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Evaluation of the Efficiency of Aqueous Extact of Neem Fruits on Insect Pest of Rice in Rice Agroecosystem of Maga in the Far North Region of Cameroon

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***Abstract*— *The chemical fight against insects pest causes many problems on the biodiversity of ecosystems, destabilizes the trophic level of the ecosystem and has harmful effects on the on health human. Mean while the biological fight using plants extractions can equally play the same role of killing pest, reason why the present study which was carried out in the irrigated perimeters of Maga in the Far North region of Cameroon, have as principal objective to evaluate the aqueous extraction of neem fruit on the insects pest of rice. The specific objectives were to know the biological diversity of insect pest in the irrigated perimeters of Maga, and their repartitioning in the phenological stages, again, to see the effects of the aqueous extractions of the neem fruits on the insects pest per variety and in function of the phenological stages, also to evaluate the damages cause by insects pest during the talling stage in function of the varieties, finally, to evaluate loss cause by the insects pest. The study was made on two rice varieties which were IR46 and NERICA3 in a split plot disposition. The capturing of the insects was done with the help of a sweep net and the identification of the species was done with the help of an entomological buttle, the identification key of insects by Heinrich (1993), Hill (1983), Heinrichs and Barrion (2004) and the families recognition keys by Delvare and Aberlenc (1989).The method of Breniere permited the estimation of loss of output at the talling and harvesting stages of rice caused by the insect pest. The analysis of variance of the result was done using SPSS 20. In the class of insects, twenty two species of insects fall in twenty families divided in seven orders were collected. Among the captured insects, we investigated fourteen insects which were pest. The biological fight have shown an effectiveness in the nursery, talling, and a positive and non negligible effects on the reduction insects pest in the heading and maturation stages and thus has permitted the reduction of damages from insects on the rice plants.*

***Keywords*— Biology fight, insects pest, rice, neem, agro ecosystem.**

I. INTRODUCTION

1. Context

Rice (*Oryza sativa* L.) constitude the most feed aliment in the whole world (Guigaz, 2002). According to FAO, world rice consomation soppose to has risen between 2012 and 2022 at least 1% per year against 1,7% for the years 90- 2010. The average consomation per habitat soppose to have increase slightly to 58, 2 kg per person (FAO, 2013). In Africa, rice is produced and consium in 39 countries (Sanni *et al*., 2009). The culture of rice is an important activity for the population of some zones in West and Central Africa assuring food security to about 20 million producers and makes about 100 million persons to live if we make the averages of five persons in peasant famillies (ADRAO, 2002). For the period of 2000 to 2005 Africa has produce about 17,4 millions of tones of paddy rice whereas in 2006 to 2009 this production increase to 22 millions tones of paddy rice (FAO, 2011). The demand for rice in West and Central Africa had increase to 6 % per year ; more faster than anywhere in the world mean while in the same time production increase to 4 % (ADRAO, 2004 ; Sanni*et al*.,2009).

Faced with this situation, the populations of these regions are forced to imports in order to meet their needs. While the world paddy rice production is 745709788 tonnes on a surface of 1 647 216 663 ha (FAO, 2013) thus a yield of 4 527,1 kg/ha, Africa has a production of 29

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318 488 tonnes on a surface of 10 931 051 ha with a yield of 2 682,1 kg / ha (FAO, 2013), which is twice as small compared to the world yield. Cameroon for its part has a production of 194094 tonnes for a cultivated surface of 166734 ha or a return of 1164, 1 kg/ha (FAO, 2013), which is three to four times smaller than the world and two times smaller than the yield in African. Cameroon is rank 64th in the world and the 16th in Africa behind Chad. Cameroon imports more than two thirds of its rice needs. The annual production of Cameroon oscillates between 100,000 and 170,000 tons. Too little to satisfy its annual requirements estimated at 600,000 tons approximately. The slightest disruption in producing States (floods or) are drought, or social unrest) is automatically felt in the basket here. Besides the food crisis of February 2008, dubbed "riots of February 2008" is a consequence of this situation. Yet Cameroon has the resources (soil, favorable climate, water) needed to be the leader in production of rice in the subregions of Central Africa. The public power and the research are expected to play a major role to boost production, which is faced with many problems. These constraints include the non-competitiveness of the local rice against the imported rice including countries in Asia, and the technical improvement of routes especially the fight against pests such as insects. Arhent and *al*. (1983), felt that among the 41.1 percent of the total losses of rice, 27.5% were due to insects. They are famous for the damage they cause to crops and diseases which they are vectors (Breniere, 1983). Woin and *al*., (2004) four species of insects transmit the virus of variegation yellow rice plants in three major irrigated rice Lagdo, Maga and Yagoua in northern Cameroon and of lowland rice paddies. These are among other *Chnootriba similis*, *Chaetocnema pulla*, *Trichispa sericea* and *Locris rubra*. Wilhelm and *al*., (2008) fourteen species of insect pests and vectors of the (RYMV) rice yellow mottle virus are associated with irrigated and rain-fed rice cultivation in the region of the far North. Among these insects four species are found in abundance throughout the region of the far North. These include *Nephotettix nigropictus* (Hemiptera: Cicadellidae), *Cofana spectra* (Hemiptera: Cicadellidae), *Diopsis thoracica* (Diptera: Diopsidae) and *Sogatella furcifera* (Hemiptera: Delphacidae).

The use of insecticides to control insect pests of rice is source of many problems and the phytosanitary industry uses all arguments to convince them of the merits of the use of its herbicides, insecticides and other pesticides. Facing these speeches, the facts are still there: industrial accidents, pesticides banned or outdated shipped in developing countries, water contamination, end, weigh definitely favour a reduction in the use of pesticides. Especially since alternatives exist.

2. Problem

Improvement and security of agricultural production and the difficulties associated with the insect attacks have pushed researchers and farmers towards the use of synthesis chemical insecticide. But these insecticides have proved its ineffectiveness against certain insect pests, according to Brevault and *al*. (2007), the whitefly, *Bemisia tabaci* (Gennadius), and aphid, *Aphis gossypii* have acquired resistance to organophosphate insecticides characters in Cameroon. In addition these pesticides are extremely stable and persistent in the environment, accumulate in living organisms and food chains, are toxic to humans and animals and cause chronic effects such as dysfunction at the level of the reproductive and immune and endocrine systems, as well as cancers, and are propagated in the environment over long distances to remote locations of the sources of emissions (IOMC, 2002).

