Research Journal of Forestry

ISSN 1819-3439

Academic Journals Inc.

www.academicjournals.com

Research Journal of Forestry 9 (2): 58-64, 2015
ISSN 1819-3439 / DOI: 10.3923/rjf.2015.58.64

Diversity and Abundance of Insects in the Mulberry Ecosystem in Ibadan South Western Nigeria

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ABSTRACT

The study investigated the abundance and diversity of insects in a mulberry plantation of Forestry Research Institute of Nigeria, using water trap and physical observation on the plants for four months (May to August, 2013). Results showed a total of 24 insect species from 9 insect orders to be associated with mulberry plants. They included; Hymenoptera, Coleoptera, Hemiptera, Orthoptera, Diptera, Lepidoptera, Araneae, Mantodea and Thysanoptera. Hymenoptera was the most abundant order (40.0%) with diversity index of 0.163 and highest species richness (7). The highest insect density was recorded in June during the period of study. The damaging insect species was relatively high (36%), therefore there is need to embark on routine insect control measures in mulberry plantation to ensure quality and mass production of mulberry leaves which is a prerequisite for a successful silkworm rearing.

Key words: Insects, diversity, abundance, *Morus alba*, ecosystem

INTRODUCTION

Mulberry (*Morus alba* L.) of family Moraceae is an exotic and hardy perennial plant. It is a deciduous tree variety that is native to China which was brought to the United States for silkworm production (Sanchez, 2002). There are several species of mulberry plant; *Morus alba*, *Morus nigra*, *Morus indica* and *Morus bombycis* among others. It is a deep-rooted perennial plant, capable of thriving under a variety of conditions ranging from temperate to tropical region. Several varieties of mulberry plant are under cultivation in Nigeria. The mulberry tree can be grown as low bush, high trunk or deep-rooted tree and as such, could be utilized in afforestation of land and anti-erosion programmes (Adeduntan and Oyerinde, 2010).

Mulberry tree is recognized as food plant for silkworm as well as an economic tree (Jaiyeola and Adeduntan, 2002). Its leaves contains high protein and is also used in cattle feed for milk production (Adeduntan and Oyerinde, 2010). The timber is used for furniture, tool handle and the fruits are used for making wine while the seeds are used for making jam, powder of *Morus alba* leaves have been used to prepare drink by some people as a healthy diet in Japan but its chemical composition was not known (Shimizu *et al*., 1992).

Mulberry is also appreciated for its fruit (consumed fresh, in juice or as preserved), as a delicious vegetable (young leaves and stems) for it medicinal properties in infusions (mulberry leaf tea) and for landscaping (De Almeida and Fonseca, 2002). Traditionally mulberry fruits have been used as medicinal agents to nourish the yin and blood. It is beneficial to the kidney and treat weakness, fatigue, anemia and premature graying of hair. It is also used to treat urinary

incontinence, tinnitus dizziness, constipation in the elderly and the anemic (Dharmananda, 2003) Mulberry contains plenty nutritious elements, such as minerals and vitamins. It can cure chronic diseases of digestive tract, promote gastric juice secretion and strengthen the ability for digestion and assimilation. It also improve appetite and eliminate abdominal distention and constipation (Dharmananda, 2003).

The perennial nature of mulberry in combination with monocultural practices, encourages several pests development and infestation throughout the year with seasonal differences (Santhi and Kumar, 2010). The production of appreciable quantity and quality mulberry leaf is often hampered by insect pests and disease. A number of pests and diseases cause damage to mulberry tree. The noxious insects of mulberry tree include Coleoptera, Lepidoptera, Hemiptera, Thysanoptera, etc.

Several insects have been identified causing most damage to mulberry plants they include *Phenococcus hirsutus* (sucks sap of stem, leaf or petiole, causing severe curling and crinkling of leaves and swelling and twisting of apical regions), *Pseudodendrothrips ornatissima* (thrips) and white grubs and termites (Santhi and Kumar, 2010). In addition to insect pests, pathogens (fungi, bacteria, virus) and nematodes causes damage to mulberry plants. They cause arrays of diseases to the plant ranging from foliar to root diseases. They foliar diseases of mulberry include, leaf spot, powdery mildew, leaf rust and sooty mould while the root diseases include root rot and root knot. More so, many wild rodents of the family Muridae may cause damage to mulberry trees especially on the base of branches.

There is currently dearth information on the insect diversity of mulberry plant in Nigeria. Therefore, this study was aimed at determining the insect diversity of mulberry plant in Ibadan South West Nigeria.

MATERIALS AND METHODS

Study area: The study was conducted at mulberry plantation of Forestry Research Institute of Nigeria (FRIN), Jericho Hills Ibadan, Oyo state, Nigeria. The area is located within latitude 7°26'N and longitude 3°54E, the climate of the area is tropical type of climate and dominated by rainfall pattern, the mean total rainfall is about 1420.106 mm and mean maximum temperature is 34.46°C minimum is 21.55°C. Mean relative humidity ranges from about 82% from June to September to approximately 60% between December and February.

