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STUDY OF THE POPULATION OF COLEOPTERA IN IRRIGATED RICE ECOSYSTEMS (MAGA AND YAGOUA) AND IN UPLAND RICE IN MAROUA

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Abstract

The coleoptera were studied in 2013 in the major irrigated rice ecosystems of Maga and Yagoua and in upland rice fields of Maroua in the Far-North region of Cameroon. Sampling of the coleoptera was carried out every forth night in upland rice fields and irrigated rice fields using a special sweep net and a aspirator D-VAC. From the samples collected in the various sites, the population of dominant coleoptera, were analysed in relation to the phenological stage of the rice plant. The following coleoptera were identified at different stages of growth of rice in irrigated rice fields and in upland rice fields: Chnootriba similis (Coleoptera: Coccinellidae), Chaetocnema pulla (Coleoptera: Chrysomelidae), and Trichispa sericea (Coleoptera: Chrysomelidae). The populaton size of these coleoptera was particularly important at the vegetative stages of the rice plant. The irrigated rice ecosystem of Yagoua were infested mainly by the coleopteran Chnootriba similis which was the most abundant specie was collected at the vegetative stages of growth of the upland and irrigated rice fields.

Keywords: *Insect, Coleoptera, Rice, Far North, Cameroon***.**

INTRODUCTION

Rice (*Oryza sativa* and *Oryza glaberrima*) is one of the most consumed cereal (Guigaz, 2002). The average consumption annual per person of rice in the world varies from less than 5 kg to nearly 200 kg of rice with an average that ranges from 65 to 70 kg (FAO, 2009). In Africa the increase in production can be based on both the increased area and yield improvements.

In Cameroon, the national production is 58 000 tonnes covers only 38% of requirements. Thus, imports increased from 21,000 tonnes in 1975 to 300,000 tonnes in 2010, despite the potential of the country, hence the need to increase production to reduce particularly expensive imports (FAO, 2009).

Increasing and securing agricultural production necessarily pass through the efficient management of production factors. One of these inputs is the protection of crops against pests and diseases. However, it is clear today that insects are a serious threat to progress to improve rice production and other crops.

Arhent et al. (1983) estimated that among the 41.1% of the total losses of rice, 27.5% were due to insects. They are famous for the damage they cause to crops and the diseases they vector (Brenière, 1983).

According Woin et al. (2004) four species of insects of the order Coleoptera transmit the virus to rice yellow mottle plants in three major rice irrigation schemes Lagdo Maga and Yagoua in northern Cameroon and in lowland rice. These are among other *Chnootriba similis Chaetocnema pulla*, *Trichispa sericea* and *Locris rubra* (Woin et al. 2004).

However, very little information is available on the list of insects of the order Coleoptera and even less on the natural enemies of these insects. Hence the need for a thorough study of insects of the order Coleoptera in two major types rice ecosystems (irrigated and rainfed) in the region of the Far North Cameroon, as a prerequisite for the development of basic a struggle against these pests.

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Objective of the study

The overall objective of the study is to improve rice production through proper management of insects of the order Coleoptera in rice ecosystems in the region of the Far North Cameroon. To achieve this overall objective, we have developed the following specific objectives:

• Identify each species collected in irrigated rice schemes (Yagoua, Maga) and upland rice (Maroua);
• Count the number of species collected during different phenological stages;
• Compare capture methods namely vacuum D-VAC and mowing with the net "sweep net";

MATERIALS AND METHODS

1. Materials

1.1. Location of the study area

The study was conducted in Cameroon, mainly in the Far North region. In this region, the rain fed ecosystem rice of Maroua (10 ° 30 'and 11 ° north latitude and 14 ° and 14 ° 30' east longitude) and irrigated rice ecosystem of Yagoua and Maga (10 ° 9 ' and 10 ° 50 'north latitude and 14 ° 57' and 15 ° 12 'east longitude) were chosen, because of the important work carried on rice production in these areas.

1.2. Plant material

In both rice ecosystems (rain fed and irrigated), the study was conducted on plots of 2500 m² (dimension used by farmers). The variety of upland rice used from June to September 2013, during the rainy season "Cisadane" was naturally infested by the viruses of rice yellow mottle after a major colonization of land by insect vectors. In the irrigated rice ecosystem at each site Yagoua and Maga studies was conducted from June to August 2013 on plots of irrigated rice by the waters of the Logone River and irrigated rice variety used was IR 46, which is naturally infested by rice yellow mottle virus.

1.3. Material collection

1.3.1. Collection using the sweep net

The sweep net is a net that is used to collect insects that live on plants (Goldstyn, 2003). The net used in this study is characterized by the length of his pocket which is about twice the diameter of the circle. The circle diameter was 40 cm, pocket 80 cm and the handle was long (more than 1 m). The fabric of the pocket has quite fine mesh, offering little resistance to the air. The net was used for rapid lateral to and fro movements. At each site, insects and spiders were captured using "sweep net" in the case of 50 double mow (100 mow) on each of the two (02) perpendicular median in each plot with interval of two weeks and as from the fifteenth day after sowing or planting. The sampling frequency of arthropods by "sweep net" practiced throughout the two-week interval corresponded to a specific phenological stage (seedling, tillering, heading and maturity).

