الجمهوريـة الجزائـريـة الديمقراطيـة الشعبيـة
People's Democratic Republic of Algeria
وزارة التعليـم العالـي والبحـث العلمـي
Ministry of Higher Education and Scientific Research

AbdelhafidBoussouf-Mila University Center

Institute of Science and Technology

Natural and Life Sciences Departement

RefN°:……

End-of-Study Project prepared for obtaining the Master'sdegree

Specialty: Applied Biochimistry

Toxicity of chemical pesticides on human health and environment

Presented by:

- **KatfiIbtissem**

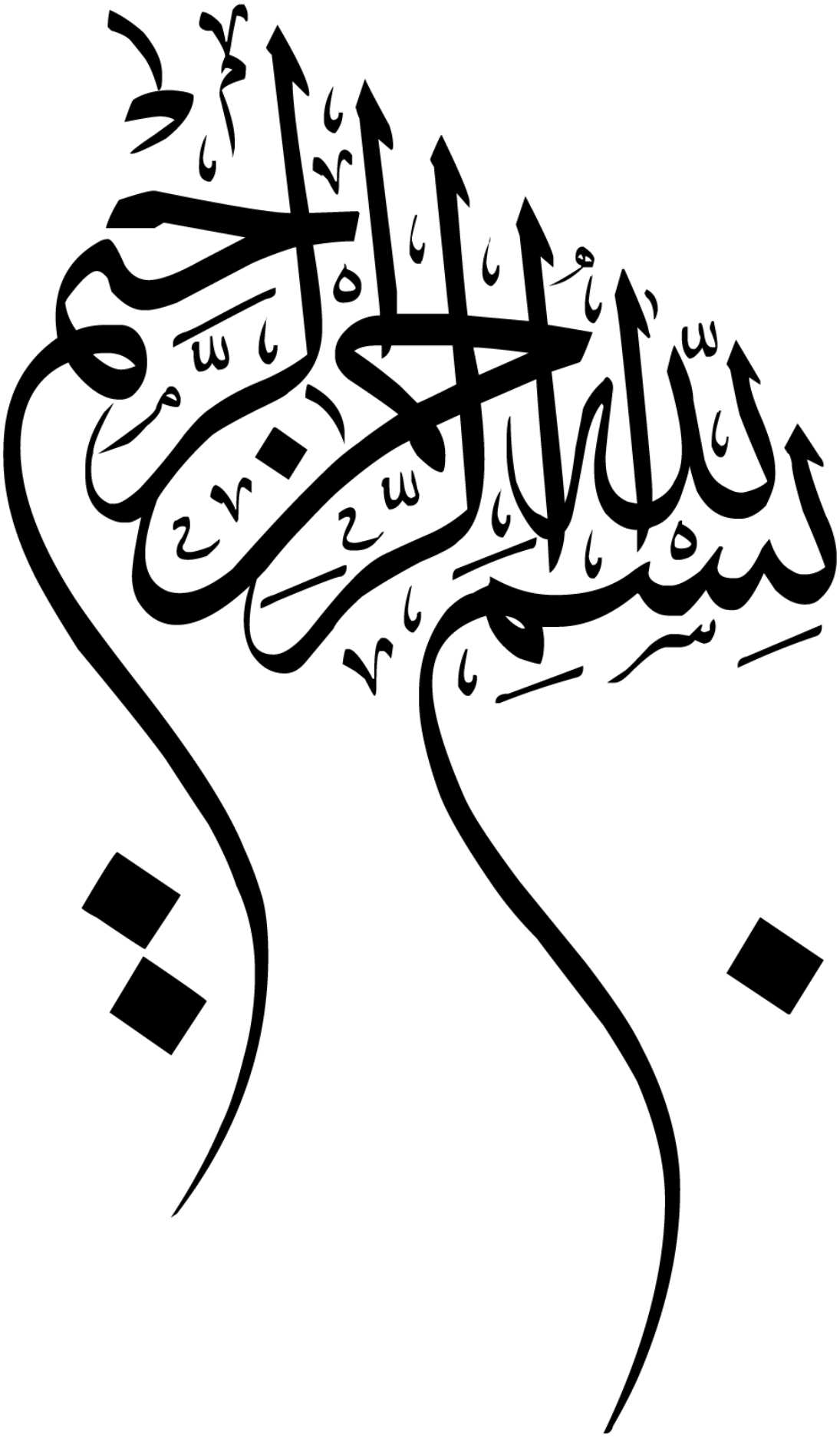
Argued before the jury:

Chair: **KennoucheSalah** **MCB. CU Mila**

Supervisor:AMARI **SalimaMAA. CU Mila**

Examiner: **BouhaliImededdineMCB. CU Mila**

Universityyear:2022/2023


بسم الله الرحمن الرحيم

Acknowledgement

All our perfect gratitude and thanks to Allah who gave us the strength, courage and will to carry out this work.

We would like to take this opportunity to express heart felt gratitude for our project guide **Ms AMARI. Salima** who provided us with valuable inputs at each and every moment and also at critical stages of this project execution .We would also like to express her support and patience throughout the development of this memory.

I offer my sincere gratitude to my committee members for their readiness and willingness to read and evaluate this thesis and for kindly reviewing this work. Special thanks to **Dr. Kennouche Salah** and **Dr. Bouhali Imed eddine**.

Our sincere thanks also go to all the biology professors for giving us a quality background during our formation.

A big thank you to everyone who has contributed directly or indirectly to the development of this project.

Dedication

*I dedicate this work to my **father** who worked hard and made every effort and supported me financially and morally with all he could, and to my **mother** who always accompanied me with her blessed prayers and kind words.*

To the companion of the path and the friend of all days good and bad: My dear husband, *I dedicate this work to you as an expression of my thanks for your continuous support to those who were always the first to support and encourage me. Thank you very much for your confidence in my success and support for the better.*

*To my daughter **Jouri Israa***

*To my sisters, **Monia** and **Ismahan***

*To my dear brothers **Adam** and **Muhammad***

To all my friends and everyone I have

Experienced during my course and all

Those who participated directly or indirectly

in the development of this work.

IBTISSEM

ABSTRACTS

الملخص

المبيدات هي مواد كيميائية تستخدم للسيطرة على الكائنات الحية التي تعتبر ضارة للمزروعات. سواء كانتمبيدات حشرية، أومبيدات فطريات، أومبيدات أعشاب من أجل تحسين الإنتاج. وفي هذا العمل يتم إجراء تحقيق مدى أثرها وخطورتها على البيئة وصحة الإنسان عندما يتلامس الشخص مع كميات كبيرة منها، والتي يمكن أن يتعرض للتسمم الحاد أو الآثار الصحية طويلة المدى مثل السرطان أو الضرر التناسلي. من خلال الاستهلاك اليومي للمنتجات الزراعية تساهم خواصها الكيميائية في حماية النباتات. وهي تهدف إلى تدمير أوالحد أو صد العناصر غير المرغوب فيها لنمو النباتات والحشرات. إنها تحارب أمراض المحاصيل أو تستخدم في إزالة الأعشاب الضارة. مبيدات الآفات هي حصرا من صنع الإنسان. يؤدي الجريان السطحي والصرف والتعرية إلى وصول هذه المنتجات إلى المياه السطحية وتلوث المياه الجوفية بالتسلل (النقل عبر باطن الأرض) أو مباشرة.

الكلمات المفتاحية: السمية، مبيدات، صحة الانسان،البيئة.

Résumé

Les pesticides sont des produits chimiques utilisés pour lutter contre les organismes nuisibles aux culturescommeInsecticides, fongicides et herbicides. Afin d'améliorer la production, dans ce travail, une enquête sur leur impact et leur gravité est menée Il affecte l'environnement et la santé humaine lorsqu'une personne entre en contact avec de grandes quantités, ce qui peut entraîner une intoxication aiguë ou des effets à long terme sur la santé tels que le cancer ou des troubles de la reproduction. Grâce à la consommation quotidienne de produits agricoles contribuent leurs propriétéschimiques dans la protection des plantes. Ils sont destinés à détruire ou réduire. Ou repoussez les éléments indésirables pour la croissance des plantes, les insectes, les parasites et autres plantes. Ils combattent les maladies des cultures ou sont utilisés pour le désherbage. Les pesticides sont exclusivement fabriqués par l'homme. Le ruissellement, le drainage et l'érosion conduisent ces produits à atteindre les eaux de surface. Contamination des eaux souterraines par infiltration (transport à travers le sol) ou directement.

Mots clés: toxicité, pesticides, santé humaine, environment.

Summary

Pesticides are chemicals used to control organisms that are harmful to crops. Whetherinsecticides, fungicides, and herbicides in order to improve production. In this work, an investigation of their impact and seriousness is conducted. It affects the environment and human health when a person comes into contact with large amounts of it, which can lead to acute poisoning or long-term health effects such as cancer or reproductive harm. Through the daily consumption of agricultural products contribute their properties chemicals in plant protection. They are intended to destroy or reduce or repel unwanted elements for plant growth, insects, pests and other plants. They fight crop diseases or are used for weeding. Pesticides are exclusive human-made. Runoff, drainage and erosion lead to these products reaching surface waters. groundwater contamination by infiltration (transportation through the ground) or directly.

Keywords: toxicity, pesticides, phytosanitary products, environment.

LIST OF TABLES AND FIGURES

List of tables

List of figures

ABREVIATIONS

Abbreviations

ACTA: Agricultural Technical Coordination Association.

DDD: Domain-Driven Design.

DDE: Departmental Directorates of Equipment.

DDT: Dichlorodiphenyltrichloroethane

EDRC: Endocrine Disputer Resource Center.

FAO: Food and Agriculture Organization of the United Nations.

Kg: kilograms.

LD_{50}: Lethal Dose 50.

Mg: milligram.

SCO: The Shanghai Cooperation Organization.

UIPP: Union of Industries and Plant Protection.

WHO: World Health Organization.

TABLE OF CONTENTS

Table of content

INTRODUCTION

Introduction

Over the centuries, the knowledge and skills needed to protect crops pests and diseases have greatly evolved. People have always used botanical and inorganic chemicals in their efforts to reduce damage produced by pests and diseases in their crops and animals (Hackin, 2005).

In Algeria, the use of pesticides for agricultural purposes is more and more frequent, followingincreasing cultivated areas to increase agricultural production. Thus, approximately 400 phytosanitary products areapproved in Algeriaof which about forty varieties are widely used by farmers (Mokhtari, 2011). Algeria uses 6,000 to 10,000 tons ofpesticides per year, which makes it a major consumer of pesticides(Bouziane, 2007).

Pesticides are classified into large families, either by function or by chemical group,depending on the main molecule used. There are more than a hundred chemical families and the most important areorganochlorines, organophosphates, carbamates, organic nitrogen as well as pyrethroids**(**Aligon *et al.*, 2010).This classification is also indicated according to the typeaggressors, grouped into three large families, herbicides, insecticides and finally،fungicides**(**Bonnemain, 2003).The increasing use of these chemical tools hasmade it possible to considerably increase agricultural productivity during the last fortyyears and to fight against the vectors of certain pathologies**(**Vigouroux-Villard, 2006).

Along with their beneficial effects in the defense of crops and the protection of harvests, chemical pesticides at same timeare toxic and their use cannot be allowed lead to the risksfor human health and natural environments likely to be affected(Deville*et al.*, 2005; Charles, 1992;Sougnabe*et al.*, 2010; Kanda *et al.*, 2013).It is in this context that we carried out our work which consists in quantify the phytosanitary products and the several risks causing by the toxicity of pesticides to humans health and environment.

This dissertation is composed of three chapters.The first chapter is devoted to a bibliographical synthesis providing general information on the pesticides. In the second chapter presentthe effects of pesticides on the human health, In the third chapter presentthe effects of pesticides on the environment,finally we end with a conclusion.

CHAPITER I

PESTICIDES

1. Generality

The pesticide or phytosanitary products are chemical, mineral or organic compounds including herbicides, insecticides and fungicides (Periquet*et al*., 2004). The word pesticide derives from "Pest", English word means all living organisms such as (bacteria, viruses, mushrooms, herbs, molluscs, worms, insects, mammals, rodents birds) about to be harmful to the man and/or his environment (Periquet*et al*., 2004). The suffix cide" means to immolate these pests (Godin *et al*., 2016). Undesirable species of animal or plant used to destroy, prevent causing damage during processing,crop storage, production transportation or marketing of foodstuffs, wood products, agricultural products, wood animal feed, or which may be administered to animals, for the control of insects(FAO, 2003; Aubertot*et al*., 2005).

