

Phosphorous Insecticides Residues in Mazandaran River Waters, Iran (2000)

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ABSTRACT

In order to study the residues of phosphorous insecticides in Mazandaran district of Iran, Ethion, Azinphosmethyl, Diazinon and Malathion four most used pesticides were chosen and river water samples were collected in April to Sept. 2000, throughout the Mazandaran state. Thin layer chromatography was used, since it was the best applicable method in area with reasonably high level of sensitivity up to 0.01 ppm and acceptable recovery of 80%. Four hundred eighty samples were collected and tested for. The tests indicated maximum amount of residues found in river water was 2.7 ppm for Ethion, and still detectable up to 0.2 ppm after 4 months at station No.2 of Torkrood. The highest level belonged to the day after application. Three ppm of Azinphosmethyl were observed after first day of application and 0.2 ppm station 2 of Tajan after 5 months 3.1 ppm Malathion and 0.2 ppm in station. No.2 of Tajan river and 3.8 ppm of Diazinon at first day and 0.1 ppm up to five months only in the station No.2 of Tajan river. The duration of showing positive test were 4, 4, 5 and 3 months for Ethion, Azinphosmethyl, Diazinon and Malathion respectively. Matching test results with the environmental condition, proved strong effect of environmental factors, such as temperature, pH of water, amount of rain, physical and chemical characteristics of pesticide, and the time and method of application.

INTRODUCTION

The Mazandaran state provide situation of having the most beneficial cultivated lands, by water discharge of 6.5 milliard cubic meter surface water per year, through more than 15 permanent rivers and the mean rainfall of 1100 mm per year. Its brilliant conditions for good agricultural practices, is appeared by 200,000 hectares of rice forms and more than 100,000 hectares of fruit gardens and citrus orchards (8,6).

The diversity of agricultural yields and suitable conditions of climate and the environment, have provided good habitats for different pest's development. The abundance of pests are so visible that the use of pesticides is unavoidable, considering it as an observable, quick method of protecting crops (6). The most used pesticides are Ethion, Azinphosmethy, Diazinon, Malathion all of them classified as phosphorous insecticides. Washouts from crops can contaminate, the highly valuable gift of life, water. The main factors accelerating water contamination by these chemical agents, are: heaving rains and high precipitation, saturation of soils by water, high water table, all resulting in drainage of polluted waters into streams or agricultural channels and ending up into food chain, producing harms to all creatures including aquatic life and human as well. Since Iran is considered to be a part of arid-areas and is located within world's arid zone, according to the international categorization, facing critical water problems in the near future, protection of waters from pollutants, such as insecticides, would have great importance. Special considerations should be taken

for protection of waters in Mazandaran state, having special weather and environmental conditions and using almost 70% of all phosphorous insecticides used in the country (7). In order to understand the situation of organophosphorous insecticide residue in water, this research is carried out during the mid spring of the year 2000, in four most important rivers of Safarood Torkrood, Tajan and Babolrood, carrying more than 70% of surface waters of Mazandaran province.

At the same time, environmental conditions, such as air and water temperature, the amount and density of rain, plus the level of water table in nearby water wells were recorded and used for weighting and comparing test results.

MATERIALS AND METHODS

After field survey and literature review and collection of environmental data about the air temperature, amount of rainfall, discharges of Mazandaran streams, agricultural practices and farm and garden areas and the kind and amount of pesticides used, four rivers and 10 stations on them were chosen for water samples (6). Safarood and Torkrood, two streams in western part of the state, Tajan river, almost in the middle, and Babolrood, a stream collecting or catching waters from eastern part of the state of Mazandaran.

The number of assigned stations in each river were 2, 2, 3 and 3 respectively. Four phosphorous insecticides among most widely used pesticides, Ethion, Azimophos methyl, Malathion and Diazinon, were chosen for testes.

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Every week or 2 weeks, a sample was tested for the amount of chosen pesticide; for a duration of 6 months grab samples were taken in cross section of the river in the previously fixed station, and mixed and sent to laboratory. Environmental tests such as: temperature of air and water, pH, amount of rain in previous day and the discharges (from surface water reports), and the day of pesticide application were also considered.

Preliminary preparations were made, then the extraction was carried out, using acetone and methylene chloride (1). Thin layer chromatography was used for determination of 4 pesticides (9,15). The method showed determination of all four indexed insecticides was possible, and the recovery was around 80%, using standard solution, which was considered very good for these conditions.

This method has proved to be applicable almost in most part of the country. 120 tests for each insecticide was run in this study (1,7,2).

RESULTS AND DISCUSSION

The Mazandaran province, having a vast area of cultivated land, mostly under rice crops and citrus orchards, undergoes many sprayings for protection of crops against the pests, every year. The immethodical and wide spread application of insecticides in the agricultural section, have results in heaving environmental

pollution, health problems, ecosystem and aquatic and soil disorders, through spreading pesticides in soil and water and penetrating river waters and aquatic lives, all ending to the food chain (4). Safarood, Turkrood, Tajan and Babolorood are among largest streams in Mazandaran of the underground seepage in the state, there for chosen for testes in this research (6). 10 stations were allocated, on everyone of them, 2, 2, 3 and 3 station respectively.

Four insecticides, Ethion, Azinophose-methyl, Malathion and Diazinon were chosen for determination of level of pesticides in surface waters of the state.

Influencing parameters such as, day and time of application of insecticide and its rate, air and water temperature, rain on the day or days before and amount of the rain were noted and considered in the interpretation of the results.

