Study of the effect of pesticides on some physico-chemicals and microbiologicals parameters of soil and water in north-eastern Algeria

Ouahiba Bordjiba and Abdelhakim Belaze

BADJI Mokhtar Annaba University, P.O.Box 12, 23000 Annaba Algeria.
Faculty of Sciences, Department of Biology
Plant Biology and environmental Laboratory

E-mail: ouahiba_bordjiba@yahoo.fr

Abstract : Among the chemicals most commonly used currently in our environment, Those are undoubtedly pesticides and related products. If pesticides are at first appeared beneficial, harmful side effects have been gradually revealed. Their toxicity, due to the molecular structure is not limited indeed to only species that we wish to eliminate. They are particularly toxic to the various components of the environment.
Our study aims to assess the degree of pollution of soil and surface water in farming areas situated in the North-Est of Algeria and subject to the effect of pesticides for several years. To do this, the physico - chemical characteristics of water and soil were determined. The analyzes have focused on pH, BOD5,COD, electrical conductivity, organic matter, nitrites and nitrates. The total microflora samples of water and soil was also evaluated. The physico-chemical parameters studied were analyzed by standard methods according to the general guidelines for storage and manipulation. The fungal microflora was determined using identification keys. The identification of isolated and purified bacteria was instead performed by a scan apiweb software (Api web Biomerieux France).
The results show that there is a pollution of water and soil. The values of some parameters often exceed the prescribed standards and especially those of nitrite and electrical conductivity. The isolated microflora consists of 97% whose most frequent are Bacillus and Micrococcus and 3% of fungi with a predominance of Aspergillus.

Keywords: pesticides, physico-chemical parameters, water, soil, microflora, bacteria, fungi.

Introduction

Most pesticides used in developing countries are highly toxic chemicals. Approximately 73% of imports of pesticides belong to categories 1a (extremely toxic) and 1b (highly toxic) according to World Health Organization. Although the application of these pesticides ensures a certain quality of crop production (in particular the performance and phytosanitary quality), it contributes to contaminate the different compartments of the environment, especially soil and water resources.

Pesticides affect soil quality by reducing fertility (loss of nutriments and organic matter, reducing the total microbial biomass). Herbicides such as sulfonylureas, bensulfuron methyl (B) and metsulfuron methyl generate a considerable reduction of the soil microbial biomass (Taiwo and Oso, 1997; Boldt and Jacobsen, 2006; Baxter and al., 2008). Also Agricultural pesticides also pollute surface water and groundwater. This contamination is seasonal, the highest concentrations being measured during and after application of rainfall period (up to a few µg / l can then be measured in the samples analyzed). In recent years, various studies realized in Algeria have demonstrated the presence of many pesticides in water (Annaba, Algiers, Sétif) and also in our food: more than 50% of fruit and vegetables produced by intensive agriculture contain various molecules of pesticides. All these toxic compounds eventually end up in our organism, brought by the soil, water and food.

So ahead this situation, the main objective of our study was to check the quality of soils and waters surface in regions of north-eastern Algeria subject to the effect of several pesticides.

Material and methods

Collect of samples

Samples are taken from farming areas located in the north-eastern part of Algeria intended to the vegetable crops (tomato, potato, pepper and wheat) and subject to the effects of many pesticides. The main pesticides used are: bromuconazol, fluazifop- p butyl, cimoxanil, propineb, mancozeb, deltamethrine, pendimethaline and tebuconazol. Soil samples were collected in sterile tubes closed. They are then placed in the same conditions in which they are mixed to obtain a representative microflora, and then kept at 4 ° C until analysis. Water are collected in bottles designed

for water samples. These are stored at 4 ° C and transported to the laboratory on the same day with a view to analysis.

Analysis of physico-chemicals parameters

Regarding water, the analyzes focused on pH, electrical conductivity, BOD5, COD, nitrates and nitrites. The techniques used are those described by Rodier (1996). Regarding the soil, only the following parameters: organic matter, electrical conductivity, pH were evaluated by standard methods and compared with the scales reported in soltner (1981), Gaucher (1981) and durand et al., (1992) .