Yet there are alternatives to the use of insecticides such as substances of plant origin. *Azadirachta indica* Juss is a tree in the Meliaceae family, native to India (Formad environment, 2013). It is used and known for its insecticide, fungal properties and medicinal (Huang and *al*., 1995; Valladares and *al*., 1999; Carpinella and *al*., 2002). This tree is present in the far North region of Cameroon, however the use of the aqueous extract of the fruit has never been experienced on insect pest of rice. Yet the work of Kosma and *al*., (2010) on the properties chemical seeds of neem on nematodes of plantain were effective more, the work of Djile, (2010) bode on the use of neem seed extracts have shown efficiency of the cake of neem on fungal diseases of Cowpea and still the experimental work of Abu Togola, (2010) using oil of neem on insect pests of rice shown very useful.

In view of all this knowing the properties of the neem tree, it is necessary before use of this plant against insect pests, to assess the effectiveness of these substances on insects before using, to see what variety is more efficient, what is its economic significance on two main varieties of rice grown in the far north region of Cameroon in an agroecosystem finally, to see the variety that is best suited for beneficial conclusions can be drawn for food security.

3. Objectives

The main objective is to assess the effectiveness of the aqueous extract of fruit of neem on insect pests of rice in the rice-growing perimeter of Maga, specifically our work ambition are:

-Know the biological diversity of insect pests in the irrigated perimeter of Maga and their distribution by phenological stage.

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-See the effect of the aqueous extract of fruit of neem on insect pests by variety and according to the phenological stages.
-Evaluate damage during talling stage according to variety
-Evaluate the losses due to drillers' insects during harvesting

II. MATERIALS AND METHODS

1. Materials

1.1. Localisation of studied area

The study was conducted in the irrigated rice area of the company of Expansion and modernization of the rice of Yagoua (SEMRY) on the site of Maga.

Maga is located in the Division of the Mayo-Danay, region of the far North, and between 10 ° 9' and 10 ° 50' latitude North and 14 ° 57' and 15 ° 12' longitude. Maga is limited:
-To the North by the Borough of Logone-Birni,.
-To the West by the Borough of Bogo,
-To the South by the Borough of Kaikai,
-The East by the river Logone.

1.2. Biological Materials

1.2.1. Cultivars of rice

The cultivar of rice used in this study will be *Oryza* sp. The two varieties of rice used are IR46 and Nerica 3.

1.2.2. The fruits of neem

Neem fruits have been picked up in the town of Maga at the level of the premises of the SEMRY, the collected fruits are those found in the ground below the neem tree, and then they are dried.

1.3. Experimental dispositive

Experimental design was a split plot consists of three blocks, divided into basic plots of 7 m x 4 m; in each block, two types of treatments (biological control and control) were applied on two varieties of rice (IR 46 and NERICA 3) with three replicates. The dimensions of each basic plot are 7 m x 4 m, between the basic plots are walkways of 1 m wide and between blocks the aisles of 2 m wide.

1.4. Materials for collections of insects

The collection equipment used here is the sweep net.

The "sweep net" is a net that is used to collect the insects that live on plants (Goldstyn, 2003). There are different types of nets for the capturing of flight, capture to the ground and mowing, but all consist of three parts: a circle (or RIM), a Pocket (or purse) and a handle. These three parts can be adapted to specific hunts types, for example in the water or in the air. The net used in this study is characterized by the length of his pocket which is approximately twice the diameter of the circle. The diameter of the circle is 40 cm, Pocket about 80 cm and the handle is long (more than 1 m). The Pocket quite fine-mesh fabric, offers little resistance to air. The net is used to mow by Rapids lateral movements of comes and goes.

Insects will be caught using net "sweep net" depending on the case at the rate of 25 double sweeps (50 sweeps) on each of two (02) perpendicular medians in each plot during periods of collections.

2. ethods

2.1. Obtention of the aqueous extract of neem fruit

The principle of obtaining extracts from seeds of the neem tree has been described since 1975 by Jacobson and Kumar (2003). Extracts from seeds of the neem tree are formed by powder, meal, aqueous and alcoholic seed extracts. The extraction of these substances from seeds of the neem tree can be done in various ways, mechanical and basis of alcoholic compounds such as ethanol and methanol. This principle will be amended to adapt it to our context which is the fruit of aqueous neem extraction

2.2. Aqueous extract of the fruit of neem

The fruits of neemier picked up are dried at a temperature of 40 ° C, for two days. We take a quantity of 2 kg of the fruit, grinds it, envelope in a canvas. The canvas is immersed in a container of 5 liter water, immersion lasts one night. Removing water canvas and spins its contents, finally we add the liquid water to have 15 litre of water then we sieve. The aqueous solution obtained is the extract. Before use is added to a wetting agent such as the detergent previously dissolved in water of 5 to 10 mg and everything is thoroughly mixed. The prepared solution is used directly in the following hours.

2.3. Application of the aqueous extract of fruit of neem

The application of aqueous extract of seed by spraying on rice plants is performed during an interval of two weeks after the nursery of plants until the last collection of insects in maturity or 0.84 per litre for 28 m 2.

2.4. Method of collecting insects

2.4.1. Rhythm of the sampling of insects after the application of the aqueous extract of the fruit of neem by sweep net

On each elementary plot regardless of the treatment applied to the basic plot, the insects will be caught using net "sweep net" depending on the case at the rate of 25 double sweeps (50 sweeps) on each of the parcels elementary so as to cover all the surface by positioning itself on two (02) perpendicular medians in each plot at two week intervals from the fifteenth day after planting or transplanting.

2.4.2. Period of collection of insects

The sampling was carried out on the following four phenological stages of rice: nursery, talling, inflorescence and seed maturation.

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2.5. Technique of observation and identification of specimens

The keys for the identification of insects from Heinrich (1993), Hill (1983), Heinrichs and Delvare (2004) and the recognition of Delvare and Abbasi families of key (1989) will be used to identify different collected species.

2.6. Measurements and data analysis

The larvae, pupae and adults will be counted as the representatives of the strength of the species on each variety, according to variety, from the application of the extract of neem and untreated plots. This allowed us to classify various specimens collected in different orders, families, genera and species and then determine the number of each of these specimens compared with the phenological stages of the plant.

The data used was the Excel software and submitted to statistical analysis using the software SPSS 20. Averages will be compared using ANOVA test to the 5% threshold.

2.7. Assessment of losses due to insects at harvest time

The methodology for this evaluation is that of Breniere (1982).

Fifteen days before the beginning of the harvest, we take 20 clumps of rice on each elementary parcel to examine. Sampling is done randomly. To do this, we simply stretch a rope with knots spaced all across the rice fields of 2 m, removed the nearest clump of each node. All stems carrying panicles are separated from each other, until we get a total of 200 stems (stop at this number). We opens then each stem with a penknife, and are classified in:

-panicles without attacks from borers in the stem: n1;

-panicles with attacks of borers in the stem (insects present or not): n2.

