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United Nations Development Programme

Food Security & Agriculture Programme
Sustainable Energy and Environment Division

30 June 1998

Tony

Dear Mr. Bellotti,

Please find enclosed a final report of the External Advisory Committee for the Ecologically Sustainable Cassava Plant Protection Project (GLO/97/119/A/11/31). The report is based on work undertaken during a 18-22 May mission to Cruz das Almas in Bahia, Brazil, conducted by Drs. Patricia Matteson (chair) and Mohamed Daniya.

UNDP is pleased with the progress described in the report. We urge that CIAT and EMBRAPA take particular note of 20 recommendations made by the EAC and with which UNDP is in full agreement.

We would like to thank the scientists and management of EMBRAPA and CIAT for their full cooperation and warm hospitality extended to the EAC, and to me, during the mission.

Sincerely,

Peter J. Matlon
Chief, Global Programme for
Food Security and Agriculture

Dr. Anthony Bellotti
Centro Internacional de Agricultra Tropical
Apartado Aereo 6713
Cali, Colombia

Food Security & Agriculture Programme.Sustainable Energy & Environment Division•
304 East 45 Street, Room 1034• New York, NY 10017 • Tel (212) 906-6408 Fax: (212) 906-6973 E-mail: peter.matlon@undp.org

Report of the External Advisory Committee

Ecologically Sustainable Cassava Plant Protection in South America and Africa: An Environmentally Sound Approach

GLO/91/013/A/01/31, 1993-1996

Ecologically Sustainable Cassava Plant Protection: A Global Strategy (Preparatory assistance)

GLO/97/119/A/11/31, 1997

Activities in South America (PROFISMA)

EMBRAPA Centro Nacional de Pesquisa de Mandioca e Fruticultura Tropical (CNPMF)
Cruz das Almas, Bahia, Brazil
18-22 May, 1998

Patricia C. Matteson, Chair
Mohamed T. Dahniya
Peter Matlon, Observer

Submitted June 22, 1998

Acknowledgements

The review committee members wish to express their gratitude to Drs. Sizemando Luiz de Oliveira, Pedro Mattos, Tony Bellotti, Marcio Porto, Bernardo Ospina, Aristóteles Matos, and their EMBRAPA and CIAT colleagues for their participation, frankness, and responsiveness, for taking care of logistic arrangements so thoughtfully and efficiently, and for the gracious hospitality and good company that made our week in Bahia a pleasure as well as a valuable learning experience. We also thank Benedito Carlos Lemos de Carvalho and Sandra Lucia de Carvalho of EBDA and the farmers of Buril, Chapada, and Roberto Santos COPALs for hosting and instructing us so well in Alagoinhas.

Acronym list

CABI	Commonwealth Agricultural Bureaux International
CGIAR	Consultative Group for International Agricultural Research
CGM	cassava green mite
CIAT	Centro Internacional de Agricultura Tropical (International Centre for Tropical Agriculture)
CNPMF	Centro Nacional de Pesquisa de Mandioca e Fruiticultura Tropical (National Center for Research on Cassava and Tropical Fruits)
COPAL	Comitê de Pesquisa Agrícola Local (Local Agricultural Research Committee)
CVMV	cassava vein mosaic virus
EAC	External Advisory Committee
EBDA	Empresa Baiana de Desenvolvimento Agrícola (Bahia Agricultural Development Agency)
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária (Brazilian Agricultural Research Agency)
ESCaPP	Ecologically Sustainable Cassava Plant Protection (Africa)
FPR	farmer participatory research
GIS	geographic information systems
ICM	integrated crop management
IITA	International Institute of Tropical Agriculture
IPRA	Investigación Participativa en Agricultura (Participatory Agricultural Research)
PCR	polymerase chain reaction
PROFISMA	Proteção Fitossanitária Sustentável da Mandioca no Brasil (Sustainable Cassava Plant Protection in Brazil)
UNDP	United Nations Development Programme

I. Introduction

Cassava is one of the chief staple food crops in many tropical countries, and Nigeria and Brazil are the world's largest producers. It is the main source of carbohydrates for a large percentage of poor people, and its production and processing generate employment for rural women. Moreover, cassava is important for food security because it requires few inputs and endures drought and poor soils, producing a yield even when other crops fail. The crop is subject, however, to pests, diseases, weeds, and numerous other constraints that limit production and threaten food security of millions of resource-poor people.