2. History

Over the centuries, the necessary skills and knowledge to anneal the crops against diseases, pests have been widely visible. People have always used inorganic, botanical, chemicals in their efforts to reduce the damage produced by diseases, pests in their animals and crops, everywhere for a long time most of the means were of a physical nature: collection of larvae, adult insects and eggs destruction (Boland *et al*., 2004).

The use of the chemical products is never the less quite old as indicated by the use of sulfur and that of arsenic. According to (Calvet*et al*., 2005). The use of pesticides increased significantly during the first and the second half of the twentieth (20^{th}) century approximately, separated by the Second World War, honest sources respect the 1940s and 1950s for pesticide era design (Boland *et al*., 2004). Several factors have had an important mark on this evolution such as: protection of the quality of food products, the search for a high return and a smaller workforce (Calvet*et al*., 2005).

During this period, the conflict against plant diseases is always ensured by sulfur and copper. The use of arsenical compounds was widespread before 1950. They were used against insect pests of trees and also against the beetle; the notorious pest of the potato (Calvet*et al*., 2005). The history of the evaluation on the three largest classes of pesticides is mentioned in Table 1.

Table 1: History of the evolution of the three largest classes of pesticides (Batsch*et al.*, 2011).

	Herbicide	**Fungicide**	**Insecticides**
Before 1900	Copper Sulfate Iron Sulphate	Sulfur Copper Salts	Nicotine
1900-1920	Sulfuricacid		Selsd'arsenic
1920-1940	Nitrodyes		
1940-1950	Phytohormones		Organchlorine and Phosphorus
1950-1960	Triazines Substituted Ureas Carbamates	Dithiocarbamates Phtalimides	Carbamates
1960-1970	Dipyridyles Toluidines	Benzimidazoles	
1970-1980	Aminophosphonates Propionates	Trizoles Dicarboximides Amides Phosphites Morpholines	Prethrimoides Growthregulators
1980-1990	SufonylUrea		

From the early 1960s, the use of pesticides skyrocketed in Asia and South America. 65% of the world's pesticides are used in growing countries but the use in developing countries is increasingly high (Calvet*et al.*, 2005).

Unfortunately the increase of systemic products has estimated the rapid appearance ofresistors that year did not know the warning. From the 1990s, the largest number of productsmarketed and regulatory requirements (approval, standardization, etc.) make the increasingly severe competition between phytosanitary industries. Industrialists preferexert their effort on the sale of a single product optimized for a well-targeted use rather thangetting out of the way in the simultaneous industrialization of other products.

3. Classification

Today, available pesticides are characterized by such a variety chemical, functional groups, structure and activity that their classification is complex; In general they are classified according to(Bourbia-AitHamlet, 2013):

- The chemical nature of the main active ingredient (second system of classification).
- The chemical nature of the species to fight (first classification system).
- There are also others classification.

It consists in distinguishing them according to the target, to be eliminated; this is the first classification system. There are three major families: herbicides, fungicides, insecticides.

- ***Herbicides:*** intended to fight against certain plants entering into competition with cultivated plants.
- ***Fongicides:*** intended to treat bacterial and viral diseases but also fungal diseases of plants.
- ***Insecticides***: intended to eliminate or preventing their reproduction in additionto the fight against harmful insects.

In addition to these three large families, we will also mention the slugs, molluscicides against snails and rodenticides against rodents, acaricides, against mites, the nematodes, against nematodes, corvicides and corvifuges, against crows and crop pest birds.

A. Second classification system

The main groups chemicals include: Organochlorines, organophosphates, carbamates, pyrethroids, triazines and substituted classification are made according to their active ingredient (Bourbia-Ait Hamlet, 2013).

- **Organochlorine**

Organochlorine pesticides (POC) as biocides (Mawussi*et al*., 2008).These molecules are characterized by a solubility high in solvents but low solubility in water (Liliana *et al*., 2005). Because of their persistence but they continue to be used in some countries they are currently bannedor very restricted in use in many countries (Tawil*et al*., 2007).The

The effectiveness of Organochlorines which has diminished gradually, requiring users to increase the doses applied at the same time. They have been widely used throughout the

world as a contact insecticide and to a lesser extent as fungicides and acaricides. Their spectrum of action is therefore very broad. Because of their ubiquitous and repeated use (Aligon*et al*., 2010).

Organophosphates

Organophosphates are esters of various alcohols with orthophosphoric acid or one of its derivatives phosphoric acid (Ramade*et al*., 2005). They can be classified into three groups: aromatics, aliphatics, and heterocycliques, or depending on the of presence sulfur atoms: organophosphates, thio-organophosphates and dithio-organophosphates (Testud*et al*., 2001). Current organophosphates a certain selectivity in their toxicity for insects unlike families of insecticides whose spectrum of action is very wide, In addition, most of them are quickly biodegradable in both soil and water(Ramade*et al*., 2005).

Carbamates

Most N-methylcarbamic acid derivatives are insecticidal carbamates (Bouchon*et al*., 2003) .Aldicarb, which is a strong systemic insecticide, is usedagainst sap-sucking pests, especially potato aphids and maggot carbaryl beet has significant insecticidal activity against phytophagous insects: caterpillars and defoliating beetles. Carbaryl (or sevin) (Figure 1) is among the most widely used of these compounds (Ramade*et al*., 2005).

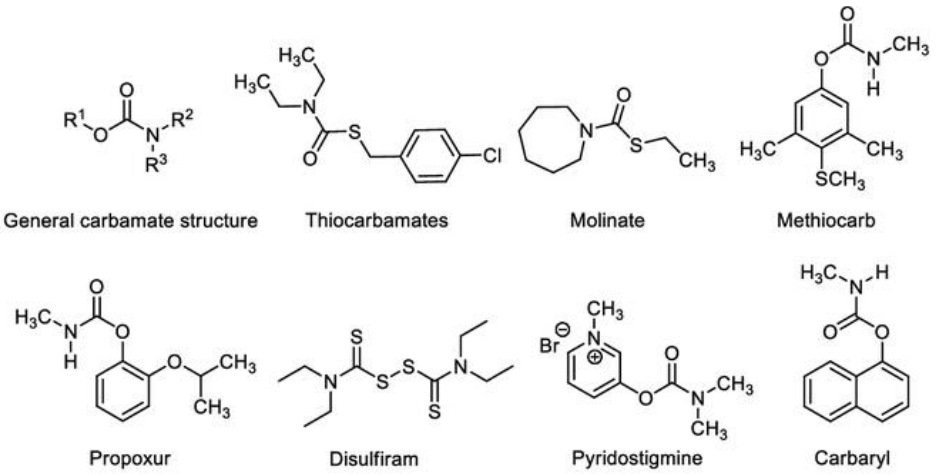
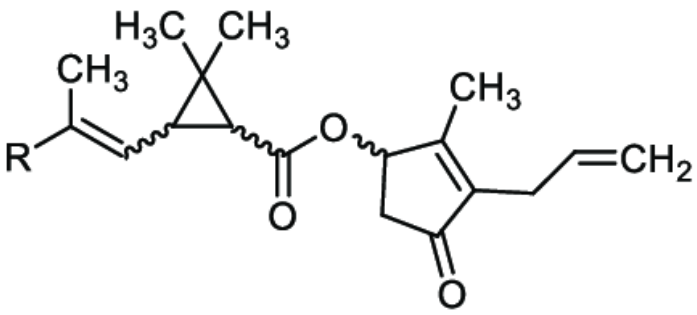


Figure 01: Chemical structure of some carbamate and thiocarbamates pesticides (Ramade*et al*., 2005).

- **Pyrethroids**

Due to the severe need for large quantities of these pesticides and due to the growing short-age of essential oils necessary for the manufacture of natural organic pyrethrum, scientists have turned to the production of synthetic pyrethroids. There are over 1000 different pyrethroids(Figure2) used today, although fewer than a dozen are usable in the United States. It is used as an active substance in many types of commercial products such as pet shampoos, human head lice treatments, pet sprays, topical mosquito repellents and of course insecticide sprays for businesses, farms, and homes, fast-acting especially against chewing insects. Although many pyrethroids insecticides can be absorbed by insect pests when they walk on dry residues, they are not effective in penetrating the soil to kill underground pests because they adhere tightly to topsoil and organic matter. In addition, they are poorly soluble in water (Gupta etCrissman, 2013; Sepposaari*et al*., 2019).



Pyrethroid

Figure 02: General structure ofpyrethroids pesticide (Tomlin *et al*., 1994).

B. Third classification system

Between the different categories of pesticides and even within these categories,link with their physicochemical properties the great diversity of targets is accompanied by a great variety of modes of action, also well (Calvet*et al.*, 2005).

Fungicides control fungi by affecting lipid formation (boscalid) or sterols (tebuconazole), respiratory processes (chlorothalonil), microtubule synthesis (propamocarb), or spore germination (Bordeaux mixture)(Ayad-Mokhtari, 2012; Serra *et al*., 2016).

Herbicides act in plants through various modes of action, such as oxidative breakdown of membranescells (paraquat), inhibition of photosynthesis (isoproturon), lipid synthesis

(clethodim) and synthesis of amino acids (glyphosate), cell division(pendimethalin) or disruption of phytohormone regulation (dicamba)(Nail, 2014; Serra *et al.,* 2016).

Insecticides act at different levels of neuronal placement, (hydramethylnon), on the synthesis of cuticular compounds (triazoxide) or on respiration (AyadMokhtari, 2012; Serra *etal*., 2016).

C. Fourth classification system

Based on the danger posed by pesticides in the short term (acute toxicity). The World Health Organization (WHO)classifies pesticides by dangerousness. Each pesticide is then placed in one of four classes: Extremely dangerous, highly dangerous, moderately dangerous, slightly dangerous, after the use of a median oral or dermal LD50 lethal (Arzul*et al*., 2008). The classification of pesticides according to toxicity is mentioned in Table 2.

Table 02: Classification of pesticides according to toxicity (Arzul*et al*., 2008).

Classes	**LD RAT mg/kg/body weight**			
	Oral Rout		**Dermal Rout**	
	Solid	Liquid	Solid	Liquid
Extremely dangerous	5 or less	20 or less	10 or less	40 or less
Highly dangerous	5-50	20-200	10-100	40-400
Moderately dangerous	50-500	200-2000	100-1000	400-4000
Not very dangerous	More than 500	More than 2000	More than 1000	More than 4000

D. Fifth classification system

The type of pesticide used depends, the nature of the crops and the climate. They exist in the world near 100,000 commercial specialties authorized for sale. Pesticides are separated into two groups, currently according to their uses (OMS, 1991):

- **Pesticides for agricultural use or phytosanitary products**

Which uses the highest tonnage of active ingredients for the protection of plants against diseases and organisms harmful to crops and ensure good performance of food products.

- **Pesticides for non-agricultural**

Used in non-agricultural environments to destroy or repel pests, and in hygiene (vector control) which are similar to pesticides for agricultural use and in other applications such as disinfection, conservation.

4. Different types

Pesticides are traditionally intended for the protection of crops against organisms deemed pests such as parasites, weeds, insects and fungi. As a result, they are classified according to their targets:

4.1. Fungicides

4.1.1. Mineral fungicides

Ensure a protection against the development of parasitic fungi. They are used against cryptogrammic diseases, there are two categories of fungicides are distinguished byPirequet (2004).

4.1.2. Copper-based fungicides

The best known is Bordeaux mixture (mixture of sulfur and copper). The most numerous and the most used.

4.1.3. Sulfur-based fungicides

We have three types of sulfur fungicides; tributary sulfur in the form of powder, sublimated sulfur obtained by condensation of steam and finally wet table sulfur compounds used in spraying are used in vapor form.

4.1.4. Potassium permanganate fungicides

They work only against powdery mildew.

4.1.5. Organic fungicides

Organic fungicides comprise a varied group of molecules whose structure chemical is varied, we distinguish:

- **Carbamates:** thiocarbamic acid derivatives, carbamic acid derivatives and benzimidazoles

- **Phenolderivatives**: Rivativesdinoap.
- **Dicarboximdes**: phthalimides, cyclic imides.
- **Amides and amines**:anilinopyrimidine, phenylamides.