Insect sampling: The mulberry plantation was divided into three sub plots, from each sub plot, three plants were selected. Raised platforms were constructed with wooden plank to the height of mulberry canopy on each sub plot. Yellow water trap were randomly placed on the platform. The yellow water trap comprises of plastic bowls measuring 8×6 cm. Soap solution was used as the trapping agent. The soap solution was prepared at the ratio of 95:5 ratio of water to liquid. Observation was also made on mulberry leaves to check for insects. No insecticide was applied during the period of the study. The plot was maintained by weeding manually with cutlass at three weeks interval until the end of the study.

Trap placement: The traps were filled to one-quarter level with the soap water solution in order to break the surface tension and to prevent escape of trap insects. The soap water solution was changed at weekly interval after removal of trapped insects.

Data collection: Data on total number of trapped insects were taken at weekly interval for sixteen consecutive weeks. The trapped insects were carefully removed from the water and

transferred to vials containing 30% alcohol and they were later identified at Entomology Section of Forestry Research Institute of Nigeria.

Data analysis: Total number of insects collected was subjected to descriptive statistics. The diversity index was calculated using the formula (Beals *et al.*, 1999):

$$D = \frac{\sum[n_i (n_i - 1)]}{N (N - 1)}$$

Where:
n_i = Individual of each species caught
N = Total number of all species caught
D = Diversity index

The graph of population dynamics of insects was plotted against each month.

RESULTS

Insect diversity in the mulberry ecosystem in Ibadan: The summary of insect diversity and abundance of mulberry plant as encountered during the study is presented in Table 1. A total of

Table 1: Insect diversity in the mulberry ecosystem in Ibadan

Insect order	Insect species	Common names	Frequency (n)	Diversity index	Species richness
Hymenoptera	*Chrysura refulgens*	Cuckoo wasp	112	0.163	7
	Camponotus pennsylvanicus	Army ant	112		
	Solenops conjurata	Sauba ant	123		
	Ampulex comprssa	Ampulux wasp	62		
	Apis meliferasus	Cicada killer ant	39		
	Monomriun minimum	Soldier ant	43		
Coleoptera	*Migdolus fryanus*	Longhorn beetle	111	0.353	6
	Euphoria spulcralis	Sprangled flower beetle	28		
	Coccinella magnifica	Ladybird beetle	39		
	Chauliognathus pennsyl vanicus	Soldier beetle	26		
	Podagrica malvae	Flea beetle	1		
	Anthonomus eugenii	Pepper weevil	1		
Hemiptera	*Maconellicoccus hirsutus*	Mealy bug	121	0.413	3
	Empaosca flavescens	Leaf hopper	56		
	Acrosternum hilare	Green stinkbug	38		
			215		
Orthoptera	*Melanoplus ponderosus*	Spur-throated grasshopper	29	0.495	2
	Romalea microptera	Lubber grasshopper	24		
			53		
Diptera	*Musca domestica*	House fly	241	0.773	2
	Bactrocera invadens	Fruit fly	36		
Lepidiptera	*Ariadne merione*	Butterfly	36	1	1
Araneae	*Palystes castaneus*	Spider	23	1	1
Mantodea	*Sphodromantisviridis*	Praying mantis	41	1	1
Thysanoptera	*Thrips tabaci*	Thrips	1	1	1
			1420		24

24 insect species belonging to 9 insect order were observed in mulberry plantation in Ibadan. The insect order include; Hymenoptera, Coleoptera, Hemiptera, Orthoptera, Diptera, Lepidoptera, Araneae, Mantodea and Thysanoptera. Hymenoptera with diversity index of 0.163 recorded highest species richness (7), followed by Coleoptera (6) with diversity index of 0.353. Lepidoptera, Araneae, Mantodae and Thysanoptera recorded only one insect species each.

Insect relative abundance in the mulberry ecosystem in Ibadan: The insects' relative abundance in mulberry plantation is shown in Fig. 1. Insects species associated with mulberry plant were relatively abundant in the study area. Among the nine insect order encountered, Hymenoptera were most abundant, (40.0%) followed by order Diptera (19.9%) while Thysanoptera (0.07%) was the least abundant order.