1.3.2. Collection with the vacuum motor D-VAC

According Rincon-Vitova Insectaries or D-VAC Company, there are two insect collectors available: Model 24 and Model 122 (Sadou, 2007). Both are driven by motors. The collector insect D-VAC model used was 122 and was brought back. Nets introduced for this purpose in the hose connected to the engine accumulates at the bottom of air pressure, the insects are collected absorbed more easily into the net. Arthropod samples (insects and spiders) with D-VAC vacuum were performed on the fifteenth day after sowing or transplanting two-week intervals until harvest rice on all the stages of rice development. They consisted of to go through the plots and sucking the arthropods swinging the pipes connected to the engine from left to right. The duration of sucking was about 5 minutes per plot (Sadou and others, 2008). The frequency of sampling arthropods using the D-VAC vacuum practiced throughout the two growing seasons corresponded to the following phenological stages: seedling, tillering, heading and maturity. Arthropods captured by these two methods were stored in vials containing 70% alcohol in order to identify them progressively.

2. Methods

2.1. Identification of specimens

Identification of key arthropod Heinrich (1993), Hill (1983), Heinrichs and Barrion (2004), as well as recognition of the key families of arthropods of Delvare and Aberlenc (1989) were used

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2.2. Determination of the number of arthropods

After this general identification, we triaged all the collected species and did counting. The method used is described in the detail manual of the International Rice Research Institute (2001). It is a method of determining the number of insects and spiders in a field during the development cycle of rice.

Larvae, pupae and adults were counted and as represented the number of insects. This allowed us to classify the different specimens collected in different orders, families, genus and species and to determine the number of each of these specimens compared to the phenological stages of the plant.

3. Data Analysis

The software excel was used to perform descriptive analysis of different families of arthropods collected, taking into account the number of arthropods, the collection method and the stage of development of rice (Sadou and other., 2008).

RESULTS AND DISCUSSIONS

Species of the order Coleoptera

The inventory of beetles in the three rice websites shows that species vary in richness (number of species) and abundance (numbers of each species) , depending on different rice sites based on rice ecosystems , by stage phenological and based on methods catches.

Number of species identified beetles

Table 1 presents the beetle species and their abundance based on rice sites, methods of catch and phenological stages. Table 1 shows that the new beetle species identified were not present in all rice sites. The upland rice in Maroua and irrigated rice of Yagoua, Maga and have hosted six species. Of these, three species were present simultaneously in the three sites while other was observed in either a site or both sites.

Beetles collected based on phenological stages in different rice websites

Table 2 shows the numbers of beetles based on phenological stages. This table shows that the species of beetles collected ranged in richness and abundance during different phenological stages in rice sites. Among the species collected, no species was captured in abundance at all phenological stages in three rice sites.

Beetle abundance identified

The abundance of different species of beetles varied significantly ($P < 0.05$) between sites and between rice ecosystems. Among the beetles collected, *Chnootriba similis* was captured in three sites was much more abundant in upland rice than in the two irrigated rice sites. *Xanthadalia effusa* is abundant in irrigated rice, but was absent in upland rice.

In different rice and during the nursery stage and heading plant sites, the D-VAC has captured the largest number of individuals compared to sweep net. During tillering and maturity stage, the sweep net proved as effective as D-VAC.

CONCLUSION

It appears from this inventory that nine species including beetles in five families were collected on irrigated rice and upland rice.

This shows that rice production in the three sites of the two ecosystems is a favorable environment for the development of these pests. Beetles are insects that can be seen in several aspects. First of all pest species found mainly herbivorous or living in stored products, some of which are major pests. Others are rather predator (Coccinelidae, Anthicidae) and any part time control pests . Pest beetles are insects that attack vegetative organs (leaves, stems and panicles) of the plant. Larvae drills a tunnel in the thickness of the sheet by consuming the tissues and adults eat the leaves. But the most serious damage is caused by the transmission of the virus by beetles of the family of chrysomelidae and coccinellidae . The abundance of beetles observed in tillering in rice three sites justified by the fact that during this stage, the plant has vegetative organs well developed and beetles prey by crushing the leaves. At maturity stage of rice the size of the population of beetles decreases. The maturity stage is marked by the senescence of leaves, stems and pest beetles cannot feed on the vegetative parts of the plant this justifies the decrease of population during this stage. However *Xanthadalia species effusa* and *Chnootriba similis* respectively in the sites of Yagoua and Maroua were still abundant.

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Table 1: Beetle species and their abundance based on rice sites, methods of catch and phenological stages.