4.2. Herbicides

Herbicides are used against "weeds". They are applied either at:

- **Floor**: pigment destroyers such as lomazone, norflurazon and cell division inhibitors (dinitroanilines) such as trifluralin, prodiamine, pendimethalin.
- **Foliar**: growth organization such as 2,4-D, dichloroprop and 2,4,5-T, destroyers of the cell membrane, photosynthesisinhibiteurs such as atrazine, simazine, cyanazine and amino acid synthesis inhibitors: example glyphosate.

4.3. Insecticides

They are grouped into three large families and they are used against insects.

- **Organochlorines**: Organochlorines are the basis of carbon, hydrogen and chlorine such as aromatic biphenyls: DDT, DDD, lindane, cyclodiènes: aldrin, dieldrin, heptachlor and polychlo terpenes such as toxaphene.
- **Organophosphates:** heterocycles: chlorpyrifos, methidathion and phosmet, Phenylderivatives such as parathion, methyl parathion and aliphatic pyrethroids and phosphates such asmalathion, dimethoate.
- **Carbamates:** such as synthetic pyrethroids.

4.4. Other families

- Molluscicides used against slugs.
- Corvicides used against birds.
- Nematicides used against nematodes.
- Rodenticides to fight against moles and rodents.

5. Use and consumption

5.1.Global Consumption

Half of the countries that appear in the top 10 consumers of pesticides (Table 3)also hold the largest agrochemical firms(Benaboud*et al*., 2014). In Africa, the use of pesticides is

lower due to poverty, instability, unreliable rains and indifferent soils that have prevented the small-scale agriculture to modernize in much of the region of all continents(Benaboud*et al*., 2014).

In Europe, the leading countries in consumption are Italy and France, the United States, Argentina, Brazil and Canada are the most important consumers next to the American continent. In addition, there are areas of intensive pesticide use in North Africa, such as the cotton regions of Sudan. Also, large commercial farms and plantations producing coffee and other export crops in South Africa(Benaboud*et al*., 2014).

Table 03:Top 10 countries consuming pesticides (Benaboud*et al*., 2014)

Rank	Country	Annual consumption	Rank	Country	Annual consumption
1	**China**	1806	6	**Italy**	63
2	**USA**	386	7	**France**	62
3	**Argentina**	265	8	**Canada**	54
4	**Thailand**	87	9	**Japan**	52
5	**Brazil**	76	10	**India**	40
WithoutClassification				**Algeria**	6-10

5.2.Algerian consumption

In Algeria the amount of pesticides used per year is between 6,000 to 10,000 T. this is six to ten times less important than the French consumption. it is also less important than that of Morocco, reaching 12,000 T in 2004(Moussaoui*et al*.,).

However, in 2013, the use of total pesticides increased to 25841 T,of active ingredients including plant growth regulators representing 22,000 T (85%) while herbicides, insecticides and fungicides-bactericides represent respectively 886 T (3%), 927 T (4%) and 2028 T (8%) of active ingredients(Moussaoui *et al*., 2011).

6. Formulation and composition

6.1.Formulation

Pesticides are available in various formulations. They can take the form suspension of capsules to be diluted in water (micro-capsules containing the active substance) liquid dispersible concentrate, emulsifiable concentrate, water-soluble powder, contact liquid or gel, powder for dusting or for dry seed treatment, bait on grain sprays, smoke box,fine granules, micro-granules, dispersible granules**(**Inserm*et al*., 2013), powders wettable liquids, pasty liquids or more or less fluid liquids, soluble granules(El Moudene*t al*., 2010).

Phytopharmaceutical is placed on the market; obtained by mixing the active substances and formulating, it comes in a plurality of forms, liquid or solid**(**Amara *et al*., 2013) to facilitate their use. These formulations can grant ready-to-use products, which is the case for products for domestic use The formulation of the pesticide corresponds to the physical form in which the product(Bouvier*et al*., 2008).

6.2.Composition

A pesticide includes one or more of the additive materials and active materials(Debbab*et al*., 2014).

a. Active substance

The content of active substance is expressed: in percentage (%) for liquid formulations and mass per volume (g/L) or in mass per mass (g/kg) for waterless formulations.An active substance represents the constituent to which is attributed in part or in whole theactivity indirect or direct biological action directed against the disease.

b. Addictive substance

Additive substances are often called adjuvants, solvents, or excipients. It can be oils, solutions, powders or varying mixtures. Additive materials can potentiate the effect of the active substances.

7. Properties

7.1.Physicochemical properties

- **Persistance**

Persistent compounds canaccumulate in the soil, the environment, or in the food chain. At the end counts, also in meat, fish or milk. Of this men are also exposed to the pesticide. A pesticide is persistent if the material only hides slowly from the environment Persistence is

the property of a plant protection product stay active for a long period of time(Calvet, 2005). The conduct of pesticides in soils is governed by a different processcomplex(Schrack*et al*., 2009).

- **Resistance**

Another mark of the plus treatments is that a harmful organism can become tolerant (less sensitive) to the pesticide used. It is then necessary to use an increasingly large quantity, to obtain the same phytosanitary result after this pesticide,If possible, regularly alternate treatments with pesticides of the type different wherever possible, and use other treatment methods phytosanitary(Calvet, 2005).

- **Water solubility**

Dissolution is the passage of ions or non-ionized molecules from a solid condensed state or liquid, in water or more exactly in an aqueous solution, whether in soils or sediments, is important for the fate of pesticides in natural environments in because of its role in their transfers and in their absorption by living organisms. This phenomenon can concern solid, liquid and gaseous substances(Calvet, 2005).

7.2. Chemical properties

- **Redox**

Pesticides contribute to oxidation or reduction reactions depending on the oxidativecharacter or soil reducer(Calvet, 2005).

- **Ionization**

Indeed, the ions are not volatile under the conditions of natural environments but are very soluble in water and the ionization of pesticides has important consequences on their future in soils in particular, in the environment(Calvet,2005).

- **Mineralization**

The mineralization of pesticides is a fundamental process in their future and their transformation, most often of biological origin, which makes them totally disappear from the environment by passing all the chemical elements from organic to inorganic forms(Calvet, 2005).

7.3.Biological properties

Toxicological properties are usually distinguished when consider their effects on eco-toxicological properties and human beings when considering is interested in other living

animal and plant organisms, biological properties concern the effects of pesticides on living organisms, they are due to modes very varied actions(Calvet, 2005).

8. Grouping of pesticides

It is known to name pesticides according to gatherings that take into account the target of the pesticide, the origin of the product, its chemical structure as well as of acting on the target and its place of action. A pesticide can therefore be grouped according to:

- His origin.
- Its category of use.
- Its chemical group.
- Its type of formulation.
- Type of activity.

8.1. Origin

Pesticides can be classified as organic or inorganic pesticides. The organic pesticides contain carbon, while inorganic ones only contain .carbon then in the form of carbonate or cyanide. These are derivatives based arsenic, mercury, fluorine, sulfur and copper, as well as cyanide derivatives. Inorganic pesticides are derived mainly minerals(Calved, 2002). Organic pesticides can be divided into 3 groups: pesticides (developed in the laboratory and produced in the factory), natural pesticides (of anima origin microbial or plant) and micro-organisms(Intra cemagref, 2005).

8.2. Category of use

There are several categories of use among those mentioned(Leveau, 199).

- Pruning coating.
- Local medicine for animals
- Pheromone
- Antifouling paint.
- Animal repellent.
- Wood preservative.
- Plant growth regulator.

8.3. Type of formulation

A formulation is developed with the aim of making the product more effective and convenient to use, therefore, safe. Most pesticides are ready-to-use formulated prod employment. The formulation of pesticide must meet 3 essential goals:

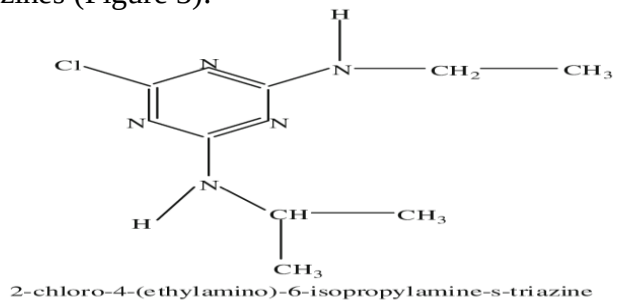
- Ensure optimum efficiency of the active ingredient.
- Limit the risk of poisoning for the handler.
- Make the active ingredient profitable. And can be the same pesticide available in several forms: solid, liquid and gaseous(Table 04).

Table 04: Examples of formulation (Bidelman,1988).

Examples of formulation	**Form ready to use or unprepared**
Solid form	
Bait Powder.Ready to use	
Wettable powder(EC)Unprepared	
Liquid form	
ArosolReady to use	
EmulsifaiblecontrateUnprepared	
Solution	Unprepared
Gaseousform	
FamigantReady to use	

8.4. Chemical group

Consists of pesticides that have amparable chemical structure. For example, the chemical structure of atrazine,presented here in two ways, allow this pesticide to be classified in the group of tetrazines (Figure 3).



2-chloro-4-(ethylamino)-6-isopropylamine-s-triazine

Figure 03: Chemical structure of atrazine (Santiago *et al.*, 2015).

8.5. Type of activity

Fungicides, herbicides and insecticides can bespecified according to their way of acting on undesirable organisms(Table 5) (Mehmet et Jean-marie, 2007). Different types of pesticides activities are shown in Table 5.

Table 05: Different types of pesticidesactivities(Mehmet et Jean-marie, 2007).

Herbicide	**properties**
Of contact	Act on parte of plant with which it comes in to contact
Systemic	Absorbed by the plant,moves inside it
Selective	Controls only certain plants
Non- Selective	Check all treated plants
Residual	Degrades slowly and controls plants for a long time period
Fungicide	Properties
Preventive	Protects the plant by preventing disease from developed
Curative	Suppress a disease that is already developed
Insecticide	Properties
Contact	Act when the insect comes into contact the product
Inhalation	Act when the breathes in the product
Ingestion	Act when the insect feeds

8.6. Mode of action

Multiple sites or modes of action are known for herbicides, insecticides as well as fungicides: Insecticides control insects; they intervene by eliminating them orpreventing their reproduction. Different types exist such as: Neurotoxins.Growth regulators, those acting on cellular respiration. Pesticides can be grouped according to site or modeaction of the undesirable organism on which they act(Intra-Cemagref, 2005).

.

Fungicides control fungi;they can act differently on plants: respiratory inhibitors, cell division inhibitors, disruptors of amino acid or protein biosynthesis and disruptors carbohydrate metabolism. Herbicides have different modes of action on plants: photosynthesis

disruptors, division inhibitors cells, cellulose synthesis inhibitors, cellulose synthesis inhibitorsof amino acids, they control the plants(Intra-Cemagref, 2005).

9. Pesticide metabolism

This metabolism, especially in the liver, can therefore lead to the formation of toxic metabolites and consequently to the occurrence of damage cellular and/or genetic(Schuetz, 2001).

10. Importance

You have to meet a few conditions to know that a pesticide treatment must be effective either:

- Using proper technique.
- At the right time,
- Applied with correct dosage (depending on degree of infestation and damage estimated potential).

Thus we obtain a treatment whose advantages can be summarized:

- The protection of plants and plant products against all organisms harmful,correct choice phytosanitary product.
- Inhibit or warn of an undesirable increase in plants,
- The preservation of plant products, unless these substances or products are subject to special provisions concerning preservatives,
- The fight against certain insects such as mosquitoes which representvectors of serious diseases such as Malaria, and certain plants such asAmbrosia (an invasive plant with very allergenic pollen that causes respiratory or skin pathologies in humans)**(**Batsch, 2011).

11. Market

11.1. In the world

They are made from 900 different active ingredients. We record 15 to 20new active ingredients that are added each year. Thus, herbicides represent 70 to 80% of the products used because of the strong growth of corn crops in Europe and South America North, while in the tropics, 50% of the products applied are insecticides**(**AyadMokhtari,2012)According to the union of industries and plant protection (UIPP, 2011), the turnover(CA) global

phytosanitary products market increased by 15%. Europe remains the leader with 27.7% of market share, followed by Asia at 26.4%, South America North at 21% and finally Africa.

Fungicides represent nearly 29% and insecticides 17%. The use of herbicides is probably linked to the increased diversification of crops and the improvement of the standard of living in certain countries, modifies. This distributionherbicides (Figure 4) are the most used pesticides on all crops in the world (46% of the market)(UIPP, 2011).