The need for improved cassava crop protection technology in Africa and South America led the United Nations Development Programme (UNDP) to fund a project to develop, test, implement, and evaluate the impact of sustainable cassava plant protection in northeast Brazil and four West African countries, using farmer-participatory methods. The 1993-1996 project *Ecologically Sustainable Cassava Plant Protection in South America and Africa: An Environmentally Sound Approach* was followed by a one-year (1997) extension, *Ecologically Sustainable Cassava Plant Protection: A Global Strategy (Preparatory Assistance)*. The Brazil part of the project, Proteção Fitossanitária Sustentável da Mandioca no Brasil (PROFISMA), was jointly implemented by the International Centre for Tropical Agriculture (CIAT) and the National Center for Research on Cassava and Tropical Fruits (CNPMF) of the Brazilian Agency for Agricultural Research (EMBRAPA). The African component, ESCaPP, was implemented by the Plant Health Division of the International Institute of Tropical Agriculture (IITA) in Cotonou, Republic of Benin, in collabortion with national programs in Benin, Cameroon, Ghana, and Nigeria.

This is the third in a series of External Advisory Committee (EAC) reviews of PROFISMA. It may serve as the final evaluation of the Brazil component of the overall project. The Advisory Committee's terms of reference are **Annex 1.**

The EAC spent five working days in Bahia collecting information for this review. At CNPMF we reviewed project documents and were briefed by CIAT and EMBRAPA staff on project research accomplishments and proposed followup. A field day visiting Local Agricultural Research Committees (COPALs) in Alagoinhas allowed us to interact with farmer and extension collaborators. Ample discussions of these activities and project management issues helped us formulate our ideas. We presented our draft observations and recommendations to project staff on the final day, in order to profit from their comments and suggestions. The review program is **Annex 2.**

II. PROFISMA achievements

PROFISMA and the overall *Ecologically Sustainable Cassava Plant Protection* project have been productive. The estimated current and potential economic benefits of the biological control initiatives against cassava green mite (CGM) in Africa and the cassava mealybug *Phenacoccus herreni* in Brazil assure a greatly favorable cost-benefit ratio and underscore the fact that support of research by this project was a good investment. We consider the entire project to be a valuable and successful undertaking that merits further support in the form of follow-on projects that will prevent loss of momentum. The EAC's detailed observations, and recommendations with a view to future activities, appear in III. below.

Most, but not all, of the original objectives and planned outputs of the project have been achieved. PROFISMA staff notes

on progress made in that regard are **Annex 3**. The most important shortcoming is that many of the planned evaluation activities are incomplete or have not yet been started.

Significant achievements of the project include:

- Introduction and establishment in Africa of three Brazilian phytoseiid mite predators of CGM. Two of the predators, *Typhlodromalus aripo* and *T. manihoti*, are estimated to be reducing African CGM populations by 50%, increasing cassava yields by one third, and adding about US$70 value per hectare to the crop. The West African economic impact of this initiative is estimated to be US$50 million value added per crop cycle.

- Introduction of three parasitoids of the cassava mealybug *Phenacoccus herreni* into northeast Brazil from Colombia and Venezuela in 1994/96. Two of them, *Acerophagus coccois* and *Apoanagyrus diversicornis*, are spreading quickly and have reduced host populations by 48% in field experiments.

- Introduction of three phytoseiid mite predators of CGM into Brazil from Ecuador and Colombia.

- Development of cassava varieties with various levels of resistance to root rots, superelongation desease, and whiteflies.

- Polymerase chain reaction (PCR) methods were developed by CIAT and transferred to EMBRAPA labs for characterizing root rot pathogens and cassava vein mosaic virus (CVMV), pathogenic variation among *Phytophthora* isolates have been determined, and CVMV isolates from Brazil characterized.

- Improvement of *in vitro* tissue culture methods of rearing the CGM pathogen *Neozygites c.f. floridana*, by adding antibiotics to control bacterial contamination.

- Initiation of molecular characterization of *Phytophthora* and *Fusarium*.

- Two new formulations of hornworm baculovirus developed and ready for testing through farmer participatory research (FPR). The objective is to turn this into a cottage industry for small-scale farmers.

- An extensive survey was conducted in 74 communities (ca. 1700 farmers) in order to assess farmer opinions about the principal constraints to cassava production, and to choose COPAL locations. This was followed by an intensive survey in 18 COPAL communities to obtain more in-depth information about production practices and perceived constraints.

