Research Article

Copy Right ©KY Publications

Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in

A Peer Reviewed & Refereed, International Open Access Journal

Vol.6.Issue.3.2019 (July-Sept) **ISSN:2455-0221(P), 2394-2606(O)**

CONTRIBUTION TO THE IDENTIFICATION OF THE INSECTS VISITORS OF MANGO (*MANGIFERA INDICA* L.) FLOWERS IN KORHOGO (NORTHERN COTE D'IVOIRE)

Michel Laurince YAPO[1]*, Konan Enoc YEBOUE[1], Tenon COULIBALY[1], Philippe KOUASSI[2]

[1]Département de Biologie Animale, UFR Sciences Biologiques, Université Peleforo Gon Coulibaly, BP 1328 Korhogo, Côte d'Ivoire

[2]Laboratoire de Zoologie - Biologie Animale, UFR Biosciences, Université Félix Houphouët Boigny, Abidjan, 22 BP 582 Abidjan 22, Côte d'Ivoire

*Corresponding author : yapomilaur@gmail.com

https://doi.org/10.33329/jabe.6319.9

ABSTRACT

Mango contributes to ameliorate the life level of the northern population of Côte d'Ivoire. This paper seeks to provide information on the main insects visitors of *Mangifera indica* flowers. The study was carried out during the flowering step of the species corresponding to the December-February period in five village situated in the communal area of Korhogo, in the northern part of Côte d'Ivoire. Flowers'insect visitors were captured twice by day in morning and afternoon, using a sweep net. The results showed that these flowers were visited by 8 insectes orders consited of Hymenoptera, Coleoptera, Diptera, Lepidoptera, Dictyoptera, Hemiptera, Odonata and Orthoptera. The Hymenopterans constituted major group of flower's visiting insects. Collected insects abundance was highest in Katiofi site. The number of visiting insects of mango flowers is high in the morning and low in the afternoon. The highest diversity indices were observed at Lakpolo.

Key words: *Mangifera indica*, Flowers, Insects, Korhogo, Côte d'Ivoire.

Introduction

Mango (*Mangifera indica* L.) is rated by its taste qualities as one of the most popular fruits of the consumer. In Asia, it is even called the 'king of fruits' (Purseglove, 1972). Mango is from India and Burma. Introduced by colonizers in the 20th century, this fruit tree is quickly adopted by the Ivorian people and its culture becomes traditional, because of its imposing size which is often worth to be used as a palaver tree. Its adoption as a cash crop in Côte d'Ivoire dates back to 1980. Mango now play a leading role in the economy of the people living in the north part of the country. This fruit, whose consumption was formerly mainly local, constitutes a significant source of foreign exchange since it is massively exported. Today, mango is the third export fruit of Côte d'Ivoire after sweet banana and pineapple (FIRCA, 2008). Mango reserved for export is particularly produced in the north of the country. To increase the amount of mango produced, farmers use divers techniques such as the use of fertilizers, pesticides ... etc. These different practices combine to increase the flowering rate. After flowering, pollination becomes the critical factor for good production. It is in this context that the intervention of pollinators is essential. To achieve pollination, flowers must be visited. Several studies have been conducted in Taiwan (Sung *et al*., 2006), Philippines (Fajardo *et al*., 2008), India (Kumar *et al*., 2016) and in Indonesia (Windriyanti *et al*., 2019) on the insects of mango flower. These studies showed that mango is visited by many insects during its flowering phase. But, in Côte d'Ivoire, there has not been much information on insect species associated with mango, regarding to either the flowers. Likewise,

Research Article

Copy Right ©KY Publications
Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in
A Peer Reviewed & Refereed, International Open Access Journal
Vol.6.Issue.3.2019 (July-Sept) ISSN:2455-0221(P), 2394-2606(O)

literature on mango insects is lacking in this country during the flowers season. The studies on the relationship between insects and mango concern the fruit flies. These research has focused only on pests (N'guetta, 1998. Hala *et al*., 2006; N'Dépo *et al*., 2009 ; N'guessan *et al*., 2011 ; N'Dépo *et al*., 2013 ; N'guessan *et al*., 2016). The purpose of this article was to study the diversity of insect visiting mango flowers during it flowering period.

