Evaluation of the Synthetic Chemical Insecticides Recommended in the Nicaraguan Marketplace for the Control of Leaf-Cutter Ants

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Introduction:

Seven species of leaf cutter ants belonging to the genera *Atta* and *Acromyrmex* plague annual and perennial crop production, stored grains, gardens and rural and urban dwellings throughout Nicaragua. These ants, popularly known in Central America as "zompopos", are considered among the most damaging pests currently confronted and also the most difficult to control The ants live in huge subterranean colonies of from several thousand to millions of workers, depending upon the species. The complex and deep underground nest structure coupled with colony size and the reliance upon a single reproductive queen buried deep underground, make most conventional chemical control methods of limited use. The worker caste can often be reduced in size temporarily, but until the long-lived queen is gone, the colony will continually recover and rebound.

Until the 1980's the prevalent method of controlling LCA was through the use of the pelletized organochlorine compound, mirex. The extremely long environmental persistence of the compound made mirex more effective, since the replacement workers were killed off by chemically saturated nest substrate residually present from even a single application. Since the removal of Mirex for sale in Nicaragua farmers, homemakers and urban dwellers have tried to substitute the much less persistent organophosphates, aluminum phosphate gas, and the prohibited organochlorine heptachlor for mirex but with very little success. There is currently no chemical control application that is considered effective against a large colony of LCA for more than 3-6 months (Baquedano, 1999) and in many cases not even that level of control is achieved.

Because of the ineffectiveness of control methods used, a highly non-rational use of insecticides is occurring in many settings, rural and urban, in Nicaragua. The chemicals chosen, formulations, and form of application are rarely in accord with the known biology of the ants. Overuse, wasted money and continued crop, etc. losses are the result. Still worse, because small amounts, several ounces at most, of chemicals are often sought for controlling a single colony, a business of repackaging insecticides for LCA control has sprung up. The chemical nature of the substances may or may not be labeled on the packages and the label may or may not actually reflect the actual substance and its concentration.

Undoubtedly all of the field personal involved in USAID funded agricultural assistance projects have been approached for guidance on LCA management by beneficiary farmers and homemakers. In rural villages and cities, repackaged materials are readily available for purchase in markets, corner general stores and groceries and in agrochemical supply stores and are widely sought out and used .by project beneficiaries..

Objective:

The objective of this study was to document the kinds of synthetic chemical materials that are currently being recommended by general store owners and agrochemical store technical staff for LCA control.

Justification: It is hoped that recognition of the correct nature of the materials recommended will constitute a first step toward rationalizing LCA control by chemical means.

Materials and Methods:

Search for and collection of materials:

Rural areas: Materials recommended for LCA control were bought in general stores and in agrochemical supply stores by the consultant in Pueblo Nuevo, Department of Estelí and in Quilalí, Department of Nueva Segovia during a field visit for environmental assessment. In Nindirí, Department of Masaya materials were bought from an ambulatory salesman.

Capital: Materials were purchased in the Eastern Market (Mercado Oriental), Managua and in two well-established agrochemical supply stores located in Managua. A project employee chose the locations (small stores) in the case of the Mercado Oriental and asked to buy material recommended for LCA control, without revealing the nature of the research underway. Similarly in the agrochemical supply stores, materials were requested and bought without revealing the nature of the study.

A total of 19 products were purchased in rural areas and the capital for the purposes of the study.

Analysis of materials:

The materials were transferred to unlabelled, coded bags. Two trials in sequence were run on the samples. Each sample was also awarded a code by the laboratory for their files and future reference.

Trial 1. The generic names listed on the labels were withheld and the laboratory was instructed to test for the presence of the organochlorines mirex, heptachlor and DDT.

Trial 2. In the second trial, the names of the generic compounds listed on the label or in one case (DDT) spoken by the seller, were provided and the laboratory was instructed to test for the presence of those compounds in the sample. This was done to eliminate the possibility that certain compounds (especially chlorpyriphos) had been confused with the peaks observed indicating organochlorines in the gas chromatography tests done in Trial 1.

