

### Pesticides in the environment and human health

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**Abstract.** The purpose of this paper is to review and confirm the importance of monitoring the input of pesticides into the environment and the impact upon human health. The chemical market has evolved very strongly in the last 50 years. Agriculture is one of the most well known branch that has benefited from this development. Environmental matrices, such as soil and water are contaminated with pesticides, thus disrupting the natural balance of the ecosystem. Also, the health of human communities is at risk. Epidemiological studies have pointed out that the use of pesticides can have an impact on the reproductive system. Adequate and consequent monitoring of pesticides is a prerogative for a modern and responsible society.

**Key Words:** pesticides, health, impact, monitoring, environment.

**Introduction.** Before we proceed further, we would like to express the fact that the approached subject holds an impressive complexity and length, and it is not our objective to make an exhaustive exposition on this issue.

Environmental problems related about chemical substances, namely pesticides, have started to enter the public awareness since the success of Carson's book "Silent Spring" in 1962. The main chemicals mentioned were organochlorine pesticides. At that time, the aforementioned chemicals were the most used in agriculture due to their efficiency to destroy crop pests. Their negative impact upon the environment has been pointed out in numerous studies (Bergqvist et al 2007; Zumbado et al 2005). Since then research and development teams have come up with a large array of pesticides that have lower persistence in the environment, lower bioavailability and lower toxicity. The market has expanded tremendously, and according to the Environmental Protection Agency from USA, sales of pesticides in 2007 were estimated at 39.4 billion \$.

In this paper, we will include two very important groups of pesticides. The first category is the one of triazine, while the second is that of organophosphates, shortly mentioning the infamous organochlorine pesticides. The former category includes compounds such as atrazine and simazine, which even though have been banned 4 years ago, their impact upon the environment has serious repercussions. The latter category includes glyphosate, the most used pesticide worldwide, which has been recently introduced on the list of EU as a substance subject to review for possible identification as priority substance or priority hazard substance (2008/105/EC Directive).

**Impact on the environment.** As mentioned in the first part the usage of pesticides can cause disruptions in the environment. The impact of such chemicals can affect the natural equilibrium of ecosystems. It is fair to say, pesticides have also increased crop yield, losses caused by pests, weeds and different destructive agents have been as significant as up to 40% (Oerke 2004).

By observing the chemicals' path it was shown that pesticides can contaminate the environmental compartments – water, soil, air (Vassilev 2006). After the effects of the infamous organochlorine pesticides have been discovered, the aforementioned category was banned in the 1970s. Alternatives such as carbamates and organophosphates started to appear. Their rapid decomposition in aqueous matrices and low persistence in soil made them suitable for crop spraying (<http://www.inchem.org>).

Water resources can be contaminated via runoff and leaching, concentrations of up to 8.28 µg/L atrazine can be found in some water bodies (Drevenkar et al 2004). Organisms affected by atrazine are generally part of the aquatic ecosystem, namely amphibians, algae and so on. The snapping turtle - *Chelydra serpentina* was found to be affected by environmentally relevant concentrations of atrazine (Solla et al 2006). Testosterone levels of the frog *Xenopus laevis* was found to decrease when exposed to 25 ppb of atrazine (Hayes et al 2002).

Pesticide toxicity can be influenced by local conditions as Staton et al (2002) proved in a study regarding salinity. The paper points out a clear interaction between salinity and pesticide toxicity for the copepod *M. litoralle* in a short exposure time (t=12 hours) at a concentration of 12 ppt of chlorpyrifos and DDT.

In a study Vendrell et al (2009) concluded that glyphosate does not pose toxic risks for the algae that pertain to Albufera Lake from Spain due to the lack of high concentrations. However, Perez et al (2011), showed that algae and aquatic plants are in fact very sensitive with an EC50 between >0.1 to <1 mg/L. In an outdoor mesocosm, it was demonstrated a delay in the periphytic colonization of new substrata, when exposed to Roundup pesticide. Considering that periphyton is extremely important to a water ecosystem, being a base of food webs, this fact can hold significant consequences on the ecology of a system.

It is worth mentioning, the market holds different formulations of pesticides based on glyphosate, thus different commercial formulations can produce different toxicities (Lajmanovich et al 2011). The World Health Organization considers that glyphosate, the main ingredient in the pesticide presents low toxicity. However, the formulated Roundup chemical can induce histopathological changes in the organs of *J. multidentata*, as well as altered male sexual activity (Hued et al 2011).

**Impact on human health.** Studies regarding the impact of glyphosate on human health are related to different type of cells exposed to certain concentrations. Glyphosate has been linked to the disruption of the mammalian cytochrome P450 aromatase activity from concentrations 100 times lower than the recommended use in agriculture (Richard et al 2005).

Arbuckle et al (2001) linked triazines with spontaneous abortions, while glyphosate was linked with late abortions. Also, the same study shows the fact that exposure to glyphosate and atrazine during the 3 months before and including the month of conception poses a 20% to 40% relative increase in risk for spontaneous abortion. Also, atrazine is considered a risk factor in reproductive cancer (Sanderson et al 2001).

Some parts of the world are still using organochlorine pesticides. Due to their bioaccumulation properties, concentrations of HCH and DDT occurred in chicken muscle at a poultry farm in India, having a mean concentration of 0.11, 0.24 mcg/g, respectively (Jadhav et al 2011).

**Conclusion.** After revolutionizing agriculture, triazine pesticides, especially atrazine, have been banned in the E.U. in 2004, while USA is still making use of them. Next, the most used pesticide worldwide, glyphosate, which initially was proved as a compound with low toxicity and persistence, has started to generate studies that are in contrast with previous researches.

While the majority of human individuals are not at risk, except the individuals who handle the compounds for spraying the crops or during the manufacturing process, the same can not be said about other organisms in the environment, such as algae, amphibians, fish etc. Riverine systems and lakes that are in the proximity of agricultural areas are at the highest risk of being contaminated via runoff with pesticides. Depending on their toxicity and persistence or time of exposure, these chemicals may disrupt the natural balance of the ecosystem.

Contamination of environmental matrices still poses an important issue for competent authorities. New approaches concerning the safety of pesticides and innovative regulatory policy need to be determined in order to protect the environment and the human health.

**Acknowledgements.** This study was realized with the support of POSDRU CUANTUMDOC “Doctoral studies for European performance in research and innovation” ID-79407 project funded by the European Social Found and Romanian Government.

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(consulted in 18.10.2011).

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How to cite this article:

Dragus A. B., Ristoiu D., 2012 Pesticides in the environment and human health. Ecoterra 31: 44-47.