Evaluation of the total soil microflora

The suspension is prepared by the dilution method described in the standard DIN 54379 for the total count of colonies.

1 g of soil from each sample was stirred in 100 ml of sterile Ringer's solution (cassagne, 1966). The resulting suspension is diluted to 1/10th and 1/100th and 1/1000th from which 1 ml is taken that spread in a Petri dish and empty 10 ml of sterile culture medium. The dishes are incubated at 30 ° C temperature for 5 to 7 days.

Isolation of fungal species is made on PDA and Muller-hinton method of Warcup (Parkinson and Waid., 1960) by seeding depth. Aliquots of soil are distributed in Petri dishes (90 mm diameter) and covered with sterile nutrient medium. The petri dishes in triplicate for each case were incubated at 30°C

Identification of the microflora isolated

Bacterial isolates were purified by subculturing on Muller-Hinton. After studying the morphology, Gram staining and study of physico-chemical characteristics galleries with API 20 E and API 20 NE, identification is then performed by a scanning software API Web (Web API Biomerieux France) .
Regarding fungal strains after purification on Sabouraud medium, they are determined using identification keys de Botton et al., 1980 (Tome1 and 2)

Results and discussion

Analysis of water physico-chemicals parameters

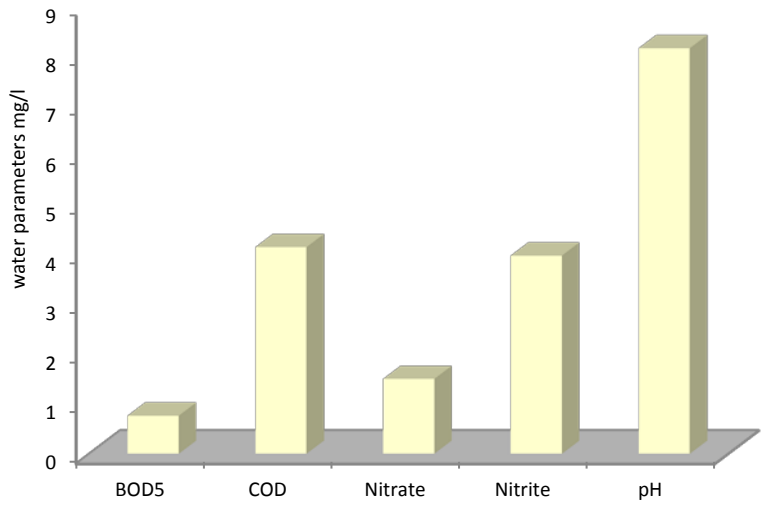

Figure 1 : mean values of physico-chemicals parameters of waters analyzed

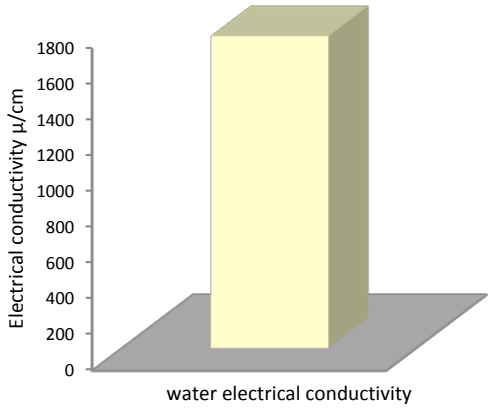

Figure 2 : Mean values of the electrical conductivity of waters analyzed

The physico-chemicals analyzes performed on water samples show firstly a high concentrations of nitrite (4 mg/l) above the allowable values which are between 1 and 3 mg/l, indicating the presence of toxic substances. Nitrites are toxic to organisms. It seems that the situation is very critical when a concentration is more than 3 mg/l of nitrite (Lisec, 2004). On the other hand, the values obtained for the electrical conductivity are also very high above international standards eligible with an average of 1745µ/cm. These high values show the presence of salts dissolved in water (MSPE, 1987). Other analyzed parameters appear below the standards values.