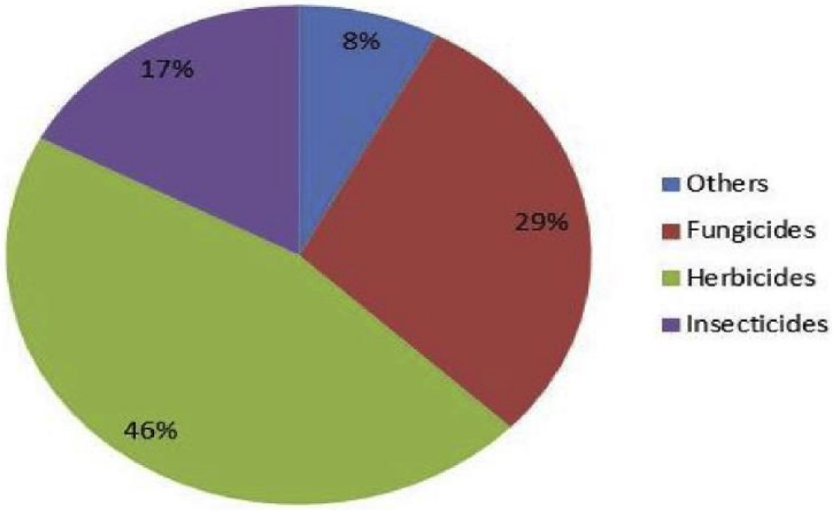


Figure 04: World pesticides market by region in 2011(UIPP, 2011).

11.2. In Algeria

The rate of national production is very low. The vast majority of phytosanitary products for agriculture come from imports. Algeria is ranked among the countries that use the most pesticides, including are pyrethroids, organophosphates and carbamates(Ayad-Mokhtari, 2012).

Regulations in force since 2009, pesticides deemed dangerous and prohibited in other countries, are still present in Algeria(Merhi, 2008). The 90s were marked by more use greater number of pesticides (all categories combined) than the 2000s. only due to a reasoning of use but also to the introduction on the market of new commercial formulations at lower doses per surface unit, which is not in no way a synonym of less environmental impact. The quantities used in Algeria by categories are displayed in Figure 4. The data are grouped by type of use (insecticides, herbicides, fungicides, etc.) and cover a 23-year period (between 1990 and 2013). Usage peaks insecticides-fungicides in 1991 and 1995 and above all insecticides in 2004, the year of the lastmajor locust invasion in Algeria(Bettiche, 2017)

CHAPTER IIPESTICIDES EFFECT ON THE ENVIRONEMENT

1. Risks associated with the use of pesticides

Pesticides migrate and enter compartments of the environment causing significant risks for humans and ecosystems, with a short or long-term effect (Meem, 2015).

1.1. Effects of pesticides on the environment

These products influence the environment by reducing the quality of its various compartments: air, water and soil (Figure 5). The risks of uncontrolled pesticide use have outweighed their beneficial effects (Hakeem *et al*., 2016).

1.1.1. Impact on air

Pesticide contamination in the air is a considerable pollution factor that causes hazardous impacts on flora and fauna as well as human health (Tudi*et al*., 2021). The losses in the direction of the different compartments of the environment vary according to the state crop development, sprayer setting and spray composition pulverized (Langenbach*et al*., 2017). Additionally, a portion of the dispersed active ingredients does not reach the targeted area, drifts in the air and is deposited in more or less distant ecosystems (Ramade, 2005).

While, pesticides can also drift into the air by wind transport and droplets evaporation outside the cultivated plots (Pimentel, 1995; Rial-Otero *et al*., 2003Pallares et Masurais, 2006).Another very important source is volatilization of pesticides from soil or plant surfaces.

These molecules contaminating the air are transported by air (Figure 5) currents and redistributed globally, polluting all kinds of ecosystems (Rudel, 1997).

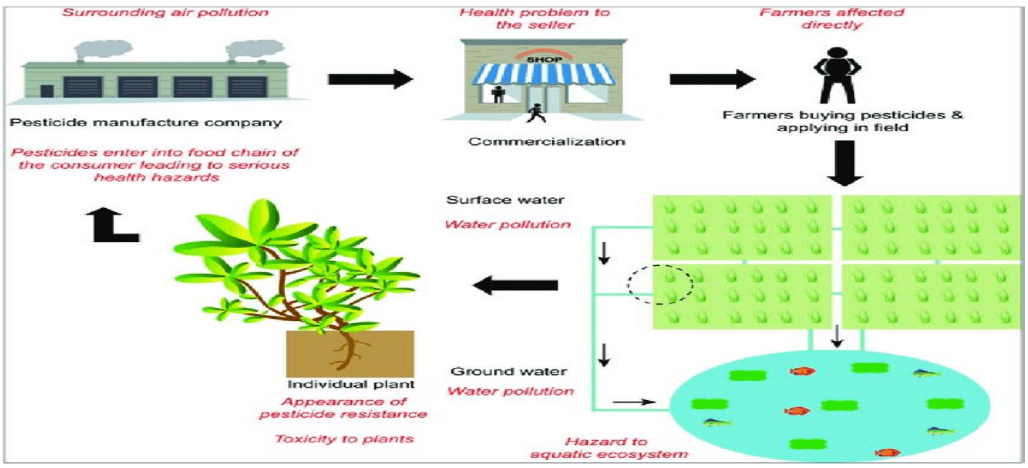


Figure 05: Effects of pesticides on air and ecosystems (Pradhan etMailapalli, 2020).

1.1.2. Impact on soil

Soil pollution has taken on increasingly large dimensions over the past few decades. Thus, more worrying, both by the multiplicity of its causes and by the growing scale of the surfaces affected to the point of becoming a major environmental and health problem public (Taudi*et al*., 2021).

The pesticide molecules are carried into the soil by water infiltration of rain. In fact, these substances are transformed in the soil into various degradation products whose toxicity is not always known. The occurrence and concentrations of pesticides in agricultural soils can be strongly influenced by the time of sampling and the time of pesticide application (Riedo*et al*., 2020). Therefore, soil contaminated by pesticides poses a widespread threat to water and the food chain (Taudi*et al*., 2021).

- **Soil microorganisms**

The pesticides in use also harm soil micro-organisms which play akey role in helping plants use the nutrients they need to growand develop, this can have a harmful effect on the fertility of the soil (Taudi*et al*., 2021). These phytosanitary products affect fungi, bacteria, algae, earth worms and insects. It is therefore important to know how long pesticides persist in those organically managed agricultural soils and whether they threaten soil health which is indispensable for these sustainable systems (Figure 6).

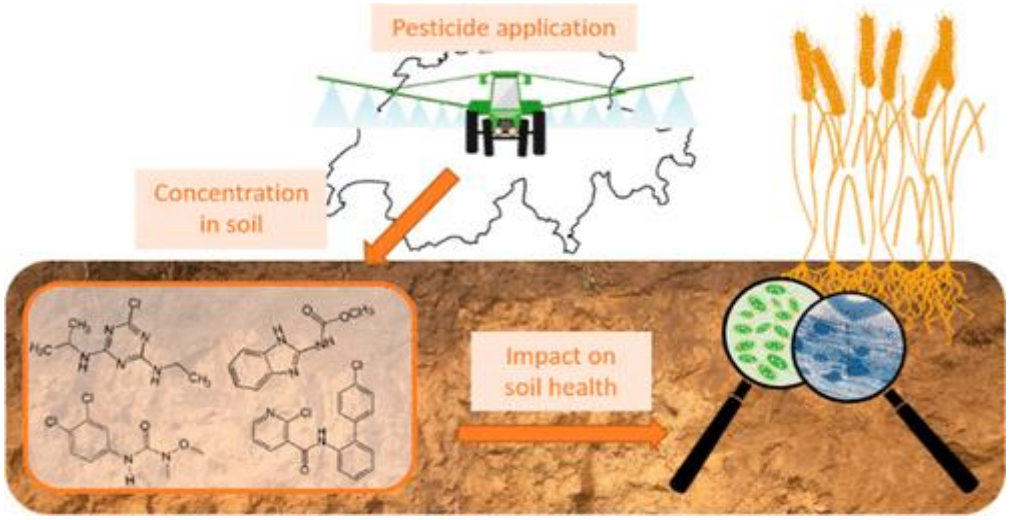


Figure 06: Pesticides and soils healthy (Riedo*et al*., 2020).

In addition, The earth worms that play the role of active agents of soil fertility are achieved by pesticides via polluted water which soaks into the ground. The effects of pesticides on soil microorganisms are very diverseCalvetetBarriuso*et al*., 2005):

- Decrease in activity and populations of algae and bacteria.
- Cause the reduction of the nodulation of legumes, and inhibition of the growth of actinomycetes.
- The multiplication of crop treatments has caused the appearance of resistances in the targets.
- Cause the inhibition of denitrification.
- Increase in aerobic nitrogen-fixing bacteria and reduction of anaerobic bacteria

This requires increasing the doses of the latter, hence increased risk. Towards the beginning of the 1990s, it was already demonstrated many species resistant to at least one pesticide (CalvetetBarriuso*et al*., 2005).

1.1.3. Impact on water

The deterioration of the quality of surface and groundwater, this is one of the major environmental consequences of intensive agriculture (Cagne, 2003). Pesticides can easily penetrate water sources (Figure 07). This can be done in three ways flow: either by runoff where the concentration is generally maximum (during heavy rains occurring shortly before application), or by artificial soil drainage (with average concentrations), or by leaching (Batch, 2011). They can also reach the waters groundwater due to their high leaching potential, which threatens the quality of this water (Gagne, 2003).

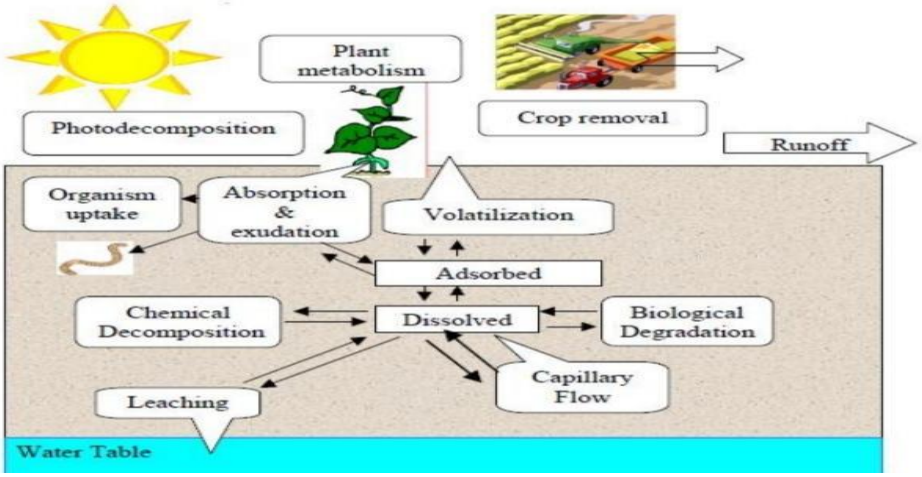


Figure 07: Pesticides and water pollution (Dem, 2004).

1.1.4. Impact on plants and Food safety

Food contamination is not only a consequence of spraying pesticides for non-target plants but also due to pesticide behavior in the environment, such as volatilization from the treated area to the air, soil, and non-target plants, and the residual pesticides transmitted from soil and water (Figure 8) to crops, vegetables, and fruits (Damallas*et al*., 2011;Carvalho, 2017; Zhang *et al*., 2017).

This environmental behavior of pesticides and their residues lead to food contamination and damage to plants (Colquhoun *et al*., 2017). Xenobiotics such as pesticides can indeed affect the survival, development and plant reproduction, and induce larger changes in the plant communities with significant ecological and agronomic impacts (Helander*et al*., 2012; Belhaouch*et al*., 2014; Yasser El-Nahhal, 2015; Nicolle-Mir, 2018; Moussa *et al*., 2018).