After threshing of grains of each batch, we get:

-p1, weight of n1.

-p2, weight of n2.

On the same location, estimate the number of panicles per square metre. To do this, we uses a rigid framework of 1 m² asked to randomly on the ground (do ten repetitions to get an average value). The following formula expresses with a fairly good approximation (by weight of grain per hectare) loss due to attacks by Drillers from the heading

$$P = \frac{200\frac{p_1}{n_1} - (p_1 + p_2)}{200} \times 10\,000\ N$$

P= Weight loss of the grain in ha

n_1=Panicles without attack of borers in stems;

n_2=Panicles with attack of borers in stems; (insects present or not);

p_1= Weight of n1;

p_2= Weight of n2;

N= Numbers of panicles in m^2

This data can then be converted into monetary value. There will be care in category n1, stems whose tassels would be altered by causes other than Drillers (blast to the neck for example). If their number is not too important, the benefit expected by the fight against the Drillers would be reduced even. Note that this method of calculation does not take account of losses (dead hearts) during tillering. Because of these inaccuracies, this assessment - is usually the actual loss. It can therefore be regarded as a minimum usable for the study of the profitability of the fight. The method is quite laborious but without difficulty.

2.8. Assessment of damage from insects during talling

To achieve this, it was noted on each parcel:

-Nt: average number of fruiting stems / m2 control plots;

-N: average number of fruiting stems per meter square plots. These values are obtained by averaging a few surveys (at least five) conducted at random in each plot using a rigid framework of 1 m².

If, on the other hand, surveys intended for the assessment of the loss of harvest due to the stem borers after tillering was conducted (using the above method) on plots of couples, the formula indicates the loss before bolting:

$$P_a = \frac{P_1}{n_1} \times 10\,000\,(N - Nt)$$

n_1= Numbers of stems without attack of borers

p_1= Weight of grains of n_1

P_a= Loss of harvest cause by insects before heading.

Applied to each control plot, this formula is used to calculate the average value of Pa of all couples (treated plots and untreated) representative of the rice-growing perimeter. The expected results will be reliable if the area concerned is relatively homogeneous and if found not in the presence of certain pests that are characterized by heterogeneous infestations: sampling, then, is more really representative of reality. All of this is generally feasible in situations of strongly framed rice which has begun investments (irrigated) requiring the guarantee of high productivity.

III. RESULTS, ANALYSIS AND DISCUSSIONS

1. Biological diversity of insects in the paddy field of Maga

1.1. Inventory of the biodiversity of insects and classification

The Table 1 show the species collected in our experimental plot in the irrigated perimeter of Maga.

Table 1 presents the species collected in our experimental plot in the irrigated perimeter of Maga, Classes, orders,

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families, genera species classification and along with their status.

Table.1: Status and classification of species caught in the rice fields of Maga

CLASS	Orders	Famillies	Gender/species	Status according to Heinrich et *al*., (2004)
insects	Diptera	Otitidae	*Physiphora clausa F*	Scavenger
		Micropezidae	*Glyphodera mantis*	Scavenger
		Culicidae	*Culex robinotus*	Scavenger
		Diopsidae	*Diopsis sp*	Scavenger
		Syrphidae	*Microdon johannae*	Predator
			Allongnota nasuta macquar	Predator
			Paragus dolichorus	Predator
	Coleoptera	Lagridae	*Lagria gesquierie*	Scavenger
		Apionidae	*Apion africanum* gull	Scavenger
		Coccinellidae	*Cheilomenes lunata*	Predator
			Xanthadalia effusa	Predator
		Staphilinidae	*Paeserus fucipes* curtis	Predator
	Hemiptera	Cicadellidae	*Nephottetix nigropictus*	Scavenger
		Pentatomidae	*Diploxys dipunctata*	Scavenger
			Agonocelis harolldi Beigs	Scavenger
		Alydidae	*Stenocoris claviformis*	Scavenger
	Héminoptera	Braconidae	*Bracon sp*	Parasitoïds
			Apanteles rufierus	Parasitoïds
	Lepidoptera	Noctuidae	*Sesamia calamistis*	Scavenger
		Pyralidae	*Maliarpha separatella*	Scavengers
	Orthoptera	Avididae	*Cussyrtus bivittatus*	Scavenger
		Tettigoniidae	*Conocephalus maculatus*	Predators and Scavengers occasionaly
	Odonata	Lestidae	*Lestes sp*	Predator
		Libellulidae	*Palpopleura sp*	Predator
Arachnida	Araneae	Araneidae	*Araneus sp*	Predator
		Tetragnidae	*Tétragnatha juculator*	Predator

It appears from this table 1 that we have surveyed 26 species of arthropods divided into two classes, the class of insects and the class Arachnida. 24 species belong to the class of insects divided into 7 orders and 18 families, and 2 species belong to the class of Arachnids in an order and two families. 13 inventoried insect species have the status of pests, 9 the status of predators and 2 species of parasitoids status. 2 arachnid species have the status of predator of insects. Insect pests of rice are diverse and numerous, addressing almost all parts of the rice plant. They are in the numbers of 14 and 4 insect pests cause damage to plants, according to Chaudhary and *al*., (2003) of *Sesamia calamistis*, *Diopsis* sp, *Nephottetix nigropictus*, *Maliarpha separatella*. By the same author: *Nephottetix nigropictus* apart from the food damage caused by suction and resulting in a shortened culture, growing in these early stages of development. It is a vector of viruses from stunting rice, nanissante jaundice, transitory yellowing, tungro of disease of the yellow sheet - orange and stunting to wales of rice.

• *Sesamia calamistis*, *Diopsis* sp, *Maliarpha separatella* are stem borers. Damage caused by these borers are boring and are carried out by the larva in the leaf sheath, generate from large longitudinal zones discolored and whitish on the feeding sites. But lead rarely wilting and drying of leaf boundaries, about a week after hatching, the larva stops feeding from leaf sheaths and hollow inside the rod to feed on the parenchyma of the stems. Such a mode of feeding often results in a rupture of the apical parts of the plant above the location of damage when this type of damage occurs during the vegetative stage of the plant, the Central whorl of leaves do not open, becomes brownish and dry, while the leaves lower remain healthy and green. This State is known as of dead heart and affected tillers die without producing tassels. Larvae feeding on the panicles sometimes cause dead hearts but

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if no further damage occurs cut parts are repelled by the new growth.