- Human capacity building, including: a team of Brazilian researchers and extensionists trained in FPR; training in molecular techniques for Brazilian scientists in universities, state agencies, and EMBRAPA; and field work in Brazil by graduate and undergraduate thesis students.

- Nineteen COPALs now functioning in northeast Brazil with varying degrees of success. From 1995-97 they carried out 45 experiments on topics such as soil fertility, cultural practices, and varietal resistance to pests.

- Adaptation of CIAT FPR training materials (three training manuals and 13 farmer training booklets), preparation of pamphlets on cassava root rots and frogskin disease, and development of taxonomic keys for phytoseiid mite species commonly found on cassava in northern South America and for adult whiteflies attacking cassava.

- Generation of many refereed publications, symposia, conference and workshop papers, reports, and a book chapter. Formulation of eight proposals and a concept note for follow-on projects. A list of project publications, presentations, and followup proposals is **Annex 4**.

III. Findings and recommendations

A. Project management

A review of project management and administration revealed that placing a CIAT scientist at EMBRAPA as CIAT Coordinator of the project, in close proximity to both his EMBRAPA counterpart and EMBRAPA's Cassava Program Coordinator, created too many opportunities for unnecessary institutional conflict. In addition, the administrative responsibilities of the CIAT Coordinator did not allow him to contribute to project research output as he might have. A CIAT presence at EMBRAPA is desirable, but would be most constructive if research scientists could be posted there, while the CIAT project coordinator is based in Colombia. During the EAC visit, the potential usefulness of a CIAT insect pathologist and/or training specialist to EMBRAPA's cassava research program was highlighted. **Recommendation 1: In future CIAT/EMBRAPA collaborative projects of this type, research scientists other than the CIAT coordinator should be posted to EMBRAPA by CIAT. The posting of a CIAT**

insect pathologist and/or continued posting of a training specialist to EMBRAPA should be considered.

B. Collaborative arrangements

There were generally good institutional linkages between CNPMF, state research and extension agencies, and universities in northeast Brazil during the project. These collaborations contributed significantly to the project's accomplishments, notably in FPR. Several graduate students from Brazilian universities undertook their research work under the auspices of the project.

State extension services suffer from a lack of resources, however, and budget cuts and the resulting lack of adequate followup contributed to the failure of COPAL activities in some locations. Since state extensionists are essential partners in FPR, future projects working with COPALs should include supplementary support for extension operations. Care should be taken, however, not to set an unsustainable precedent that will cause support to COPALs to collapse at project ending. Topping up of salaries and/or partial coverage of operational costs (especially travel expenses) could be considered, but ways should be sought for the state to gradually reassume those financial responsibilities as the productivity of COPALs rises, and/or to recover costs from COPAL participants and perhaps the private sector (e.g., cooperatives, casas de farinha).

Recommendation 2: Sustainable means of providing needed financial support to state extension agencies should be designed into future projects of this type, and anticipated in the project budget.

It is important to find ways to maintain and strengthen the linkages between CIAT, IITA, and national collaborators. There was considerable ongoing personal exchange between CGM and mealybug biocontrol scientists at IITA and CIAT, but this took place largely on an *ad hoc* basis and therefore depended on personal initiative. There did not appear to be the same level of interaction between scientists in other disciplines in the two centers. The project held meetings on an irregular basis as good opportunities arose (e.g., following international conferences of mutual interest). An unexploited opportunity exists for greater mutually beneficial exchange of experiences and methodology in several areas: farmer participatory approaches to improving the sustainability of agriculture, including FPR and Farmer's Field Schools; cassava processing and marketing; and sustainable control of root rots.

"South to south" contact between Brazilian scientists and their African counterparts working in the project could be greater, as well. There have been interactions in the areas of training and cassava postharvest technology. EMBRAPA's new project for training Portuguese-speaking Africans is a further step in the right direction.

Recommendation 3: Any future similar project should make provision for more regular and inclusive interaction between scientists in the International Agricultural Research Centres as well as those in the national programs in Africa and South America. Annual or biannual meetings of personnel from both continents, including representatives of national programs, should be considered.

PROFISMA drew upon CIAT geographic information systems (GIS) maps in choosing geographic areas for the collection and introduction of parasites and predators in classical biological

control initiatives. The project did not, however, make as much use of the GIS facilities as they could have, due to the high price.

