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CHECK-LIST AND SEASONAL DISTRIBUTION OF HETEROPTERA POPULATION IN MOROCCAN RICEFIELDS

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ABSTRACT

We undertake in this work a qualitative descriptive study of Heteroptera fauna in the moroccan rice farming which is totally practiced in the lowest region of the Gharb plain due to the favorable climatic and soil conditions. The systematic study stand at 10 stations covering the entire paddy rice during the two campaigns of 2014 and 2015. 30 species distributed in 10 sub-families were identified in the study area with a predominance of predatory species which have an interest against the proliferation of living species at the expense of rice plant. The biotypology study of this population demonstrated the presence of 3 principle species groups which have spatio-temporal distribution despite of the short period of the study imposed by the imperative of submersion period. Those groups are: summer species, autumnal species and species which have large distribution spectre along rice growing. Therefore, ricefields agrosystem has a structure, dynamics and evolution which correspond to that of natural lakes where the impoundment is shorter or longer during the year. Associated with biotic conditions, the hydrological cycle of rice, temperature and oxygen levels affect the distribution, occurrence and abundance of species.

KEYWORDS: Heteroptera, Moroccan, biotypology, ricefields agrosystem.

INTRODUCTION

World rice farming occupies an area 1.49 million km^2 of land all over the word. This surface representing the total of freshwater lakes area estimated between 1.2 and 2.0 million km^2.[1] In addition to their economic importance, ricefields represent an important ecological and scientific capital due to two main factors:

- Late artificially flooded from may to september, during the drying of natural temporary ponds,
- Evaporation and groundwater has no significant influence on the level of water that is fed regularly by irrigation.

Several multidisciplinary studies have been conducted with the aim to understand the functioning of this artificial agrosystem,[2,3,4] to study the fauna,[5,6,7] and its weedy vegetation.[8,9] In Morocco, rice farming is practiced exclusively in the Gharb plain and Loukkos basin. Indeed, due to favorable climatic and soil conditions offered by these regions and richness of its natural water systems, rice has been a spectacular success in terms of area and production. Scientific investigations in the country carried out on this agrosystem are very limited and focus on plant pathology aspects of culture.[7,13,14] Faunal research on Moroccan ricefield are limited to a few malacological inventories.

We proceed in this work a qualitative descriptive study of Heteroptera fauna in different stations of Moroccan ricefields of the Gharb plain. We report a complete inventory of this group species sampled, allowing to fill gaps in the field of inventories in artificial aquatic environments. At last part, we state spatio-temporal distribution of Heteroptera species and their ecological affinities.

2. MATERIALS AND METHODS

2.1. Choice of stations

Teen (10) stations were selected for study between 2014 and 2015. The choice of these stations was based on species richness, abundance of taxa, aquatic vegetation and the maximum coverage of the three rice-growing areas. The stations were selected in the three rice-growing areas of Gharb plain (Fig. 1):

- Tazi area (zone 1 in the card)

This area is located in the Sidi Allal Tazi region, 57 Km Kenitra. These ricefields area are irrigated by a canal of the river Sebou. Selected stations in the study area are S1, S2, S3, S4.

- Moghrane rice area (zone 2 in the card)
Located in the Moghrane region on the left bank of the Sebou river far from 22 Km to Kenitra. Ricefields in this area have Beht river as a source of irrigation. In this area, we chose the following stations : S5, S6, S7, S8, S9.

- Belksiri area (zone 3 in the card)
Located in the region of Bel Ksiri, 62 km from the city of Kenitra. Water flooding come from the irrigation canal which receives water from the Sebou River downstream of Sidi Allal Tazi. Stations S10, S11, S12, S13 and S14 are part of this ricefield area.

2.2. Procedures for sampling and analysis of biological material
The faunistic samples were taken in spring and summer of 2014 and 2015 between June and September, in four fixed sampling points in the littoral area of the land rice, three with and one without the presence of vegetation.

We used the net plankton for qualitative and semi-quantitative sampling. The net used was 0.05 mm diameter mesh, 20 cm of opening diameter and 25 cm depth. The volume of water filtered is theoretically calculated using the formula: $V = \pi r^2.d$, where d is the slice surveyed (in meters) water and r is the radius of the net mouth. The procedure involved dragging the net twice for 10 to 15 seconds in the different parts of each sampling point. However, this method apparently only allows sampling of Heteroptera fauna inhabiting the water between the macrophytes, making unfeasible the sampling of some individuals that were adhered to plants. The samples were fixed in 4% neutral formalin immediately after collection.