Population fluctuation of insects on mulberry plants: The monthly population fluctuation of insect species associated with mulberry plant is shown in Fig. 2. The highest density of insects was recorded in June and it belongs to order Hymenoptera. Hymenopteran density was highest all

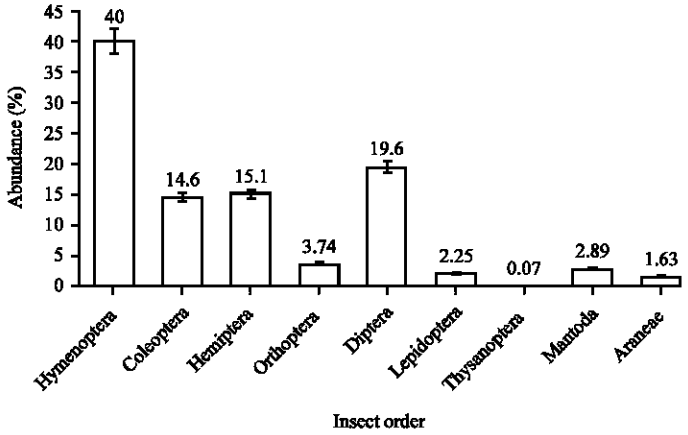

Fig. 1: Insects relative abundance in the mulberry ecosystem in Ibadan

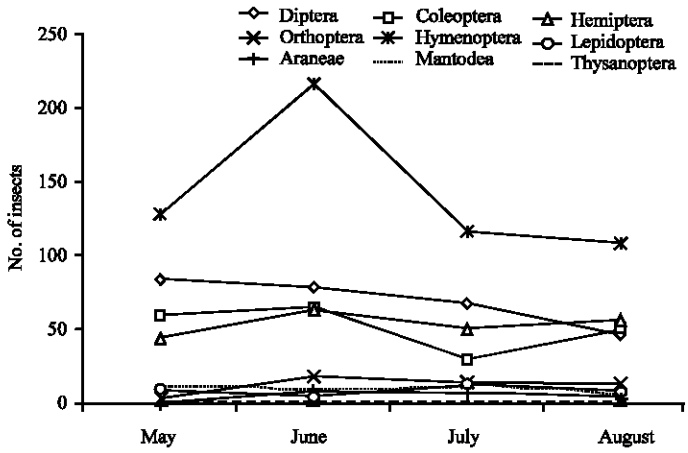

Fig. 2: Population fluctuation of insects on mulberry plants

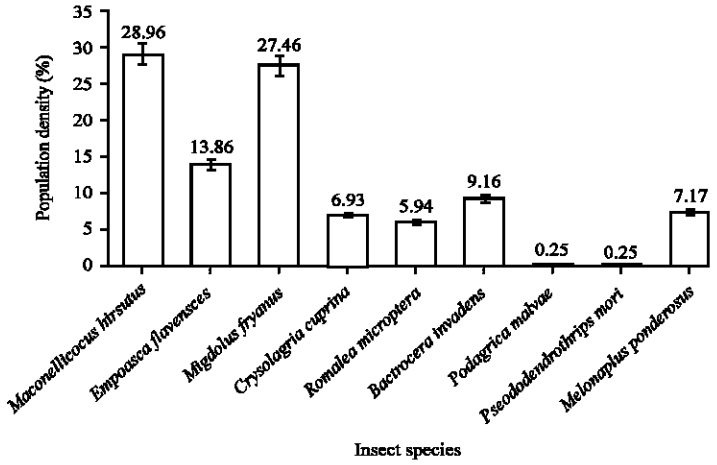

Fig. 3: Insect pests with proven damaging relationship with mulberry plant in Ibadan

through the four months of the study. Diptera recorded highest population in May and reduced through August. Coleoptera on the other hand slightly increased from May to June, declined in July and picked up slightly again in August. The population fluctuation of Lepidoptera, Araneae, Mantodea and Thysanoptera followed the same pattern and were at low densities throughout the period of the study.

Insect pests with proven damaging relationship with mulberry plant in Ibadan: Insect pest with proven damaging relationship with mulberry plant is shown in Fig. 3. Nine insect species were found to be causing damage to the mulberry plant in the study area. They include; *Maconellicocus hursutus, Peudodendrothrips mori, Crysolagria cuprina, Migdolus fryanus, Empoasca flavensces, Bactrocera invadens, Podagrica malvae, Melanoplus ponderosus* and *Romalea microptera. Maconellicocus hursutus* (Mealy bug) was the most abundant (28.96), followed by *Migdolus fryanus* (long horn beetle) (27.46%). *Podagrica malvae* and *Pseudodendrothrips mori* (0.25%) each were least among them. All the observed destructive insect species apart from *Bactrocera invadens* were vegetative pests of mulberry plant. *Bactrocera invadens* is a fruiting pests of mulberry plant.

DISCUSSION

The order Hymenoptera was the most dominant and largest order. Seven Hymenopterans were recorded. They include: *Chrysura refulgens, Camponotus pennsylvanicus, Solenops conjurata, Ampulex compressa, Apis meilifera, Sphecius spheciosus, Monomrium minimum.* Santhi and Kumar (2010) reported that hymenoptera was the second dominant order in mulberry ecosystem in south India.