Recommendation 4: Arrangements should be made within CIAT to promote greater use of the center's GIS capacity in support of the activities of follow-on projects. This will be particularly useful for diagnostic activities and the siting of future COPALs, to ensure greater representativity and enhance the usefulness of extrapolating COPAL research results.

C. Training

The CIAT Training Officer did an excellent job. Nevertheless, his work would have been easier if technical support provided by FPR consultants were available on an ongoing basis rather than in the form of periodic consultancies. Follow-on FPR projects should incorporate more training expertise in response to FPR needs.

Recommendation 5: A follow-on project should include a full-time specialist in adult education/training.

The FPR manuals used for training researchers and extension agents were those developed in Colombia by CIAT's IPRA program (Investigación Participativa en Agricultura). They appeared to work well, and the Training Officer commented that trainers will probably profit even more from them with further experience. The farmer training booklets were edited slightly, but otherwise the contents and illustrations were those developed by IPRA in Colombia. The Training Officer commented that these were successful--farmers read and consulted them extensively--but that the illustrations are not always appropriate to northeast Brazil.

Recomendation 6: If the COPAL activities are scaled up enough to justify another Portuguese-language printing of the farmer training manuals, COPAL members, state research and extension agencies, and EMBRAPA should collaborate to produce a new Portuguese edition with Brazilian illustrations that have been carefully pretested with a cross-section of farmers.

EMBRAPA has not yet appointed a counterpart for the CIAT training officer, who will leave soon.

Recommendation 7: It is important that EMBRAPA appoint a full-time training officer soon, to assume the COPAL-related responsibilities of the departing CIAT Training Officer. This person should be an experienced specialist, preferably with previous knowledge of farming conditions in northeast Brazil.

D. Research

Farmer participatory research

Technology development and transfer activities took root during the project in 19 COPALs, which are functioning well. Another six experienced problems related to weak internal organization and/or poor technical assistance. The EAC made a one day field visit to Alagoinhas, Bahia where members of the Buril, Chapada, and Colonia Agrícola Roberto Santos COPALs presented their results and showed the visitors some of their experimental plots.

Two of the three COPALs had already completed two sets of cassava experiments. Two were testing varietal resistance and tolerance to CGM, and the third compared a local vs. an EMBRAPA variety grown with and without ridging against root rot. They were supported by the PROFISMA project coordinator of the state

extension organization, Empresa Baiana de Desenvolvimento Agrícola (EBDA).

The level of participation of COPAL farmers looks good: they seem to understand the problems, decided what to test and how, have been monitoring the experimental plots, and answer questions well and with confidence. They have requested COPAL activities in citrus and passion fruit, and with other field problems as well as pest control. EMBRAPA scientists have responded positively. After having had no previous experience with farmer-participatory work, the researchers appear to have become less skeptical and to be getting involved. Both EMBRAPA scientists and COPAL farmers enjoyed and were motivated by exchange visits between the EMBRAPA center and COPALs. In general, improving farmers' confidence and ability to dialogue with researchers is an important part of the empowerment that the FPR program hopes to achieve.

According to the Training Officer, 110 other communities are requesting their own COPALs. State agencies have strongly endorsed FPR and there is strong demand for FPR training for extensionists. When asked what will happen now that PROFISMA is ending, these farmers declared their intention to keep their COPALs active. When asked what help they needed, they said that periodic visits by extension officers and an exchange of research ideas and materials such as superior cassava varieties would be a great help.

The EAC applauds these FPR achievements by the farmers and their PROFISMA research and extension collaborators. COPALs appear to be a model that merits wider implementation, and the ones we visited make the future seem hopeful. Nevertheless, it must be kept in mind that we visited an exceptionally successful location. Even there, two of the three COPALs have partially drawn down their initial operating grant, which was to be maintained by selling experimental produce. Moreover, it is our

experience that the kind of continued followup and technical support that the farmers requested is usually necessary to motivate and sustain productive FPR on the longer term.

Recommendation 8: EMBRAPA and state research and extension agencies should try to find mutually beneficial ways to continue supporting the COPALs already established, though perhaps at a reduced level given probable resource constraints after project ending.

Recommendation 9: New COPALs should be established if conditions favorable to long term sustainability can be created. Perhaps income-generating activities facilitated by COPALs could be leveraged to help pay for research and extension support of the program: a cassava processing and marketing component; the multiplication and sale of clean cassava cuttings (provided by EMBRAPA's Biofabrica) and other high quality planting material; and/or the production and sale of cassava hornworm baculovirus.

