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Insect Pests Diversity of Nursery and Plantation in Bangladesh

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Abstract **– A total number of 314 individuals representing 37 families under 9 Orders were recorded. The 72 insect pest species were identified out of a total of 82 insect pests species. Of these Lepidopteran 62% and Coleopteran 19%. The highest number of insect pest individuals recorded in the month of July (18.89%) and lowest in September (1.91 %). The highest number of insect population was recorded in Rajshahi (14.33%) and the lowest number of individuals in Maherpur (0.31%). The highest number of pest population was recorded for *Sweitenia macropylla* king (29.30%) and the lowest number of individuals was *Aegle marmelos* L. Shannon's diversity index and simpson's diversity index represent moderate value (H = 3.429) and moderately low value (λ = 0.091) respectively indicating moderate diversity richness for insect pests of nursery and plantation. The value of species evenness (E = 0.778) tends to be higher indicating that the species are eventually distributed.**

Keywords **– Insect Pests, Diversity, Host Plants, Abundance, Diversity Index, Evenness.**

I. INTRODUCTION

Insect are the most diverse and dominant group of the world. They are everywhere, by far, the most common animal on our planet. Globally, insects are three-fourth out of the total living organism (Bulbul S, *et al.* 2011).Most of them have not been described. Although over 1 million species of insect have been described, current estimates of total insect diversity vary from 2-10 million species (Samways, 2005). In the world, some 900 thousand different kinds of living insects are known, this representation approximates 80% of the world's species and the number of described species is approximately 91,000, undescribed species of insect in the United States, however, is estimated at some 73,000 (Bug Info, November 2018). A Total approximately 300 insect species were identified out of 6000 (Six thousand) Collected insect in the insect Museum of the Protection Division of Bangladesh Forest Research Institute (BFRI), Chattogram. A total of 2,470 different Species of insects was studied and identified over a period of 30 years, out of 29 Orders 20 were listed and housed in the insect Museum of the Zoology department of Chittagong University (Bhuiya and Mazumder, 2016). Beetles (Coleoptera) make up 40% of described insect species, but some entomologists suggest that flies (Diptera) and Hymenoptera (waps, bees and ants) could be as diverse or more so five orders of insects stand out in their levels of species richness: Hymenoptera, Diptera, Coleoptera, Lepidoptera and the Hemiptera. A recent study estimated the number of beetles at 0.9-2.1 million with a mean of 1.5 million (Stork, N.E; *et al* 2015). Nursery is the place where plants are propagated and grown to usable size. In nursery, different kind of fruits, forest, medicinal plants and ornamental species seedlings are grown. Nursery is the place where seeds are sown or grafts are transplantation to raise seedlings with the target to achieve healthy stock for transplantation in orchards, at this stage, because of tender shoots and succulent leaves, they are always vulnerable to attack by

insect pests (Jha & sen-sarma). Diverse group of incest pests attack nursery seedlings. Pests and diseases are also common in nursery, seeds trees in homestead, road sides, and crop land in plantation (Rahman *et al.* 1997). The damage is more likely to be severe in the nurseries, at this stage the plants are young tender and thus more susceptible to various pest attack (Forest entomology series, Bulletin-7). Diversity depends on different key factors such as habits, topography, climates. This study area have very imaging diversity but no detailed research work about diversity on the insect pests on nursery and plantation in Bangladesh. The objective of the study was to collection and identify and calculate diversity, species richness and evenness of insect pests of nursery and plantation in different district of Bangladesh.

II. MATERIALS AND METHODS

Survey Areas

The study was conducted from 2017-2020 in different nursery and plantation of different districts in Bangladesh. A total 242 Nos nursery of 32 selected districts of Dhaka, Rajshahi, Khulna, Chattogram, Barishal, Rangpur division which are Mid, North-west, south-west, Sothern and Northan parts of Bangladesh were selected for the survey area of study. Dhaka, N. Gonj, Faridpur, Chandpur of Dhaka division, Rajshahi, Bogura, Naogan, Sirajgong, Pabna, Nator districts of Rajshahi Division. Khulna, Jessore, Bagherhat, Narail,Jhenaidha, Magura, Khulna, Kushtia Meherpur, Chuadanga, Satkhira districts of Khulna Division and Chottagram, Feni, Noakali, districts of Chattogram division, Barisal, Perojpur, Jhalokati of Barishal Division and Nilphamari, Dinajpur, Thakurgaon, Panchagarh, Rangpur districts of Rangpur division were designed for survey (Fig. 1). Regular field survey was conducted in selected nursery and plantations in selected area to this study.

Sample Collection

The larvae of insect pests were collected from different areas during the morning. Sometimes in the evening and after sunset. Queerness Method was applied also, we interviewed worker, nursery owner about land area, infestation and damage of insects, number of seedlings etc. During sample collection we used sweep net, plastic bail, Killing jar, Alcohol, Brush hand gloves and sample bag. All samples were brought to the Entomology laboratory of the Forest Protection Division (FPD) of Bangladesh Forest Research Institute (BFRI). Specimen were examined and sorted under microscope, moulted on pins and dried. After labeling, the specimens were identified up to genus or species level. Recorded insect order, family, and collection month, and host plant from different location of different districts of Bangladesh.

Identification

The common specimens were identified by comparing reference in the insect museum of Forest Protection Division (FPD) of Bangladesh, Forest Research Institute (BFRI). Insect pest identification were done by using the key and description used by Pests and the followed references of Browne, G.F., (1968), Beeson, F.G., (1941), Baksha, M.W. (2008), Antram (1986), D.O. Garg (1978).

Insect Pests Calculation of Deferent Parameter

Collected and recorded data were analysed and calculated percentage (%) of insect pests on diversity to deferent parameter. These of monthly abundance, Insect orders, families, host plants of insect pests and also calculated that month-wise population rarefaction (Cumulative) curve of the faunal assemblage of insect pests.

Diversity Richness

Diversity was measure by the mostly used Shannon diversity index (H) and Simpson diversity index (λ) as model. Using the following two formula for diversity measured:

Shannon diversity index (H) = $\sum_{-i=0}^{s} = 1\text{Pi}ln\text{pi}$

Simpson diversity index ((λ) = $\sum_{i}^{s} = 1\text{pi}^2$

Where, P = Proportion, S = Number of species, *In* = Natural log.

∑ = Sum of the calculation values of (i = 1, 2, 3 …s)

n / N = Individuals of one particular species (n) divided by the total number of individuals in all species (N). Simpson index of diversity (1- λ): The index represent the probability that two individuals randomly selected in a community /Society will belong to different species. Simpson reciprocal index (1/ λ): The index represent a community Society only the number of equally common species that will the observed Simpson index.

Evenness

Evenness was calculated by using basis on Shannon diversity index given below: Species evenness (E) = $\frac{H}{ln(S)}$.

Fig. 1. Map of Bangladesh indicating the survey area in different districts.