Analysis of physico-chemicals soil parameters

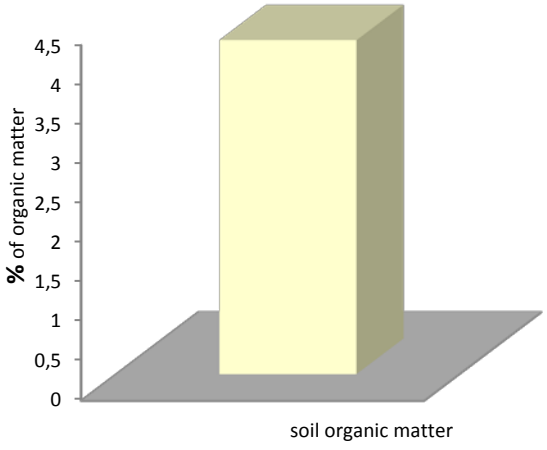

Figure 3 : Mean values of organic matter soils

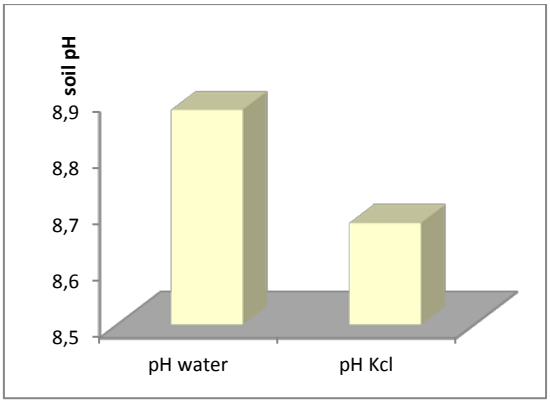

Figure 4 : mean values of pH soils

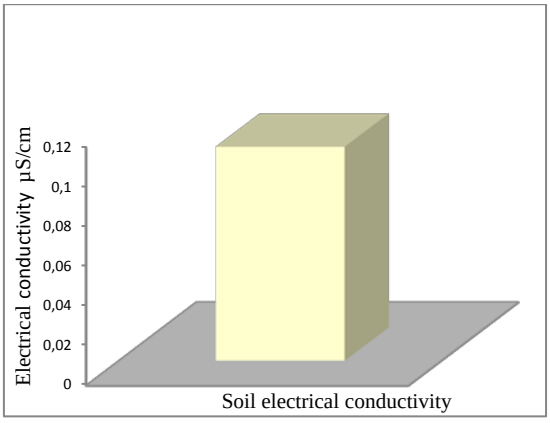

Figure 5 : Mean values of the electrical conductivity soils

The values of the parameters determined and compared with those of several authors scales indicated that the soil is rich in organic matter, with basic pH and unsalted poor in minerals with a very low conductivity probably due to the presence of pesticides.

Evaluation of the total soil microflora

Table 1: Evaluation of fungal and bacterial microflora of different analyzed soils

number of bacteria /gramme of soil	number of fungi / gramme of soil	Total
51407	1088	52495

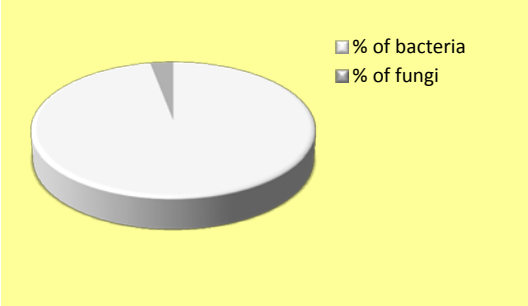

Figure 6 : percentage of bacteria and fungi/ gramme of soil analyzed

Table 2 : Identification of isolated soil microflora

bacterial strains	fungal strains
Aeromonas *Bacillus* *Chryseobacterium* *Micrococcus* *Pasteurella* *Pneumotropica* *Serratia* *Vibrio*	*Absidia* *Aspergillus* *Fusarium* *Penicillium* *Trichoderma*

The total microbial microflora isolated is composed of 52495colonies / g soil, most of which consists of bacteria (97%). The bacteria appear to be more tolerant to the effects of pesticides sprayed on the ground. The fungal microflora appears to be more sensitive because it is less abundant with a much smaller number (3%). In addition, we find that there is not much difference from a sample to another, the same genera are present in almost all samples with higher or lower frequencies.The most common bacteria are mainly *Micrococcus*, *Bacillus*, *Aeromonas*, *Chryseobacterium* and *Serratia*. *Aspergillus*, *Penicillium* and *Trichoderma* are the most predominant among fungal microflora.

