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Entomofauna of cucumber *Cucumis sativus* (L.), damage assessment caused by insect pests in Dabou in south of Côte d'Ivoire

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Abstract
One of the constraints of cucumber production is the pressure of insect pests. The need to effectively control these pests while maintaining entomological diversity has led to an inventory of the insects associated with the crop and to the damage caused by insect pests. This study was conducted from April to July 2014, in Dabou, in the Guinean zone of Côte d'Ivoire. Catches were made twice per a week, manually with pliers applying technique of mowing with sweep net and the plants have been inspected to identify damage caused by pests. 46 species grouped into 29 families and 11 orders were listed. The latter consisted of insect pests, predators and pollinators. The highest number of insects (1682 individuals) was registered to fruiting. The species of Tephritidae *B. cucurbitae* (237 individuals) *and B. dorsalis* (98 individuals) were the most harmful. At the before flowering stage, the attack rates of defoliating and sucking insects were 29.79 ± 4.79% and 13.12 ± 3.30%, respectively. At flowering stage, the attack rates of defoliating and sucking insects were 48.75 ± 6.58 and 29.16 ± 2.52, respectively. At fruiting stage, defoliating insects, sucking insects and the borer have induced attack rates respective of 72.08 ± 6.91%, 60.83 ± 2.30% and 63.65 ± 11.81%, respectively.

Keywords: cucumber, insect pests, auxiliary insects, phenological stages, attack rate

1. Introduction
In Côte d'Ivoire, cucumber production has become a booming activity in urban and peri-urban sites these recent years. Its culture has a short cycle and the sale of these products is relatively easy (Déclert, 1990) [1]. Unfortunately, insect pests are real problems for producers because of the damage they cause. Pesticides are most often used for the control of these pests (Bani 1990, Kekeunou *and al*., 2006) [2, 3]. This results in a significant reduction in the entomological diversity present in crops (Hou *and al*., 2002) [4]. While pesticides can control some phytophagous insects, they also contribute to the decline of other functional groups of insects such as predators, parasitoids and pollinators, which are essential for maintaining the equilibrium of agro-systems. Crop protection must first be preventive. According to Choudourou *and al*. (2012) [5], the preliminary step for successful protection of a crop is knowledge of these pests. It therefore requires frequent Phytosanitary inspections to detect the onset of attacks and attempt to halt their development by the most appropriate means. The cucumber Entomofauna has been the subject of little study in the Guinean zone of Côte d'Ivoire. The objective of this study is to contribute to the knowledge of the entomological fauna of cucumber and to evaluate the damage of these pests on these crops in Dabou.

2. Material and Methods
2.1 Study area
The study was conducted in Dabou (5°19' north latitude; 4 °22' west longitude) located in south of Côte d'Ivoire. The sub-equatorial climate is characterized by four seasons [13, 14]. a long dry season from December to March; a long rainy season from April to mid-July; a small dry season from mid-July to mid-September; a small rainy season, from mid-September to November. The study period extended from April 2014 to July 2014 with average temperatures between 25.6 and 28.2 °C, relative humidity between 83.35 and 85.9% and a rainfall of 396.22 mm.

2.2 Material
The plant material is the variety "Tokyo" of cucumber (*Cucumis sativus* L.). The animal material is represented by the insects caught on the experimental plot. The technical material is composed of clip, a net sweep, of gangs, small bottle, ethyl alcohol at 70 °C and Petri dishes.

2.3 Experimental field
The size experimental plot was 100.44 m² with 18.6 m at length and 5.4 m at wide. It was a randomized complete block design with three replications. It is divided into three blocks distant of three meters. Each block was composed four buttes of 0.6 meter of width separated from each other by 0.6 m. On each butte there were two lines of 10 plants spaced from each other by 0.6 m. One butte contains a total of 20 plants; a total of 80 plants per subplot.
The experimental plot was not treated with any pesticide during the experimentation.

