

## MICROBIAL PEST CONTROL - EXPERIENCES OF LATIN-AMERICAN COUNTRIES.

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### 1. Introduction

Modern agriculture faces economic and environmental challenges that stimulate the adoption of principles for the conservation of natural ecosystems. To adjust the production to this new challenge an integrated approach for pest management is necessary and the development and use of biological products are of great importance in this context.

Some examples of integrated pest management, carried out during the last century in Latin America, show the effectiveness of pest control, for agricultural and human health purposes, through the development of massal production of bacteria, in special the *Bacillus thuringiensis* and *Bacillus sphaericus*.

In the beginning of this century, the market of biological control products reached values close to US\$ 500 million, with microbial pesticides representing around 65% of this market. But in terms of global pesticide market, biopesticides represent less than 2% of this market.

We will discuss about these facts and, in special, will focus on Latin American market for bacteria based biocontrol products.

### 2. Bacteria production in Latin America

*Bacillus thuringiensis* (Bt) is the most worldwide used bacteria for biocontrol; USA and Canada are the biggest markets (50% of the annual commercialized values). The effort of some Latin American countries to develop the massal production of this bacterium is remarkable, considering the liquid and semisolid fermentation. For more details about the processes it is suggested further readings like: screening, small scale production and basic studies - Alves (1998); large scale fermentation processes - Bernhard & Utz (1993) and Couch (2000); substrate and selection of carbon and nitrogen sources - Del Bianchi et al. (2001), Arruda (1999); Moraes & Capalbo (1985) and Aranda et al., (2000); production control and its parameters - Moraes et al., (1998; 2001a); selection of reactors, controls and monitoring - Capalbo & Moraes (1997), Arruda & Moraes (2003), Moraes et al., (1998).

Despite these studies, the industrial production of Bt in these countries is minimal, and the market is supplied with imported products, having a high cost for being imported. An additional problem is the lack of knowledge and rural support for handling and applying such a biological product in the fields, which is determinant for its effectiveness and large use.

One of the approaches that we propose to overcome these difficulties is the local production next to the places where the products will be used, whose purpose is: (\*) to reduce the transportation expenses; (\*) to explore the local diversity of microorganism with characteristics that help its control and could be more specific against the regional pests; (\*) to generate jobs; (\*) to promote the technological development; (\*) to achieve higher efficiency for the control of regional pests and/or for the initial phases of a MIP program; (\*) to offer biocontrol products for crops with high-cost of production and small cultivated area; (\*) to reduce, consequently, the costs of the end harvested product.

### 3. Strength and weakness

The scientific level of the studies developed in the majority of Latin American countries and the existence of well adapted diversity of microorganisms to control regional pests, seem to indicate that the critical point for the achievement of a larger use of microbial control in agriculture is the transposition to the productive sector. This important step depends, however, on the strengthening of the confidence in the quality of the product by the users and also a higher confidence in the market by the private sector. The integration of the production with the local demands for pest

control systems seems to be the goal to be achieved. The scale of production to be reached is certainly lesser than the ones at the industrialized countries. The quality control in smaller scales is the main differential. The market could be extended if a competitive product, in price and quality, presents good quality and continuity of offer.

Thus, the production/distribution model with regional production and local/regional commercialization seems to be the better option; therefore, the microbial products (whose targets are specific and possess a relatively low shelf life) should be produced "on demand" for small local and/or regional markets. A survey (in press) of the studies carried out in five Latin American countries and the production reached in each one of them, will be present:

*In Brazil* - some studies (screening, production, formulation) are being developed; initiatives of private sector associated with public research institutes promote the biopesticide production and use against agricultural pests and vectors of human diseases.

*In Mexico* - studies are being carried out by many research groups. The production process in solid state was considered interesting for the so-called "rural systems" - where the research interacts more directly with the producers.

*In Peru* - the studies are developed by universities. *Bt var. israelensis* is being produced by a simple local process, for the control of some vectors of tropical diseases in artificial wells. The key point for the success of this process is the participation of the community in the program.

The studies, *in Argentina*, are concentrated in La Plata National University and National Institute for Agriculture Technology (INTA) that developed a technological package for production of Bt for agriculture. The cost of the formulated bioinsecticide is low and its stability and efficiency had been proven in the field.

The production *in Cuba* is done in small and semi-industrial scale, aiming the diversification of products to different target pests and crops using local microbial varieties. It is demonstrated that for the reality of that country, the optimal scale can be reached with small regional production.