Conclusion

This study allowed us to obtain a fairly rich microflora distributed almost uniformly throughout all sites. It is composed of several microbial species which may survive in the conditions of a highly polluted soil by the action of several herbicides, fungicides and insecticides. However, the growth of fungal species is sometimes inhibited in most samples. We think that this inhibition is probably due to the presence of pesticides in the treated soil.
The accumulated doses following repeated treatments for several years, become toxic to the fungal strains.
Micrococcus, *Bacillus* and *Aspergillus* particular are the most predominant microorganisms of the microflora. They are resistant to various pollutants and endure high concentrations of herbicides (Domsch and al., 1980; Sage and al., 1997 ; Steiman and al., 1992).

The distribution of the soil microflora is influenced by the characteristics of the habitat, such as, pH, organic matter content, humidity, soil texture and electrical conductivity.

References

Baxter, J & Lumming, S.P. (2008). The degradation of the herbicide bromoxynil and its impacts on bacterial diversity in a top soil. *Journal of Applied Microbiology*. 104 (6) : 1605-1616

Blieffert, C & Perraud, R. (2001). Chimie de l'environnement : air, eau sol, dechets. *Ed.Deboeck université* .

Boldt, TS., & Jacobsen, CS. (2006). Different toxic effect of the sulfonylurea herbicides metsulfuron methyl, chlorsulfuron and thifensulfuron methyl on fluorescent Pseudomonas isolated from an agricultural soil. *FEMS. Microbiology Letters*. 161 (1) : 29-35.

Botton, B. (1990). Moisissures utiles et nuisibles .Importance industrielle. *2eme Ed. Paris Masson*. 210-220.

Cassagne, H. (1996). Milieux de culture et leur application. *Ed. La tourelle. Saint-Mandé (Seine).* 2eme.ed. 379 p.

Domsch, K.H., Gams, W., & Anderson, T.H. (198). Compendium of soil fungi. Vol 1 et 2. *Academic. Press*. London.

Durand, P**.,** Neal, C., & Lelong., F. (1992). Effects of land-use and atmospheric input on stream and soil chemistry: field results and long term simulation at Mont-Lozere (Cevennes National Park, Southern France). *Sci. Tot. Environ*., 119, 191-209. (1.455).

Lisec. (2004). Contrôle van de fysicochemische kwalit eit van de viswaters van het brussels hoofdstedelijk Gewest. R*apport effectué pour le compte de l'IBGE*.
Parkinson, D & Waid, J. S. (1960). The ecology of soil fungi. Liverpool University Press.

Ministère de la santé publique et de l'environnement (MSPE). (1987). Arrêté royal du 4 novembre 1987 fixant les normes de qualité de base pour les eaux du réseau hysdrographique public relative aux déversement des eaux usées, dans les eaux de surface ordinaires. *MB du 21-11-87.*

Organisation mondiale de la santé (OMS). (2002). Directives de la qualité de l'eau de boisson. Genève 2002.

Rodier, J., Bazin, C.,B routin, J.P., Chambon, P., Champsaur H., & Rodi, L.(1996). L'analyse de l'eau. Eaux naturelles, eaux résiduaires, eaux de mer, 8ème edition. *Dunod (ed), Paris*.France.

Sage, L., Bennasser, L., Steiman, R., & Seigle-Murandi, F. (1997). Fungal microflora diversity as a function of pollution in oued Sebou (Morroco). *Chemosphere* 35(4): 751-759.

Steiman, R., Benoit-Guyod, J. L., Seigle-Murandi, F., & Muntalif, B**. (**1992). Degradation of pentachloronitrobenzene by micromycetes isolated from soil. *Sci. Tot. Environ*. 123/124 : 299-308.

Taiwo, L.B., & Oso, B. O. **(**1997). The influence of some pesticides on soil microbial flora in relation to changes in nutrient level roch phosphate solubilization and release under laboratory conditions. *Agric. Ecosyst. Environ*. 65 (1) : 59-68.