**Journal of Computational Methods in Molecular Design, 2013, 3 (4):1-5**

**Scholars Research Library**
*(http://scholarsresearchlibrary.com/archive.html)*

**ISSN : 2231- 3176**
**CODEN (USA): JCMMDA**

# Approach based on a generic predictive model in search of the least toxic insecticides inbiological application of "SysPL" tool

**BouarichaHouda, BerrebbehHouria, DjebarYacine, Rouabhi Rachid*, NouredineGuersi, Mohamed TaharKimouretDjebar Mohammed Reda**

*Laboratory of cellular toxicology, Annaba University, 23000, Algeria*
**Biology Department, Tebessa University, 12000, Tebessa, Algeria.*

---

**ABSTRACT**

*Try to minimize as much as possible toxic effects of pesticides on the environment, especially in the agricultural sector could be a very promising alternative. Find a product that meets this expectation becomes crucial. This research aimed to know in a first step, the reactions in some experiments used for this purpose, a large number of insecticides products existing on the market; then in a second step, to identify the product whose effects are less toxic. The use of traditional methods based on comparisons between the effects of each product might prove tedious especially with the complexity of the number of products tested. The use of computational approaches suited to this type of research could be a great contribution in this area. This is the solution that we adopted for our study through an adaptation to our problem of computers 'SysPL' that is based on an optimization of reuse in the product line approach and a generic predictive model.*

**Keywords:**line products, Asset, Asset generic, id toxicity histological effects, Biochemical, Physiological Effects, Model variability. Pesticides, in-silicoSysPL, Bioinformatics.

---

## INTRODUCTION

Agriculture over the past twenty years has done a remarkable qualitative leap, taking advantage also of advanced scientific research and of course the use of fertilizers and pesticides (herbicides, insecticides, fungicides ...). Yet researchers are still asking the question of the threshold is reached using these pesticides and what level is not exceeded [1].

According to the Codex Alimentarius (FAO / WHO, 1994) Pesticide residues are a constant concern of the scientific community and public health organizations worldwide. Monitoring of pesticide residues is a key tool to ensure compliance with regulations and monitor compliance with Good Agricultural Practices [2].

Some studies show that farmers exposed to pesticides develop hundred to a thousand times more abnormal cells, which can turn into blood cancer [3,4]. If we ask today, the question of the use of pesticides is related to the debate that stirs the countries of the European Union with which the Maghreb countries are bound by a partnership agreement. Therefore, everything that Union sets rules for us, however, the European Parliament has taken major exclusion criteria for substances considered hazardous including the CMR (carcinogenic, mutagenic, Reprotoxic) and endocrine disruptors [4,5].

**Problem**
The representation of the structure of the product is based on biological models (molecular structures) difficult to implement especially with the increase in the number of test products.

The method used to identify the structure of the least toxic product that is based on the realization of simple connections between the structures of existing products may lead to poor performance and away from the optimality sought time and effort.

**Purpose of our work**
Our work concerns the identification of the structure of the least toxic of a large family of plant protection products exist on the market from a number of existing products in the field of insecticides and not from scratch xenobiotic. The evaluation of the toxicity of existing products is obtained through in toxicity tests including the identification of intracellular disturbances (biochemical and physiological, etc.). In this context, we discuss the construction of the structures of the products in a product line strategy. A process of building assets for each product allows expressing variability.

The latter is represented by an improved model adapted to our biological application that takes into account most of the existing types of variability, a new type on the transitory nature of the feature (the feature), in our case the effect. So there are features that can change the type of variability in their lifetime (Variability unstable or temporary).

Another process used to build generic assets from the assets of the products. Structures of products, assets and generic assets are stored in databases for possible reuse. At each update of the base product, an update of the basis of assets is then followed by other base generic assets. Among the generic assets built, two are of particular aspect generic optimal asset which includes all the possible choices that may lead to any asset and also a generic asset generic closest in structure to the asset the least toxic product.

## MATERIALS AND METHODS

The biological material is the snail *Helix aspersa* collected from an unpolluted area "Seraidi, northeast Algeria" snails average weight of 10 ± 0.35 g were reared in transparent plastic boxes with a perforated lid and a wet sponge to retain moisture, optimal environmental conditions are: 18 h photoperiodicallight/24h, temperature 20 ± 2 ° C, relative humidity 70-80% [6]. The animals are fed wheat flour [7, 8].

The chemical materials used in this study is insecticide based on Emamectinbenzoate.The experimental data on tested insecticide molecules represent the results of the work cited in [9].

**Method of treatment**
Snails are treated by atopic [10] increasing concentrations of the insecticide 0.08, 0.2, 0.8 and 1.6 mM, with three batches for each concentration, and five snails per lot.

We weighed snails at the beginning of the experiment and after 7 and 15 days of treatment with insecticide to monitor their average weight.