Test results for 4 pesticides are shown in Tables 1 to 4 separately for duration of 6 months, and interpreted as the results on the mean of duration of pesticide application on crops and gardens. Results can be discussed as follow. The Ethion was determined at most stations after first day of application on crops. It was detectable after 4 months, but only on Safarood station 2 and Turkrood stations 1-2.

Table 1. Ethion residue in the water Mazandaran province rivers (2000) (mg/lit)

Ethion	1st day	1st month	2th month	3th month	4th month	5th month	6th month
Safarood 1	2	1.3	0.7	0.2	0	0	0
Safarood 2	0	1.5	0.8	0.4	0.1	0	0
Turkrood 1	2.7	1.8	0.9	0.5	0.1	0	0
Turkrood 2	0	1.9	1	0.6	0.2	0	0
Tajan 1	2	0.8	0.3	0	0	0	0
Tajan 2	1.2	0.9	0.3	0	0	0	0
Tajan 3	1.8	0.5	0.1	0	0	0	0
Babolorood1	2	1.1	0.7	0.2	0	0	0
Babolorood2	1.5	0.8	0.3	0	0	0	0
Babolorood3	0	0.8	0.3	0.1	0	0	0

Table 2. Azinphos-Methyl residue in the water of Mazandaran province rivers (2000) (mg/lit)

Azinphos- Methyl	1st day	1st month	2th month	3th month	4th month	5th month
Safarood 1	3	1.3	0.7	0.2	0	0
Safarood 2	0	1.2	0.6	0.1	0	0
Turkrood 1	2	1.3	0.9	0.4	0.1	0
Turkrood 2	0	1.5	0.7	0.2	0	0
Tajan 1	1.10	0.6	0.1	0	0	0
Tajan 2	0	2.1	1.2	0.6	0.2	0
Tajan 3	0	2	1.5	0.9	0.1	0
Babolorood1	3	1.3	0.9	0.4	0.1	0
Babolorood2	0	2	1.1	0.3	0	0
Babolorood3	0	0	0.6	0.2	0.1	0

Most probably because it is most heaving used in western part of Mazandaran nd the latest time used was only one month before. Azinphos-methyl was observed up to 3ppm at station No.1 of Safarood and still detectable to 0.1 ppm in Torkrood, Tajan and Babol rood. Aninophose- methyl is used almost in the Mazandaran. Malathion was observed maximum 3.1 ppm at station No.2 of Babolorood. This insecticide is better accepted in the eastern part of the state. The test showed 0.2 ppm of Malathion in station No.2 of Tajan river, after 4 months. Diazinon is the highest pollution insecticide in the Mazandaran province, since it is newly presented and most liked by rice farmers.

The highest level of Diazinon was observed to be 9.0 ppm after first day of application in rice crops of area in the station No.2 of Tajan river and at the same station still was recognized after 5 months at the rate of 0.1 ppm. The main reason is that, this pesticide is used against the stemborning caterpillar (chillo spp) and is used frequently during the farm practices.

As the overall conclusion it is suggested that Ehion and Malathion remains much less in time in water circumstances than Azinophos methyl and Diazinon, due to their physical and chemical characteristics. Also water pH, temperature, turbulence (dissolving more Oxygen and faster regeneration of oxygen depletion), slope of the river, daily and seasonal rains, time of application of insecticide, the rate of application and its Concentration in the first solution, have important effects on the duration and the amount of the residues in water bodies (4). Lack of knowledge of farmers about the necessary dosage, method and suitable time of pesticide application, have a marked negative effects resulting in using more pesticides, benefiting less, and polluting the environment as well. Educating of farmers is the first thing to do by the responsible directors and health officers (3).

Table 3. Malathion residue in the water of Mazandaran province rivers (2000) (mg/lit)

Malathion	1st day	1st month	2th month	3th month	4th month	5th month
Safarood 1	1	0.7	0.3	0.1	0	0
Safarood 2	0	0.6	0.3	0.1	0	0
Turkrood 1	2.1	0.9	0.3	0.1	0	0
Turkrood 2	1	0.5	0.1	0	0	0
Tajan 1	1.3	0.8	0.1	0	0	0
Tajan 2	0.5	0.7	1	0.5	0.2	0
Tajan 3	0	1	0.6	0.2	0	0
Babolorood 1	2	1.1	0.4	0.1	0	0
Babolorood 2	3.1	1.7	0.8	0.3	0	0
Babolorood 3	0	1	0.5	0.1	0	0

Table 4. Diazinon residue in the water of Mazandaran province rivers (2000) (mg/lit)

Diazinon	1st day	1st month	2th month	3th month	4th month	5th month	6th month
Safarood 1	1.8	1	0.7	0.4	0.1	0	0
Safarood 2	0	1	0.5	0.4	0.1	0	0
Turkrood 1	3	2.1	1.3	0.6	0.3	0	0
Turkrood 2	0	1.5	0.9	0.4	0.1	0	0
Tajan 1	8	0.4	0.2	0.1	0	0	0
Tajan 2	9	1	0.6	0.3	0.1	0	0
Tajan 3	0	0.6	0.2	0	0	0	0
Babolorood 1	3.8	1	0.5	0.1	0	0	0
Babolorood 2	3	2.1	0.9	0.3	0.1	0	0
Babolorood 3	0	1.1	0.6	0.2	0.1	0	0

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