2.4 Capture and identification of insects
The insects were captured by using pliers and nets. They were stored in small bottle containing alcohol at 70 ° C and taken to the laboratory for identification and counting. The identification was carried out using a binocular microscope, using family identification keys based on adult morphology (Delvare & Aberlenc, 1989) [6] and others as those of Hill (1983), Villiers (1948), Michel & Bournier (1997), Poutouli *and al*. (2011), (De Meyer, 1996; 1998; 2000) [7-13] to determine certain kind and species of insects. Two ecological parameters used to analyze the data are: relative abundance and frequency of occurrence. The relative abundance (Ar), was calculated according to the formula of Zaime & Gautier (1989) [14], in which: Ar (%) = (Ni / N) x 100 where Ni, number of individuals of a given species and N is the total number of individuals of all species combined.
Depending on the value of Ar, there are four classes of species: very abundant species (Ar> 10%), abundant species (5% ≤ Ar <10%), quite abundant species (1% ≤ Ar < 5%) and sparse species (Ar <1%).
According to the formula of Dajoz (2000) [15], the frequency of occurrence (C) is following: C (%) = (Pi / P) x 100 where Pi is the number of occurrence of a species and P is the total number of observations.
Depending on the value of C, the classes of occurrence are following: Ubiquist species (C = 100%), constant species (50% ≤ C <100%), commun species (25% ≤ C <50%) and by-catch species (C < 25%).

2.5 Assessment of damage caused by insect pests
A subplot was chosen randomly per block. Assessment of the damage caused by defoliating insects, sucking insects and borer was done by counting the attacked plants at of their leaves, stems, flower buds and pods on subplot. For each group of insects, the rate of attacked plants was calculated using the formula following hundred (Dupriez *& al*., 2001, Murúa *and al*. 2006) [16, 17].
Rate of attacked plants (%) = (Number of attacked plants / Number of total plants) x 100
Then, the mean attack rates caused by the three groups of insects were calculated for each Phenological stage.

2.6 Data Analysis
The data collected on the damage were subjected to analysis of variance (ANOVA) using the Statistica software version 7.1. The comparison of means was performed by the test of Newman - Keuls to the 5% threshold.

3. Results
3.1 Number of insects inventoried according to the phenological stages
The inventory permitted to identify 2997 insects. They belong to 46 species grouped into 29 families and 11 orders.
At the stage before flowering, 360 individuals were captured. *Aulacophora foveicolis* had the highest abundance (29 individuals); next came *Asbecesta cyanipennis* (27 individuals) and *Henosepilachna elaterii* (24 individuals).
At flowering stage, 995 individuals were caught. The species with the highest abundance was *Bemicia tabaci* (64 individuals), followed by *Aphis gossypii* (59 individuals) and *Liriomysa sp* (57 individuals).
At fruiting stage, 1682 individuals have been captured *B. cucurbitae* had the highest abundance (237 individuals). It was followed by *B. dorsalis* (98 individuals) and *Bemicia tabaci* (89 individuals) (Table 1).

Table 1: Number of insects identified according to the Phenological stages of the cucumber

			Numbers by Phenological stages			
Orders	**Families**	**Species**	**Stage before flowering**	**Flowering stage**	**Fruiting stage**	**Total**
Odonata	Libellulidae	*Hemistigma sp.*	0	25	42	67
		Trithemis sp.	0	23	40	63
Orthoptera	Tettigoniidae	*Ruspolia nitidula*	0	3	6	9
	Tetrigidae	*Tettiela arcuata*	1	0	5	6
	Acrididae	*Acrida turrita*	0	0	3	3
Dermaptera	Forficulidae	*Forficula sp.*	0	3	14	17
Dictyoptera	Mantidae	*Miomantis sp.*	1	6	11	18
Thysanoptera	Thripidae	Frankliniella sp	22	43	67	132
Heteroptera	Pentatomidae	*Coridius viduatus*	2	5	10	17
		Nezara virudula	1	4	9	14
		Dalsira costalis	0	3	7	10
	Reduviidae	*Rhynocoris sp.*	0	8	19	27
		Hediocoris fasciatus	0	4	13	17
	Coreidae	*Leptoglossus australis*	1	12	15	28
		Leptoglossus gonagra	2	8	16	26
		Cletus sp.	1	7	15	23
	Pyrrhocoridae	*Dysdercus wolkerii*	0	32	49	81
Homoptera	Aleyrodidae	*Bemicia tabaci*	22	64	89	175