MATERIAL AND METHODS

Study Area

The study was conducted in some mango orchards in the communal area of Korhogo. Five sites were chosen according to their accessibility (Figure 1). Korhogo is situated in the northern part of Côte d'Ivoire. The climat of this region is characterized by two seasons : a rainy season which extend from May to October and a dry season which extend from November to April.

Material and Methods

The work focused on plant material consisting of *Mangifera indica* flowers. In northern Côte d'Ivoire, this plant has its flowering phase which lasts from December to February.

The insects visiting flowers of *Mangifera indica* survey was carried out from January to February 2019 during the flowering period (December to February). The capture of insects visiting flowers was made using a sweep net twice a month (once every two weeks). Insect harvesting was conducted from 08 am to 11 am and from 03 pm to 05 pm (local time). Sampling was carried out every 30 minutes per plant survey (Ukoima *et al*., 2016**)**. The specimens collected were preserved in a concentrated ethanol at 70 °C. In the laboratory, specimens were sorted and identified by use of systematic and classification keys proposed by Delvare & Aberlenc (1989). Insects were counted and numbers of each species were expressed.

Statistical analysis

The diversity and community structure of insects were determined by using species richness, Shannon-Weiner index (Shannon and Weaver, 1949), Pielou evenness index (Pielou, 1966), abundance and relative abundance. The biodiversity indices were computed using Paleontological Statistics Software Package (PAST) 3.10. The statistical analysis employed Statistica version 7.1, one-way Anova was used to determine the differences in species richness, the abundance of species, the diversity and evenness indices of insects on each site.

Results

The insects visitors of *Mangifera indica* flowers belonged to 8 taxonomic orders. These were Hymenoptera, Hemiptera, Diptera, Coleoptera, Orthoptera, Lepidoptera, Odonata and Dictyoptera. Seven orders of insects were collected at Lapkolo, 6 at Katiofi and 5 orders were observed in each of the other 3 sites (Table 1). There was no significant difference ($P>0.05$) in the diversity of insects collected. A total of 418 individuals were collected. They were divided in order of importance as follows: Hymenoptera (48%), Hemiptera (23%), Diptera (19%), Coleoptera (5%) and Orthoptera (2%) (Figure 2). Lepidoptera, Odonata and Dictyoptera each accounted for 1% of insects collected. Insect abundance was highest in Katiofi and lowest in Kapélé (Table 1). There was no significant difference ($P>0.05$) in the abundance of insects collected between sites. The monthly variation in abundance showed that in Katiofi, the number of insects increased from 94 (January) to 24 (February). At Kapélé, the abundance has increased from 59 to 0. At Lakpolo, collected insect number varied from 68 (January) to 12 (February). In Torgokaha, the number of insects oscillated between 56 (January) and 20 (February), while in Natiokobadara, the number of insects decreased from 52 (January) to 33

Research Article

Copy Right ©KY Publications

Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in

A Peer Reviewed & Refereed, International Open Access Journal

Vol.6.Issue.3.2019 (July-Sept) ISSN:2455-0221(P), 2394-2606(O)

(February). The number of visiting insects of mango flowers generally decreased from morning to afternoon at all sites. The number of individuals observed is high in the morning and low in the afternoon (Figure 3). There is no significant difference (P>0.05) in the abundance of insects collected according to daily time. Shannon-Wiener diversity index varied from 1.07 (Kapélé) to 1.45 (Lakpolo) while Evenness value oscillated between 0.66 (Kapélé) and 0.74 (Lakpolo and Katiofi) (Figure 4). There was no significant difference (P>0.05) in the diversity index and Evenness between study sites. Likewise, there was no significant difference (P>0.05) in diversity indices according to daily time.