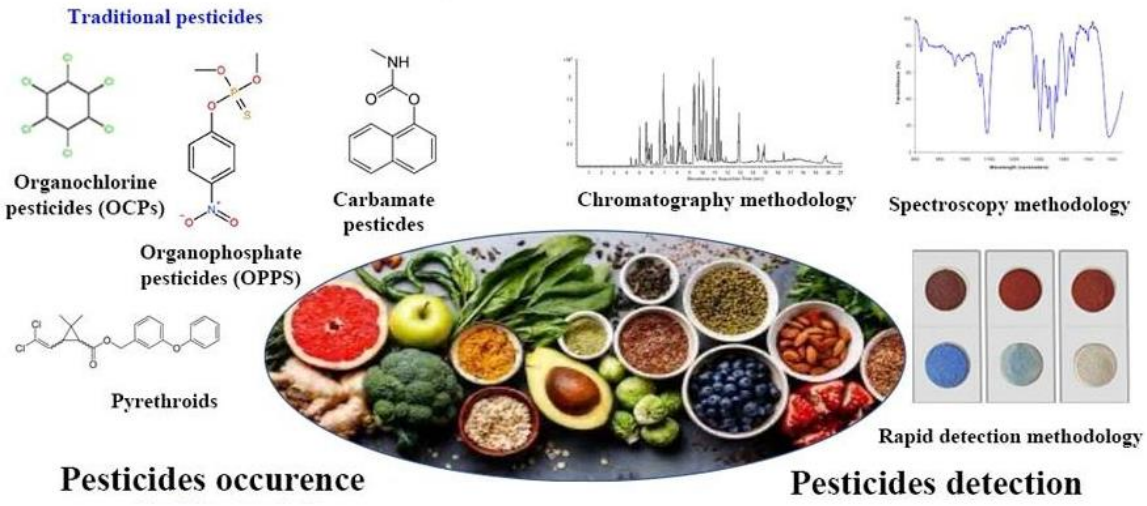


Figure 08: Pesticides detection in foods and plants (Liang *et al*, 2022).

For example, exposure to the herbicide clopyralid can reduce the yields of potato plants. Volatilization of only 1% of the applied clopyralid is enough to damage non-target plants. It is also showed that plants indirectly suffer from pesticide applications since pesticides are harmful to soil microorganisms and beneficial insects (Tudi*et al*., 2021).

1.1.5. Impact on ecosystems areas

Agricultural areas are important sources of pesticides that can distribute in various ecosystems, with potential implications on public health (Pimentel, 1995; Rial-Otero *et al*., 2003).

1.1.5.1.Impact on aquatic ecosystems

The risk of pesticides to aquatic ecosystems reside to chronic disruption of reproductive and hormonal cycles of fish, and reduce the diversity of plant and algal communities (Bereswill*et al*., 2012; McMahon *et al*., 2012).Thus, it lead to massive mortalities of fish, invertebrates and aquatic plants(Mccahon*et al*. Pascoe, 1990; Giger, 2009; Mcmahon*et al*., 2012). Thus, aquatic species accumulate toxic molecules through direct contact with their surrounding environment (Barrette. 2006).

- **Fish**

The accidental pollution of the waters by organochlorines insecticide leads to the death of thousands of fish For example. In the United States, 6 to 14 million fish die each year due to them (Brown, 1978, Alix*et al*., 2005). Fish are the first organisms to have been studied from the point of view of their responses to the deterioration of the quality of aquatic environments. The presence of dead fish at the surface of a river or body of water constitutes the existence of environmental pollution aquatic (Pimentel *et al*. 1993, Hayo et Vander Werf , 1997).

The fish species are exposed to a variety of pesticides in contaminated surface water by three common ways; dermal absorption, through integument, oral absorption indirectly through inhalation during respiration, and directly throughout, drinking pesticides contaminated water or feed pesticide contaminated (Figure 9). Acute effect of toxicity with different types of pesticides mainly depends on the fish species and duration of pesticide exposure (Pradip Kumar Maurya*et al*, 2019).

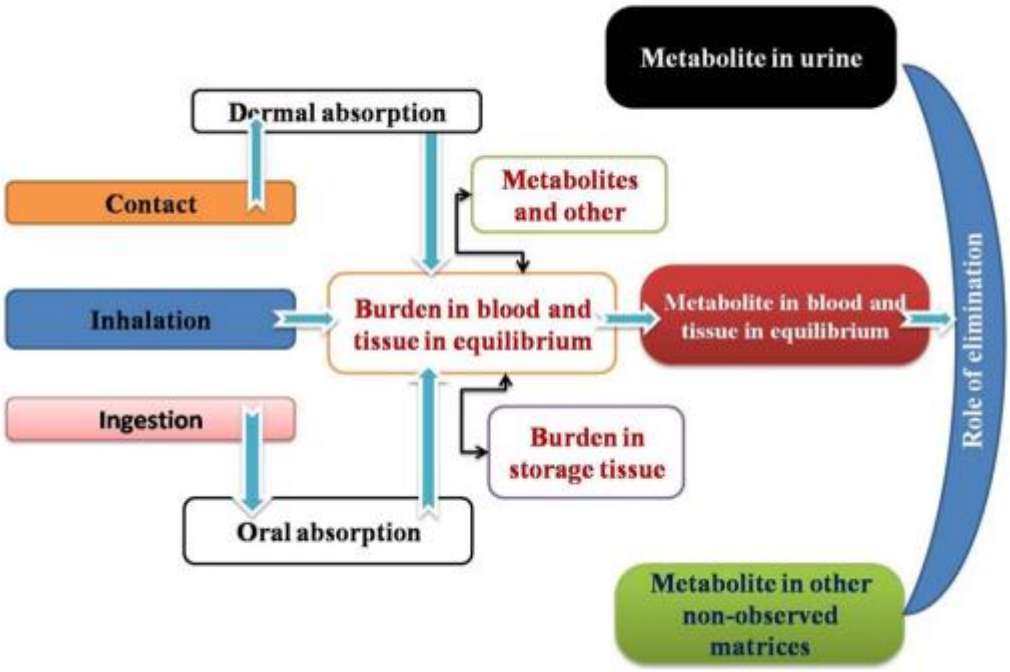


Figure 09: Fish absorption of pesticides by contact, inhalation and ingestion (Pradip Kumar Maurya*et al*, 2019).

1.1.5.2.Impact on terrestrial ecosystems

The pollution by pesticides induces new pressures of selection with impacts on biodiversity (Helander*et al*., 2012; KöhleretTriebskorn, 2013). Pesticides have impacts on non-target plant communities, soil fauna, beneficial insects (bees), mammals, amphibians and bird populations (Aubertot et al., 2005). They are not only affected directly by the pesticides, but also indirectly through the destruction of their habitats and imbalances in resources or predators (Fleeger *et al*., 2003; Isenring, 2010).

Insects such as bees and butterflies, cold-blooded animals such as reptiles and amphibians are the more affected by pesticides as well as by food intake (Barrette. 2006). Whereas for terrestrial species the food is the main source of bioaccumulation (Fabres*et al*., 2008).

- ***Honeys bees***

Studies have shown the role of insecticides from the family of neonicotinoids, in the decline of bees by affecting their mobility and inducing symptoms such as loss of balance, tremors, hyperactivity and effects on reproduction, which will lead to the decline of plant diversity. Thus, Contact with a sub-lethal dose of pesticides generally allows the bee to return

to the hive (Figure 10), which may expose the whole colony to the harmful substance (Murawska*et al*., 2021).

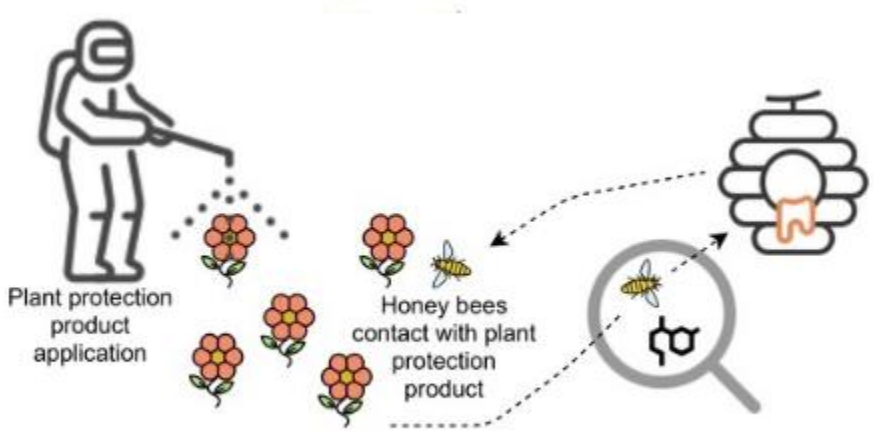


Figure 10: Honey bees contact with plant protection product (Murawska *et al*, 2021).

❖ ***Weeds***

Furthermore, pesticides used in agriculture can reduce the abundance of weeds which are important food source for many species, and ultimately lead to decline population such as butterfly species (Faubert, 2012). Therefore, these broad-spectrum insecticides pose a high risk to other non-target organisms (Strobl*et al*., 2020).

❖ ***Biocenosis***

Component contamination biotics of the environment by pesticides involve processes and accumulation trends specific to living beings: bioaccumulation, bioconcentration, bioamplification (Bendjellouli, 2009). Any living being, during its existence, is likely to come into contact, breathe or ingest pesticides that may be retained in these tissues (Fabres*et al*., 2008).

❖ **Birds**

In the early 1950s, scientists recorded bird mortality infields treated with pesticides. Or the birds have ingested insects disabled by the insecticides. At this time, a treatment of seeds with Organochlorines can led also to the death of birds. When the ingested dose is insufficient, it can cause sublethal effects (Leblan, 1995), or cause egg laying thin-shelled eggs (Hall, 1987).

The repeated exposure of low doses of pesticide, to birds leads to the heavy effect of many pesticides on hormonal systems. When these organisms, having accumulated the pesticides to which they have been exposed, it results an increase of the high concentration of toxic molecules in their tissues. Then, this bio-accumulation of pesticides can have consequences on their growth, development and reproduction(Barrette, 2006). Several pesticides could cause significant bird mortality even when the indicated application rates are followed and the instructions on the use of the product are rigorously followed (Tellier, 2006).

CHAPITER III

PESTICIDE EFFECT ON HEALTH HUMAIN

1.2. Effects of pesticides on human health

Pesticide poisoning is a public health problem in several countries in worldwide. They are potentially toxic for humans, including cancers, on reproduction and on the system endocrine, immune and nervous. Pesticides are estimated to be responsible for three million of severe acute poisoning each year with 220.00 deaths. Thus it can have effects adverse health events (Kintz, 1998). They are characterized by a multiplicity of exposure pathways (Figure 11).

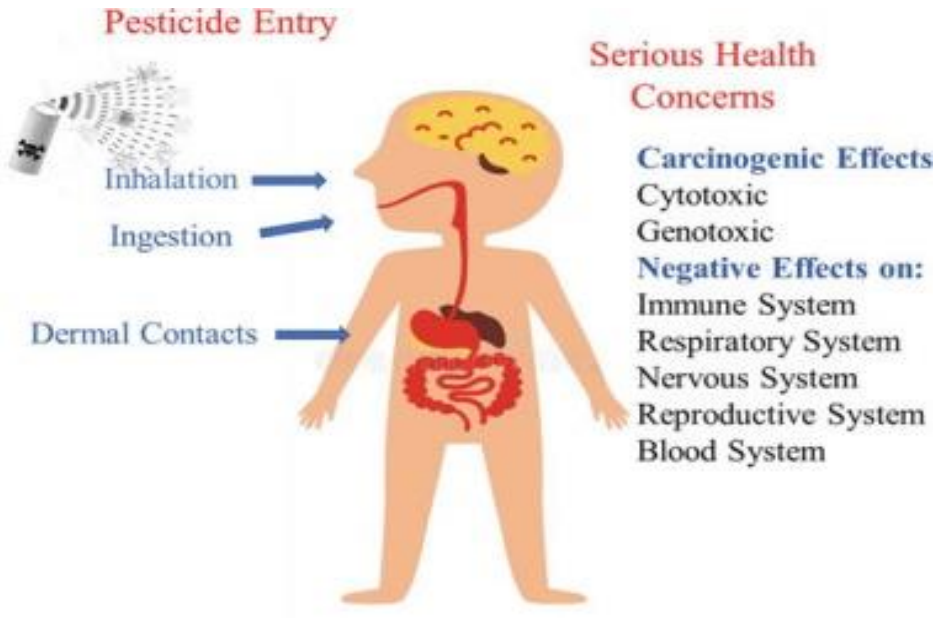


Figure 11: Exposure routs and effects of pesticide exposure on human health(Murawska *et al*, 2021).