III. RESULTS

A total of 314 individuals were recorded in these study (Table 1). The highest number of insect pests (84) of the species *Hypsiphila robusta* (Pyralidae: Lepidoptera) and the lowest number (1) for *Bemisia* spp. (Aleurodidae: Hemiptera.), *Podontia quatuordecim punctata* (Chrysomelidae: Coleptera), *Criculla trifenestrata* (Saturniidae: Lepidoptera), *Inderbela quardinotata* (Inderbelidae: Lepidoptera), *Thosa* spp. (Limacodidae: Lepidoptera). In March, a total number of 34 individuals was collected. The highest number of insect pests (9)

of the species *Hypsiphila robusta* (Pyralidae : Lepidoptera) and the lowest number (1) for *Psiloptera fastuosa* (Buprestidae : Colioptera), *Amrapiplosis amraemyia* (Cecidomydae : Hemiptera), *Trioza fletcheri* (Psyllidae : Homiptera), *Diaphorina citri* (Psyllidae : Homiptera), *Oryctes rhinoceros* (Scarabaeidae : Colioptera), *Argyroploce tonica* (Eucosmidae : Lepidoptera), *Cricula trifenestrata* (Suterniidae : Lepidoptera), *Drosicha* spp. (Margarodidae : Hemiptera), *Helopeltis antonii* (Capsidae : Hemiptera), *Inderbela tetraonis* (Inderblidae : Lepidoptera), *Sotenopsis germinate* (Formicidae : Hymenoptera). In April, a total number of individuals (45) was collected. The highest number of insect pests (12) of the species *Hypsiphila robusta* (Pyralidae : Lepidoptera) and the lowest number (1) for *Aspidiotus* sp. (Diaspididae : Hemiptera), *Macalla* Sp., *Orthaga exvinacea* (Pyralidae : Lepidoptera), *Agrotis ipsilon* (Noctuidae : Lepidoptera), *Calopepla leayna* (Chysomeli--dae: Coleoptera), *Cryptothelea crameri* (Psychidae : Lepidoptera), *Idiocerus*Sp. (Margarodidae :Hemiptera), *Icerya pulcher*. (Margarodidae : Hemiptera), *Eurama blanda* (Pieridae: Lepidoptera), *Horaga viola* (Lymentrid--ae : Lepidoptera), *Lymantria obfuscate* (Lymantriidae : Lepidoptera), *Metanastria hytaca* (Lasiocampidae: Lepidoptera), *Papilio demoleus* (Papilionidae: Lepidoptera), *Pseudococcus* Spp.(Coccidae: Hemiptera), *Sotenopsis germinate* (Formicidae: Hymenoptera), *Teranychus urticae* (Tetranychidae: Acarina), *Thretra* Sp. (Sphirigedae: Lepidoptera), *Bactocera rubus* (Cemambycidae:Coleoptera), *Coleophora* sp. (Coleophoridae), *Pseudococcidae Filamentosus* (Pseudococcidae: Hemiptera). In June, a total number of individuals (40) was collected. The highest number of insect pests (12) of the species *Hypsiphila robusta* (Pyralidae: Lepidoptera) and the lowest number (1) for *Amrapiplosis amraemyia* (Cecidomydae: Hemiptera), *Oryctes rhinoceros* (Scarabaeidae: Coleoptera), *Myllocerus* Sp. (Curculionidae: Coleoptera), *Brachytrypes portentosus* (Glylidae : Othoptera), *Bemisia* sp. (Aleurodidae: Hemiptera.), *Podontia Quatuordecimpunctata* (Chysomellidae : Coleoptera), *Idiocerus* Sp. (Margarodidae : Hemiptera), *Eurama blanda* (Pieradae : Lepidoptera), *Acherontia styx* (Sphingidae : Lepoptera), *Chelidonium cinctum* (Cerambycidae : Coleoptera), *Phyllocnistis citrella* (Phyllocnistidae : Lepidoptera). In July, a total number of individuals (59) was collected. The highest number of insect pests (16) of the species *Hypsiphila robusta* (Pyralidae: Lepidoptera) and the lowest number (1) for *Acrocercops telestis* (Lithocolitidae : Lepidoptera), *Phyllocnistis* sp. (Lithocolitidae: Lepidoptera), *Caloptilia iselaea*, *Pinnaspis scrobicularum* (Diaspididae: Hemiptera), *Arthoschista hilaralis* (Pyralidae: Lepidoptera), *Glyphodes* Sp. (Pyralidae: Lepidoptera), *Macalla* Sp. (Pyralidae: Lepidoptera), *Orthaga exvinacea* (Pyralidae: Lepidoptera), *Trioza fletcheri* (Psylidae : Hemiptera), *Popillia japonica* (Scarabaeidae : Coleoptera), *Alcidodes frenalus* (Curculionidae : Coleoptera), *Podontia Quatuordecimpunctata* (Chysomelidae: Coleoptera), *Eurema* sp. (Pieridae: Lepidoptera), *Labdia semicoccinea* (Cosmopleragidae: Lepidoptera), *Phyllocnistis citrella* (Gracillariidae : Lepidoptera). In August, a total number of individuals (29) was collected. The highest number of insect pests (10) of the species *Deporaus marginatus* (Curculionidae : Coleoptera) and the lowest number (1) for *Trioza fletcheri* (Psyllidae : Hom), *Pauropsylla* sp. (Psyllidae : Homoptera), *Alcidodes frenalus* (Curculionidae : Coleoptera), *Pagiophlecus longclavis* (Curculionidae : Coleoptera), *Calopepla leayna* (Chysomelidae : Coleoptera), *Podontia Quatuordecimpunctata* (Chysomelidae : Coleoptera), *Euproctis fraternal* (Lymantriidae : Lepidoptera), *Odontotermes* sp. (Termitidae : Isoptera), *Oecophylla samaragdina* (Formicidae: Hymenoptera), *Tetranychus* Spp. (Tetranycidae : Acarina). In September, a total number of individuals (06) was collected. The highest number of insect pests (3) of the species *Inderbela quardinotata* (Inderbelidae : Lepidoptera), (Curculionidae : Coleoptera) and the lowest number (1) for *Tetranychus* Spp. (Tetranycidae : Acarina). In November, a total number of individuals (20) was collected. The highest number of

insect pests (7) of the species *Hypsiphila robusta* (Pyralidae : Lepidoptera) and the lowest number (1) for *Amrapiplosis amraemyia* (Cecidomydae: Hemiptera), *Macalla* Sp.(Pyralidae: Lepidoptera), *Orthaga exvinacea* (Pyralidae : Lepidoptera), *Deporaus marginatus* (Curculionidae : Coleoptera), *Cricula trifenestrata* (Suturniidae : Lepidoptera), *Idiocerus* Sp.(Margarodidae : Hemiptera), *Icerya pulcher* (Margarodidae : Hemiptera), *Nyphantis serinopa* (Xyloryictidae : Lepidoptera), *Tetranychus* (Tetranychidae : Acarina), *Phyllocnistis citrella* (Phyllocnistidae : Lepidoptera). In December, a total number of individuals (40) was collected. The highest number of insect pests (16) of the species *Hypsiphila robusta* (Pyralidae: Lepidoptera) and the lowest number (1) for *Macalla* Sp. (Pyralidae : Lepidoptera), *Orthaga exvinacea* (Pyralidae : Lepidoptera), *Oryctes rhinoceros* (Scarabaeidae: Coleoptera), *Platypeplus approta* (Eucosmidea : Lepidoptera), *Anacampis rivalis* (Gelechidae : Lepidoptera), *Inderbela Quadrinotata* (Inderbelidae : Lepidoptera), *Odontotermes obesus* (Termetidae : Isoptera), *Papilio demoleus* (Papilionidae : Lepidoptera), *Teranychus urticae* (Tetranychidae : Acarina). Percentage of order wise population (Fig 2), Out of the recorded 9 order Lepidoptera (62%) were the highest number of the total individuals of the insect pest species. The lowest number of the order Othoptera (0.32%) were recorded. Percentage of Family wise (Fig. 3). Month wise population (Fig. 4), the highest number of insect pests were recorded in the month of July (18.89%), Followed by April (14.33%), June (12.74%), December (12.74%), March (10.83%), August (9.24%), February (7.96%), November (6.37%), January (5.1%) and the lowest in September (1.91%) (Table 2). Host plant wise population shown to (Fig. 5), the highest number of insect pest population to *Sweitenia Macropylla* king. (29.30%) and the lowest number of individuals (0.32%) For *Aegle Marmelos* L., *Dillenia indica*, *Syzygium samaranges* Merr., *Terminalia catapa* Linn., *Bambusa vulgaris* scherd, *ficus benghalensis* Linn., *Albizia rcherdiana* Voigt, *Acacia mangium* willd, *Terminalia bellirica* Roxb., *Phyllanthus emblica* L., *Cinnamomun tamala* Fr., *Thuya orientalis* Linn., respectively. Month-wise population rarefaction cumulative curve of the funal assemblage of nursery and plantation in Bangladesh (Fig 6), the total 82 estimated species were recorded of nursery and plantation under 9 orders, Lepidoptera are highest number of individuals (195), where Coleoptera (61), Hemiptera (22), Homoptera (11), Diptera (8), Isoptera (6), Hymenoptera (5), Acarina (5) and the lowest number of individuals Othoptera (1). Diversity richness, the values of Shannon diversity index (H), Simpson diversity index (λ) and evenness (E) were calculated separately as H = 3.42993, λ = 0.09118 and E = 0.77834 respectively (Table 2).