Table 1. Taxa richness and abundance of insects visiting mango flowers.

*=Presence of taxa

	Study sites				
Insects Orders	**Katiofi**	**Kapélé**	**Lakpolo**	**Torgokaha**	**Natiokobadara**
Hymenoptera	*	*	*	*	*
Hemiptera	*	*	*	*	*
Coleoptera	*		*		*
Diptera	*	*	*	*	*
Odonata	*	*			
Lepidoptera			*	*	
Dictyoptera	*		*		
Orthoptera		*	*	*	*
Taxa S	**6**	**5**	**7**	**5**	**5**
Abundance	**118**	**59**	**80**	**76**	**85**

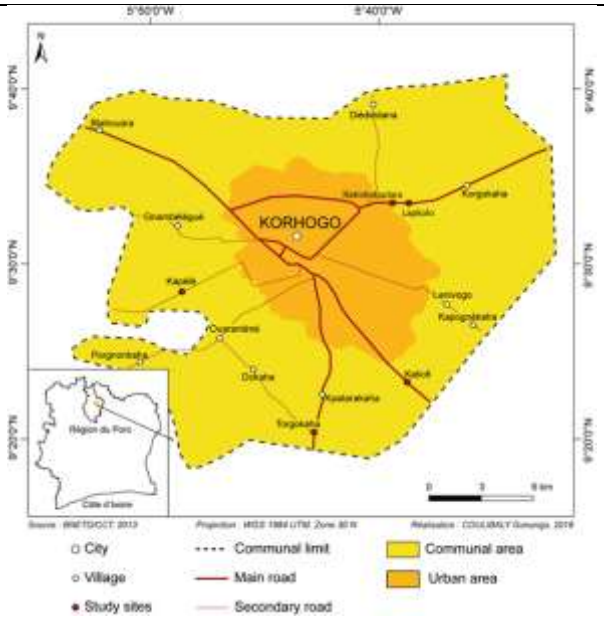

Figure 1. Location of the study sites.

Research Article
Copy Right ©KY Publications
Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in
A Peer Reviewed & Refereed, International Open Access Journal
Vol.6.Issue.3.2019 (July-Sept) ISSN:2455-0221(P), 2394-2606(O)

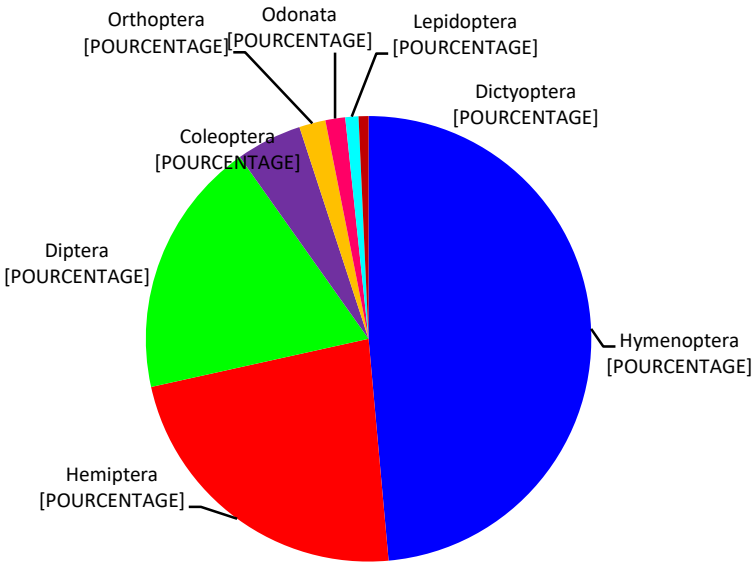

Figure 2. Relative abundance of the different orders of insects collected.

