
9. Ane NU, Hussain M. Diversity of insect pests in major rice growing areas of the world. Journal of Entomology and Zoology Studies. 2016; 4(1):36-41.
10. Ghosh LK. Handbook on Hemipteran pests in India, Zoological Survey of India, Kolkata, 2008, 226-227.
11. Srinivasa N, Ramya N, Meshram NM. Taxonomic Studies of Leafhoppers (Hemiptera: Cicadellidae) Fauna Associated with Mango from India. Interntional Journal of Current Microbiology and Applied Sciences. 2017; 6(10):2108-24.
12. Rahman A, Bathari M, Borah P, Taye RR, Patgiri P. Diversity Of insect species along with their host in Assam Agriculture University, Jorhat. Journal of Entomology and Zoology Studies. 2017; 5(6):2307-12.
13. Waterhouse DF. The major arthropod pests and weeds of agriculture in Southeast Asia: distribution, importance and origin, Australian Centre of International Agricultural Research. (ACIAR), Monograph No 21, Canberra, 1993, 11-22.
14. https://libocsb.kku.ac.th/img/5192064j/article.php?900da4=black-and-red-squash-bug
15. Emmanuel N, Sujatha A, Gautam B. Record of leaf chafer beetles Adoretus versutus Harold and *Apogonia blanchardi* Ritsema on cocoa (*Theobroma cacao* L.) in Andhra Pradesh. Insect Environment. 2010; 16(1):23.
16. Tegelaar K. Dynamics of the aphid-ant mutualism. (Dissertation). Stockholm University, Stockholm, Sweden, 2015, 4-5.
17. Myers SW, Gratton C, Wolkowski RP, Hogg DB, Wedberg JL. Effect of soil potassium availability on soybean aphid (Hemiptera: Aphididae) population dynamics and soybean yield. Journal of Economic Entomology. 2005; 98(1):113-120.
18. Dixon AFG, McKay S. Aggregation in the sycamore aphid *Drepanosiphum platanoides* (Schr.) (Hemiptera: Aphididae) and its relevance to the regulation of population growth. The Journal of Animal Ecology. 1970; 39(2):439-454.
19. Stadler B, Dixon AF. Ecology and evolution of aphid-ant interactions. Annual Review of Ecology Evolution and Systematics. 2005; 20(36):345-372.