	Aphididae	*Aphis gossypii*	20	59	78	157
	Cicadellidae	*Empoasca flavescens*	9	18	25	52
Coleoptera	Chrysomelidae	*Aulacophora foveicolis*	29	42	54	125
		Aulacophora africana	15	26	33	74
		Altica nigirta	14	19	28	61
		Ootheca mutabilis	10	18	22	50
		Asbecesta cyanipennis	27	33	57	117
		Aspidiomorpha sp.	20	38	49	107
	Coccinellidae	*Henosepilachna elaterii*	24	39	57	120
		H. reticulata	11	18	27	56
		Cheilomones sulphurea	19	27	33	79
	Cicindellidae	*Cicindella regalis*	0	4	9	13
	Meloidae	*Mylabris holoscericera*	10	19	27	56
	Tenebrionidae	*Lagria villosa*	4	24	30	58
Hymenoptera	Formicidae	*Camponotus sp.*	4	11	19	34
		Formica rufa	7	12	22	41
		Messor barbarus	2	11	19	32
		Pheidole sp.	7	13	25	45
	Vespidae	*Vespula vulgaris*	0	5	13	18
	Apidae	*Apis melifera*	0	23	31	54
	Sphecidae	*Prionys sp.*	0	5	9	14
Lepidoptera	Pyralidae	*Diaphania nitida*	10	29	34	73
		Margaronia indica	7	19	30	56
	Pieridae	*Nd*	5	17	31	53
	Nymphalidae	*Nd*	4	17	28	49
Diptera	Tephritidae	*Bactrocera cucurbitae*	17	54	237	308
		Bactrocera dorsalis	9	23	98	130
	Agromyzidae	*Liriomysa sp.*	23	57	75	155
	Syrphidae	*Episyrphus* sp.	0	25	52	77
			360	955	1682	2997

3.2-Distribution of captured insects according relative abundance

Among 46 species identified, *B. cucurbitae* was very abundant.

The four species (*Liriomysa sp*., *Bemicia tabaci*, *Aphis gossypii*) have been abundant. Twenty-nine mostly belonging to the order Coleoptera, Heteroptera, Hymenoptera, Odonata and Lepidoptera were quite abundant. Twelve belonging mostly to the order Dermaptera, Dictyoptera, Heteroptera and Orthoptera were scarce (Table 2).

Table 2: Relative abundance of the species captured

Orders	Families	Species	Relative abundances (%)	Classes
Odonata	Libellulidae	*Hemistigma sp.*	2,24	Quite abundant
		Trithemis sp.	2,10	Quite abundant
Orthoptera	Tetigoniidae	*Ruspolia nitidula*	0,30	Scarce
	Tetrigidae	*Tettiela arcuata*	0,20	Scarce
	Acrididae	*Acrida turrita*	0,10	Scarce
Dermaptera	Forficulidae	*Forficula sp.*	0,57	Scarce
Dictyoptera	Mantidae	*Miomantis sp.*	0,60	Scarce
Thysanoptera	Thripidae	Frankliniella sp	4,40	Quite abundant
Heteroptera	Pentatomidae	*Coridius viduatus*	0,57	Scarce
		Nezara virudula	0,47	scarce
		Dalsira costalis	0,33	Scarce
	Reduviidae	*Rhynocoris sp.*	0,90	Quite abundant
		Hediocoris fasciatus	0,57	Scarce
	Coreidae	*Leptoglossus australis*	0,93	Quite abundant
		Leptoglossus gonagra	0,87	Quite abundant
		Cletus sp.	0,77	Scarce
	Pyrrhocoridae	*Dysdercus wolkerii*	2,70	Quite abundant
Homoptera	Aleyrodidae	*Bemicia tabaci*	5,84	Abundant
	Aphididae	*Aphis gossypii*	5,24	Abundant
	Cicadellidae	*Empoasca flavescens*	1,74	Quite abundant
Coleoptera	Chrysomelidae	*Aulacophora foveicolis*	4,17	Quite abundant
		Aulacophora africana	2,47	Quite abundant
		Altica nigirta	2,04	Quite abundant
		Ootheca mutabilis	1,67	Quite abundant
		Asbecesta cyanipennis	3,90	Quite abundant
		Aspidiomorpha sp.	3,57	Quite abundant
	Coccinellidae	*Henosepilachna elaterii*	4,00	Quite abundant
		H. reticulata	1,87	Quite abundant