These results compared to that done by Wilhelm and *al*., (2013) in the same ecosystem. Shows us that there are some insects that are more present as *Chaetocnema pulla*, *Chnootriba similis*, *Locris ruba*, *Cofana spectra*, *Sogatella furcifera*, *Nilaparvata lugens*. This can be caused by climatic factors which are not favourable to the outbreak of these insects during this period. Compared to the result of Ondo and *al*., (2014) our biodiversity is less rich in species, this can is hard to different ecosystems, the method of collection of various insects and different varieties of rice.

1.2. Inventory of insects captured in different phenological stages and classification

The Table 2 show the inventory in different stages shows that insect pests vary in richness (number of species), in abundance (number of each species), based on different stages.

Table.2: Insect pests inventoried in the nursery

Class	**Orders**	**Familles**	**Genders/Species**	**IR46**	**N3**
Insecta Hexapoda	Diptera	Otitidae	*Physiphora clausa F*	83	94
		Culicidae	*Culex robinotus*	183	176
		Micropezidae	*Glyphodera mantis*	196	211
		Diopsidae	*Diopsis sp*	1	4
	Coleoptera	Lagridae	*Lagria gesquierie*	0	1
		coccinellidae	*Cheilomenes lunata*	0	1
	Hemiptera	Cicadellidae	*Nephottetix nigropictus*	48	56
	Lepidoptera	Noctuidae	*Sésamia calamistis*	0	1
Total	**4**	**8**	**8**	**511**	**544**

IR46: Total number of insects collected in plots IR46

N3: Total number of insects collected in plots NERICA3

This table shows the number of insects captured on control plots, rice varieties IR46 and NERICA 3 nursery depending on their class, order, family, genus and species. The insects captured at the nursery stage vary in numbers and species. They are spread over 4 orders and 8 families of Diptera, the order that has the most species, and the most abundant species is *Glyphodera mantis*.

At the nursery stage, the plants has characteristic of being very young and has well developed leaves bodies which promotes the development of phytophagous insects as defoliators insects and sucking biting of the leaves and it is what will justify the presence of Diptera pests and bugs. The table 3 shows the number of insects captured on control plots, rice varieties IR46 and NERICA3 during talling.

Table.3: Inventory of insect pests at the talling stage

Classe	**Orders**	**Familles**	**Genders/species**	**IR1**	**N1**
Insect hexapoda	Diptera	Otitidae	*Physiphora clausa F*	342	316
		Culicidae	*Culex robinotus*	132	133
		Micropezidae	*Glyphodera mantis*	212	427
		Diopsidae	*Diopsis sp*	0	2
	Coleoptera	Lagridae	*Lagria ghesquierie*	3	0
			Cheilomenes lunata	2	2
	Hemiptera	Cicadellidae	*Nephottetix nigropictus*	92	249
	Lepidoptera	Pyralidae	*Maliarphas eparatella*	1	2
		Noctuidae	*Sesamia calamistis*	0	0
Total	**4**	**9**	**9**	**784**	**1131**

IR46: Total number of insects collected from plots IR46

N3: Total number of insects collected from plots NERICA3

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This table 3 shows the number of insects captured on control plots, rice varieties IR46 and NERICA3 during talling depending on their class, order, family, genus and species.

At the talling stage insect pests that we have captured, we divided them into 4 orders, 9 families and 9 species.

At the talling stage the plants are young, well developed, bushy so insects grow best because the environ is conducive for their outbreak. So, defoliating, biting and sucking phytophagous insects belonging to the orders of Diptera and hemipteran especially develops. According to Grist and *al.*, (1969), Hemiptera *Nephotettix* sp were indeed recognized as vectors of serious diseases of Tungro, Yellow dwarf and the Grassy Stunt Virus including the extension seems to expand with the development of highly productive varieties and high talling.

The table 4 shows the number of insects captured on control plots, rice varieties IR46 and NERICA3 in heading stage.

Table.4: Inventory of insect pests in heading

Class	**Order**	**Famillies**	**Genders/species**	IR1	N1
Insecta Hexapoda	Diptera	Otitidae	*Physiphora clausa F*	255	413
		Micropezidae	*Glyphodera mantis*	182	260
		Culicidae	*Culex robinotus*	15	15
		Diopsidae	*Diopsis sp*	21	15
	Coleoptera	coccinellidae	*Cheilomenes lunata*	1	0
		Lagridae	*Lagria gesquiere*	0	1
	Lepidoptera	Pyralidae	*Maliarpha separatella*	18	24
		Noctuidae	*Sesamia calamistis*	6	4
	Hemiptera	Cicadellidae	*Nephottetix nigropictus*	111	129
		Alydidae	*Stenocoris clariformis*	1	1
	Orthoptera	Avididae	*Cussyrtus bivittatus*	0	1
Total	**5**	**11**	**11**	**610**	**863**

IR1: Total number of insects collected in plots IR46
N3: Total number of insects collected in plots nerica3

This table 4 shows the number of insects captured on control plots, rice varieties IR46 and NERICA3 in heading stage depending on their class, order, family, genus and species.

At the heading stage we caught 11 species of insect pests in 5 orders and 11 families the order Diptera was dominant and abundant. Insects caught in this stage are defoliators and also sucking biting, we note the presence of a grain pest, Stenocoris clariformis

At the heading stage the plant has the characteristics of tillering but the difference of the output of the panicle is warranting that they are almost of the same type of insect pests and paniculaire initiation the granivores call where the presence of *Stenocoris clariformis*.

The table 5 shows the number of insects captured on control plots, rice varieties IR46 and nerica 3 at the stage maturite.

Table.5: Inventory of insect pests in mature

Class	**Order**	**Famillies**	**Gender/species**	**IR1**	**N1**
Insect	Diptera	Otitidae	*Physiphora clausa F*	14	33
		Culicidae	*Culex robinotus*	7	10
		Micropezidae	*Glyphodera mantis*	1	16
		Diopsidae	*Diopsis sp*	43	34
	Coleoptera	Coccinellidae	*Cheilomenes lunata*	0	0
		Apionidae	*Apion africanum gull*	1	0

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		Pentatomidae	*AgonocelisharolldiBeigs*	1	2
			Diploxys dipunctata	2	2
		Alydidae	*Stenocoris claviformis*	0	1
	Hémiptera	Cicadellidade	*Nephottetix nigropictus*	12	13
Total :	**3**	**9**	**10**	**81**	**111**

IR1: Total number of insects collected in plots IR46

N3: Total number of insects collected in plots NERICA 3

This table 5 shows the number of insects captured on control plots, rice varieties IR46 and NERICA3 at the stage maturite function of their class, order, family, genus and species.