1.2.1. Routes of exposure

The penetration of pesticides into the body can be done by several routes: by voluntary or involuntary ingestion (soiled hands), by inhalation, by contact skin. There are two types of exposure:

- **Primary exhibitions**

The persons concerned here are the persons directly handling the products, at the time of preparation, application, cleaning of equipment, emptying the tanks. Most of them are farmers and professionals using these products, but also individuals for domestic use. This exhibition is rather sporadic, and occurs during treatment periods. However, it is contamination at higher doses, the product being pure or diluted for treatment, Farmers and

workers who prepare the mixtures and carry out the treatments are more at risk are more likely than the rest of the population to be affected by contact with the skin or by inhalation (Dorothee, 2011).

- **Secondary exhibitions**

They concern the entire population, through exposure to residues arising from the use of pesticides, through food and the environment. The effects observed could result from the accumulation of molecules that are slowly eliminated, reaching a critical concentration threshold at after a certain time, or, in the case of rapidly eliminated molecules, result from the addition of subclinical and irreversible effects.In general, humans absorb pesticides and their by-products via the food, water, the air inhaled or by contact with the skin (Dorothee, 2011).

1.2.2. Routes of entry

The toxicity of a pesticide depends on its nature and its mode of penetration into the body. There are various routes of entry:

a- The cutaneous route (the skin)

This is the most frequent route of contamination and the most intense (Bayneset Hodgson, 2010). Liquids can easily penetrate the skin, especially when they are in the form of oily solutions. Indeed, the skin is impermeable to water but not oils (Lachuer, 2011). On the other hand, according to Moundosso, (2013), the powders easily cross the barrier of the skin and the diffusion is very fast at the level of the conjunctiva of the eye. Certain factors promote skin penetration such assweating or the presence of sores. Also, contamination is possible through clothes if they are not sufficiently waterproof (Dorothee, 2011).

b- The digestive tract

Responsible for the most serious poisonings in the event of a mixture with food or by accidental ingestion (Moundosso, 2013). Poisoning by direct ingestion is quite rare, however, it is very common by indirect ingestion: by contact with soiled hands (from eating or smoking); unclogging a nozzle by blowing with the mouth (Lachuer, 2011).

c- The respiratory route (inhalation)

Constitutes the fastest and most direct route. Pesticides that are normally applied as an aerosol, mist or gas can easily be inhaled (Moundosso, 2013). In general, the air ways provide

the fastest route of entry and the slowest dermal route. One of the reasons for this major difference is mainly because the thickness of the membrane, which is actually the physical distance between the external environment (surface of the skin, air in the lungs or lumen of the intestine) and blood capillaries, varies through these portals of entry. The overall input depends on both the quantity present and the saturability of the processes of transport involved (Bayneset Hodgson, 2010; Lachuer, 2011).

1.2.3. Become pesticides in the body

The body's response to a toxic product depends on the quantity of the latter. Several factors are involved in the processes of toxic action during the phasestoxicokinetics and toxicodynamics. Toxicokinetics concerns the processes leading to the formation of metabolites and which govern the path of the toxin in the body, namely: absorption, distribution, biotransformation and elimination. While, toxicodynamics is interested in the influence that a toxin exerts on the body and the factors involved in the toxic response, the toxic effects of a substance observed during this phase (Lapointe, 2004; Bayneset Hodgson, 2010). The toxicity of a pesticide is its potential to produce adverse health effects, short or long term (Arias, 2008).

1.2.3.1.Effects on the endocrine system

Some chemicals act as endocrine disruptors. They may alter the synthesis, storage, transport, metabolism, uptake or the elimination of natural hormones in the body thus causing an imbalance physiological. They are called “endocrine modulators” (Dugeny, 2010).

These substances are divided into three categories (Sadibou, 2003):

- **Mimetic substances** induce the same chemical reactions as natural hormones.
- **Paralyzing substances** prevent the entry of natural hormones into the cell by binding to receptors.
- **Trigger substances**; they cause unusual and atexted reactions in the cells.

A group of researchers from the Endocrine Disrupter Resource Center (EDRC) have compiled a list of pesticides that cause endocrine disruption. Half of substances mentioned belong to the group of Organochlorines (Camard, 2010). Organochlorine pesticides and particularly DDT (Dichloro-DiphenylTrichloroethane) and its main metabolite DDE (1, 1-Dichloro-2, 2-bis (p-chlorophenyl) (ethylene) are factors in the occurrence of breast and

prostate cancer, the reduction of male fertility and reduced immune system (Camard, 2010).Example of pesticides that affect endocrine glands and reproduction are shown in Table 6.

Table 06: Example of pesticides that affect the endocrine glands and reproduction (Kelley, 2003).

Diseases	**type**	**Pesticide and group**
Endocrine disruptors Reproduction	Azoospermite Infertility Sexual Characteristics Estrogen Synthesis	1,3-Dibromo-3-chlorpropane Chlordecane Atrazine Endosulfaine Organophosphate Glyphsate

1.2.3.2.Effects on nervous system

Neurological effects are one of the most common manifestations of acute poisoning from pesticides (Cuppen*et al*., 2000).Three types of effects can occur (Dugnet, 2010), these are:

- Polyneuropathies.
- Neuropsychological disorders: mood disorders, anxiety, difficulty in concentration, memory impairment and suicide.
- Parkinson's disease.

Pesticides pyrethroids work on the central nervous system, which causes fluctuations in the dynamics of sodium cation channels in the membrane of the nerve cell, which leads to an increase in the time of opening of the sodium channels. The sodium cation stream extends across the membrane in both vertebrates and insects are natural insecticides derived from the extracts of *chrysanthemum* flowers known as pyrethrin found in Kenya (He, 1994; Kamita*et al*, 2005; Perry *et al*., 2013). A neuronal hyperexcitation can be a result of these actions (Narahashi*et al*., 1992 ; He, 1994; Narahashi, 1996; Garcia *et al*., 2012; Perry *et al*., 2013).Example of pesticides that cause Parkinson neurodegeneration are shown in Table 7.

Table 07: Example of pesticides that cause Parkinson neurodegeneration (ORP, 2008).

Diseases	Type	Pesticide and group
Neuro-degenerative	Parkinson	Organochlorine Organo phosphate Carbonates Parquet
	Alzheimer	Organo phosphate Organochlorine Carbonates

1.2.3.3.Effects on reproduction

Pesticides can affect human reproduction by exerting toxicity either directly on the reproductive organs either by interfering with the hormonal function (Aissaoui, 2012). Several studies have shown the effect of pesticides on the devicein particular the case of 2, 4, 5-tetrachloro-2, 3, 7, 8 and dibenzo-p-dioxin. Of the cases of fetal mortality have been observed (WHO, 1991).

A French study on the effect of exposure of pregnant women to atrazine, this study demonstrated that women with traces of atrazine or one of its metabolites inurine was 50% more likely to have a low birth weight child and 70% more additional risks of having a child with a small head circumference at the birth (Chevrier, 2011).

1.2.3.4.Carcirogenesis

The hypothesis of a link between cancers and exposure to pesticides was born from the observation of a significant number of cases of cancer recorded among farmers (Dugny, 2010).

Several experimental and epidemiological studies on different molecules in particular, the2, 4-D, 2, 4, 5-T, suggest that these pesticides are responsible for the appearance of certain cancers in humans, as well as arsenicals used in pesticides cause respiratory cancers (WHO, 1991).

The types of cancer most often observed are cancer of the brain, lungs, liver, stomach, soft tissue sarcomas, non-Hodgkin lymphomas and leukemia (Capkin, 2006)**.**Example of some carcinogenic pesticides are shown in Table 8.

Table 08: Example of some carcinogenic pesticides (Aloui, 2019).

Disease	Type	Pesticide and group
Cancer	Pancreas	Pendinéthaline
	Lungs	Chlorpyrifos
		Terbufos
		Diazinon
		Dicamba
		Métolachlore
	Prostate	Cloredecone
	Leukemia	Terbufos
		Diazinon
		Chlordane
		Chlorpyrifos
	Rectum	Chlordane
		Chlorpyrifos
	Colon	Chlorpyrifos
	Lymphohematopoietic	Alachore

1.2.3.5.Effects on the immune system

Several commonly used pesticides may suppress the normal responsefrom the immune system to the invasion of viruses, parasites, and tumors (Cuppen, 2000).Immunosuppressive pesticides may increase the risk of developing certain cancers such as non-Hodgkin's lymphoma, leukemia and carcinomas scaly skin and lips (Purchas, 1999).

1.2.3.6.Effects on skin

Some pesticides can also be responsible for dermatological effects such as contact dermatitis which are inflammatory, acute or chronic skin reactions, caused by a chemical, biological or physical agent. These reactions are characterized by the appearance of itching, redness and skin lesions.

1. 3. Toxicity of pesticides

Convenient but arbitrary terminology is frequently used to designate the various forms of intoxication according to the frequency and duration of exposure. Various forms of poisoning were mentioned inTable9.

Table 09: Form of poisoning ( )

Form of poisoning administration	Frequency	Exposure time
Acute	**Unique**	**≤ 24 hours**
Sub acute	**Repeated**	**1 month**
Sub chronic	**Repeated**	**1 to 3 month**
Chronic	**Repeated**	**≥ 3 month**

1.3.1. Acute toxicity of pesticides

Acute toxicity encompasses all specific phenomena and adverse signs, which occur immediately or within the first few days after exposure to the toxic agent. A convenient way to characterize and classify the toxicity of a substance is to determine its Lethal Dose 50 (LD_{50}). This refers to the dose of a substance that can cause the death of 50% of an animal population under experimental conditions precise (Lapointe, 2004; Thamer and AL-Mashhady, 2016). Therefore, the measurement of theLD_{50} can establish a ranking for these substances: the lower it is, the higher the substance is toxic, and the reverse is true (Frank 1992). The scale of the classification of toxic substances is shown in Table10.

Table 10: Scale of the classification of toxic substances (Frank 1992).

LD50	Toxicity index
1mg Up to /kg	Extremely toxic
1 to 50mg/kg	Highly toxic
50 to 500mg/kg	Moderately
500 to 5000mg/kg	Slightly toxic
5000 to 15000mg/kg	Almost non-toxic
More than 15000mg/kg	Relatively harms

1.3.2. Subacute and chronic toxicity

Subacute toxicity is due to repeated exposure to a dose of the toxicant, which does not cause no obvious acute toxicity, for a fairly prolonged period but provided not to constitute a significant part of the life of the species examined. Oral administration for 28 or 90 days in rats (or mice) or dogs, respectively, would be typical (Hodgson and Cunny, 2010; Thamer and AL-Mashhadi, 2016).

Chronic toxicity includes all the deleterious effects that affect aliving organism following exposure or habitual administration of a toxic in multiple non-lethal doses. These doses, individually, are in sufficient to cause an immediate effect. The exposure must be repeated on a long period to cause adverse effects. The onset of these effects is often insidious of sudden manifestation without any alarming symptoms, it can bereversible or irreversible (Hodgson and Cunny, 2010; Thamer and AL-Mashhadi, 2016).

The toxicity of pesticides relies on several numbers of factors **(**El Bakouri, 2006; Berrah, 2011):

- The terms of the exhibition.
- The dose
- The time the person is exposed.
- The degree of absorption.
- The nature of the effects of the active ingredient and its metabolites.
- Accumulation and persistence of the product in the body as well as sensitivity (history, genetic heritage, etc…).

CONCLUSION

Conclusion

In this study, we were interested in the impact of pesticides on the environment and human health.Pesticides exist in several forms and fight different pests, because of theirchemical composition, are dangerous forthe environment and for people.

Pesticides exist in several forms and fight different pests: insects, weeds, fungi or even rodents. Due to their chemical composition, pesticides are dangerous for humans but not only. The dangers of phytosanitary products mainly affect farmers, soils and biodiversity. We have seen that pesticides, when we are too exposed to them, like farmers, lead to various sometimes incurable diseases, including cancer.

Soil infertility, the disappearance of pollinators, or the changes in the way of life of fish are also due to pesticides propagated in the air and water. However, there are different possible alternatives that are more or less profitable. Instead of using insecticides, we can install ladybugs in our plantations for example. Organic farming is surely the most effective solution. But, it is not profitable enough in view of the high yields sought. So there remains integrated agriculture, which certainly uses pesticides but in moderation. It is currently the best possible solution.

We can therefore say that it is possible to have high agricultural yields without using pesticides. We therefore advise you to no longer consume products from intensive agriculture, or at least to reduce their consumption and to favor organic products. If you do not have this possibility, it is strongly advised to wash your fruits and vegetables well and peel them to get rid of the traces of pesticides present in them as well as possible.