Although EMBRAPA has declared FPR to be its official research policy, some research scientists are still skeptical and are not participating. State agencies also need reorientation. There is a possibility that the gains achieved in FPR during the project may be lost if the concept is not institutionalized within the Brazilian agricultural system.

Recommendation 10: The EAC recommends that EMBRAPA researchers and state scientists and extensionists receive further training in FPR principles and methodologies. In addition, every effort should be made to educate EMBRAPA and state policy makers about FPR and to involve them in COPAL activities.

Three FPR projects, each with slightly different methodology, are being implemented in CNPMF currently--PROFISMA's

COPALs represent only one of those FPR models. The underlying principles of all of them are the same, however, and small differences should not be allowed to distract attention from the value and urgency of advancing the implementation of FPR in a way best suited to Brazilian conditions.

Recommendation 11: Implementation of the COPAL model must continue to be flexible enough to be adapted to local community needs and conditions. Rather than insisting on a strictly uniform implementation formula, a set of basic participatory principles should be agreed upon, after which Brazilian field experience should continue to allow the evolution of locally-appropriate ways to apply them.

Basic research

The project made significant progress in the search for natural enemies of the cassava green mite and the cassava mealybug *P. herreni*. Releases of natural enemies in Africa and northeast Brazil contributed greatly towards the control of those cassava pests on both continents. Evaluation of the safety of these predators, parasitoids, and pathogens as biological control agents is an important part of the research program.

The project was designed with a heavy early emphasis on farmer-participatory diagnostic activities and crop loss assessment work, the results of which were to orient and help focus subsequent technology development. The objective was only partially achieved. Some formal crop loss assessment work was carried out (e.g., on CVMV), and results of the extensive diagnostic survey were available quickly and led to early adjustment in project priorities. However, rather than narrowing the focus of work, the extensive survey led to the broadening of

coverage from cassava crop protection to integrated crop management (ICM).

A number of problems plagued the intensive diagnostic survey that followed. Analysis and availability of the data, which should also have been used quickly for priority setting and followup investigations, was slow. For instance, if that data had been available sooner, a promising postharvest technology component might already have been incorporated into COPALs. Similarly, leafcutter ants would have been earmarked for more attention. The survey also did not ask "why?" questions that might have helped researchers understand seemingly inefficient crop management practices of farmers, and design research that is better targeted to farmers' conditions. Finally, the intensive survey did not distinguish among constraints affecting farmers in different land-holding or income groups.

Recomendation 12: CIAT should help strengthen the intensive diagnostic research methods currently being used. Particular effort should be made to explore reasons underlying apparently inefficient crop management practices and to accelerate the availability of the results. The farm- and community-level diagnoses should also be considered as dynamic and ultimately iterative exercises conducted before and after technology testing. Greater effort should be made to identify socioeconomic and institutional constraints during diagnostic exercises, focusing in particular on the poorest householdes.

Root rots received greater emphasis in response to both diagnostic surveys, which estimated yield losses up to 80%. Moreover, they are also a problem in Africa and there is a proposal for collaborative research with IITA for collecting and genetically characterizing pathogen isolates. Both CIAT and EMBRAPA have scientists with the necessary expertise to address

the problem. PROFISMA has made good progress in methods development for characterizing pathogens and their distribution, but primarily in relation to the Colombian situation, where *Phytophthora* causes most root rot problems. Surveys indicate that *Fusarium* is the major root rot pathogen in Brazil; therefore *Fusarium* would have been a better focus for PROFISMA work. **Recommendation 13: Root rot should be addressed by followon projects in Latin America, and we encourage the proposed intercontinental collaboration with IITA. Projects including northeast Brazil and other regions where *Fusarium* is dominant should, however, shift the focus of root rot research toward that pathogen accordingly.**

It is important that the productive mealybug and CGM biological control work and *B. tabaci* biology and population studies continue, but when PROFISMA ends there will be no scientists at EMBRAPA to carry this work forward until young researchers in training come back with their Ph.D. degrees. **Recommendation 14: High priority should be given to identifying funding sources for interim EMBRAPA staffing (three years) so that the momentum of mealybug, CGM, and whitefly biological control work in Brazil will not be lost.**

Work to date has failed to show that CVMV has a significant effect on cassava yield and dry matter content. One last CVMV crop loss assessment experiment is in progress, under drought conditions.

Recommendation 15: Absent new evidence of the importance of CVMV, work on this problem should be deemphasized or eliminated in favor of urgent new priorities such as frogskin disease, in order to make the best use of scarce resources.