Family	Genus and species	Phenological stage and collection methods								
		nursery		tillering		heading		maturation		
		SN	DV	SN	DV	SN	DV	SN	DV	total
Sites of Maga										
Chrysomelidae	*Chaetocnema pulla*	0	2	1	0	0	0	0	0	**3**
	Trichispa sericae	0	0	0	0	0	0	0	0	**0**
Coccinellidae	*Chnootriba similis*	3	2	2	0	0	0	0	0	**7**
	Cheillomenes lunata	0	0	0	0	0	0	0	0	**0**
	Xanthadalia effusa	2	0	6	9	0	3	0	0	**20**
Apionidae	*Apion sp.*	0	1	0	0	0	0	0	0	**1**
	Canopion sp.	0	0	0	0	0	0	0	0	**0**
Anthicidae	*Formicomus sp.*	0	0	5	0	0	0	0	0	**5**
Bruchidae	*Callosobruchus sp.*	0	2	0	0	0	0	0	0	**2**
Total	**9**	**5**	**7**	**14**	**9**	**0**	**3**	**0**	**0**	**38**
Site of Yagoua										
Chrysomelidae	*Chaetocnema pulla*	0	0	0	4	0	0	0	0	**4**
	Trichispa sericae	0	0	0	0	0	0	0	0	**0**
Coccinellidae	*Chnootriba similis*	0	0	3	0	1	8	1	0	**13**
	Cheillomenes lunata	0	0	0	0	0	0	0	0	**0**
	Xanthadalia effusa	4	0	14	9	0	9	12	2	**50**
Apionidae	*Apion sp.*	0	0	2	0	0	0	0	0	**2**
	Canopion sp.	0	0	2	11	0	0	0	0	**13**
Anthicidae	*Formicomus sp.*	0	1	0	0	0	2	1	0	**4**
Bruchidae	*Callosobruchus sp.*	0	0	0	0	0	0	0	0	**0**
Total	**9**	**4**	**1**	**21**	**24**	**1**	**19**	**14**	**2**	**86**
Site of Maroua										
Chrysomelidae	*Chaetocnema pulla*	0	2	0	0	0	4	0	1	**7**
	Trichispa sericae	0	0	0	2	0	0	0	0	**2**
Coccinellidae	*Chnootriba similis*	0	3	5	0	0	6	3	9	**23**
	Cheilomenes lunata	0	9	0	3	0	0	0	0	**12**
	Xanthadalia effusa	0	0	0	0	0	0	0	0	**0**
Apionidae	*Apion sp.*	0	0	0	1	3	0	0	0	**4**
	Canopion sp.	0	0	0	0	0	0	0	3	**3**
Anthicidae	*Formicomus sp.*	0	0	0	0	0	0	0	0	**0**
Bruchidae	*Callosobruchus sp.*	0	0	0	0	0	0	0	0	**0**
Total	**9**	**0**	**14**	**5**	**6**	**3**	**10**	**3**	**13**	**51**

SN : sweep net
DV : D-VAC

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Table 2: Number of beetles based on phenological stages in upland rice in Maroua and irrigated rice Maga and Yagoua

Family	Genus and species	Phenological stage				
		nursery	tillering	heading	maturation	total
Site of Maga						
Chrysomelidae	*Chaetocnema pulla*	2	1	0	0	**3**
	Trichispa sericae	0	0	0	0	**0**
Coccinellidae	*Chnootriba similis*	5	2	0	0	**7**
	Cheillomenes lunata	0	0	0	0	**0**
	Xanthadalia effusa	2	15	3	0	**20**
Apionidae	*Apion sp.*	1	0	0	0	**1**
	Canopion sp.	0	0	0	0	**0**
Anthicidae	*Formicomus sp.*	0	5	0	0	**5**
Bruchidae	*Callosobruchus sp.*	2	0	0	0	**2**
Total	**9**	**12**	**23**	**3**	**0**	**38**
Site of Yagoua						
Chrysomelidae	*Chaetocnema pulla*	0	4	0	0	**4**
	Trichispa sericae	0	0	0	0	**0**
Coccinellidae	*Chnootriba similis*	0	3	9	1	**13**
	Cheillomenes lunata	0	0	0	0	**0**
	Xanthadalia effusa	4	23	9	14	**50**
Apionidae	*Apion sp.*	0	2	0	0	**2**
	Canopion sp.	0	13	0	0	**13**
Anthicidae	*Formicomus sp.*	1	0	2	1	**4**
Bruchidae	*Callosobruchus sp.*	0	0	0	0	**0**
Total	**9**	**5**	**45**	**20**	**16**	**86**
Site of Maroua						
Chrysomelidae	*Chaetocnema pulla*	2	0	4	1	**7**
	Trichispa sericae	0	2	0	0	**2**
Coccinellidae	*Chnootriba similis*	3	5	6	12	**23**
	Cheilomenes lunata	9	3	0	0	**12**
	Xanthadalia effusa	0	0	0	0	**0**
Apionidae	*Apion sp.*	0	1	3	0	**4**
	Canopion sp.	0	0	0	3	**3**
Anthicidae	*Formicomus sp.*	0	0	0	0	**0**
Bruchidae	*Callosobruchus sp.*	0	0	0	0	**0**
Total	**9**	**14**	**11**	**13**	**16**	**51**

SN : sweep net
DV : D-VAC