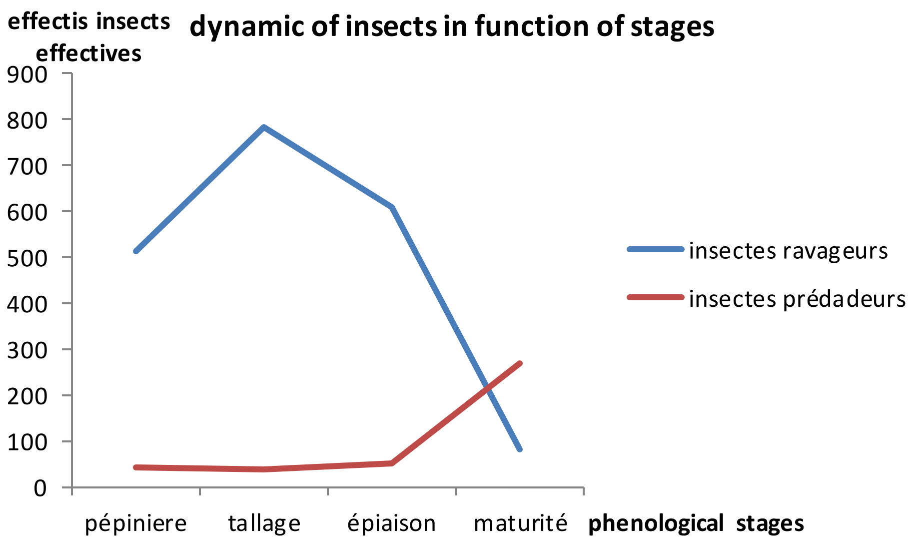
At the maturity stage we captured 10 species of insects. Divided in 3 levels and 9 families, insect pests are less abundant and are of sucking biting of seeds which are dominate.

The mature stage is marked by the senescence of leaves and stems. Insects are struggling to feed on the foliage for insects phylophages, also on the stem to stem borers. But the training and seed development promotes granivores insect outbreaks of the justifying the increase in species of Hemiptera much.

1.2.. Population dynamics

- **Population dynamics of insects on the IR46 varieties**

The figure 1 shows the dynamics of insect phenological stages.



- **Dynamic of the population of insects on NERICA 3 variety**

Fig.1: Curve of the dynamics population of insects on the IR46 variety

The curve of insect pests has almost the shape of a Bell, the size of the population of insects at the talling stage has the highest number followed by the heading and the nursery, insect pests are more numerous than the predators except at the end of maturity where the predators are more numerous than insect pests.

Insect pests are more numerous at the tillering stage because at this stage the plant is young and well developed. Combined with climatic factors this stage promotes the overgrowth of insect pests, at the nursery stage pests such as stem borers are in the larval stage which makes a very difficult conditions for their capture by the sweep net.

- **Dynamics population of insects on NERICA 3 variety**

The figure 2 shows the dynamics population of insects on NERICA 3 variety

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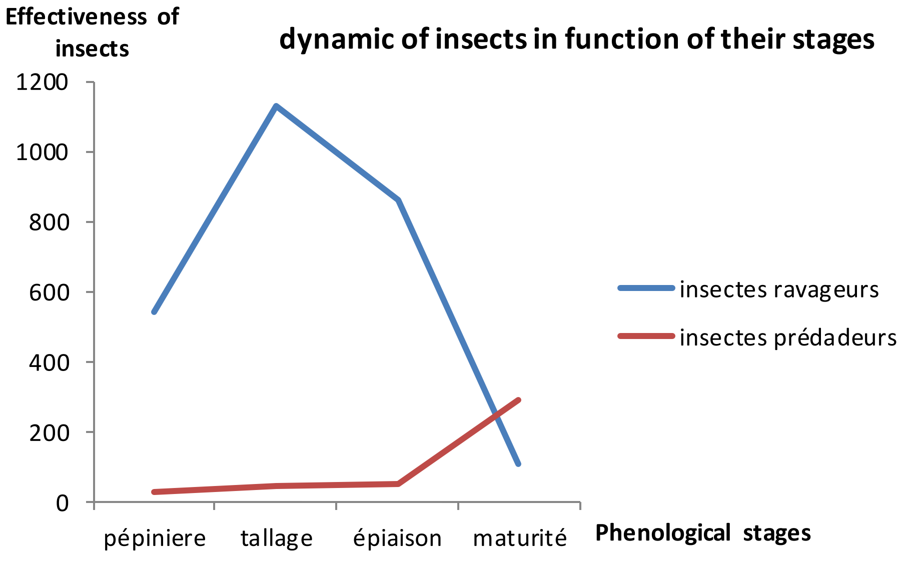


Fig.2: Dynamic of the population of insects on NERICA 3 variety

2 Evaluation of the aqueous extract of neem fruit on rice variety

The curve of pest insects in the shape of a Bell (figure 2), she believed from the nursery until the tillering reaches an optimum and decreases to the maturation. This means that throughout the growth of the rice, the population of insects varies according to the phenological stages and varieties. Tillering is the stage or insects are more likely followed by the heading, nursery and finally maturation. The curve of Predatory insects believes slowly. The nerica3 variety has more bugs than the variety IR46 no matter the phenological stages. The variation of the insects throughout the growth of rice can be explained because each phenological stage has a peculiarity and involves some specific insects, and play on their density in relation to the ecological environment. During the talling stage the plant are bushy well-developed, phytophagous insects like defoliators of leaf sucking biting, and also of stem borers are present in abundance. The duration of this status and the ecological conditions for the development of insects can explain significant outbreak of insects in this stage.

During the heading stage, the quality and quantity of SAP contained in the leaves and parts of the plants declines, leaves are sparse and poor quality this justifies the decline in population during this stage.