E. Environmental assessment

The EAC notes that the Environmentalist left the project after the first EAC review recommended that this aspect of the project be deemphasized. No one has continued her work, and EMBRAPA has not been able to comply with the EAC recommendation that vertebrate testing be contracted to an outside laboratory.

Recommendation 16. The PROFISMA project should immediately consult CABI Bioscience's Biological Pest Management unit (formerly the International Institute of Biological Control) to make sure it has remained in compliance with internationally accepted biological control safety norms. Possible negative nontarget effects of moving species from one region of Brazil to another should also be considered, even though there may be no official regulations governing this type of intracountry movement. Remedial action should be taken if deficiencies are detected, and due importance should be given to biodiversity/environmental safety in followup proposals.

F. Reporting and evaluation

The evaluation aspect of this EAC visit was made considerably harder for both EAC members and project staff by the fact that PROFISMA's progress reports and annual financial accounts were not formatted in accordance with the objectives, outputs, and budgets presented in the original project description.

Recommendation 17: Follow-on projects should make an effort to facilitate monitoring and evaluation by choosing reporting formats consistent with funded proposals.

Good economic analysis demonstrates return to investment, and impact studies are important in documenting the usefulness of technologies to farmers. High quality information on the impact and value of classical biological control initiatives is essential for securing continued support of the research. The EAC noted, however, that no economic analysis was carried out by PROFISMA on the various technologies being developed on station and in farmers' fields, including the introduction of green mite predators and mealybug parasitoids into Brazil from northern South America.

In addition, the impact ot project training at all levels has yet to be evaluated. Although an impressive computerized COPAL monitoring and evaluation database has been created, planned adoption and impact studies of COPAL activities have not been completed. While the argument of the project scientists, that the two cassava crops harvested since the inception of the project would provide inadequate data on FPR benefits, could be true, the results from any impact studies could be extremely useful to farmers, federal and state government authorities, and donors.

The potential for valuable collaboration from COPALs in impact assessment should not be overlooked. Participatory evaluation of the adoption and economic impact of technologies developed in COPALs should be a routine COPAL activity. Those results could stimulate government and donor support for scaling up the COPAL model.

Recommendation 18: New resources need to be identified for carrying out rigorous economic analyses. Possibilities for tapping new economic expertise within EMBRAPA, securing necessary economists' services on a consultant basis, and soliciting assistance from state governments, the CGIAR Impact Assessment

Evaluation Group, and CIAT's impact assessment unit should be investigated.

Recommendation 19. Evaluation of training impacts and participatory adoption studies of COPALs should be completed as soon as possible, with a view to planning appropriate followup activities and to fundraising for possible scaling-up.

G. Future focus

The project has provided useful preliminary information about the pest problems of cassava in West Africa and South America, taken valuable steps toward the sustainable management of those problems, and identified new subjects for urgent investigation: superelongation disease, cassava bacterial blight, and cassava frogskin virus disease. Among the important tasks remaining to be done are the following:

- Find new CGM biological control agents for distribution in dry and subtropical regions of Africa.
- Design integrated control strategies for a number of pests, including CGM in semiarid regions.
- Develop postharvest processing and markets to increase farmer income and stabilize cassava prices.
- Apply the FPR and Farmer Field School models to solving cassava pest management, production, and postharvest processing problems in new regions in Latin America and Africa.

It is doubtful whether any future project that seeks to cover all problems, as opposed to selected high-priority ones, will be looked upon with favor by potential donors or able to achieve very significant results during its lifetime.

Recommendation 20: The EAC suggests that any future project(s) should be properly focused on a few specific problems that are of economic importance in both Africa and South America. These research themes, drawn from the ICM spectrum, should be chosen based on the problem identification and results of the present project, after rigorous evaluation of economic importance and the potential for near-term impact.

Annex 1.

TERMS OF REFERENCE - PROJECT GLO/97/119
EXTERNAL ADVISORY COMMITTEE REVIEW MISSION
18-22 MAY 1998, CRUZ DAS ALMAS, BRAZIL

The External Advisory Committee is responsible for assessing progress and problems in the execution of GLO/91/013 and its continuation GLO/97/119 and to make recommendations to improve the quality, focus and probability of successful impact of project activities. The EAC will visit implementing agency and selected collaborating national programmes as appropriate. In advance of the mission, EAC will receive documentation, including the project documents, previous EAC reports and other relevant correspondence.