In laboratory, the organisms were observed under optical microscope and stereomicroscope with identification performed from the usual dissection methods and specialized bibliography. For each sample, the quantification was carried out through three 2-mL replicates into Sedgwick-Rafter-type chambers, prepared specifically for this volume. The samples with a low number of organisms were counted in full.

3- RESULTS AND DISCUSSION

The purpose of this inventory is to enhance taxonomic knowledge of Heteroptera zoological group in Moroccan ricefields. Species identification was based on the identification key developed by Fourteen Heteroptera species were recorded, distributed among the families Corixidae (4), Pleidae (1), Notonectidae (1), Nocoridae (1), Nepidae (1), Mesoveliidae (2), Veliidae (1), Gerridae (1), Nabidae (1) and Pentatomidae (1).

Sub-Order: Hydrocorises: Cryptocerates
Family: Corixidae
- *Micronecta scholtzi-Scholtz - 1848*
- *Sigara lateralis - Leach, 1818*
- *Sigara stagnalis - Leach, 1818*
- *Sigara scripta - Rambur, 1824*

Family: Pleidae
- *Plea leachi - Mc Gregor & Kirk* 1899

Family : Notonectidae
- *Anisops sardea - Herrich-Shaffer, 1850*

Family: Nocoridae
- *Naucoris maculatus maculatus –Fabricius, 1798*

Family: Nepidae
- *Nepa rubra rubra - Linné, 1758*

Sub-Order: Amphibicorises: Gymnocérates
Family: Mesoveliidae
- *Misovelia furcata - Mulsant & Ray, 1852*
- *Mesovelia Vittigra – Horvarth, 1895*

Family: Veliidae
- *Microvelia pygmea – Dufour, 1833*

Family: Gerridae
- *Gerris thoracicus thoracicus – Shummel, 1832*

Family: Nabidae
- *Nabis ferus –Linné*

Family: Pentatomidae
- *Eusarcoris inconspicuus –E-S*

It appears from this inventory that composition of Moroccan Heteroptera ricefields revealed the conventional taxonomic composition of small lacustrine environments. These 14 species form a banal classic taxonomic composition and shallow areas of coastal areas and lakes. However, some representatives of that community would be unique to this type of agricultural system, it is the case of *Eusarcoris inconspicius* and *Nabis ferus* which are not included in entomological lentic environments. In addition, the study of interspecific relationships based mainly on bibliographical data reveals the predominance of predatory species that are characterized by active behaviour, allowing them hunting a large number of preys. Indeed, insect pests of rice seedlings are subject to significant attack by larvae and adults Heteroptera and another group of insects (beetles and dragonflies) depending on the growth stage of the rice plant.

The biotypology study of this population demonstrated the presence of 3 principle species groups which have spatio-temporal distribution despite of the short period of the study imposed by the imperative of submersion period. Those groups are: summer species, autumnal species and species which have large distribution spectre along rice growing.

Summer species
The species of *N. maculatus, Nabus ferus, S. lateralis, S. stagnalis* and *S. scripta* were harvested in great abundance in the samples following the submerging of

the rice during the two years of study. Indeed, thanks to their varied diet, adults of Corixidae, Naucoridae and Nabidae attack the Culicidae especially Anopheles larvae which are known malaria vector, as well as those chironomid particularly *Chironomus pulmosus* and *Glyptotendipes viridis* species which feeds on dead organic matter, considered as miner of leaves of aquatic plants, including rice plants.

Autumnal species

The population autumnal is essentially dominated by the aquatic Heteroptera swamped in the end of rice cycle. These species are *M, pygmea, M. furcata and M. vittigra.* They are harvested in abundant aquatic plants which have supernatant leaves. This cover hosts a large number of aphids that attack the rice plant during this season. About *Eusarcoris inconspicuus,* its autumnal development is linked to the plant itself rice which is considered by many authors as phytophage, very harmful to crops.

Species which have large distribution spectre

A. sardea, G. thoracicus, M. leachi and *P.scholtzi* were present in all our surveys throughout the rice season. Their development flourishes in alkaline water at elevated temperatures, rich in organic matter and have a great predatory powers.