		Cheilomones sulphurea	2,64	Quite abundant
	Cicindellidae	*Cicindella regalis*	0,43	Scarce
	Meloidae	*Mylabris holoscericera*	1,87	Quite abundant
	Tenebrionidae	*Lagria villosa*	1,94	Quite abundant
Hymenoptera	Formicidae	*Camponotus sp.*	1,13	Quite abundant
		Formica rufa	1,37	Quite abundant
		Messor barbarus	1,07	Quite abundant
		Pheidole sp.	1,50	Quite abundant
	Vespidae	*Vespula vulgaris*	0,60	Scarce
	Apidae	*Apis melifera*	1,80	Quite abundant
	Sphecidae	*Prionys sp.*	0,47	Scarce
Lepidoptera	Pyralidae	*Diaphania nitida*	2,44	Quite abundant
		Margaronia indica	1,87	Quite abundant
	Pieridae	*Nd*	1,77	Quite abundant
	Nymphalidae	*Nd*	1,63	Quite abundant
Diptera	Tephritidae	*Bactrocera cucurbitae*	10,28	Very abundant
		Bactrocera dorsalis	4,34	Abundant
	Agromyzidae	*Liriomysa sp.*	5,17	Abundant
	Syrphidae	*Episyrphus* sp.	2,57	Quite abundant
			100,00	

3.3-Distribution of insects according to the frequency of occurrence

The distribution of insects according to the frequency of occurrence revealed the presence of 24 constant species belonging to six orders (Coleoptera, Diptera, Homoptera, Hymenoptera, Lepidoptera and Orthoptera); 11 common species belonging mostly to the order (Coleoptera, Dermaptera, Heteroptera and Hymenoptera); 11 by-catch species belonging mostly to the orders (Dictyoptera, Heteroptera and Orthoptera) (Table 3).

Table 3: Frequency of occurrence of the species captured

Orders	Families	Species	Frequency of occurrence C(%)	Classes
Odonata	Libellulidae	*Hemistigma sp.*	68,75	Constant
		Trithemis sp.	62,5	Constant
Orthoptera	Tetigoniidae	*Ruspolia nitidula*	12,5	By-catch
	Tetrigidae	*Tettiela arcuata*	12,5	By-catch
	Acrididae	*Acrida turrita*	6,25	By-catch
Dermaptera	Forficulidae	*Forficula sp.*	25	Constant
Dictyoptera	Mantidae	*Miomantis sp.*	18,75	By-catch
Thysanoptera	Thripidae	*Frankliniella sp*	56,25	Constant
Hétéroptera	Pentatomidae	*Coridius viduatus*	18,75	By-catch
		Nezara virudula	18,75	By-catch
		Dalsira costalis	6,25	By-catch
	Reduviidae	*Rhynocoris sp.*	25	Common
		Hediocoris fasciatus	18,75	By-catch
	Coreidae	*Leptoglossus australis*	25	Common
		Leptoglossus gonagra	25	Common
		Cletus sp.	18,75	By-catch
	Pyrrhocoridae	*Dysdercus wolkerii*	56,25	Constant
Homoptera	Aleyrodidae	*Bemicia tabaci*	56,25	Constant
	Aphididae	*Aphis gossypii*	56,25	Constant
	Cicadellidae	*Empoasca flavescens*	25	Common
Coleoptera	Chrysomelidae	*Aulacophora foveicolis*	81,25	Constante
		Aulacophora africana	81,25	Constant
		Altica nigirta	25	Common
		Ootheca mutabilis	18,75	By-catch
		Asbecesta cyanipennis	62,5	Constant
		Aspidiomorpha sp.	75	Constant
	Coccinellidae	*Henosepilachna elaterii*	87,5	Constant
		Henosepilachna reticulata	81,25	Constant
		Cheilomones sulphurea	81,25	Constant
	Cicindellidae	*Cicindela regalis*	18,75	By-catch
	Meloidae	*Mylabris holoscericera*	43,75	Common
	Tenebrionidae	*Lagria villosa*	43,75	Common
Hymenoptera	Formicidae	*Camponotus sp.*	50	Constant
		Formica rufa	43,75	Common
		Messor barbarus	50	Constant
		Pheidole sp.	50	Constant
	Vespidae	*Vespula vulgaris*	18,75	By-catch
	Apidae	*Apis melifera*	37,5	Common