A report of not more than 20 pages will be prepared by the EAC and submitted to UNDP within one month of completion of the mission. This report will include:

1. A review of the objectives of this project and determination whether they have been met. An assessment of the focus and quality of project activities. Areas where major progress has been achieved should be highlighted. Problems encountered should be identified and steps taken to resolve the problems discussed and assessed. Particular attention should be given to the effectiveness of collaboration with national partners, to capacity building, sustainability and to impact at the farm level. These assessments should be structured around immediate objectives and outputs as set up in the project document. The major achievements of the past five years should be identified.

2. An assessment of the management and administration of the project by both executing agency UNOPS and the implementing agency CIAT. Problems encountered should be identified and discussed.

3. Recommendations to improve project execution, increase the probability that the project will have significant impact on building national capacities, ensure farm-level impact, and the design and scope of future projects in Latin America.

4. Other observations and suggestions considered important by EAC members and in reference to farmer participatory approaches in IPM and the needs of national programmes, with a special focus on Brazil.

Annex 2.

PROFISMA EXTERNAL REVIEW

PROGRAM

May 18		**Responsible(s)**
	Arrival, welcome and orientation	Porto, Matos, Ospina and Mattos
May 19		
08:00	Opening remarks	Oliveira, Porto, Bellotti, Matlon
08:20	Control of cassava root rots	Fukuda, Alvarez, Matos
09:30	Root rots: future directions and priorities	Same
10:00	Cofee Break	
10:30	Diagnosis and control of Cassava Vein Mosaic (CVMV)	Calvert and Meissner
11:30	CVMV: future directions and priorities	Same
12:00	Lunch	
14:00	Training on Farmer Participatory Research	Ospina,Cardoso and S.L.Carvalho
15:15	Coffee Break	
15:30	FPR: future directions and priorities	Same
16:00	Visit to CNPMF laboratories	CNPMF Staff
17:00	EAC Report Preparation	EAC Members
19:30	Dinner	
May 20		
08:00	Field Day: visit to Alagoinhas/EBDA (COPAL Colônia Roberto Santos)	S.L. Carvalho, Matos, Ospina
17:00	EAC Report Preparation	EAC members
May 21		
08:00	Integrated Crop Management: weeds	J.E.Carvalho
08:30	Biocontrol of Cassava Green Mite	Bellotti, Noronha and Matos
10:00	Coffee Break	
10:30	Strategic/Applied Research in Entomology (Mites, Mealybugs, Whiteflies) "Damage and Biological Control"	Noronha, Bellotti and Bento
11:30	Entomology: future directions/priorities	Same
12:30	Lunch	
14:00	Project Financial Administration Review	Matos, Bellotti, Ospina, Fonseca
15:00	EAC Report Preparation	EAC members
May 22		
08:00	Free for EAC Report Preparation	EAC Members
10:00	Presentation of Draft Report Feedback	EAC Members
11:30	Closing of the Meeting	UNDP, CIAT, CNPMF
12:00	Lunch	
14:00	Departure to Salvador	EAC Members

Annex 3.

PERFORMANCE AGAINST PROJECT OBJECTIVES AND OUTPUTS AS SET OUT IN THE PROJECT DOCUMENT
(Drafted by project staff)

Objective 1. Determine major pest constraints in principal agroecological zones.

Output 1.1. CIAT and Brazil counterpart teams develop appropriate workplans, procedures, and protocols for activities planned.

--Trained Brazilian nationals in diagnostics, on-farm trial procedures.
--Prepared workplans for Brazil and CIAT
Done:
5 regional courses
2 seminars
Field days
Visits by farmer groups to CNPMF/EMBRAPA
1 regional workshop on root rots
5 training internships for project personnel

Output 1.2. Determine chief cassava pests in major agroecological zones in Northeast Brazil.

Extensive farmer surveys were done in 75 communities (ca. 1600 farmers).

Intensive farmer surveys were done in 19 communities. Their results indicated this farmer ranking of pest importance: leafcutting ants 29.4, root rots 20.7, CGM 13.8, hornworm 16.5, whitefly 8.2, and phytoplasm 3.2.

Expert surveys were done for green mite, mealybugs and their natural enemies, root rots, and CVMV.

Output 1.3. Selection of sites for on-farm trials to test pest intervention technologies.

--Select representative sites

25 community sites in 4 states were selected.