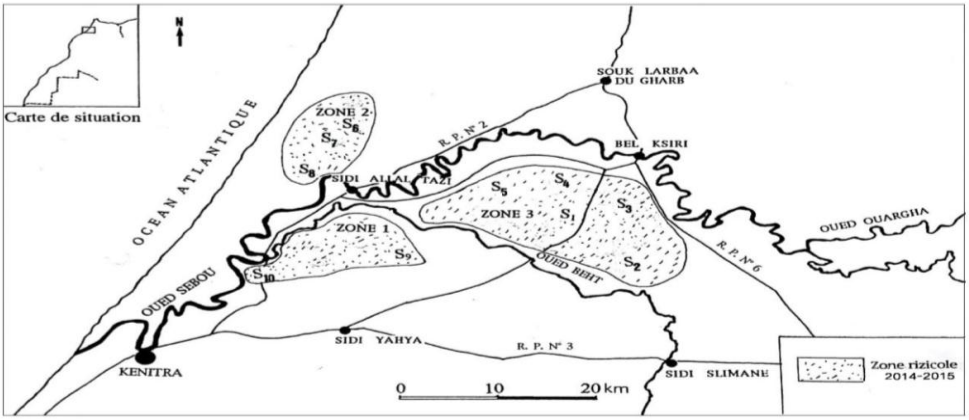

Figure 1: Location of the sampling stations in Moroccan ricefields.

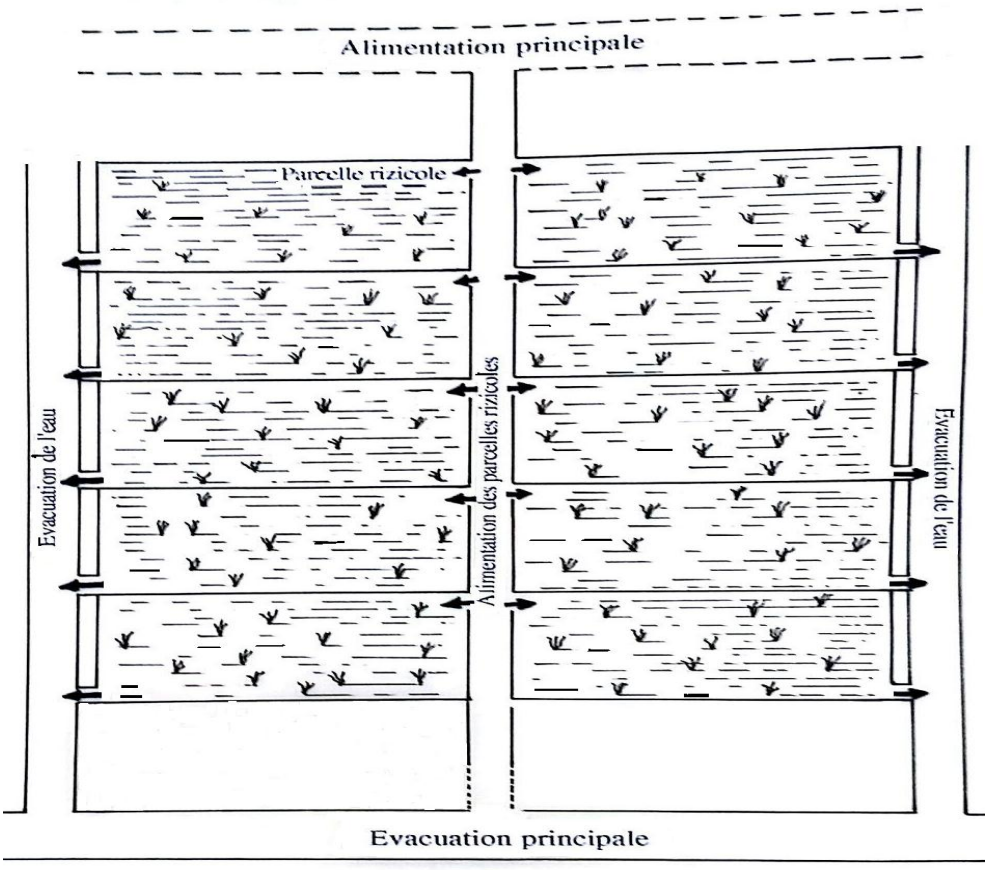

Figure 2: Functioning of rice field ecosystem.

4- CONCLUSION

Despite of the short period of the study imposed by the imperative of submersion period, we have been able to demonstrate spatio-temporal distribution of Heteroptera species. Therefore, ricefields agrosystem has a structure, dynamics and evolution which correspond to that of natural lakes where the impoundment is shorter or longer during the year. The hydrological cycle of rice, the vegetative cycle of *Oryza sativa* and herbarium, temperature and oxygen levels appear to be the main agents influencing the distribution, occurrence and abundance of species of Heteroptera in this agrosystem. Associated with biotic relationships such as predation, interspecific and intraspecific competition for food, it follows a species succession during summer and autumn phases.