	Sphecidae	*Prionys sp.*	25	Common
Lepidoptera	Pyralidae	*Diaphania nitida*	75	Constant
		Margaronia indica	75	Constant
	Pieridae	*Nd*	75	Constant
	Nymphalidae	*Nd*	81,25	Constant
Diptera	Tephritidae	*Bactrocera cucurbitae*	75	Constant
		Bactrocera dorsalis	62,5	Constant
	Agromyzidae	*Liriomysa sp.*	56,25	Constant
	Syrphidae	*Episyrphus* sp.	62,5	Constant
			100	

3.4 Status and actions of insects

Several categories of insects have been distinguished according to the age of the plant, the organs visited and the mode of feeding. These are: pests and auxiliary insects (pollinators and predators).

3.4.1 Pest Insects

Depending on how they were fed, the insect pests caught were divided into three groups: defoliating insects, sucking insects and borers.

- **Defoliating insects**

The majority of insects from the order Coleoptera, Orthoptera and larvae of Lepidoptera belonged to this group. Coleoptera represented by Chrysomelidae (*Aulacophora foveicolis*, *Aulacophora africana*, *Asbecesta cyanipennis*, *Altica nigrita*, *Aspidiomorpha sp*, *Ootheca mutabilis*, Coccinellidae (*Henosepilachna elaterii*, *H. reticulata*) and Tenebrionidae (*Lagria villosa*) partially devoured the leaves of the plants, resulting in perforations of the limb, the Orthoptera consisting of Tettigoniidae (*Ruspolia nitidula*), Acrididae (*Acrida turrita*) and the Tetrigidae (*Tettiela arcuata*) gnawed at the leaves and sometimes cut the stems of the young plants, while the larvae of the Lepidoptera Pyralidae, Nymphalidae and Pieridae consumed the leaves.

- **Sucking insects**

They were constituted by Homoptera Aphididae (*Aphis gossypii*), Cicadellidae (*Empoasca flavescens*, Aleyrodidae (*Bemisia tabaci*). Diptera Agromyzidae (*Liriomysa sp*.) and Thrips belong to this group. Heteroptera of the family Pentatomidae (*Coridius vidualis*), *Nezara virudula*, *Dalsira costalis*), Coreidae (*Leptoglossus australis*, *L. gonagra*), Pyrrhocoridae (*Dysdercus wolkerii* and *Cletus sp*.) are also the representatives of this group. These different insects sting and suck the sap in the leaves and flowers

- **Borers**

The larvae of Diptera Tephritidae (*B. cucurbitae* and *B. dorsalis*) were the representatives of this group. The gravid females of these flies lay their eggs in the fruits. After hatching the eggs, the larvae feeding on them dig galleries in the fruit thus deteriorating their quality.