Pikapau was unlabelled but known from studies done in the 1980's to contain dodecachlor (mirex). The presence of dodecachlor was tested for those packages..

The analytical procedures were carried out by Laboratorio Laquisa, León, Nicaragua in May of 2001. The Laboratory's own codes for the materials tested are given in Annex I.

Results:

The compounds found in each of the two trials and their concentrations, the label specifications, point of purchase and commercial names are given in Table 1.

Table 1. Results of the two analytical trials (gas chromatography) carried out on 19 products recommended and sold for the control of leaf-cutter ants in Nicaragua.

#	Source Munic.	Source Type	Commercial Name (label)	Form	Generic Name on label	Active Ingredient Trial 1*	%. p/p	Active Ingredient Trial 2	% p/p
1	Mga	Mercado Oriental	Balazo	P	heptacloro	heptachlor	.4.4	heptachlor	.44
2	Mga	Mercado Oriental	Malation	P	Malation	Non OC		malation	1.86
3	Mga	Mercado Oriental	Lorsban	P	chlorpyrifos	Non OC		Not chlorpyrifos	
4	Mga	Mercado Oriental	Pikapau	P	none	Non OC		Not dodecachlor	
5	Mga	Mercado Oriental	Balazo	P	heptachloro	Non OC		Not heptachlor	
6	Mga	Mercado Oriental	Lorsban	P	none	Non OC		Not chlorpyrifos	
7	Mga	Mercado Oriental	Lorsban	P	none	Heptachlor	2.0	Chlorpyrifos	.85
8	Mga	Mercado Oriental	Terbufox	G	none	Eldrin	0.2	Not terbuphos	
9	Mga	Mercado Oriental	Malathion	P	malation	Non OC		Not malathion	
10	Pueblo Nuevo	Gen store	DDT (verbal)	P	none	Non OC		Not DDT	
11	Quilali	Vecinos Mundiales	Mirex-S	G	sufluramida	Mirex (flour)	.27	Sufluramid	.27
12	Mga	Agrocentro	Rimalation	P	malation	Non OC		malathion	3.5
13	Mga	Servico Agricola Gurdian	Lorsban	P	clorpirifos	Eldrin	2.3	chlorpyriphos	4.1
14	Mga	Agrocentro	Rimpririfos	P	clorpirifos	Eldrin	3.3	chlorpyriphos	4.5
15	Mga	Rappaccioli MacGregor	Malation	L	malation	Non OC		malation	46.4 1.05 g/l

16	Mga	Rappaccioli MacGregor	Vexter 48	L	clorpirifos	Profenophos		chlorpyriphos	45.7 1.09 g/l
17	Masaya	Ambulatory salesman	Balazo	P	heptacloro	No-identificado		heptachlor	.19
18	Masaya	Ambulatory salesman	Pikapau	P	none	Non OC		Not dodecachlor	
19	Masaya	Ambulatory salesman	Lorsban	P	clorpirifos	Non OC		chlorpyriphos	2.53

*non-OC = not determined to be an organochlorine

In the first trial the organochlorines heptachlor, eldrin and mirex were apparently detected in six of the products. After running the second trial, only two products could be confirmed to contain the organochlorine heptachlor, the mirex detected in trial 1 was a flourated compound sufluramid, and only one product, commercial name "Terbufox" in granular form purchased in the Oriental Market could still possibly contain the organochlorine eldrin. The other samples initially thought to contain eldrin were found to be pure samples of chlorpyriphos. The product verbally sold as DDT was not an organochlorine and nor were the products labeled as Pikapau, a product that had contained mirex during the 1980's.

After the two trials, seven samples could still not be identified as they were found not to contain the compound either listed on the label or suspected, in the case that no active ingredient was listed.

Discussion

A number of problems with the products offered to the consumer for LCA control were detected by the analysis central to this study.

Products with no active ingredient listed:

Three packages had **no active ingredient listed** on the label, either as part of the commercial name or in addition to the commercial name.

The two packages of Pikapau analyzed had no chemical compound listed. They were tested for the presence of dodecachlorine but were found not to contain that compound. The chemical nature of Pikapau was undetermined in this study.