REFERENCES

References

Abutaha N, AL-Zharani M, Alotaibi A, Anne M, Cordero W, Bepari A and Alarifi S. Invitroandinvivoinvestigation of polypharmacology of propolis extract as anticancer, antibacterial, anti-inflammatory, and chemical properties. Chemistry.2(1); 864-874, 2021.

Damalas C A, Eleftherohorinos I. Pesticide Exposure, Safety Issues, and Risk Assessment Indicators.Int J Environ Res. 8 ; 1402–1419, 2011.

Zhang Q, Xia Z, Wu M, Wang L, Yang H. Human health risk assessment of DDTs and HCHs through dietary exposure in Nanjing, China.Chemosphere.177 ; 211–216. 2017.

Karbab A. Extraction, isolation, structure elucidation and evaluation of toxicity, anti-inflammatory and analgesic activity of *Piturantho*s*scoparius*constituents.Thesis of 3rd cycle doctorate in biology (Biochemistry). 1–128, 2020.

Rudel H. Volatilization of pesticides from soil and plant surfaces. Chemosphere, 35 ; 143-152,1997.

Carvalho F P. Pesticides, environment, and food safety. Food Energy Secur, 6 ; 48–60,2017.

Colquhoun J, Heider D J, Rittmeyer R A. Seed Potato Growth and Yield as Affected by Mother Plant Exposure to Herbicides. Weed Technol. 31; 136-147, 2017.

Tudi M, Daniel Ruan H, Wang L, Lyu J, Sadler R, Connell D, Chu C, Phung D T. Agriculture Development, Pesticide Application and Its Impact on the Environment. Int J Environ Res. 18 ; 1112, 2021.

Langenbach T, Mano D, Campos M M, Cunha A L, De Campos T M. Pesticide dispersion by spraying under tropical conditions. J Environ Sci Health Part B. 52 ; 843-849, 2017.

Liang P Z, Abdelshafy A M, Luo Z, Belwal T, Lin X, Xu Y, Wang L, Yang A, Ming Qi M M, Dong Y Y, Li L .Occurrence, detection, and dissipation of pesticide residue in plant-derived foodstuff: state-of-the-art review . Food Chemistry.384 ; 132494, 2022.

Pradip Kumar Maurya D S M and Amit S. Impacts of pesticide application on aquatic environments and fish diversity Contaminants in Agriculture and Environment. Health Risks and Remediation.0162-09, 2019.

Strobl V, Domenic C, Angela M, Stephanie W, Michael E, Peter N and Lars S. Positive Correlation between Pesticide Consumption and Longevity in Solitary Bees: Are We Overlooking Fitness Trade-Offs?". Insects.11 ; 819, 2020.

Murawska A, Paweł M and Adam R. Effects of Plant Protection Products on Biochemical Markers in Honey Bees. *Agriculture* .11(7) ; 648, 2021.

Ayad-MokhtariN**.** Identification and dosage of pesticides in Agriculture and related environmental issues. University of Oran. Master's memoir. p.87,2012.

Aissaoui. Evaluation of the level of contamination of dam waters Grouzhammam in the region of OuedAthmania (wilaya de Mila) by activities agricultural. Memory of Magister.UMTO.p75, 2012.

Aubertot JN , Barbier JM , CarpentierA , Gril J J , Guichard L , Lucas P , Savary S , Savini I , Voltz M. Pesticides, agriculture and environment , Reduce the use of pesticides and their environmental impacts, Collective scientific expertise, summary of the report, INRA and Cemagref, France, 64 p, 2005.

Acta / UIPP. Union des Industries de la Protection des Plantes,Products phytopharmaceuticals and the environment. Union des Industries de la Protection des Plants, 11p, 2000.

Aligon D, Bonneau J, Garcia G, Gomez D**.** Project estimate ofsanitary risks. School of Advanced Studies in Public Health, 7p, 2010.

Arias-Estevez M,López-Periago E, Martínez-Carballo E, Simal-Gándara J, Mejuto J C, Garcia-Río L. The mobility and degradationof pesticides in soils and the pollution of groundwater resources. Agriculture Ecosystems and Environment 123(4), p.247-260, 2008.

Aligon D,Bonneau J, Garcia G, Gomez D.Project estimate ofsanitary risks. School of Advanced Studies in Public HealthAlix A, Barriuso E, BedosC, Bonicelli B, Caquet,37p, 2010.

Arias-Estévez M, López-Periago E, Martínez-CarballoE, Simal-Gándara J, MejutoJ C, García-RíoL.The mobility and degradation of pesticides in soils and the pollution of groundwater resources. Agriculture, Ecosystems and Environment, 123:247-260, 2008.

Arzul G, Quiniou F, Ciseau C, Durand G. Physiology of interactions between potatoes and aphids: towards a new control strategy based on plant defense systems. Cahiers Agricultures vol.17, n°, 396: 395-398.M, 2008.

AlMounden, ElShabbaby O A, Abdel Migid H M, Soliman M I, Mashaly. Mitotic abnormalities induced by silk dyeing industry effluents in the cells of Allium cepa . Cytologia 2001; 66: 235–239

Arzul G, Quiniou F, Videau C, and Durand G. The toxicity of pesticides varies depending on the stage of development of the phytoplankton cultures at the time of their exposure. Poster GFP, Brest, 2008.

Aloui N. Study of the biodegradation of some pesticides by bacteria isolated from different ecological niches of the wilaya of ouargla.Thése de Doctorat. University of Ghardaia.54, 2019.

Bidelma T F. Atmospheric transport and air surface exchange of pesticides. Water, air and soil pollution .115: 115-166,1989.

Bouchon.Line pesticide contamination level of the coastal marine environments of Guadeloupe and research of biomarkers of genotoxicity. Final report, University of the Antilles and Guyana, Guadeloupe, 43 p, 2003.

BaynesR E, HodgsonE. Absorption and Distribution of Toxicants. In: A Textbook of Modern Toxicology. 4th ed. John Wiley & Sons.Inc (Hoboken, NJ), 79-114, 2013.

Belal Samar, ChettaNesrine. Phytosanitary survey on the use of pesticides (herbicides) in cultivation Market gardening in the Zemmouri region, M'HamedBougara University of Boumerdes.57p, 2019-2020.

Bonnemain.The phytosanitary arsenal against enemies Plant.General considerations.Biological Reports, 326(1), 1-7, 2003.

Bereswill R, Golla B, Streloke M, Schulz R. Entry and toxicity of organic pesticides and copper in vineyard streams: Erosion rills jeopardize the efficiency of riparian buffer strips. Farm.Ecosyst. Approx., 146: 81-92, 2012.

Bouvier G. Contribution to the evaluation of the exposure of the Ile-de-France population to pesticides, doctoral thesis from the University of Paris 5, France,2005.

BourbiaAitHameletS. Evaluation of the toxicity of a mixture of pesticides on a bioindicator of soil pollution H. aspersa. Doctoral Thesis.Badji Mokhtar University, Annaba, 110 p,2013.

BetticheF. Uses of phytosanitary products in greenhouse crops of the ziban (Algeria) and assessment of the possible environmental consequences (Doctoral dissertation, Mohamed Kheider-Biskra University), 2004.

BenaboudJ, OujidiJ, ElachouriM, ChafiA. Pesticides used by Moroccans Farmer in oriental Morocco.Case of Berkanerégion. Academia Journal of Environmental Sciences, 2(4), 52–58 Sci., 3(3)(2014) 2321-2527, 2014.

Bouziani M. Water pollution by pesticides, a concern for Algerian researchers. ACEDD Scientific Day, Oran, 2011.

Batch D. The impact of pesticides on human health. Doctoral Thesis in Pharmacy, Henri Poincaré-Nancy 1 University, France. p185,2011.

Boland J, KoomenI, van Lidthde JeudeJ, OudejansJ. Pesticides composition, use and risks. Wageningen: Agrodok, 2004.

Boland J, Irene K, Joep Van LidthJ, Oudejans J.Pesticides: composition, use and risks.124p, 2004.

Bendjelloul M. Development of sustainable agriculture in the wilaya of Bejaïa: Impact of phytosanitary control. State engineer's dissertation in Ecology and Environment: A/MIRA University of Bejaia. 57p, 2009.

BarretE. Pesticides and groundwater: preventing environmental contamination agricultural. Terrestrial Policy Branch, Department of Sustainable Development, Environment and Parks, Quebec.15 p. ISBN: 2-550-46789, 2004.

Brown in Alix, Barriuso E, Bedos C, Benoit P, Charnay M P, and Coquet Y. Spatial approach to the chronic pollution of surface waters by pesticides. Case of atrazine in the Sousson watershed (Gers, France). Doctoral thesis from Engref Paris VI, Montpellier, 233p, 2005.

Camard JF, Magdelaine C. Phytosanitary products: risksfor the environment and health (knowledge of uses in areas notagriculture), ORS, IAU, France, p3 Cuppen J.G.M., Van Den Brink P.J., Camps E., Uil K.F., Brock T.C.M.2000.Impact of the fungicide carbendazim in fresh water microcosms.Water quality breakdawn of particulate organic matter and responses of macro invertebrates.aquatToxicol.Vol 48:233-250, 2010.

CharbonnelJ, GlorennecP. Contrib33ution of the atmosphere to exposure to pesticides through the consumption of garden products. Memory of the ENSr,2007.

Charles M.Council of Europe. pesticide 7 edition Tips and recommendation for use by national and other authorities and manufacturers concerned through the registration of agricultural and non-agricultural pesticides. Council of Europe. 155p,1992.

Cpp.Health risks related to the use of phytosanitary products. Committee of Prevention and Protection.p47, 2002.

Capkin E, Altinok I, Karahan S. Water quality and fish size affect toxicity ofendosulfan, an organochlorine pesticide, to rainbow trout. Chemosphere, 2006. Vol 64:1793-1800.

Calvet R, BarriusoE,Bedos C, Benoit P, Charnay M, Coque. Pesticides in the soil (agronomic and Environmental), Edition France agricole, p. 36-52, 2005.

Calvet R. The fate of plant protection products in the soil
In Pesticides and phytosanitary protection in a changing agriculture. ACTA publishing,Paris, 805-833 pp,2002.

Dugeny F. Phytosanitary Products, Environmental and Health Risks -
Knowledge of uses in Non-Agricultural Zones 9, 2010.

Dugnet.,Guide to classification of active ingredients by chemical group,
Quebec, Ministry of Sustainable Development, Ecknvironment and Parks: 35p.

Debbab**.**Raportiigrupittëpunës "Ushqimiikafshëvedhesiguriaushqimore".ushqim", 2014.

Devillers J, Farret R M, GirardinP, Rivière JL, Soulas G.Indicators for assessing the risks associated with the use of pesticides (pp.278-p). Tech and Doc, 2005.

Damodara R, MailapalliSaheli, Pradhan and Mailapalli.Indian Institute of Technology Kharagpur | IIT KGP Department of Agricultural and Food Engineering PhD Contact.
Nanopesticides for Pest Control,10.1007/978-3-030-33281-5_2.73p, 2021.

Dorothée. Information report made on behalf of the common mission
information on pesticides and their impact on health and the environment. N4β Senate.
Regular session of 2013-2011.

DicambaNail, SerraFerguson A, and Shipp L R. Incidence of tomato pinworm keiferia Lycopersicollorwalsingham (Lepidoptera: Gelechiidae) on greenhouse tomato in southern Ontario and its control using mating description. Pp 122-136,2014-2016.

Dem**.** Effects of vine pesticides on the biological cycle of
the snail in various exhibition contexts. Doctoral Thesis, Specialties; Science of Life and Environment, Doctoral School; Man, Environment, Health, University
Franche-Comité. 326p, 2004.

El Bakkouri H, Bertha. Development of new techniques for determining
pesticides and contribution to reducing their impact on water through the use of
natural organic substances. Doctoral thesis, AbdelmalekEssaâdi University,
Faculties of science & technology, Tangier, 200 p, 2001.

El Bakkouri. Development of new techniques for determining
pesticides and contribution to reducing their impact on water through the use of
natural organic substances. Doctoral thesis, AbdelmalekEssaâdi University,
Faculties of science & technology, Tangier, 200 p, 2006.

Fanbert.Allium chromosome aberration test for
evaluation effect of cleaning municipal water with constructed wetland in SwetiTomaz, Slovenia.J. Bioremediation & Biodegradation.Vol.4, issue-4, 2012.