The total protein was performed according to the method of [11].
The determination of malondialdehydeis performed according to the method of [12].
The determination of acetylcholinesterase activity in *Helix aspersa*is performed according to the method of [13].
The dosage of Glutathione is produced by the method of [14].
The activity of Glutathione-S-transferaseis performed according to the method of [15].
The determination of catalase activity is performed according to the method of [16].

Effects of contaminants on the biochemical and physiological parameters:

Table 1 shows the different treatments snails by insecticides available taking into account the physiological and biochemical parameters tested.

**Table 1. Effects of molecules onthe tested snail.**

| *Original molecule* | *Physiological effects* | *Biochemical effects* | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Growth* | Protéin | MDA | GSH | GST | CAT | AchoE | GPX | Réf |
| Emamectine Benzaote | +++ | ++ | ++ | + | + | ++ | + | / | |
| Spinosad | +++ | ++ | ++ | + | + | +++ | + | / | (9) |
| Chlorpyrifos | / | / | ++++ | ++ | / | / | +++ | / | (10) |
| Dichloride | / | / | ++++ | +++ | / | / | +++ | / | (10) |
| Carbofuran | / | / | ++++ | +++ | / | / | + | / | (10) |
| Methomyle | / | / | +++ | + | / | / | + | / | (10) |
| Oxychloride de cuivre | / | / | +++ | ++ | + | ++ | / | +++ | (11) |
| Hydroxide de cuivre | / | / | + | ++ | + | + | / | + | (11) |
| Sulfate de cuivre | / | / | ++ | ++ | ++ | + | / | + | (11) |

*++++:control (nontoxic),+++: moderately toxic,++: Toxic.+: very toxic.*

**Table 2. Identification of variability according to the effect**

| *Effet* | *Types de variabilité* |
|---|---|
| Effets Physiologiques | Obligatoire stricte |
| Croissance | Obligatoire stricte |
| Effets biochimiques | Obligatoire stricte |
| Protéines | Obligatoire stricte |
| MDA | Optionnelle stricte |
| Acho-E | Obligatoire transitoire |
| GSH | Obligatoire stricte |
| GST | Optionnelle transitoire |
| GPX | Optionnelle transitoire |
| CAT | Optionnelle stricte |

## RESULTS

**1) Application of our approach to study**
**2) Application of the approach**

**a) Definition of the target molecule**
Optimal asset corresponding to a molecule of an insecticide found the least toxic insecticides in the studied area.
**b) Adaptation of SysPL approach to case study**
After the study of the results obtained by the team of biologists on different parent molecules, we found that the tests partially or totally relate to two types of biochemical and physiological effects.
**c) Structure of the asset corresponding to the least toxic compound**
Thus, "SysPL" tool has allowed us to establish asset whose structure is shown in Figure 1.

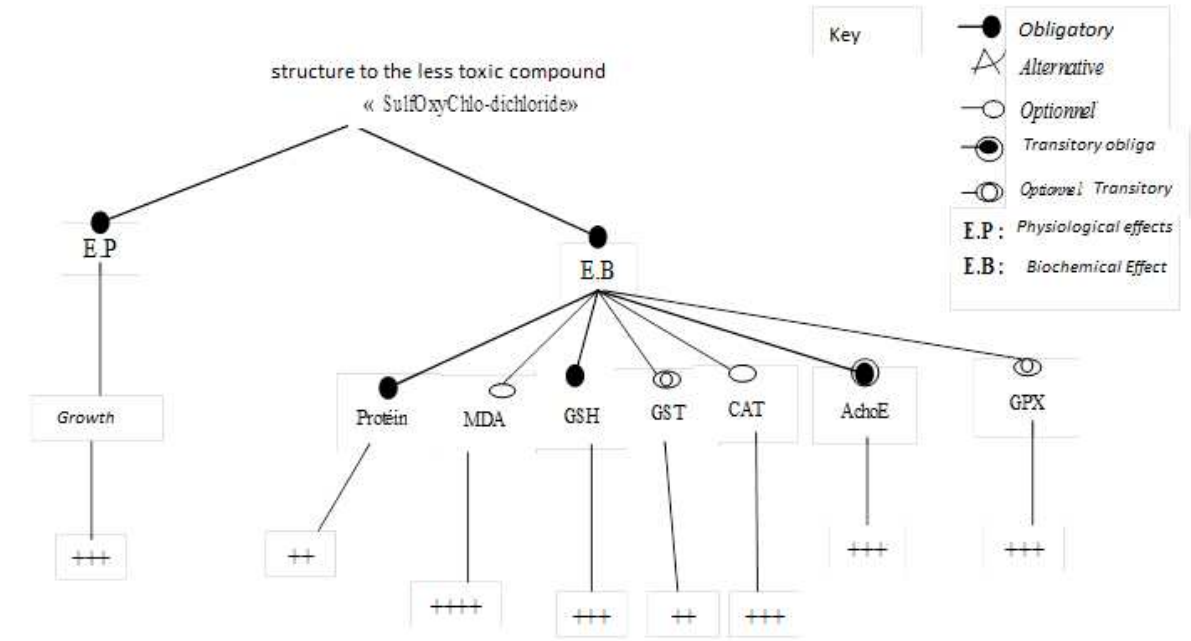


Figure 1. the less toxic compound model « SulfOxyChlo-dichloride»