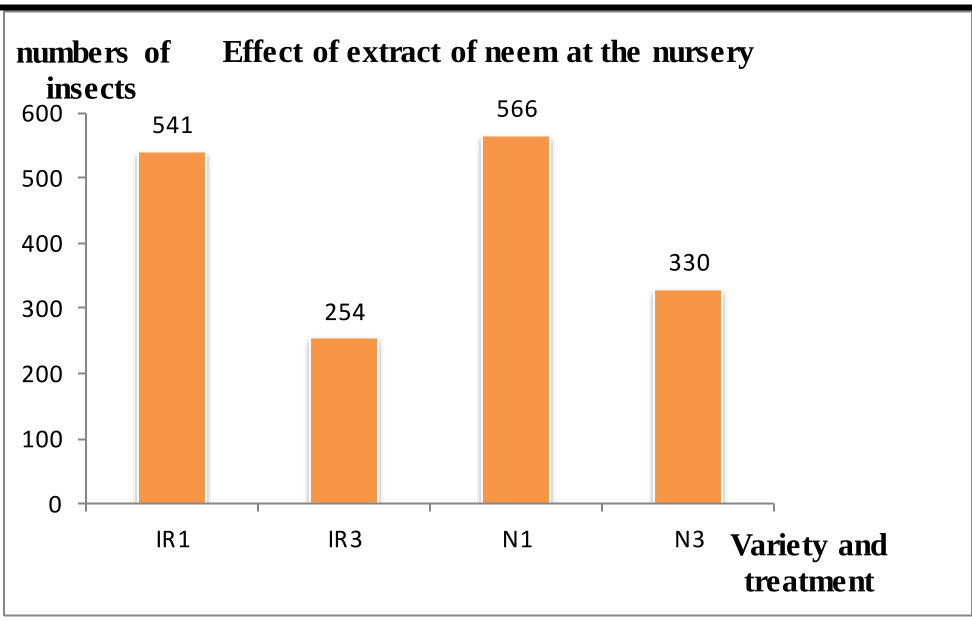
The maturity stage is marked by the senescence of leaves and stems so insects do feed on the vegetative parts of the plant, the maturity stage is especially marked by advanced defoliation and senescence. All this helps to reduced numbers of insect pests, the abundance of predators in this stage can be explained by the effect that the maturity stage coincides with the arrival of rains which promotes the Tettigonidae outbreaks.

Given this dynamic of insects from the rice phenological stage we realize that insects have much more visited the heading, nursery and talling stage and it more on during talling, nurseries and early heading stages that should be considered to fight against insect pests. In mature climatic conditions may favour the outbreak of insect predators.

3. Assessment of the effect of the aqueous extract of the fruit of the neem on insects of rice

- **Nursery**

The figure 3 shows the diagram of the strength of insects, collected in the different treatments by the variety at the nursery stage.



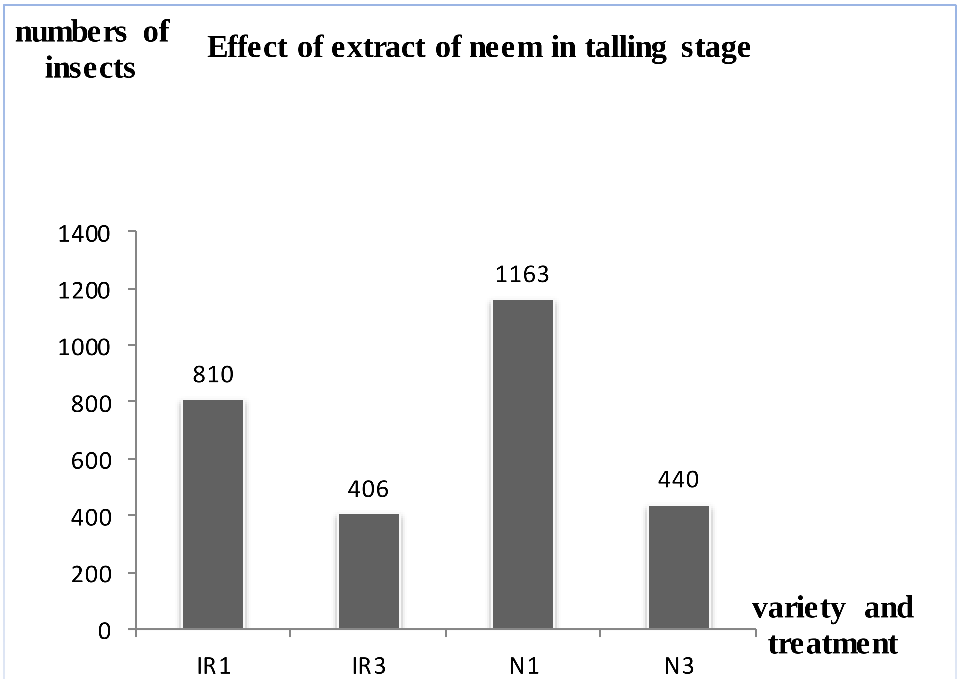
IR1: control IR46, IR3: Treatment of IR46 with aqueous extract of neem seeds, N1 control NERICA3, N3: treatment of NERICA 3 with aqueous extract of neem seeds.

Fig.3: Effect of biopesticide in the nursery

One notes that the number of insect pests on the control is larger, than the number of insect pests on plots treated with aqueous neem fruit extract regardless of the variety of rice. On the threshold of 5% biological treatment is significant for the variety IR46 compared with control IR46, and organic NERICA3 treatment is significant as compared to the nerica3 control. This means that the treatment has been effective insect pests affect hard rice by hunting and by inhibiting food intake. Jacobson (1984), demonstrates the inhibition of food intake of the flea beetle of *Podagrica uniforma* and development of larvae of the beetle and the Epilarchnacrysoelina melon lemon *Papiliode modocus*.

- Talling

Figure 4 shows the diagram of the strength of insects, collected in the different treatments by variety at the tillering stage.



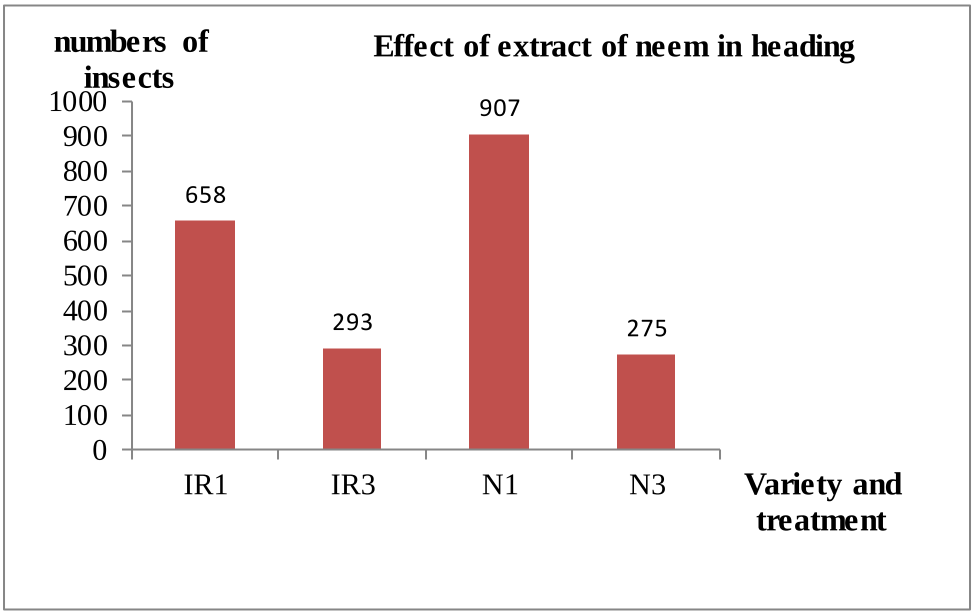
IR1: control IR46, IR3: Treatment of IR46 with aqueous extract of neem seeds, N1 control NERICA3, N3: treatment of NERICA 3 with aqueous extract of neem seeds

Fig.4: Effect of biopesticide in talling

Numerically the number of insect pests on witnesses is larger, than the number of insect pests on plots treated with aqueous neem fruit extract regardless of the variety of rice. On the threshold of 5% biological treatment of Nerica is significant on the control Nerica treatment and IR46 biological treatment has a positive effect on insects from the control of IR46. The insecticidal action of the aqueous extract of neem fruit had an effect on insects pest by reducing their numbers on treated plots according to Gaby (1997) the action of the neem tree is at least 100 species of pests including rice leafhoppers, flies etc...