IV. DISCUSSION

A total number of 82 species of insect pests under 37 families belonging 9 orders were identified from 241 nursery and plantation of 32 districts in Bangladesh. 72 species out of 82 species of insect pests were identified rest of 10 species were unidentified. Approximately more than 9 Orders of insect pests species like Lepidoptera, Coleoptera, Diptera, Hymenoptera, Hemiptera, Homoptera, Orthoptera, Isoptera, Acarina as described insect are more common of nursery and plantation in Bangladesh. Of the total of 5688 insects belonging 133 families and 21 orders recorded from the traps, the hymenopterans were the most abundant (3229) while Diptera was the most diverse with 39 families fallowed by Coleoptera with 21 families (Kyerematen., R. *et al.*, 2014). Their occurrence is seasonal in different habitats among them *Hypsiphyla robusta* (84) were the most dominant species of insect pests in this account of number of individuals followed by *Deporaus marginatus* (30), *Cricula trifenestata* (18). So the most abundant species for the entire survey was hypshiphila robusta which belong the family pyraliadae under the order lepidoptera. *Daporus Marginatus* were the second most abundant species which belong the family curculionidae under the order coleopteran (Table 1). Among the recorded species, 9

species having 5-10 individuals and 28 species having 2-4 individuals and 42 species were single individuals showing of each (Table 1). The Insect order Lepidoptera were the most diverse group followed by the coleopteran (Fig. 2). Insect family Piralidae were the most dominant family followed by the curculionedae (Fig. 3). The highest population of insects were recorded in the month of July. In Bangladesh June and July is the rainy season. It is the favourable time for the insect growth and reproduction (Fig 4). As a host plant, *Sweitania Mahagoni* were the more suitable host plants attacking insect pest followed by *Mangifera indica* (Fig 5). Diversity can be quantified in many different ways. The two main factors taken into account when measuring diversity are richness and evenness. Diversity depends not only on richness but also evenness. Richness is a measure of the number of different kinds of organisms present in a particular area. Then evenness compares the similarity of the population size of the species present richness is computed by using Shannon's diversity index (H) and Simpsons's diversity index (λ). Ganeshaih *et al.* (1997) stated that the diversity indices H and λ appeared useful as they incorporated species richness. In this study, Shannon diversity index and Simpsons diversity index represent moderate value (H = 3.42993) and moderately low value (λ = 0.09118) respectively indicating moderate diversity richness for insect pests species in nursery and plantation in Bangladesh area (Table 2). Ludwig and Reynolds (1988) revealed that the value of λ decrease with increasing diversity. Evenness index provides an insight into the relative abundance of the species in the community. Sanjayan *et al.* (1995) described the value of E tend to be zero indicates that the species becomes more dominant in a community. The value of E tends to be higher indicating the species are evenly distributed. In this study, the value of E (0.77) tends to be higher indicating that the species are eventually distributed.

Table 1. list of different species of insect pest of nursery / plantation recorded with monthly abundance in Bangladesh.

Family (Order)	Local Name	Scientific Name (Pest of Insect)	Name of Plant (Scientific Name / Local name)	Monthly abundance										Total
				Ja.	Fe.	Ma.	Ap.	Jn.	Ju.	Au.	Se.	No.	De.	
Lithocolletidae (Lep:)	Leaf miner	*Acrocercops* Sp.	*Licthi chinensis* sonn./ Licthi	0	0	0	0	0	4	0	0	0	0	4
	Leaf miner	*Acrocercops telestis* Myrick	*Syzygium cumini* Linn./Jam	0	0	0	0	0	1	0	0	0	0	1
	Scale insect	*Aspidiella* sp.	*Switenia mahogoni* Linn./Mahogony	0	0	3	0	0	0	0	0	0	0	3
	Leaf miner	*Phyllocnistis* sp.	*Polyalthia Longifolia* Sonn./Dabdaru	0	0	0	0	0	1	0	0	0	0	1
Buprestidae (Col:)	Leaf Beetle (defoliator)	*Psiloptera fastuosaFbr.*	*Acacia auriculiformis* A. Cunn./Akashmony	0	0	1	0	0	0	0	0	0	0	1
Diaspididae (Hem:)	Sapsucker (Mealy bug)	*Aspidiotus* sp.	*Samanea saman* jacq. /Raintree	0	0	0	1	0	0	0	0	0	0	1
	Leaf roller	*Caloptilia iselaea* Meyrick	*Spondias pinnata* Kurz. /Amra	0	0	0	0	0	1	0	0	0	0	1
	Sapsucker	*Pinnaspis scrobicularum* Green	*Elaeocarpus floribundus* Bl./Jalpai	0	1	0	0	0	1	0	0	0	0	2
	Red scale	*Aonidiella auranti*	Citrus Spp. / Lemon	0	1	0	0	0	0	0	0	0	0	1

Family (Order)	Local Name	Scientific Name (Pest of Insect)	Name of Plant (Scientific Name / Local name)	Monthly abundance										Total
				Ja.	Fe.	Ma.	Ap.	Jn.	Ju.	Au.	Se.	No.	De.	
		Maskell												
Cecidomyidae (Dip:)	Slaty gall Insect	*Amrapiplosis amraemyia* Rao	*Mangnifera indica* Linn./Amm	0	1	1	0	1	2	0	0	1	0	6
	Reddish gall	*Amradiplosis echinogalliperda* Mani	*Mangifera indica* Linn./Amm	0	0	0	0	0	0	0	0	0	2	2
Pyralidae (Lep:)	Defoliator	*Arthoschista hilaralis* Walker	*Anthocephalus chinensis* Lamk. /Kadam	0	1	0	3	0	1	0	0	0	0	5
	Shoot borer	*Glyphodes* Sp.	*Artocarpus heterophyllus* Lamk /Jackfruit	0	0	0	0	0	1	0	0	0	0	1
	Shoot borer	*Hypsiphyla robusta* Moore	*Swietenia mahogoni* Linn. / Mahogony	4	6	9	12	12	16	2	0	7	16	84
	Skelitonizer	*Macalla* Sp.	*Mangifera indica* Linn./Amm	0	0	0	1	0	1	0	0	1	1	4
	Leaf titcher	*Agrotera basinotata* Hampson	Syzygium cumini Linn./ Jam	0	1	0	0	0	0	0	0	0	0	1
	Leaf Webber	*Orthaga exvinacea* Hampson	*Mangifera indica* Linn./ Amm	0	0	0	1	0	1	0	0	1	1	4
Psyllidae (Hom:)	Psyllid	*Heteropsylla cubana* rawford	*Leucaena leucocephala* Lam. / Ipil-Ipil	0	0	2	0	0	0	0	0	0	0	2
	Gall insect	*Trioza fletcheri* Crawford	Terminalia arjuna Roxb. /Arjun	0	0	1	0	2	1	1	0	0	0	5
	Psyllid	Unknown	*Swietenia mahogoni* Linn/ Mahagoni	0	0	1	0	0	0	0	0	0	0	1
	Gall	*Pauropsylla* sp.	*Cinnamomun tamala* Fr./ Tajpata	0	0	0	0	0	0	1	0	0	0	1
	Psyllid	*Diaphorina citri* Kuwayana	*Citrus* Spp. / Lemon	0	0	1	0	0	0	0	0	0	0	1
Scarabaeidae (Col:)	Shoot borer	*Oryctes rhinoceros* Linn.	*Cocos nucifera* Linn. /Coconut	0	0	1	0	1	0	0	0	0	1	3
	Defoliator	*Popillia japonica* Newman	*Vitis Vinifera* Linn. / Grape	0	0	0	0	2	1	0	0	0	0	3
Curculionidae (Col :)	Top shoot Borer	*Alcidodes frenalus* Faust	*Mangifera indica* Linn./Amm	0	1	4	0	0	1	1	0	0	2	9
	Leaf cutter Weevil	*Deporaus marginatus* Pascoe	*Mangifera indica* Linn./Amm	0	4	2	0	3	4	10	0	1	6	30
	Defoliator	*Myllocerus* Sp.	*Aegle marmelos* L. /Wood apple	0	0	0	0	1	0	0	0	0	0	1