3.4.2 Assessment of damage caused by insect pests following phenological stages

- **Stage before flowering**

At the stage before flowering, the first defoliators appeared were Chrysomelidae (*Aulacophora foveicolis*, *Aulacophora africana*, *Asbecesta cyanipennis*, *Altica nigrita*, *Aspidiomorpha sp*, *Ootheca mutabilis*), Coccinellidae (*Henosepilachna elaterii*, *H. reticulata*). They gnawed the leaves, leaving many holes in the limb. They were followed by sucking biters, Aleyrodidae (*Bemicia tabaci*), Aphididae (*Aphis gossypii*), Cicadellidae (*Empoasca flavescens*) and Agromyzidae (*Liriomysa sp*.). The latter sting and remove the sap of the leaves thus revealing an embossed appearance and mines on the leaves. Some individuals of Tephritidae have been observed.

During this stage, the attack rates of defoliating and sucking insects were respectively 29.79 ± 4.79% and 13.12 ± 3.30% (Figure 1A).

- **Flowering stage**

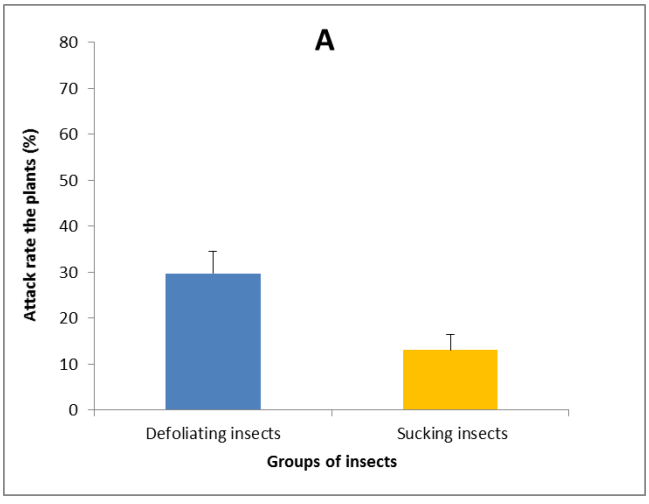
During this phase, several Lepidoptera of the family Pyralidae, Nymphalidae and Pieridae appeared on the flowers. Meloidae (*Mylabris holoscericera*), and larvae of Lepidoptera gnawed at the flowers. Pests observed during the stage before flowering increased further, increasing plant damage. Larvae of Lepidoptera devoured the leaf parenchyma, revealing only the veins. Many individuals of Pentatomidae (*Coridius vidualis*, *Nezara virudula*, *Dalsira costalis*) and Thripidae appeared. The number of *B. cucurbitae* and *B. dorsalis* flies increased slightly.

During flowering stage, defoliating insects induced an attack rate of 48.75 ± 6.58% while that of sucking insects was 29.16 ± 2.52% (Figure 1B).

- **Fruiting stage**

Many larvae of Coccinellidae, Pyralidae, Nymphalidae and Pieridae were present on the leaves. In addition to the previously mentioned insects, many Pyrrhocoridae (*Dysdercus wolkerii*) and Coreidae (*Leptoglossus australis*, *L. gonagra*, *Cletus sp*.) have appeared on leaves, flowers and fruits. Several females of Tephritidae (*B.cucurbitae* and *B. dorsalis*) laid their eggs in fruit, thereby infesting them.

During this stage, the attack rates of defoliating, sucking insects and borers were respectively 72.08 ± 6.91%; 60.83 ± 2.30% and 63.65 ± 11.81% (Figure 1C).