The taxonomic study shows that it is very diverse in comparison with other similar environments, despite the short period of the rice cycle. It has 14 species distributed in 10 most representative families of Heteroptera group. On the other hand, through their predation very evident, most of the listed species support a significant biological control by controlling occurrences of insect pests in rice, especially in areas where it is not made use of a wide range of pesticides.

5- BIBLIOGRAPHY

1. Anonyme. Atlas du bassin de sebou, 51 planches + notices., 1970; 143 pages.
2. Anonyme. Le riz, rapport de l'O.R.M.V.A.G. Ministère de l'agriculture et de la réforme agraire, 1974; 13.
3. Anonyme. La riziculture dans le Gharb : situation actuelle et perspectives, O.R.M.V.A.G., 1988 ; 13.
4. Aoujdad R. Recherches écologiques et systématiques sur les crustacés cladocères de la plaine du Gharb (Maroc). Thèse de 3éme cycle, Univ. Ibn Tofail, Kénitra, 1996; 135.
5. Apperet J. et Deuse J. Insectes nuisibles aux cultures vivrières et maraichères. Ed. Maisonneuve et Larose, 1988; 105.
6. Arahou M. Etude faunistique et écologique des peuplements entomologiques de l'illiacaie du Moyen-Atlas marocain. Thèse de Doct Etat, Univ. Med. V, Rabat, 1990; 251.
7. Balachowsky A.S. Entomologie appliquée à l'agriculture. Tome II, Lépidoptères. Ed. Masson et Cie, 1966; 1057.
8. Berady K., Fadli M, Douira A et Fekhaoui M. La faune odonatologique des rizières du Maroc : inventaire commenté et cycles biologiques. 1er congrès national de l'A.M.L., 20 et 21 Décembre, Fès, Maroc, 1995.
9. Berady K. Recherches bio-écologiques sur le peuplement entomologique des rizières de la plaine du Gharb (Maroc). Thèse de 3éme cycle, Univ. Ibn Tofail, Kénitra, 1997; 158.
10. Boulet C. et Bouhache M. Diversité floristique, biologique et nuisibilitédes adventices des rizières du gharb (maroc). Actes, I.A.V. haasnII, 1990; 10(2): 5-24.
11. Boudoudou H., Hassikou R., Ouzzani Touhami a., Badoc A. et Douira A. Pramétres physico-chimiques et flire fongique des sols des rizières marocaines. Bull. Soc. Pharm.. Bordeaux, 2009; 148: 17-44.
12. Feakin S.D. Pest control in rice. London, Tropical pesticides research headquarters and information unit, 1971; 270.
13. Gaud J. Données sur la biocénose culicdienne de quelques gites du Gharb en 1952. Bull. Inst. Hyg., Maroc, 1952; 12: 55-72.
14. Gheit A. Recherches sur la biologie de la faune hémiptérologique aquatique marocaine : Hydrocorises et Amphibicorises peuplant des hudrosystémes supra-littoraux et continentaux. Thèse Doct. Etat. Univ. Med V, Rabat, 1994; 248.
15. Heurtaux P. et Marazanoff F. Une méthode de prélèvement en écologie aquatique. Ann. Limnol., 1965; 1: 191-196.
16. Heinrichs E.A. Biology and management of rice insects, 1983.
17. Jansson A. The corixidae (heteroptera) of Europe and some adjacent regions. Acta. Ento. Fennica., 1986; 47: 1-94.
18. Kirkpatrick T. W. The mosquitos of Egypt. Governement Press Cairo, 1925; 224.
19. Luong M. C. Studies of the resistance of traditional rice varieties to major insect pests and diseases in the MEKONG Delta (ENG), Omonrice, 1992; 2: 78-85.
20. Rosenberg L.E. Life history of the tadpole shrimp (Apus) and its relation to the rice crop of California. Anat. Rec, 1947; 99: 616-617.
21. Shepard B.M., Barrion A.T. & Listenger J.A. Rice-feeding insects of tropical Asia. I.R.R.I., 1995; 228.
22. Thiery A. Contribution à la connaissance des Héteroptères du Mroc : les héteropteres aquatiques du Haut-Atlas occidental. Bull. Ins. Sc. Rabat, 1981; 5: 13-34.