Family (Order)	Local Name	Scientific Name (Pest of Insect)	Name of Plant (Scientific Name / Local name)	Monthly abundance										Total
				Ja.	Fe.	Ma.	Ap.	Jn.	Ju.	Au.	Se.	No.	De.	
	Collar borer	*Pagiophlecus longclavis* Marshall	*Swietenia macrophylla* King/Mahogny	0	0	0	0	0	0	1	0	0	0	1
Noctuidae (Lep:)	Catworm	*Agrotis ipsilon* Hufnagel	*Eucalyptuscamaldulensis*Dehn./Eucalyptus	0	0	0	1	0	0	0	0	0	0	1
Eucosmidae (Tor.) (Lep:)	Leaf folder	*Argyroploce tonica* Meyrick	*Elaeocarpus floribundus*Bl./Jalpai	0	0	1	0	0	0	0	0	0	0	1
	Leaf roller	*Platypeplus approta* Meyrick	*Licthi chinensis* sonn./ Litchi	0	0	0	0	0	0	0	0	0	1	1
	Shoot borer	*Laspeyresia* sp.	*Azadirachta indica* A. /Neem	0	0	2	0	0	2	0	0	0	0	4
Gelechiidae (Lep:)	Defoliator	*Anacampis rivalis*	*Terminalia bllirica* Roxb./Bohera	0	0	0	0	0	0	0	0	0	1	1
Gryllidae (Orth.)	Field Cricket	*Brachytrypes portentosus* Lichteins	*Cocos nucifera* Linn./ Coconut	0	0	0	0	1	0	0	0	0	0	1
Aleurodidae (Hem.)	White fly	*Bemisia* sp.	*Psidium guajava* Linn. /Guava	1	1	0	0	1	0	0	0	0	0	3
Chrysomelidae (Col.)	Defoliator	*Calopepla leayna* Latr.	*Gmelina arborea* Linn / Gamer	0	0	0	1	0	0	1	0	0	0	2
	Defoliator	*Podontia Quatuordecimpunctata* Linn.	*Spondias pinnata* Kurz./Amra	1	1	0	0	1	1	1	0	0	0	5
Pshycihidae (Lep.)	Bagworm	*Cryptothelea crameri* westwood	*Thuya orientalis* Linn./Thuja	0	0	0	1	0	0	0	0	0	0	1
Suturniidae (Lep.)	Defoliator	*Attacus atlas* Linn.	*Lagerstroemia speciosa* L./Jarul	0	0	0	0	2	0	0	0	0	0	2
	Defoliator	*Cricula trifenestrata* Helfer	*Mangifera indica* Linn./Amm	1	1	1	3	0	6	0	0	1	5	18
Margarodidae (Hem.)	Sap-sucker	*Drosicha* spp.	*Artocarpus heterophyllus* Lamk /Jackfruit	0	0	1	0	0	0	0	0	0	0	1
	Leaf hoper	*Idiocerus* Sp.	*Mangifera indica* Linn./Amm	0	1	0	1	1	0	0	0	1	0	4
	Leaf scale	*Icerya pulcher* Leonardi	*Mangifera indica* Linn./Amm	0	0	0	1	0	2	0	0	1	0	4
Pieridae (Lep.)	Defoliator	*Eurama blanda* Boisduval	*Albizia lebbeck* L. / Kori	2	0	0	1	1	0	0	0	0	0	4
	Defoliator	*Eurema* sp.	*Samanea saman* Jacq. /	3	0	0	0	4	1	2	0	0	0	10

Family (Order)	Local Name	Scientific Name (Pest of Insect)	Name of Plant (Scientific Name / Local name)	Monthly abundance										Total
				Ja.	Fe.	Ma.	Ap.	Jn.	Ju.	Au.	Se.	No.	De.	
			Rain tree											
Capsidae(Hem)	Sapsucker (Moshok bug)	*Helopeltis antonii* Signoret	*Azadirachta indica* A./Neem	0	0	1	0	0	0	0	0	0	0	1
Lymantriidae (Lep.)	Defoliator	*Horaga viola* Moore	*Elaeocarpus floribundus* Bl./Jalpai	0	0	0	1	0	0	0	0	0	0	1
	Leaf Defoliator	*Lymantria obfuscate* walk	*Prunus avium* /Cherry	0	0	0	1	0	0	0	0	0	0	1
	Defoliator	*Euproctis fraternal* M.	*Ziziphus mauritiana* Lam. / Kul	0	0	0	2	0	0	1	0	0	0	3
Inderbelidae (Lep.)	Bark eating	*Inderbela tetraonis* Moore	*Mangifera indica* Linn./Amm	0	0	1	2	0	0	0	0	0	0	3
	Bark eating	*Inderbela Quadrinotata* Walker	*Albizia procera* Roxb. / Kori	1	0	0	0	0	0	0	3	3	1	8
Cosmopleragidae (Lep)	Leaf miner	*Labdia semicoccinea* Stainton	*Spondias pinnata* Kurz /Amra	0	0	0	0	0	1	0	0	0	0	1
Lasiocampidae (Lep.)	Defoliator	*Metanastria hytaca* Cramer	*Terminalia catappa* /Kat Badam	0	0	0	1	0	0	0	0	0	0	1
	Defoliator	*Streblote siva* Lefbvre	*Swietenia macrophylla* King./ Mahogony	2	0	0	0	0	0	0	0	0	0	2
Xyloryctidae (Lep.)	Defoliator	*Nyphantis serinopa* Myrick	*Cocos nucifera* Linn./ Coconut	0	0	0	0	0	0	0	2	1	0	3
Termitidae (Isop.)	Termite	*Odontotermes obesus* Rambur	*Cocos nucifera* Linn./ Coconut	0	1	0	0	3	0	0	0	0	1	5
	Termite	*Odontotermes* sp.	*Camaldulensis Dehn./* Eucalyptus	0	0	0	0	0	0	1	0	0	0	1
Papilionidae (Lep.)	Defoliator	*Papilio demoleus*Linn.	*Citrus Lemom* /Lemon	0	0	0	1	0	0	0	0	0	1	2
Gracillariidae (Lep.)	Leaf minor	*Phyllocnistis citrella*	*Polyalthia longifolia* Soon. /Debdaru	0	0	0	0	0	1	0	0	0	0	1
Coccidae (Hem.)	Mealy bug	*Pseudococcus* Spp.	*Bambusa valgaris* Schrad. / Bamboo	0	0	0	1	0	0	0	0	0	0	1
Formicidae (Hyme.)	Ants	*Sotenopsis germinate* Fabr.	*Calamus tenuis* Roxb. / Cane	0	0	1	1	0	0	0	0	0	0	2
	Red tree Ant	*Oecophylla samaragdina* Fabricious	*Mangifera indica* Linn./Amm	0	0	0	0	0	2	1	0	0	0	3