The product sold verbally as DDT in Pueblo Nuevo had no label whatsoever. It was found not to contain DDT and the nature of the product has not yet been determined.

Mislabeled products

Of the nineteen packages of insecticide, four packages clearly labeled with the name of a chemical compound were found not to contain that compound, thereby considered by this study to be **mislabeled**. The chemical nature of the active ingredient in these products was undetermined in this study.

Balazo was bought in three different presentations with obviously different label designs. All of the packages were labeled as heptachlor but only two actually contained heptachlor. The chemical nature of the third package was undetermined.

One package labeled as clorpyriphos was found not to be chlorpyrifos, one package labeled as malathion was not malathion and the package labeled as terbufos was not terbufos..

Misleading labels

Pikapau in the 1980's was a product containing dodecachlorine, or mirex. Pikapau sold currently and with the same label, albeit with no mention of the active ingredient, is not dodecachlorine (mirex). People who remember the effectiveness of Pikapau from the 1980's are currently purchasing a product with diminished effectiveness, given that is is not an organochlorine and therefore much less persistent in the environment.

Mirex-S is a sufluramid, an organoflourine. It is not persistent in the environment as was Mirex and provides not nearly the long-term control that mirex did. Furthermore, the concentration of active ingredient in this product was found to be only .27%.

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Incorrectly labeled concentrations

Even in the event that repackaged materials were correctly labeled as to the active ingredient, either they do not express the concentration of active ingredient on the label or the concentration is incorrect.

Balazo does not express the concentration of heptachlor on the label. The concentration of heptachlor in the two packages that in fact contained it was very low, .44% and .19%.

The two packages of Lorsban bought in the Mercado Oriental that were correctly labeled as chlorpyrifos were supposed to contain 5% active ingredient in both cases. One contained .85% active ingredient and the other 2.53%.

These packages provide only 20% - 50% the active ingredient of the similarly labeled product bought in established supply stores.

Substances prohibited in Nicaragua

Heptachlor, the active ingredient present in two out of three presentations of Balazo and labeled as such, is a prohibited substance according to Resolution of the National Commission on Agrochemicals 5/08/93 (Corriols, 2001).

The product sold as terbufos in the Mercado Oriental, was determined in the first trial to be the organochlorine eldrin. More studies of this product are needed in order to confirm this result.

Substances not permitted by US Regulation 216

Heptachlor and sufluramid are substances not permitted under US Regulation 216. Mirex- S, active ingredient sufluramid is a Brazilian product never registered for use in the United States. Heptachlor, an organochlorine, is prohibited in the United States. The rest of the correctly labeled products would be permitted for use under Reg 216.

Recommendations:

Practical applications of the results:

1. USAID-funded Project personnel should not buy or recommend any product for leaf cutter ant control except those sold in recognized agricultural supply stores with a verifiable original label.

2. Work should be initiated with recognized agricultural supply stores to change the presentations available to the consumer so that they are appropriate for LCA control A single application for one nest will be approximately 75 g (2 oz) of a ca 4% a.i. product. (Baquedano, 1999) and should cost the consumer around . Ambulatory salesmen and re-packagers are currently perceiving correctly the consumer need, but providing inadequate products for the reasons listed above.

3. Mirex-S and Balazo are products that cannot be recommended, purchased or sold by personnel working for projects in compliance with Regulation 216.

Further studies:

1. Determine the active ingredients contained in the seven unlabelled and mislabeled packages and their concentrations.

REFERENCES

Baquedano, F. 1999.Evaluación de malatión 4% y *Beauveria bassiana* en Zamorano, Honduras y validación de prácticas en Estelí, Nicaragua para el manejo del zompopo (*Atta* spp). Tésis Ing. Agr. Zamorano, Honduras. 69p.

Corriols, M. 2001. Evaluación Toxicológico de Plaguicidas. Informe no-publicado Proyecto Evaluación Ambiental de Plaguicidas USDA-USAID-Zamorano.

Annexes:

ANNEX I. Laboratory reports on results of gas chromatographic analyses of 19 products recommended in the Nicaraguan marketplace for the control of leaf-cutter ants.