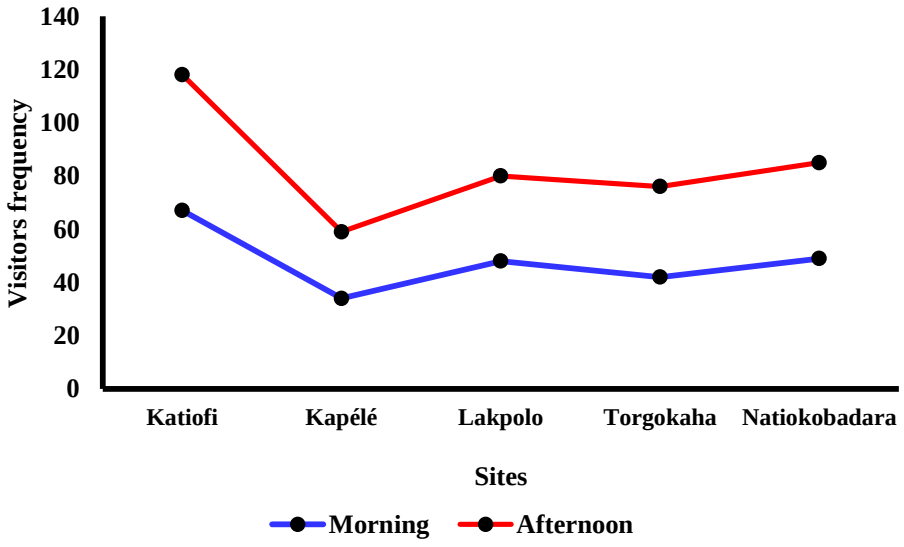

Figure 3. Evolution of frequency of insects visitor of Mangifera indica flowers as a function of times of the day.

Research Article
Copy Right ©KY Publications
Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in
A Peer Reviewed & Refereed, International Open Access Journal
Vol.6.Issue.3.2019 (July-Sept) ISSN:2455-0221(P), 2394-2606(O)

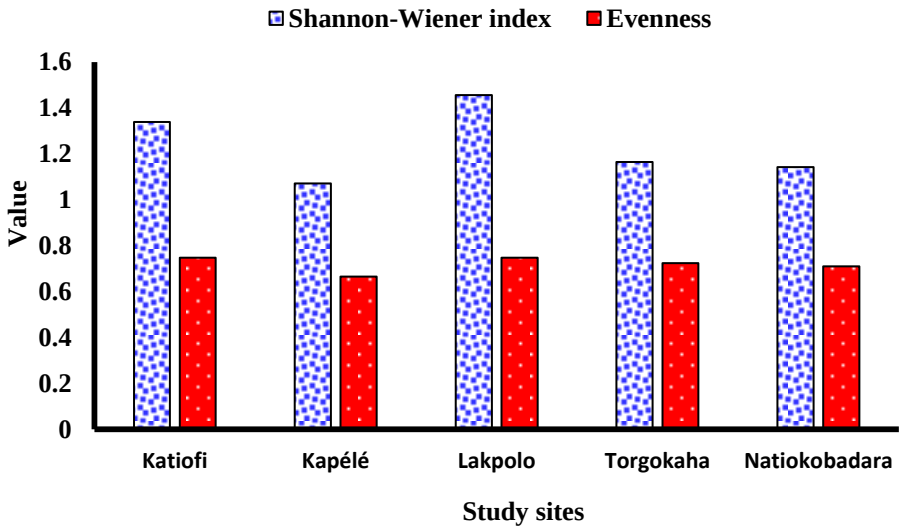

Figure 4. Spatial variation of diversity indices of insects visiting mango flowers.