Family (Order)	Local Name	Scientific Name (Pest of Insect)	Name of Plant (Scientific Name / Local name)	Monthly abundance										Total
				Ja.	Fe.	Ma.	Ap.	Jn.	Ju.	Au.	Se.	No.	De.	
Tetranychidae (Acarina)	Mite	*Tetranychus* Spp.	*Acacia auriculiformis* A. / Akashmony	0	0	0	0	0	0	1	1	1	0	3
	Mite	*Teranychus urticae*	*Rosa involucrate* Rox. / Roes	0	0	0	1	0	0	0	0	0	1	2
Sphingidae (lep.)	Defoliator	*Thretra* Sp.	*Dillenia indica* Linn. /Chalta	0	0	0	1	0	0	0	0	0	0	1
	Defoliator	*Acherontia Styx westwood*	*Syzygium cumini* L./Jam	0	0	0	0	1	2	0	0	0	0	3
Cerambycidae (Col.)	Stem borer	*Bactocera rubus* Linn.	*Mangifera indica* Linn./Amm	0	2	0	1	0	0	0	0	0	0	3
	Shoot borer	*Chelidonium cinctum* G.	*Citrus* Spp. / Lemon	0	0	0	0	1	0	0	0	0	0	1
Coleophoridae(Lep.)	Defoliator	Coleophora sp.	Rose	0	0	0	1	0	0	0	0	0	0	1
Hapialidae (Lep.)	Shoot borer	*Endoclita* sp.	*Anthocephalus chinensis* Lamk. / Kadam	0	1	0	0	0	0	0	0	0	0	1
Limacodidae (Lep.)	Defoliator	*Thosia* sp.	*A. Mangium* / Hybrid Akashia	1	0	0	0	0	0	0	0	0	0	1
Pseudococcide(Hem.)	Mealybug	*Pseudococcidae Filamentosus* Cockerell	*Citrus* Spp. / Lemon	0	0	0	1	0	0	0	0	0	0	1
Phyllocnistidae (Lep.)	Leaf miner	*Phyllocnistis citrella* Stainton	*Citrus Lemon* /Lemon	0	0	0	0	1	1	3	0	1	0	6
Unknown (Col.)	Beetle	Unknown	*Syzygium samarangene* nerr/ Jamrul	0	1	0	0	0	0	0	0	0	0	1
Unknown (Lep.)	Defoliator	Unknown	*Eucalyptus Camaldulensis Dehn.*/ Eucalyptus	0	0	0	1	0	0	1	0	0	0	2
Unknown (Hem)	Sapsucker	unknown	*Ficus benghalensis* Linn. / Bot	0	0	0	1	0	0	0	0	0	0	1
Unknown (Lep.)	Folder	Unknown	*Swietenia macrophylla* King./ Mahogony	0	0	0	1	0	0	0	0	0	0	1
Unknown (Hem.)	Sapsucker	Unknown	*Phyllanthus emblica* Linn. /Amloki	0	0	0	0	1	0	0	0	0	0	1
Unknown (Lep.)	Folder	Unknown	*Artocarpus heterophyllus* Lamk (jackfruit)	0	0	0	0	0	1	0	0	0	0	1
Unknown (Lep.)	Folder	Unknown	*Ziziphus mauritiana* Lam. (Kul)	0	0	0	0	0	1	0	0	0		1
Unknown (Col.)	Root feeder	Unknown	*Albizia richerdiana* Voigt./ Raj koi	0	0	0	0	0	1	0	0	0	0	1

Family (Order)	Local Name	Scientific Name (Pest of Insect)	Name of Plant (Scientific Name / Local name)	Monthly abundance										Total
				Ja.	Fe.	Ma.	Ap.	Jn.	Ju.	Au.	Se.	No.	De.	
Unknown (Hom.)	Sapsucker	Unknown	*Ziziphus mauritiana* Lam. (Kul)	0	0	0	0	0	0	1	0	0	0	1
Total	82	82	82	16	25	34	45	40	59	29	6	20	40	314

Table 2. How to various indices change as the relative number of each insect pests species change in nursery and plantation.

SL. No.	Insect Pests (Name)	Insect Pests (Scientific Name)	Host Name (Scientific name / Local name)	Individuals	*Pi*	Pi^2	*Pi Inpi*
1	Leaf miner	*Acrocercops* Sp.	*Licthi chinensis* sonn./ Licthi	4	0.01273885	0.00016228	-0.05558087
2	Leaf miner	*Acrocercops telestis* Myrick	*Syzygium cumini* Linn./ Jam	1	0.00318471	0.00001014	-0.01831017
3	Scale insect	*Aspidiella* sp.	*Switenia mahogoni* Linn./Mahogony	3	0.00955414	0.00009128	-0.04443421
4	Leaf miner	*Phyllocnistis* sp.	*Polyalthia Longifolia* Sonn./Dabdaru	1	0.00318471	0.00001014	-0.01831017
5	Leaf Beetle (defoliator)	*Psiloptera fastuosa Fbr.*	*Acacia auriculiformis* A. Cunn.	1	0.00318471	0.00001014	-0.01831017
6	Sapsucker (Mealy bug)	*Aspidiotus* sp.	*Samanea saman* /jacq	1	0.00318471	0.00001014	-0.01831017
7	Leaf roller	*Caloptilia iselaea* Meyrick	*Spondias pinnata* Kurz. / Amra	1	0.00318471	0.00001014	-0.01831017
8	Sapsucker	*Pinnaspis scrobicularum* Green	*Elaeocarpus floribundus* Bl. /Jalpai	2	0.00636943	0.00004057	-0.03220539
9	Red scale	*Aonidiella auranti* Maskell	*Citrus* Spp. / Lemon	1	0.00318471	0.00001014	-0.01831017
10	Slaty gall Insect	*Amrapiplosis amraemyia* Rao	*Mangnifera indica* Linn./Amm	6	0.01910828	0.00036513	-0.07562357
11	Reddish gall	*Amradiplosis echinogalliperda* Mani	*Mangifera indica* Linn./Amm	2	0.00636943	0.00004057	-0.03220539
12	Defoliator	*Arthoschista hilaralis* Walker	*Anthocephalus chinensis* Lamk. / Kadam	5	0.01592357	0.00025356	-0.06592285
13	Shoot borer	*Glyphodes* Sp.	*Artocarpus heterophyllus* Lamk. / Jackfruit	1	0.00318471	0.00001014	-0.01831017
14	Shoot borer	*Hypsiphyla robusta* Moore	*Swietenia mahogoni* Linn./Mahogony	84	0.26751592	0.07156477	-0.35274013
15	Skelitonizer	*Macalla* Sp.	*Mangifera indica* Linn./ Amm	4	0.01273885	0.00016228	-0.05558087
16	Leaf titcher	*Agrotera basinotata*Hampson	*Syzygium Cumini* L. /Jam	1	0.00318471	0.00001014	-0.01831017
17	Leaf Webber	*Orthaga exvinacea* Hampson	*Mangifera indica* Linn./ Amm	4	0.01273885	0.00016228	-0.05558087