#### 4. Final remarks

A reflection about the reasons of the limited use of bacterial pesticides in Latin America is important to guide any action in order to extend its use and to stimulate the local production. Some constraints could be numbered:

- the gap of knowledge about the advantages and the easiness of the operational use, from the growers;
- the selling pressure practiced by the chemical pesticide industry;
- the culture of relying in the synthetic insecticides;
- the unacquainted to the cost/benefits relationship -- despite the price of the products that could be high in some cases, the results are very good, especially when it is considered the safety to the environment and to the human being.

The Latin America biopesticide production, developed by qualified groups of researchers, offers good products, competitive in efficiency and in quality when compared to the ones available in the international market. The critical point seems to be the transposition for the productive sector, a step that depends on the confidence the product and in the market.

Factors that still discourage the production are the registration requirements that are expensive and complex for small-scale producers. This indicates that efforts must be concentrated in doing the evaluations simpler and cheaper, in order to improve such biological products that are recognized as being less harmful to the environment.

Finally, there are possibilities of cooperation programs in Latin America and they have to be improved. Certainly we will be able to arrive to the best methods of production, use and application of the entomopathogenic bacteria and its toxins, if we develop studies in cooperation among countries with multidisciplinary teams.

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## References

- ALVES, S.B. (Ed.), 1998. Controle microbiano de insetos. 2ª ed. Fealq, Piracicaba, 1163 p.
- ARANDA, E.; LORENCE, A.; TREJO, M.R.; 2000. Rural production of *Bacillus thuringiensis* by solid state fermentation, in: J-F CHARLES, A. DELECLUSE, C. NIELSEN-LeROUX, (eds.), Entomopathogenic bacteria: from laboratory to field application. Kluwer Academic Publishers, Netherlands, p. 317-332.
- ARRUDA, R.O.M.; 1999. Estudo da fermentação semi-sólida para produção de *Bacillus thuringiensis*. São Paulo, . 87p. Thesis (Doutorado) – Faculdade de Ciências Farmacêuticas, Universidade de São Paulo.
- ARRUDA, R.O. M.; MORAES, I.O., 2003. Pasteurização de substrato fermentativo com microondas. *Farmácia e Química* 36(3): 28 – 33.
- BERNHARD, K.; UTZ, R. 1993. Production of *Bacillus thuringiensis* insecticides for experimental and commercial uses, in: P.F. Entwistle, J.S. Cory, M.J. Bailey, S. Higgs (eds) *Bacillus thuringiensis*, an environmental biopesticide: theory and practice. John Wiley, England, . p. 255-267.
- CAPALBO, D.M.F.; MORAES, I.O.; 1997. Use of agro-industrial residues for bioinsecticidal endotoxin production by *Bacillus thuringiensis* var. *israelensis* or *kurstaki* in solid state fermentation, in: S. Roussos, B.K. Lonsane, M. Raimbault, G. Viniegra-Gonzalez (eds), *Advances in Solid State Fermentation*, Dordrecht/Netherlands, Kluwer Academic Publ., p.475-482.
- COUCH, T. L.; 2000. Industrial fermentation and formulation of entomopathogenic bacteria, in: , J-F. CHARLES, A. DELECLUSE, C. NIELSEN-LeROUX, (eds.), Entomopathogenic bacteria: from laboratory to field application, Kluwer Academic Publishers, Netherlands, p 297-316.
- DEL BIANCHI, V.L.; MORAES, I.O.; CAPALBO, D.M.F.; 2001. Fermentação Semi Sólida. In: LIMA, U. A. et al, ed. *Série Biotecnologia Industrial - Engenharia Bioquímica*, Vol. 2. Cap 13, pp 247 – 276.
- MORAES, I.O.; 1973. Bacterial Insecticide production using submerged fermentation, MSc Thesis, FEA/ UNICAMP, Campinas, BRASIL, 70pp.
- MORAES, I.O.; CAPALBO, D.M.F.; 1985. The use of agricultural by-products as culture media for bioinsecticide production, in: M. Le Mauger, P. Jelen (eds), *Food engineering and process applications*, London, Elsevier Appl. Sci. Publ., p. 371-381.
- MORAES, I.O.; ARRUDA, R.O.M.; TAMBOURGI, J.E.; MORAES, R.O.; PELIZER, L.H.; CAPALBO, D.M.F.; DEL BIANCHI, V.L.; 2001. The history of *Bacillus thuringiensis* development in Brazil, in: 5th Italian Conference on Chemical and Process Engineering, Florença, Proceeding ICheaP 5, Florence: The Italian Association of Chemical Engineering, 2001. v. 2, p. 1061-1063.
- MORAES, I.O.; CAPALBO, D.M.F.; ARRUDA, R.O.M.; 2001. Produção de bioinseticidas, in: U.A. Lima, et al (eds), *Biotecnologia Industrial*, Vol.3, Ed. Edgar Blücher, p. 249-278.