Order Coleoptera was the second largest order, six insect species were recorded; *Migdolus fryanus, Euphoria sepulcralis, Coccinellidae magnifica, Chauliognathus pennsylvacus, Podagrica malvae* and *Anthonomus eugenii. Coccinella magnifica* in family of Coccinellidae was beneficial among them. They were seen preying on mealy bugs. Joshi *et al.* (2003) also reported coccinelids were effective predators of soft bodied insects and they also feed on fungal growth of such as powdery mildew.

Hemiptera was the third largest order observed in the study area. Hemiptera has two sub orders: Homoptera and Heteroptera. Two homopterans and one heteropterans were recorded. *Maconellicoccus hirsutus* of family Pseudococcidae was dominant among members of this order. Santhi and Kumar (2010) also reported that the family Pseudococcidae was the largest family recorded in mulberry ecosystem among the Hemipterans.

Insects of Orthoptera, Diptera, Lepidoptera, Araneae, Mantodea and Thysanoptera were found in mulberry ecosystem in Ibadan southwestern Nigeria. Among them, *Peudodendrothrips mori*, (thysanoptera) *Bactrocera invadens* (diptera) are serious pest of mulberry. Sathyaprasad *et al.* (2000) and Dandin *et al.* (2001) similarly reported that *Pseudodendrothrips* is a major pest of mulberry.

CONCLUSION

Insects associated with mulberry plants in Ibadan South western Nigeria were diverse, hymenopterans were the dominant insects in the mulberry ecosystem. The insect diversity was due to the morphology and the chemical constituents of the plants. Weather condition contributed to the fluctuation of the insects. The insects were either defoliators, pollinators, predators or visitors. The damaging insect species was relatively high, therefore there is need to embark on routine insect control procedures in mulberry plantation to ensure a qualitative and quantitative mulberry production which is a prerequisite for a successful silkworm rearing.

REFERENCES

Adeduntan, S.A. and A.S. Oyerinde, 2010. Evaluation of nutritional and antinutritional characteristics of Obeche (*Triplochition scleroxylon scleroxylon*) and several Mulberry (*Morus alba*) leaves. Afr. J. Biochem. Res., 4: 175-178.

Beals, M., L. Gross and S. Harrell, 1999. Diversity indices: Simpson's D and E. http://www.tiem.utk.edu/~gross/bioed/bealsmodules/simpsonDI.html.

Dandin, S.B., J. Jayaswal and K. Giridhar, 2001. Handbook of Sericulture Technologies. Central Silk Board, Bangalore, India, Pages: 287.

De Almeida, J.E. and T.C. Fonseca, 2002. Mulberry Germplasm and Cultivation in Brazil. In: Mulberry for Animal Production (FAO Animal Production and Health Paper 147), Sanchez, M.D. (Ed.). Food and Agriculture Organization, Rome, Italy, ISBN-13: 9789251045688, pp: 73-96.

Dharmananda, S., 2003. Fruit as medicine: Morus fruit (Mulberry). http://www.itmonline.org/arts/morus.htm.

Jaiyeola, V. and S.A. Adeduntan, 2002. Sericulture in Ondo State: A Means of Alleviating Rural Poverty. In: Forestry and Challenges of Sustainable Livelihood, Abu, J.E., P.I. Oni and L. Popoola (Eds.). Forestry Association of Nigeria, Ondo State, Nigeria, pp: 202-207.

Joshi, S., P. Mohanraj, R.J. Rabindra and N.S. Rao, 2003. Production and use of coccinellid predators. Technical Bulletin, Issue 32, Project Directorate of Biological Control, Bangalore, India, pp: 1-26.

Sanchez, M.D., 2002. World Distribution and Utilization of Mulberry and its Potential for Animal Feeding. In: Mulberry for Animal Production (FAO Animal Production and Health Paper 147), Sanchez, M.D. (Ed.). Food and Agriculture Organization, Rome, Italy, ISBN-13: 9789251045688, pp: 1-10.

Santhi, A.M. and S.P. Kumar, 2010. Diversity of insects in the mulberry ecosystem. The Silkworm, July 25, 2010. http://silkwormmori.blogspot.com/2010/07/diversity-of-insects-in-mulberry.html.

Sathyaprasad, K., D. Manjunath, M.V. Rajan and A. Sarkar, 2000. Screening of mulberry germplasm for tolerance to sucking pests. Proceedings of the National Conference on Strategies for Sericulture Research and Development, November 16-18, 2000, Central Sericultural Research and Training Institute, Mysore, India..

Shimizu, T., M. Yazawa and N. Takeda, 1992. Aromatic amino acids in the leaves of *Morus alba* and their possible medicinal value. Sericologia, 32: 633-639.