Using multibiomarker approach and taking into account our results about Gift growth kinetics changes in the rate of protein, biomarkers of toxicity such as GSH, the GST, ACHE, CAT and GPx activity variations of a biomarker of lipid peroxidation in this case the MDA, we chose an adapted version of the tool "SysPL" initially designed to improve the reusability in software product lines, we have added an important feature in the field of biology is to find optimal structures produced from existing products.

Indeed,SysPL is able to create a line of products from existing products and not from scratch. Structure allows asset if the general is no need to reuse in a product line approach to find the diagram the characteristics of a traditional engineering LdP.SysPL also optimizes the research and development of a product from the base of assets and that of generic drugs; assets. The approach used by ameliorated SysPL based on a model of variability, a generic of model in addition to the consideration of existing products gives it support extensibility of a product line. Automating the execution of steps SysPL optimization and adaptation to address the construction of current research areas are under development.

The least toxic product developed by SysPL tool consists of two three insecticides molecules that are copper sulfate, copper oxychloride and Dichloride.

## CONCLUSION

The in silico identification of pesticides caused by toxic effects would be highly desirable, as it relates not only to the protection of human health, but also produces a variety of environmental benefits and sustainable management of resources, as well as protection of fauna and flora. The in silico studies are generally less risky than clinical trials. In our work, we used the results from several studies available in the literature and this using a multi-biomarker approach based on toxicological testing of several pesticides on the snail.

The use of computational approaches suited to this type of research is a major contribution in this area. This is the solution adopted in our study through an adaptation of the tool 'SysPL' based on an improvement in the product line approach a generic model that is a less toxic to humans and the environment.

Pesticides have a complex of specific features that distinguish them from other chemicals used by humans, mainly including their intentional introduction into the environment, their inevitable circulation in the biosphere, the possibility of exposure of very large populations and their high biological reactivity. Before their marketing and their current use pesticides undergo a number of tests that lead to the elimination of compounds considered dangerous to humans, carcinogenicity and genotoxicity are the first properties.

The overall results allow us to conclude that these pesticides pose a great risk not only to human beings and their environment, but also to non-target species that are an essential component of the ecosystem.

## REFERENCES

[1] L Touati, Usage des insecticides,A-t-on atteint le seul de tolerence. www.tunisia-today.com/archives/56120,**2008**.
[2] MNivsarkar, AK Gupta and MPKaushik, *Tetrahedron Lett*, **2004**, 45(37), 6863–6866.
[3] N Bonnefoy, Compte rendu de la mission d'information du senat francais sur les pesticides:http://www.senat.fr/compte-rendu-mmissions/20120305/mci-pesticides.html,**2012**.
[4] La commission europeene "Vers une strategie thematique concernant l'utilisation durable des persticides", **2007**.
[5] G Barbier, "Rapport n° 765 (2010-2011) fait au nom de l'office parlementaire d'evakluation des choix scientifiques et technologiques , deposé le 12 juillet **2011**.
[6] A Gomot-de Vaufleury, ABispo, *Environ. Sci. Technol*,**2000,**34, 1865-1870
[7] ESAPS (Engineering Software Architectures, Processes and Platforms for System-Families ), Introduction to domain analysis., Délivrables du projet ESAPS. http://www.esi.es/esaps, **2001**.
[8] NBelhaouchet, MRDjebar, LMeksem, NGrara, IZeriri, HBerrebbeh,*Journal of Applied Sciences Research,***2012**, 8(8), 4199-4206.
[9] AK Slama,AKOsman,NA Saber and SA Soliman,*Pakistan Journal of Biological Sciences*,**2005**, 8(1):92-96.
[10] KS El-Gendy, MA Radwan, AF Gad,*Chemosphere***, 2009**, 77(3):339-344.
[11] MMBradford,*Analytical Biochemistry*, **1976,** 72, 248-254.
[12] HHDraper,MHadley,*Meth. Enzymol*, **1990**, 186, 241-431.
[13] GLEllman, KDCourtney,VAndres,RMFeatherstone,*Biochem. Pharmacol*, **1961,** 7, 88-95.
[14] GWeckberker,GCory,*Cancer letters*,**1988,**40 ,257-264.
[15] WHHabig, MJPabst, WBJakoby,*Journal of Biological Chemistry*, **1974,** 249, 7130-7139.
[16] FRegoli,SGorbi,DFattorini, STedesco,ANotti,NMachella,RBocchetti, FRegoli,GPrincipato,*Aquatic Toxicology***, 1995,** 31**,**143-164.