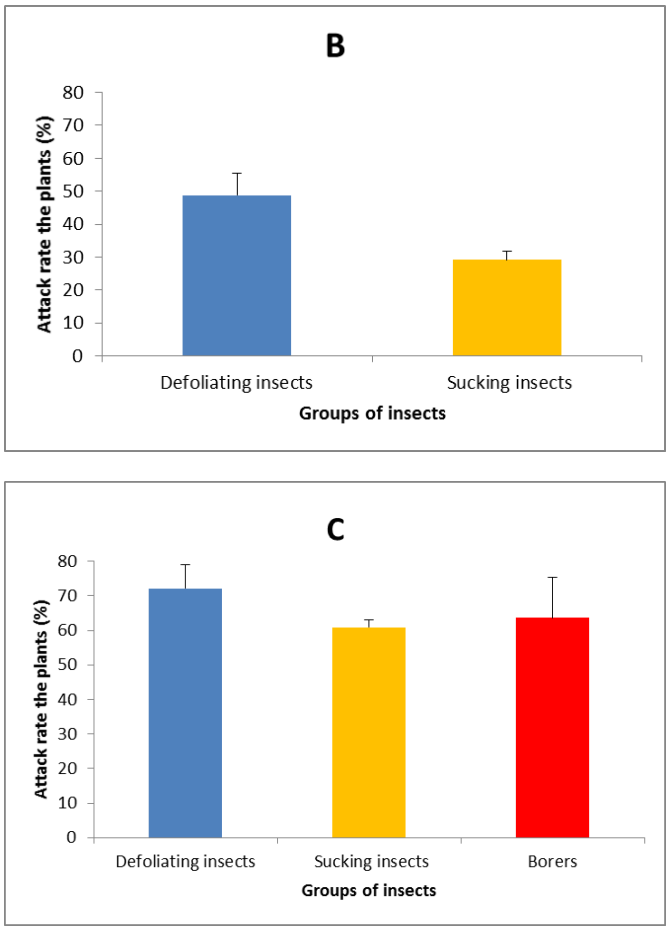


Fig 1: Attack rates of insect pests during the phenological stages **(A:** Stage before flowering**; B:** Flowering stage**; C:** Fruiting stage**)**

3.4.3 Action of insect auxiliary

- **Predators**

The predators captured belonging to family: Mantidae (*Miomantis sp*), Cocinellidae (*Cheilomenes sulphurea*), Cicindellidae (*Cicindela regalis*), Reduviidae (*Hediocoris fasciatus* and *Rhynocoris sp*.), Libellulidae (*Hemistigmata sp*. and *Trithemis sp*.) and Forficulidae (*Forficula sp*.).

Some species of the family Formicidae attacked eggs, caterpillars and larvae of other insects. Several have been found extracting Bactrocera larvae from fruit or recovering third stage hoppers that have skipped fruit.

- **Pollinators**

At the flowering stage, several pollinating insects appeared on the cucumber. The majority of these are Apidae (*Apis melifera*), Vespidae (*Vespula vulgaris*), adults of Syrphidae (*Episyrphus sp*.), Pyralidae, Nymphalidae and Pieridae which foraged the flowers.

4. Discussion

The study of cucumber entomofauna revealed the presence of 46 species grouped into 29 families and 11 orders. Many authors have reported that insect species associated with cucurbits belong to several orders and families. Adja *et al.* (2014) [18], in their work on the entomofauna of cucurbites (*Lagenaria siceraria* and *Citrullus lanatus*) in Côte d'Ivoire reported 71 insect species grouped into 41 families and 10 orders. Fomekong *et al*. (2008) [19] inventoried in Cameroon, on *Cucumeropsis mannii* 37 species grouped to 36 families and 9 orders.

The number of insects captured varied with the phenological stage of cucumber. Insects captured during fruiting stage were higher than that of flowering stage. The smallest number of insects was recorded during stage before flowering. This same observation was made by [17] Adja *et al*., 2014 on cucurbites. A similar finding was made by Séri-Kouassi (2004); Obodji *et al.* (2016) and Ossey *et al* (2017) [20, 21, 22].

The relative abundance study revealed that the species (*A. foveicolis*, *A. africana*, *A. cyanipennis*, *A. nigrita*, *Aspidiomorpha sp*., *O. mutabilis*, *H. elaterii*, *H. reticulata*, *B. tabaci*, *A. gossypii*, *Liriomysa sp*.) and *Frankliniella sp*. were abundant in the stage before flowering, whereas in the fruiting stage. *B. cucurbitae* and *B. dorsalis* were the most abundant. Several authors (Collingwood, 1984, Blancard *et al*., 1991, Vayssières, 2000, Adja *et al*., 2014) [23, 24, 25, 18] reported that these pests were commonly found on Cucurbitaceae at these stages.