Discussion

A total of 8 orders were collected in this study. These orders consited of Hymenoptera, Coleoptera, Diptera, Lepidoptera, Dictyoptera, Hemiptera, Odonata and Orthoptera. Hymenoptera, Diptera, Lepidoptera, Hemiptera and Coleoptera correspond to the settlment that generally visited Mango flowers. This result is in appropriateness with these obtained by Usha *et al*. (2014), Chauhan *et al*. (2018) and Windriyanti *et al.* (2019). The Hymenopterans constituted major group of insects visiting on mango flowers. Its followed by the Hemipterans and the Dipterans. These orders can be considered as constant visitors. The dominance of Hymenoptera and Diptera as major group of insects visiting on Mango flowers was shown (Usha *et al*., 2014; Windriyanti *et al.,* 2019). A difference in the monthly variation in abundance was observed. Indeed, the abundance of insects collected in January was higher than that of February. The high abundance of insects observed in January could be due to the fact that this month coincides with the period of intense flowering. At this moment, the insects would be strongly attracted by the scented smell of mango flowers. On the other hand, the low abundance registered in February could be due to the fact that after the first collection of this month, a rain preceded by a raging wind fell. The wind made the flowers fall so that it was difficult to observe the insects because of the lack of flowers. The insect diversity index of mango flower visitors of the different sites range from 1.07 to 1.45. These value are in the moderate category, namely the diversity index at intervals $1 \leq H' \leq 3$. Diversity is a combination of the number of species in a community (species richness) and evenness of each species (Evenness) (Magurran, 2004). Evenness index value (E) is a measure of species scatter patterns in a habitat. Evenness index values vary from 0 to 1. The closer to 1, all species have almost the same level of evenness. If the value approaches 0 it is estimated that a species becomes more dominant (Magurran, 2004). Evenness values of the sites ranged from 0.66 to 0.74. They were closer to 1 indicated equal distribution of individuals (Turkmen and Kazanci, 2010). Evenness value in the different sites tends to be close to 1, which means that in these sites, most taxa have similar abundance.

Research Article

Copy Right ©KY Publications
Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in
A Peer Reviewed & Refereed, International Open Access Journal
Vol.6.Issue.3.2019 (July-Sept) ISSN:2455-0221(P), 2394-2606(O)

Conclusion

This study relative to visiting flower insects identification showed that the most frequently orders encountered are Hymenoptera, Hemiptera and Diptera. The highest abundance of insects was recorded in morning. The results obtained from visiting flower insects are of great importance for future mango pollinator recognition programs. They will serve as a basis for studying the floral biology of *Mangifera indica* and its pollinators in order to increase and regulate fruit production.

Acknowledgement

We thank the owners of mango orchards who allowed us to carry out our study in their respective orchards.

References

[1]. Chauhan, A. K., Chandra U. and Gupta P. K. (2018). Study of pollinator's diversity on Mango (*Mangifera indica* L.) *var.* amrapali. Journal of Entomology and Zoology Studies, **6**(3): 974-975

[2]. Delvare, G. and Aberlenc H. P. (1989). Les insectes d'Afrique et d'Amérique tropicale.Clés pour la reconnaissance des familles. Montpellier, GERDAT, 302 p.

[3]. Fajardo, A. C. Jr. Medina J. R., Opina O. S. and Cervancia C. R. (2008). Insect Pollinators and Floral Visitors of Mango *(Mangifera indica* L. cv.Carabao). Insect the Philippine Agricultural Scientist, **91**(4) : 372-382.

[4]. FIRCA. (2008). Le FIRCA et la filière mangue: la mangue, une mine d'or pour la région nord de la Côte d'Ivoire, Bulletin d'information du FIRCA, N°03, 2^{e} trimestre 2008, 26 p.

[5]. Hala, N., Quilici S., Gnago A. J., N'Depo O. R., N'Da Adopo A., Kouassi P. and Allou K.(2006). Status of fruit flies (Diptera: Tephritidae) in Côte d'Ivoire and implications for Mango exports, in: Fruit flies of economic importance: from basic to applied knowledge, Proc. 7th Int. Symp. Fruit Flies of Economic Importance, Salvador, Brazil, 10–15September 2006 : 233–239.

[6]. Kumar S., Joshi P. C., Nath P., Singh V. K. and Mansotra D. K. (2016). Role of Insects inPollination of Mango Trees. International Research Journal of Biological Sciences, **5**: 64-67.