SL. No.	Insect Pests (Name)	Insect Pests (Scientific Name)	Host Name (Scientific name / Local name)	Individuals	*Pi*	Pi^2	*Pi Inpi*
18	Psyllid	*Heteropsylla cubana* Crawford	*Leucaena leucocephala* Lam. /Ipil-Ipil	2	0.00636943	0.00004057	-0.03220539
19	Gall insect	*Trioza fletcheri* Crawford	*Terminalia arjuna* Roxb. /Arjun	5	0.01592357	0.00025356	-0.06592285
20	Psyllid	Unknown	*Switenia mahogoni* Linn./ Mahogony	1	0.00318471	0.00001014	-0.01831017
21	Gall	*Pauropsylla* sp.	*Cinnamomum camphora* Linn./Tajpata	1	0.00318471	0.00001014	-0.01831017
22	Psyllid	*Diaphorina citri* Kuwayana	*Citrus lemon* L./Lemon	1	0.00318471	0.00001014	-0.01831017
23	Shoot borer Gonder Poka)	*Oryctes rhinoceros* Linn.	*Cocos nucifera* Linn. /Coconut	3	0.00955414	0.00009128	-0.04443421
24	Defoliator	*Popillia japonica* Newman	*Vitis vinifera* L. / Grape	3	0.00955414	0.00009128	-0.04443421
25	Top shoot Borer	*Alcidodes frenalus* Faust	*Mangifera indica* Linn./ Amm	9	0.02866242	0.00082153	-0.10181374
26	Leaf cutter Weevil	*Deporaus marginatus* Pascoe	*Mangifera indica* Linn./Amm	30	0.09554140	0.00912816	-0.22434990
27	Defoliator	*Myllocerus* Sp.	*Aegle marmelos* L. /Wood apple	1	0.00318471	0.00001014	-0.01831017
28	Collar borer	*Pagiophlecus longclavis* Marshall	*Swietenia macrophylla* King / Mahogony	1	0.00318471	0.00001014	-0.01831017
29	Cutworm	*Agrotis ipsilon* Hufnagel	*Eucalyptus camaldulensis* dehn. /Eucalyptus	1	0.00318471	0.00001014	-0.01831017
30	Leaf folder	*Argyroploce tonica* Meyrick	*Elaeocarpus floribundus* Bl. /Jalpi	1	0.00318471	0.00001014	-0.01831017
31	Leaf roller	*Platypeplus approta* Meyrick	*Licthi chinensis* sonn./ Licthi	1	0.00318471	0.00001014	-0.01831017
32	Shoot borer	*Laspeyresia* sp.	*Azadirachta indica* A. /Neem	4	0.01273885	0.00016228	-0.05558087
33	Defoliator	*Anacampis rivalis*	*Terminalia bllirica* Roxb./Bohera	1	0.00318471	0.00001014	-0.01831017
34	Field Cricket	*Brachytrypes portentosus* Lichteins	*Cocos nucifera* Linn. /Coconut	1	0.00318471	0.00001014	-0.01831017
35	White fly	*Bemisia* sp.	*Psidium guajava* Linn. /Guwava	3	0.00955414	0.00009128	-0.04443421
36	Defoliator	*Calopepla leayna* Latr.	*Gmelina arborea* Linn. /Gamer	2	0.00636943	0.00004057	-0.03220539
37	Defoliator	*Podontia Quatuordecimpunctata* Linn.	*Spondias pinnata* Kurz. /Amra	5	0.01592357	0.00025356	-0.06592285

SL. No.	Insect Pests (Name)	Insect Pests (Scientific Name)	Host Name (Scientific name / Local name)	Individuals	*Pi*	Pi^2	*Pi Inpi*
38	Bagworm	*Cryptothelea crameri* westwood	*Thuya orientalis* Linn./Thuja	1	0.00318471	0.00001014	-0.01831017
39	Defoliator	*Attacus atlas* Linn.	*Lagerstroemia speciosa* L./ Jarul	2	0.00636943	0.00004057	-0.03220539
40	Defoliator	*Cricula trifenestrata* Helfer	*Mangifera indica* Linn. /Amm.	18	0.05732484	0.00328614	-0.16389294
41	Sap-sucker	*Drosicha* spp.	*Artocarpus heterophyllus Lamk*. / Jack fruit	1	0.00318471	0.00001014	-0.01831017
42	Leaf hoper	*Idiocerus* Sp.	*Mangifera indica* Linn./Amm	4	0.01273885	0.00016228	-0.05558087
43	Leaf scale	*Icerya pulcher* Leonardi	*Mangifera indica* Linn./Amm	4	0.01273885	0.00016228	-0.05558087
44	Defoliator	*Eurama blanda* Boisduval	*Albizia lebbeck* L./ Kori	4	0.01273885	0.00016228	-0.05558087
45	Defoliator	*Eurema* sp.	*Samanea saman* Jack. / Rain tree	10	0.03184713	0.00101424	-0.10977095
46	Sapsucke(Moshok bug)	*Helopeltis antonii S*ignoret	*Azadirachta indica* A./Neem	1	0.00318471	0.00001014	-0.01831017
47	Defoliator	*Horaga viola* Moore	*Elaeocarpus floribundus* Bl. / Jalpi	1	0.00318471	0.00001014	-0.01831017
48	Leaf Defoliator	*Lymantria obfuscate* walk	*Prunus avium* L./ Cherry	1	0.00318471	0.00001014	-0.01831017
49	Defoliator	*Euproctis fraternal* M.	Ziziphus mauritiana Lam./ kul	3	0.00955414	0.00009128	-0.04443421
50	Bark eating	*Inderbela tetraonis* Moore	*Mangifera indica* Linn./ Amm	3	0.00955414	0.00009128	-0.04443421
51	Bark eating	*Inderbela Quadrinotata* Walker	*Albizia Procera* Roxb./ Kori	8	0.02547771	0.00064911	-0.09350195
52	Leaf miner	*Labdia semicoccinea* Stainton	*Spondias pinnata* Kurz. /Amra	1	0.00318471	0.00001014	-0.01831017
53	Defoliator	*Metanastria hytaca* Cramer	*Terminalia catappa* Linn. / Kat Badam	1	0.00318471	0.00001014	-0.01831017
54	Defoliator	*Streblote siva* Lefbvre	*Swietenia macrophylla* King./ Mahogony	2	0.00636943	0.00004057	-0.03220539
55	Defoliator	*Nyphantis serinopa* Myrick	*Cocos nucifera* Linn. / Coconut	3	0.00955414	0.00009128	-0.04443421
56	Termite	*Odontotermes obesus* Rambur	*Cocos nucifera* Linn. / Coconut	5	0.01592357	0.00025356	-0.06592285
57	Termite	*Odontotermes* sp.	*Eucalyptus Camaldulensis* Dehn./ Eucalyptus	1	0.00318471	0.00001014	-0.01831017
58	Defoliator	*Papilio demoleus* Linn.	*Citrus Lemon* L./ Lemon	2	0.00636943	0.00004057	-0.03220539
59	Leaf minor	*Phyllocnistis citrella*	*Polyalthia longiflolia* Soon. / Debdaru	1	0.00318471	0.00001014	-0.01831017

SL. No.	Insect Pests (Name)	Insect Pests (Scientific Name)	Host Name (Scientific name / Local name)	Individuals	*Pi*	Pi^2	*Pi Inpi*
60	Mealy bug	*Pseudococcus* Spp.	*Bambusa vulgaris* Schard. / Bamboo	1	0.00318471	0.00001014	-0.01831017
61	Ants	*Sotenopsis germinate* Fabr.	*Calamus tenuis* Roxb. / Cane	2	0.00636943	0.00004057	-0.03220539
62	Red tree Ant	*Oecophylla samaragdina* Fabricious	*Mangifera indica* Linn./ Amm	3	0.00955414	0.00009128	-0.04443421
63	Mite	*Tetranychus* Spp.	*Acacia auriculiformis* A. / Akashmony	3	0.00955414	0.00009128	-0.04443421
64	Mite	*Teranychus urticae*	*Rosa involucrata* Roxb./ Roes	2	0.00636943	0.00004057	-0.03220539
65	Defoliator	*Thretra* Sp.	*Dillenia indica* Linn./ Chalta	1	0.00318471	0.00001014	-0.01831017
66	Defoliator	*Acherontia styx westwood*	*Syzygium cumini* Linn./ Jam	3	0.00955414	0.00009128	-0.04443421
67	Stem borer	*Bactocera rubus* Linn.	*Mangifera indica* Linn. / Amm	3	0.00955414	0.00009128	-0.04443421
68	Shoot borer	*Chelidonium cinctum* G.	*Citrus Lemon* L. / Lemon	1	0.00318471	0.00001014	-0.01831017
69	Defoliator	*Coleophora* sp.	*Rosa involucrata* Roxb. / Roes	1	0.00318471	0.00001014	-0.01831017
70	Shoot borer	*Endoclita* sp.	*Anthocephalus chinensis* Lamk. / Kadam	1	0.00318471	0.00001014	-0.01831017
71	Defoliator	*Thosia* sp.	*Acacia Mangium* Willd / hybrid Acacia	1	0.00318471	0.00001014	-0.01831017
72	Mealybug	*Pseudococcidae Filamentosus* Cockerell	*Citrus Lemon* L / Lemon	1	0.00318471	0.00001014	-0.01831017
73	Leaf miner	*Phyllocnistis citrella* Stainton	*Citrus* spp./ Jambura	6	0.01910828	0.00036513	-0.07562357
74	Beetle	Unknown	*Syzygium samarangene* / Jamrul	1	0.00318471	0.00001014	-0.01831017
75	Defoliator	Unknown	*Eucalyptus Camaldulensis* Dehn. / Eucalyptus	2	0.00636943	0.00004057	-0.03220539
76	Sapsucker	Unknown	*Ficus benghalensis* Linn. / Bot	1	0.00318471	0.00001014	-0.01831017
77	Folder	Unknown	*Swietenia macrophylla* King./ Mahogony	1	0.00318471	0.00001014	-0.01831017
78	Sapsucker	Unknown	*Phyllanthus ablica* Linn. / Amloki	1	0.00318471	0.00001014	-0.01831017
79	Folder	Unknown	*Artocarpus heterophyllus* Lamk./ Jackfruits	1	0.00318471	0.00001014	-0.01831017
80	Folder	Unknown	*Ziziphus mauritiana* Lam./	1	0.00318471	0.00001014	-0.01831017