- **Heading**

The figure 5 shows the diagram of the strength of insects, collected in the different treatments by variety at the heading stage.



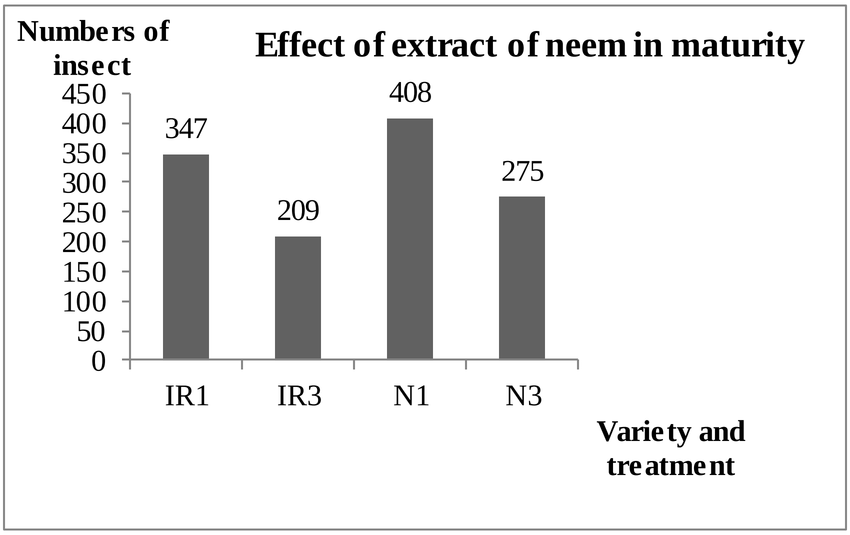
IR1: control IR46, IR3: Treatment of IR46 with aqueous extract of neem seeds, N1 control NERICA3, N3: treatment of NERICA 3 with aqueous extract of neem seeds

Fig. 5: Effect of biopesticide in heading

On the threshold of 5% biological treatments had effects on control the action of the aqueous extract of neem on insects, it is not significant because the dose was not sufficient at this point or Sunshine which quickly denatured the product during heading.

- Maturation

The figure 6 shows the diagram of the strength of insects, collected in the different treatments by variety at the maturity stage



IR1: control IR46, IR3: Treatment of IR46 with aqueous extract of neem seeds, N1 control NERICA3, N3: treatment of NERICA 3 with aqueous extract of neem seeds

Fig.6: Effect of biopesticide in maturity

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The strength of the insect pests on plots of varieties IR46 and NERICA3, is significantly higher compared to plots treated with aqueous extract of fruit of neem in the maturity stage. But on the threshold of 5% biological treatments are not significant. This can be due to climatic conditions which are not conducive to the application of the aqueous extract of neem fruit. Because the maturity stage coincides with the onset of the rains. Jacobson (1997), advocate that the aqueous extract of neem fruit may protect rice during two week to condition that does not rain.

- **Effect of the varieties on insects**

The figure 7 shows diagram of the population of insects on IR46 and NERICA3 varieties

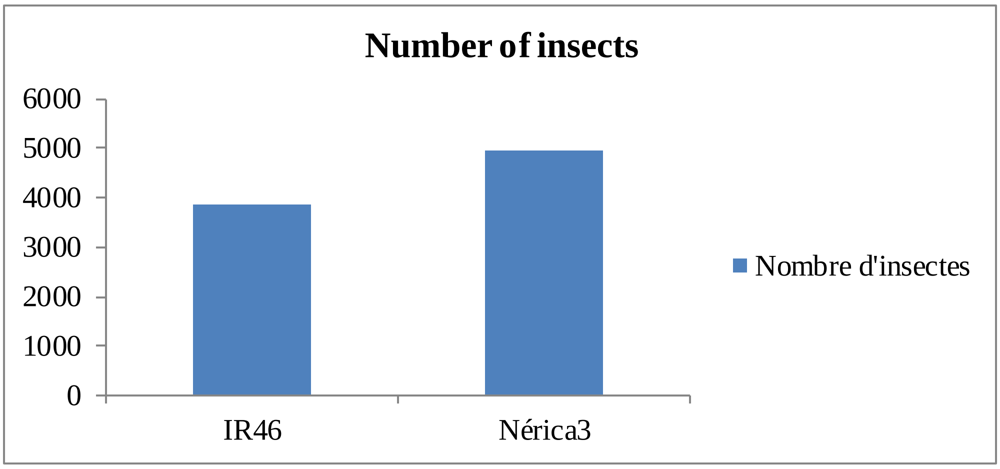

Fig.7: Diagram of the population of insects on IR46 and NERICA3 varieties

Insects are many on the NERICA3 variety IR46 variety but statistical analysis on the threshold of 5% is not significant on the presence of insects on the different varieties.

2. Assessment of damage during talling

The table 6 presents the average number of fruiting stems per square metre on plots of witness, the average number of fruiting stems per square metre on the treated plots, the weight of grain of n1 and the loss of harvest due to insects acting before bolting.

Table.6: Components of the estimate of the damage during talling

IR1	N1
n_1=93 P_1 =0,11 N= 365,5 Nt= 358	n_1=104 P_1 =0,082 N= 480 Nt= 480
Pa=88,71 Kg	Pa=520,38 Kg

N = number of stems without attacks by Drillers
P1 = n1-grain weight
N1 = number of stems without attacks by Drillers
PA = loss of crop due to insects acting before bolting
NT: average number of fruiting stems / m2 control plots;
N: average number of fruiting stems per meter square of plots
IR1: control of IR46 plot
N1: control of NERICA 3 plot

The estimate of damage caused by insects pests before bolting for the control of variety IR46 parcel is Pa = 88, 71 Kg, and for the control of the nerica3 variety plot is Pa = 520, 38 Kg. These results indicate that if rice plant is not treated with the aqueous extract there will be losses due to insect pests before bolting of Pa = 88, 71 Kg for the variety IR46 and Pa = 520, 38 Kg for the variety of rice NERICA3 in this rice agroecosystem. The aqueous extract of neem fruit has a positive effect on the yield of rice, in the sense that it prevents insect pests to their devastating actions on rice.