A high number of defoliators (Chrysomelidae and Coccinellidae) and sucking insects (Aleyrodiddae, Aphididae, Thripidae and Agromyzidae) observed in the before flowering and flowering stages could be explained by the fact that at these stages almost all plant organs were tender and gorged with sap. As such, they were an easy-to-use food source.

Adults of Chysomelidae have pierced the leaves and sometimes the flowers of small holes. Coccinellidae when they devoured the parenchyma and the lower epidermis between the veins. The attacked leaves became translucent, grayish in color and dried. The other defoliators meanwhile, have consumed the leaves by cutting the borders of the limb thus leaving irregular deformations.

The sucking insects stung, sucked the sap of the leaves, and secreted the honeydew that led to the formation of sooty mold that inhibits photosynthesis and weakens the plant. Following the injection of toxic saliva from some of them, the leaves became embossed and rolled down. These sucking insects sometimes transmitted viruses to plants. Similar observations have been made by Blancard *et al*., 1991; Fomekong *et al*., 2008; Adja *et al*., 2014 [24, 19, 18] on crops of Cucurbitaceae.

At fruiting stage, a high number of flies *B. cucurbitae* and *B. dorsalis* were observed in cucumber crops. The authors (Vayssières *et al*., 1999; Fomekong *et al*., 2008; Adja *et al*., 2014) [26, 19, 18] also mentioned fly attacks on Cucurbitaceae fruits at this stage. This could be explained by the fact that the abundant fruit odor has attracted a large number of Tephritidae adults for mating and therefore egg-laying by pregnant females under the epidermis of the fruit. The larval development of these Tephritidae caused the fruit to fall or decay.

Many predatory insects were encountered in the crops during our surveys. Several other authors (Vayssières *et al*., 2000, Fomekong *et al*., 2008 and Adja *et al*., 2014) [25, 19, 18] have reported the presence of predators in Cucurbitaceae crops. Most of these insects have mostly observed outbreaks of Aleyrodidae and Aphididae. These would play a critical role in the natural control of insect pest populations (Hawkins, 1999) [27].

In our study, many pollinating insects (Hymenoptera, Lepidoptera Diptera and Syrphidae) were attracted to cucumber flowers. Entomophilous pollination is a key factor in fruit production in cucurbitaceae. Most monoecious or gynoic varieties require the presence of pollinating insects for fruit production and higher yield (Free 1993, Nogueira-Couto & Calmona 1993, Gingras *et al*.,1996, Fomekong *et al*. 2008)

[28-30, 19].

5. Conclusion

The inventory of the entomofauna associated with cucumber cultivation in southern Côte d'Ivoire revealed the presence of 46 species grouped into 29 families and 11 orders. The various insects listed are divided into two functional groups, essential for maintaining the equilibrium of agro-systems. We distinguish insect pests and auxiliary insects (predators and pollinators). Among the pests, we distinguish the defoliating insects, the sucking insects and the borers. The attack rates induced by these varied according to the groups and the phenological stage of the plant. Thus, during the stage before flowering, the attack rates of defoliating and sucking insects were respectively 29.79 ± 4.79% and 13.12 ± 3.30%. At flowering stage, the attack rates of defoliating and sucking insect were 48.75 ± 6.58 and 29.16 ± 2.52, respectively. During fruiting stage, the attack rates of defoliating, sucking insects and borers were 72.08 ± 6.91%, 60.83 ± 2.30% and 63.65 ± 11.81%, respectively. The problem, most important, at the entomological level, remains that posed by Tephritidae (*B. cucurbitae* and *B. dorsalis*) which cause damage to the fruit causing their total decay and a considerable reduction in marketable yield.

6. References

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