SL. No.	Insect Pests (Name)	Insect Pests (Scientific Name)	Host Name (Scientific name / Local name)	Individuals	*Pi*	Pi^2	*Pi Inpi*
			Kul				
81	Root feeder	Unknown	*Albizia recherdiana* Voigt / Raj koi	1	0.00318471	0.00001014	-0.01831017
82	Sapsucker	Unknown	Ziziphus mauritiana Lam./ Kul	1	0.00318471	0.00001014	-0.01831017
Total				314	1.00000000	0.09118017	-3.42993155

Measure	Value
S	82
λ	0.09118017
1-λ	0.90881983
1/ λ	10.967297
H	3.429931547
E	0.778341291

Some pictorial view of insect pests of nursery and plantation in Bangladesh.

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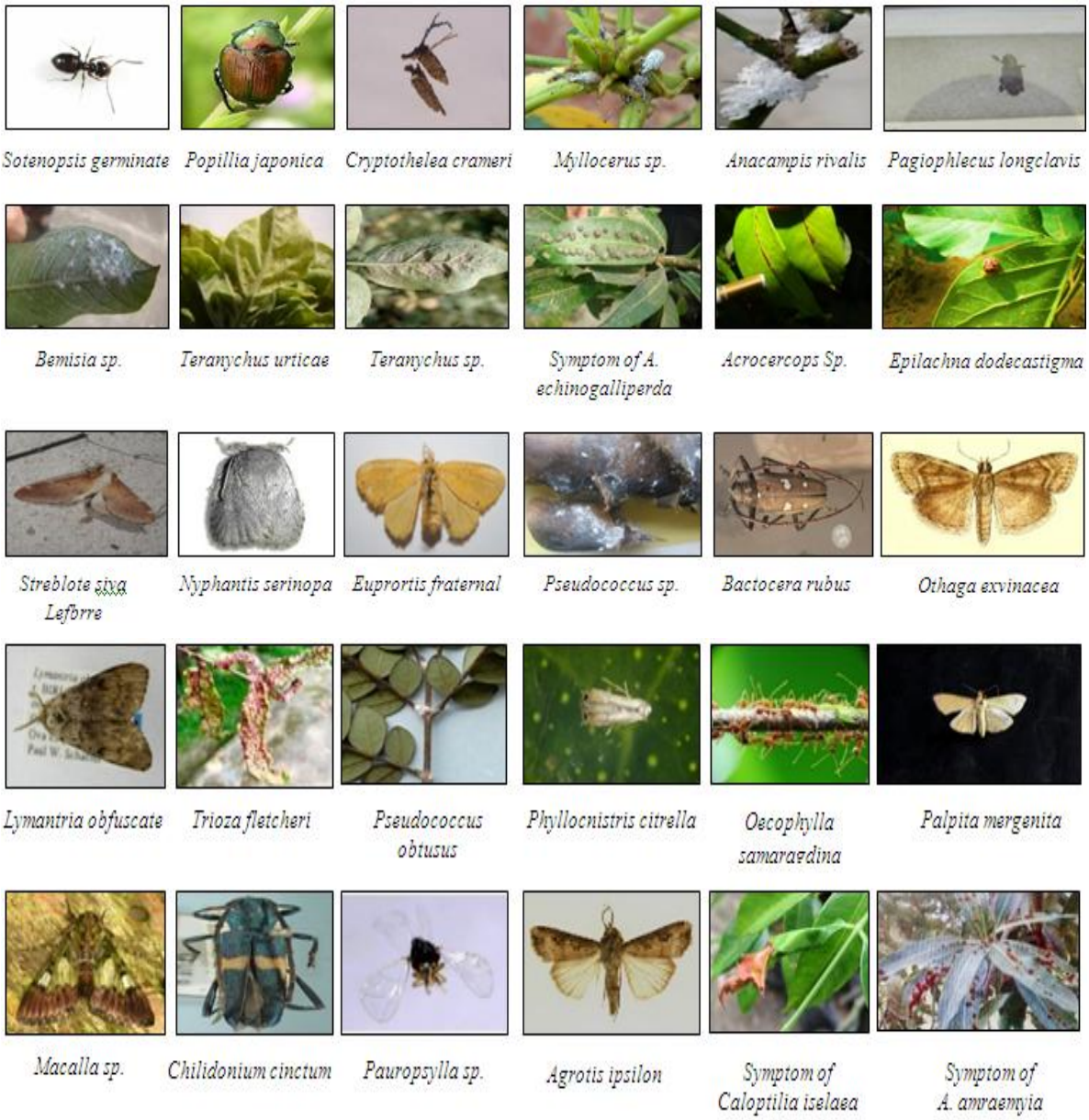

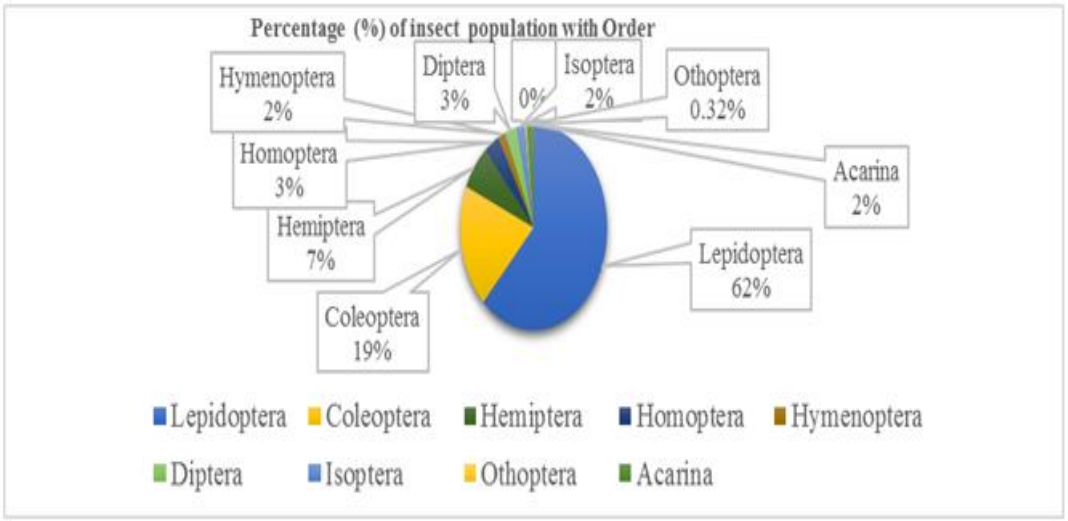

Fig. 2. Percentage of insect pests population in different orders of nursery and plantation in Bangladesh.