3. Evaluation at the time of harvest of losses due to borers

The table 7 presents the results of 200 fruiting stems counted on the 20 clumps of rice plants, collected samples of our basic plots, depending on the treatment and the variety. The panicles of the 200 primocanes are divided in panicles without attack of stem borers and panicle with attack of stem borers.

Table.7: Enumeration of the 200 primocanes by treatment

	T1	T3
IR46	n_1= 107 n_2= 93	n_1=93 n_2=107
NERICA3	n_1=106 n_2=94	n_1= 107 n_2=93

T1 : control T3: biological treatment

The table 8 shows another component of the formula for the evaluation of losses.

This table 8 shows average fruiting stems per square metre and the weight of panicles without attacks and attacks.

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Variety and treatment	weight of panicle(Kg)	Average of fruitified stem in m^2
IR1	p_1=0,122 p_2=0,1	375
IR3	p_1=0,08 p_2=0,09	365,5
N1	p_1=0,092 p_2=0,053	558
N3	p_1=0,01 p_2=0,075	358

IR1: control IR46, IR3: Treatment of IR46 with aqueous extract of neem seeds, N1 control NERICA3, N3: treatment of NERICA 3 with aqueous extract of neem seeds

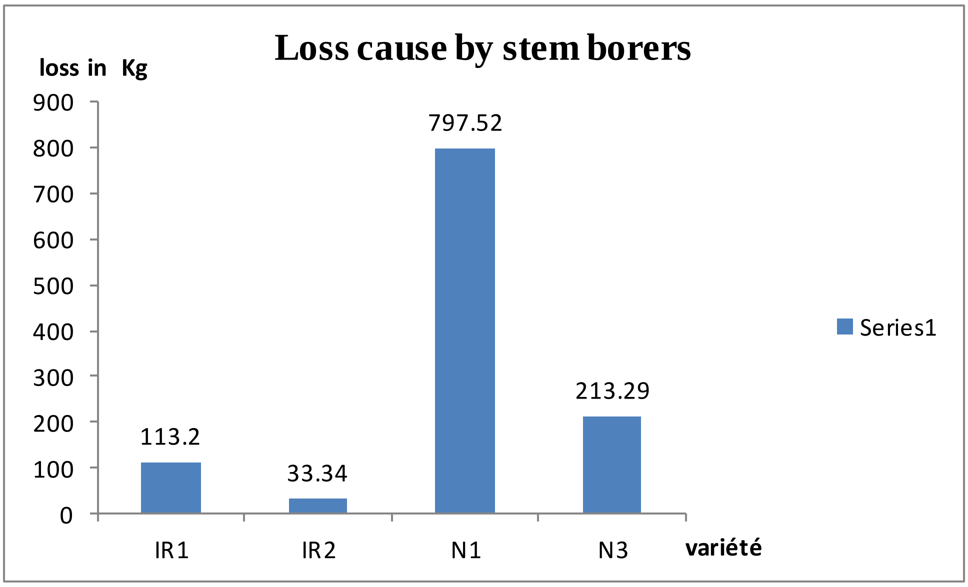
.

P1: weight of panicules without attacks from borers in the stem.

P2: weight of panicles with attacks of borers in the stem (insects present or not).

The fruitful shoots average per square meter is higher for the control compared to the treated plots. This is due to anti parasite and insecticides of the aqueous extract of fruit of neem on borers, which consequently reduces their action on the rice plant by preventing the formation of dead hearts.

The figure 8 shows the damage caused by the action of insect borers on the rice plant.



IR1: control IR46, IR2: Treatment of IR46 with aqueous extract of neem seeds, N1 control NERICA3, N3: treatment of NERICA 3 with aqueous extract of neem seeds.

Fig.8: losses caused by stem borers on the basis of treatments

Losses caused by stem borers at harvest for control of IR46 is 113,20 Kg, biological treatment of IR46 is 33, 34 Kg, control of nerica 3 797, 52 Kg, biological treatment of nerica 3 213, 29 Kg. The control recorded more losses in the aqueous extract of fruit of neem in treated plots, but the Nerica variety, had more loss than the variety IR46.

The aqueous extract of neem fruit has an effect on insect borers, this influence reduces their damage to the rice plant and causes the increase in efficiency.

IV. CONCLUSION

Rice (*Oryza sativa l.*) is the base food of over half of the population of the globe (Guigaz, 2002). But this culture faced many obstacles to its production including attacks from insect pests, control by use of synthetic insecticides and have negative impacts on the biodiversity of the ecosystems and human health yet nature gives us ways to biocontrol through crop protection of crops as the aqueous extract of neem seed against these insects was at issue for us in this study to evaluate the effectiveness of the aqueous extract of fruit of neem on insect pests of rice. To get there we set specific objectives:

- Know the biodiversity of insects in the area irrigated by Maga left by phenological stage of the rice plant.
-To see the effect of the aqueous extract of fruit of neem on insect pests by variety and according to the phenological stages.
-Evaluate insect on the plant during talling damage according to variety
-To assess losses due to insect borers.

As indicated in this study that there are two classes of arthropods, class Arachnida, and the insecta. The class of Arachnids is represented by an order, two families, and two species of insects, the class of insects is distributed in seven orders, twenty families, and twenty-four species. All species of spiders are predators. Among the captured insects we identified 13comon insect pests, of which four are classified as the fearsome enemies to the cultivation of rice. They registed a damage of up to 100% yield loss, it's *Sesamia calamistis*, *Diopsis* sp, *Nephottetix nigropictus, Maliarpha separatella*. Insect predators include 9 species and parasitoids are numbers 2 species of insects.

The distribution of insect pests by phenological stage varies in abundance in each phenological stage. The most visited stadium by insects is the talling stage. Because at this point the rice plant is well developed and shaped tuft, favourable to the development of insects. The insects were much more abundant on the variety of rice NERICA 3 on the variety of upland rice IR 46.

The aqueous extract of fruit of neem shown to be effective against insects in the nursery and talling stages and had effects on reduction and the action of insects on the rice heading and ripening plant.

The aqueous extract of neem fruit resulted in a reduction of the yield losses caused by insects, and therefore it has improved the yield of rice. Despite to kill insects and reduce the losses caused by them, the aqueous extract of neem seed is more efficient than the use of insecticides synthetic insecticides on insects but contributed enormously to the respect for the environment by decreasing its impact on biodiversity ecosystems.

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