Faostat. Situation of cotton production in Benin, Burkina Faso,

Ivory Coast and Mali. http:// http://www.fao.org/faostat/fr/#data/QC, (03/07/2016).

FAO.Guidelines on good practice in ground application of pesticides. Food and Agriculture Organization of the United Nations.Roma, 2003. ISBN 92-5-104718-2 Fao, 2003.

Fleeger, Gómez A S, Rey GM, Cancho GB, Simal G J. Determination of carbamates and organophosphorus pesticides by SDME–GC in natural water, Analytical and bioanalytical chemistry.vol 383 (4), 2005 p: 557-561,2003.

GodinM, Richter ED.Hazards associated with aerial spraying of organophosphate insecticides in Israel. Rev. Approximately. Health 9, 229–238, 2016.

Gagnée.The use of pesticides in agriculture.end memory of study. University of Quebec at Rimouski.17p, 2003.

Giger MacMahon.The Rhine red, the fish dead-The 1986 Schweizerhalle disaster, a retrospect and long-term impact assessment.Approximately.Science.pollute. Res. Int., 1: S98-S111,2012.

Gupta Crissement, Seppo, SarriAouimeur S, Bouroga I, Sekour M, Guezoul O, and Ababsa L. Bioecology of the potato moth Phthorimaeaoperculella (Gelechiidae, Lepidoptera) and its impact on yield in Algeria. 3rd Workshop on Saharan agriculture: "Assessment and potato development prospects in the Saharan regions".KasdiMerbah. Ouargla. Algeria, 2013-2019.

Garcia HeNarahashi. Pesticides and other phytosanitary treatment products.Towards a new non-tariff barrier. Soon the EU will require zero traces of chemicals on agricultural products. Freedom of Algeria newspaper, 1994.

Halander.Acute toxicity of green synthesis of silver nanoparticles using crocus sativus L. on white albino rats. International Journal of Phytopharmacology, 7(1), 13-16, 2012.

Hakeem KR, Mahmood I, Imadi SR, Shahzadi K, Gul A. Plant, soil and Microbes: Implication in crop science Effects of pesticides on environment, volume1. Ed.Springer international publishing,switzerland,2016.

Helander M, Saloniemi I, Saikkonen K Glyphosate in northern ecosystems. Trends Plant Science., 17: 569-574, 2012.

Hodgson E, Cuny H. Toxicity Testing. In: A Textbook of Modern Toxicology.4th ed. John Wiley & Sons.Inc (Hoboken, NJ), 409-456, 2005.

Hall**.** Study of the importance of parasitism and associations of insecticide products in cotton growing, dissertation for an engineer in agronomy.ISE, Université de Ouagadougou (Burkina Faso).77p,1987.

HeKimata, KangHammock, InceogluPerequette. Contribution to the study of the future of products phytosanitary during flows in the pits: Physico-chemical characterization and hydrodynamics. Doctoral thesis, Joseph-Fourier University, Grenoble. 15p, 2005-2013.

HalanderKannan, Tab S, Ranch A, and TatsukawaR.Tricbskorn.,(2013).Persistent organochlorine residues in foodstuffs from India and their involvement on
human dietary exposure. Journal of Agriculture and Food Chemistry, 5:18-24, 2012.

IsernCarrière J, Ginez A, Giraud M, Goillon C, Goude M, Lambion J, Lefèvre A, Séguret J, Tabone E, Terrentroy A, TrottinCaudal Y. Protection strategies tomato crops under cover against TutaAbsoluta: Integrated Biological Protection,
Organic Agriculture. Technical notebook TUTAPI, Paris, 16p,2013.

InraCemagref. Expertise "Pesticides, agriculture and environment:
reduce the use of pesticides and limit their environmental impact" (report and summaries), 2005.

Isenring **.**Pesticides and the loss of biodiversity, How the intensive use of pesticides affects wildlife and species diversity, Pesticide Action
Network Europe, Belgium, 31p, 2010.

Judith RiedoFelix E, WettsteinAndrea Roch, Chantal Herzog, Samiran Banerjee, Lucie Büchi, Raphael Charles, Daniel Wachter, Fabrice MartinLaurent, Thomas D, BucheliFlorian Walderand Marcel GA, van der Heijden. Widespread Occurrence of Pesticides in Organically Managed Agricultural Soils the Ghost of a Conventional Agricultural Past 55, 2919−2928,2021.

Jasmine GeorgeYogeshwer Shukla.Proteomics Laboratory, Indian Institute of Toxicology Research, Council of Scientific and Industrial Research (CSIR),
Mahatma Gandhi Marg, Lucknow 226001 (U.P), India, 2011.

Kanda M, DjaneyeBoundjou G, Wala K, Gnandi K, Batawila K, Sanni A, and Akpagana K.Application of pesticides in market gardening in Togo. Vertigo: the reviewelectronics in environmental sciences, Volume 13, N° 1, 2013.
Kintz . Forensic Toxicology and Pharmacology.France: Publishing
Elsevier Masson;736 p, 1998.

Kelley J R, Duggan JM. Gastric cancer epidemiology and risk factors.Journal of Clinical Epidemiology, n. 56, p.9, 2003.

Leveau M, Bouillon. Industrialmicrobiology, edition: Lavoisier, Paris, 2004.

LachuerEliane**.** Phytosanitary products distribution and application:
the application of a phytosanitary product and product legislation.Op.cit,p53, 2010.

LapointeG. Notions of toxicology. 2nd ed. Committee on Health and occupational safety (Quebec, Canada). 16-20, 2010.

LapointBaynes, Hodgson. Absorption and Distribution of Toxicants. In: A Textbook of Modern Toxicology.4th ed. John Wiley & Sons.Inc (Hoboken, NJ), 79-114, 2010.

Leblan. Production, quantity and market of vegetables in countries mediterranean. çukurova University, Faculty of Agriculture, Department of Horticulture, Adana (Türkiye). A/no 19,1995.

Mamane A, Serra AA, AlbertoD,SulmonC, GouesbetG, Couée I. Acute Health Effects of Exposure to Pesticides in Environmental rural: study in a Northern country: study pytoRiv: study in a Southern country: phytoNiger.(Doctoral dissertation).Public health and epidemiology University of Bordeaux, France, 23p, 2015-2016.

McCahon C P, and Pascoe D.Episodic pollution: causes, effects toxicological and ecological significance. Functional ecology.4(3), 375-383, 1990.

Mehmet A, Oturan and Jean-marie Mouche.Pesticide impacts environmental, management and treatment, 2015.

Meen.Ministry of the Environment, Energy and the Sea: General Commission for Sustainable Development, The impacts of pesticides, Agriculture, France, 2015.

MokhtariM. Research of residues of some pesticides by coupling GC/MS in some fruits and vegetables. Magister thesis, National School Polytechnic (ENP), Algiers.103p, 2011.

Moussaoui KMBoussahel R, Choulak Y, Haouchine O, Bennani M, Dalacin.Use, evaluation and impacts of pesticides in Algeria. School National Polytechnic, Algiers, Algeria.31p, 2001.

Moussaoui KM and Tchoulak Y. Survey on the use of pesticides in Algeria, Results and analysis. National Polytechnic School, Algiers, Algeria, 11p, 2008.

MerhiM. Study of the impact of exposure to mixtures of pesticides at low doses: characterization of the effects on human cell lines and on the system murine hematopoietic. Doctoral thesis.University of Toulouse.13-249p, 2008.

MoundossoAlbert. safety message – occupational health, publibook edition. PARIS, France, 2013.

Moussaoui K, Boussahel R, Tchoulak Y, Haouchine O, Benmami M, and Dalachi N. Use, evaluation and impacts of pesticides in Algeria. National School Polytechnique, Algeria, 31p,2001.

OMS. Prevention of health risks during preparation and packing Pesticides, 80p, 1994.

ORP.Observatory of Pesticide Residues. In: Errami M. Becoming atmosphere of bupirimate and transfer of its metabolites (diazines) into the atmosphere, its dissipation in tomato fruits and its degradation electrochemical. Doctoral thesis, Université de Reims Champagne-Ardenne, Reims, 212p, 2008.

Perequette A, Boisset M, Cassé F, Catteau M, Lecerf JM Leguille C. Pesticides, risk and food safety, APRIFEL, Agency for research and information on fresh fruit and vegetables, France, 2004.

Pimentel D. Amounts of pesticides reaching target pests: environmental impacts and ethics. JAgriculture. Approx. Ethics, 8:17-29,1999.

Purchas.Note on the surveillance of phytosanitary products in Alsace, PP 05-09,1999.

Pallares C, Masurais S.Note on the surveillance of phytosanitary products in Alsace, PP 05-09,2006.

Pimentel D, LevitanL. Pesticides: amounts applied and amounts reaching pests.Biosciences, 36, 86-91, 1993.

RegnaultRoger Firbas Peter, Samuel O, Carrier G, Pouliot B, Sanfaçon G.Test aberracionittëkromozomevetëaliumitpërvlerësimiiefektittëpastrimittëujitkomunal me ligatinën e ndërtuarnëSweetyTomaz,Slovenia.J. Bioremediation Biodegradation, 2008.

RamadeF. Element of ecology.Applied ecology. DUNOD, Paris, 6th edition, 864p, 2005.

Sougnabe SP, Yandia A, Achaleke J, Brevault T, Vaissayre M, Ngartoubam L T. Peasant phytosanitary practices in the savannas of Africa centrale, In Developing African savannahs: innovating to last, 20-23April 2009, Garoua, Cameroon, 1-13, 2007.

Santiago MCand Castro MDL. Use of Lactobacillus spp to Degrade Pesticides in Milk. Department of Analytical Chemistry, Annex Marie Curie Building, Campus ofRabanales, University of Córdoba, Córdoba, Spain, 7p,2015.

Sadibou.Contribution to the bio-ecological study of insects and harmful mites in protected culture in the Tlemcen Region and development of a fight strategy. Magister, option: pyrotechnics. National Institute of Agronomy EL_Harrech, Algeria, 418, 2003.

Serra A, GouesbetG, Couée I.Implications of peri-agricultural plant communities in environmental dynamicspollution. Journal of Ecology (Terre et Vie), Vol. 71 (3), 203-221.

Aghris O, TahiriAlaoui BF, Laghrib A SA, FarahiM, Bakasse A DS, Sakrane A S Lahrichi hasMA, ElMohammedi A. .Extraction and determination of flubendiamide insecticide in food samples:A review Current Research in Food Science 5. 401–413, 2022.

Scratch**.** Fate of pesticides in soils depending on the state of humidity and of the mode of circulation of water in the soil, Doctoral thesis, National Polytechnic Institute of Lorraine, France. 341p, 2009.

Testud. Organophosphate insecticides, carbamates, pyrethroids of synthesis and miscellaneous. Medical-Surgical Encyclopedia, Toxicology-Pathology Elsevier, Paris, 2007, 16059 C10, 2001.

TomazLangenbach. Persistence and Bioaccumulation of Persistent Organic Pollutants (POPs)10.5772/56418, 2009.

Tellier. Pesticides in agricultural areas: state of the environmental situation and promising initiatives, Terrestrial Policy. Branch,Pesticide Services, Ministry of Sustainable Development, Environment and Parks, Quebec, 90p, 2010.

The white**.**Acute toxicity. In: A Textbook of Modern Toxicology. 4th ed. John Wiley & Sons.Inc (Hoboken, New Jersey), 2010.

TomlinMAYER A, CHRISMAN J, MOREIRA J C, KOIMAN S.Analytical methods applied to the determination of pesticide residues in foods of animal origin. A review of the past two decades.J.Chromatogr.A, 1218,8: 1021-1036, 1994.

UIPP. Unionof Plant Protection Industries. The use of plant protection products. Union of Plant Protection Industries.6p, 2001.
TachinE S. Plant protection and crop management market gardening: chemical pesticides, both useful and dangerous. hives/sante/7315-protection-of-plants-and-management-of-vegetable-crops, 2009.

VigourouxVillard A. Level of impregnation of the general population to pesticides: selection of substances measured as a priority. French Agency for environmental and occupational health safety, 2009.

Van Der WerfA. Assessing the impact of pesticides on the environment. Mail from the environment of INRA n°31. 22p, 1997.

WHO. The Who Recommended Classification of Pesticides By Hazard and Guidelines To Classification 2009.World Health Organization.p.60, 1991.