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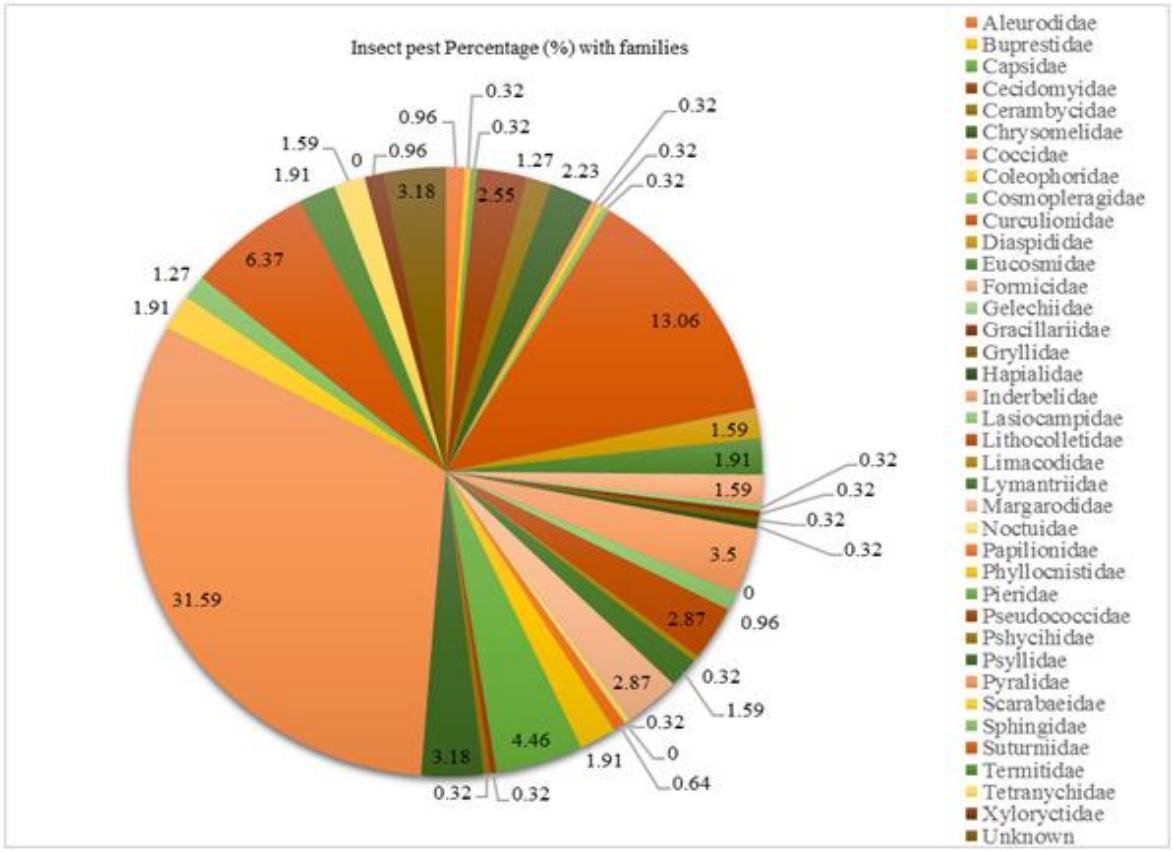

Fig 3. Percentage of insect pests population in different families of nursery and plantation in Bangladesh.

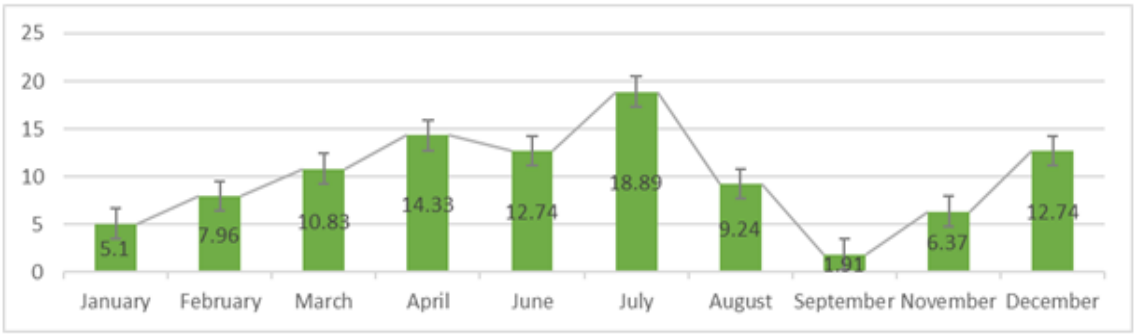

Fig. 4. Percentage of pests population in different months of the nursery and plantation in Bangladesh.

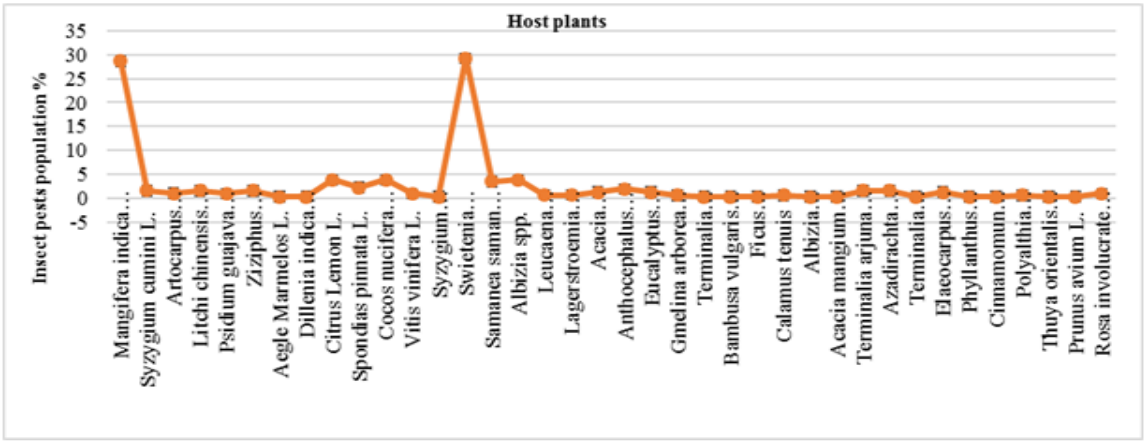

Fig. 5. Percentage of insect pests population in different host plants of the nursery and plantation in Bangladesh.

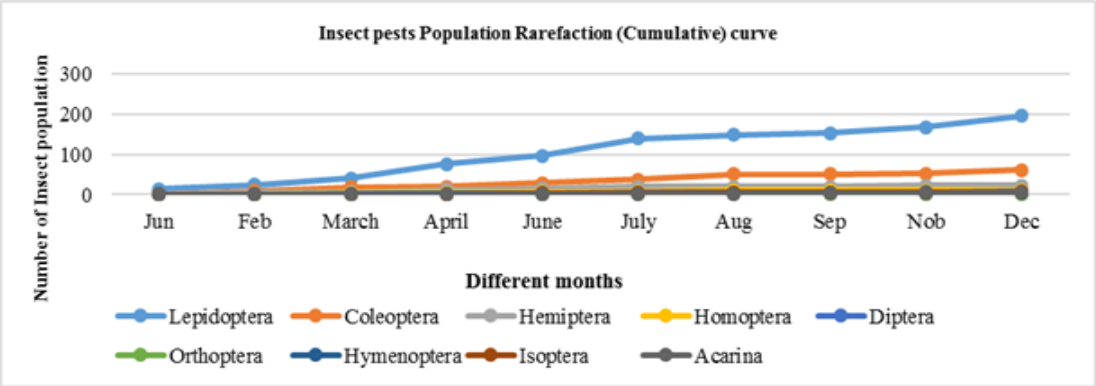

Fig. 6. Population Rarefaction (Cumulative) curve of the faunal assemblage of insect pests of the nursery and plantation in Bangladesh.

V. Conclusion

Bangladesh is a tropical evergreen country also rich in plants. But at present, the amount of plants is decreasing day by day as a result of urbanization. To produce quality seedling to be afforested, seedling and trees need to be protected from insect in nursery and planted seedling gardens. It is necessary to present a documentary on insect population, insect pests diversity, abundance, infestation, insect host in nursery and plantation. In this case, this article has highlighted the diversity of insect pests in nursery and plantation of Bangladesh. In the case of afforestation, the documentary presented in this study will play very important role for nursery and plantation. Concerned persons including forest department, nursery and plantations, garden owners will also be benefit. This study will play an important role in future rich research.

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