[7]. Magurran A. E. (2004). Measuring Biological Diversity. Victoria, Australia: Blackwell Publishing 215pp.

[8]. N'dépo, O. R., Hala N., Allou K., Aboua L. R., Kouassi K. P., Vayssières J.-F., De Meyer M. (2009). Abondance des mouches des fruits dans les zones de production fruitières de Côte d'Ivoire: dynamique des populations de Bactrocera invadens. Fruits, **64** : 313-324.

[9]. N'dépo, O. R., Hala N., N'Da A., Coulibaly F., Kouassi P., Vayssières J. F. and De Meyer M. (2013). Fruit flies (Diptera : Tephritidae) populations dynamic in mangoes production zone of Côte d'Ivoire. Agricultural Science Research Journal, **3** (11) : 352-363.

[10]. N'guessan, E. N. M., Aboua L. R. N., Séri-Kouassi P. B., Koua H. K. and Vayssieres J-F. (2011). Demographic parameters of the invasive species Bactrocera invadens (Diptera :Tephritidae) in guinean area of Côte d'ivoire. Journal of Asian Scientific Research, **6**:312-319.

[11]. N'Guessan E. N. M., Aboua L. R. N., Kadio E. A., Ahebe B., Tano D. K. C., Obodji A. and Seri-Kouassi B. P. (2016). Comparative study of some parameters biological of *Bactrocera dorsalis* and *Ceratitis cosyra* (Diptera :Tephritidae) pests of mango (*Mangifera indica*) in Côte d'Ivoire. Journal of Advances in Biology, **9**(3): 1887-1895.

[12]. N'guetta K. (1998). La cochenille farineuse du manguier *Rastrococcus invadens* (Homoptera: Pseudococcidae) en nord Côte-d'Ivoire, aspect économiques et perspectives de lutte. In: Lutte contre les ravageurs et les maladies du manguier en zone nord Côte-d'Ivoire (Eds), CNRA, 9 p.

Research Article

Copy Right ©KY Publications

Journal of Advanced Studies in Agricultural, Biological and Environmental Sciences (JABE) www.jabe.in

A Peer Reviewed & Refereed, International Open Access Journal

Vol.6.Issue.3.2019 (July-Sept) ISSN:2455-0221(P), 2394-2606(O)

[13]. Pielou, E. C. (1966). The mesurment of diversity in different types of biological collection. Journal of Theoritical Biology, 13:131-144.

[14]. Purseglove, J. W. (1972). Mangoes wesr of India. Acta Horticulturae, 24: 107-174.

[15]. Shannon, C. E. and Weaver W. (1949). The mathematical theory of communication. Urbana Illinois Press (USA), 117.

[16]. Sung, I. H., Lin M. Y., Chang C. H., Cheng A. S., Chen W. S. and Ho K. K. (2006).Pollinators and Their Behaviors on Mango Flowers in Southern Taiwan. FormosanEntomologist, **26**: 161-170.

[17]. Turkmen G. and Kazanci N. (2010). Applications of various biodiversity indices to benthic macroinvertebrate assemblages in streams of a national park in Turkey. Revue Hydrobiologique, **3** :111–125.

[18]. Ukoima H. N., Chukunda F. A., Abere, S.A., and Ebere, N. (2016). Diversity and Abundance of Insect Visitors to Flower of *Irvingia gabonensis* at Forestry and Environment Arboretum. Entomology and Applied Science Letters, **3**(2):1-9.

[19]. Usha, Srivastava P. and Goswami V. (2014). Diversity of floral insect visitors of mango during blooming period at Pantnagar. Indian Journal of Agricultural Sciences, **84**(3): 363–4.

[20]. Windriyanti W., Karindah S., Sulistyowati L. and Rahardjo B. T. (2019). Insect diversityVisitors to gadung 21 variety of Mango flower on off Season and on Season. Journal of Biodiversity and Environmental Sciences, **14**(2) : 63-70.