Output 1.4. Identification of additional research needs for pests which are significant constraints to production, but for which control technology components have not been developed, or have not been tested at the farm level.

--Lab and on-station crop loss assessment and development testing of possible interventions.

The appearance of cassava frogskin disease and the farmers' rating of ants are two areas that gained importance during the course of the project.

Distribution by ecozone, maintenance, effectiveness of natural enemies of whiteflies, CGM, and mealybugs were activities throughout the project.

Two new formulations of hornworm baculovirus are being developed and are ready for FPR. The objective is to turn this into a cottage industry for the small farmer.

Cassava germplasm with resistance to whiteflies is ready for evaluation using FPR.

CVMV was completely sequenced and pathogen diversity was determined.

Molecular characterization of *Phytophthora* and *Fusarium* was initiated. *Phytophthora* can be detected using PCR methods with stem cuttings.

Objective 2. Test and adapt selected crop protection technology components in farmer controlled trials.

Output 2.1. Effective, ecologically sustainable crop protection interventions which are attractive to, and suitable for implementation by, farmers.

--Prepare intervention technologies, including promising natural enemies for introduction and their mass production.

--Implement farmer-controlled trials, with season-long monitoring.

45 experiments were conducted on 19 COPALs. Experiments included varietal testing for CGM and root rot resistance, cultural practices for soil fertility (composting, mulching), and ridges for root rot control.

Baculovirus has been distributed to several of the COPALs to help control attacks of the hornworm.

Output 2.2. Multitrophic and multidisciplinary systems analysis for characterizing important interactions and measuring impact at different levels.

--Develop systems models which can be used to study critical interactions between ecological, agronomic, and socioeconomic factors.

This was principally an African component--not done in Brazil.

A computer program was developed to optimize mass rearing of phytoseiid mites.

A computer database was developed to manage information on the COPALs.

Output 2.3. Evaluation of newly developed and recently adapted crop protection technology components.

Three mealybug parasites were introduced into northeast Brazil from Colombia and Venezuela during 1994-96. Two were spreading quickly (*A. coccois* and *A. diversicornis*).

Evaluation of resistant cassava varieties and cultural practices to control root rots.

Introduction from Brazil to Africa and establishment of three species of CGM predators.

Introduction from Ecuador and Colombia to Brazil of CGM predators. These were released in sites in Bahia and Pernambuco states.

Objective 3. Train farmers, extension workers, and national program researchers in the principles of ecologically sustainable crop protection and FPR.

Output 3.1. Training modules covering the principles and practices of sustainable cassava plant protection and FPR will be developed for national program staff, extensionists, and farmers by project collaborators in Africa and South America.

Three training manuals on FPR methodologies were prepared

13 farmer training guides were prepared

1 pamphlet on cassava root rots was prepared

1 pamphlet on cassava frogskin disease was prepared

Taxonomic keys developed for major phytoseiid mite species and adult whiteflies attacking cassava.

Output 3.2. Trained network of Brazilian national program support staff, extension workers, and farmers with knowledge of the theory and practice of sustainable plant protection and FPR.

Done, including training for:
12 national program staff
6 project and state researchers
120 farmers

A Brazilian scientist was trained at CIAT in mealybug and parasite biology, mass rearing, and field release methodology.

One national scientist and one university professor were trained in PCR detection of CVMV and the technology was transferred to CNPMF and the Universidade Federal do Ceará.

National scientists and extension agents were trained at CNPMF on PCR techniques, and at CIAT in *Phytophthora* isolation and inoculation methodologies.

Objective 4. Assess impact of training, impact and adoption of improved crop protection technology.

Output 4.1. Evaluation of the tested intervention technologies in each participating country.

--Measure effect on yield and root quality in on-farm test sites and by determining the adoption and spread of these technologies at the community level.

Done or partly done.

Evaluation of COPAL experiments and effect on yield done.

Studies of parasite impact on mealybug populations ongoing (started in 1997). Preliminary data on per cent and spread of parasitism are available.

Adoption of technologies by farmers was not done. Because of the short time scale and lack of input from the CIAT cassava economist (position cut in 1996), this activity did not receive adequate attention. A CNPMF economist started work early in 1998, and this activity is planned for 1998.

Output 4.2. Evaluation of the training program at all levels within the country.

--Evaluate training impact at all levels within the country.

Not done. This activity is planned for July-September 1998. A draft questionnaire has been prepared.

Output 4.3. Exchange of information related to sustainable plant protection activities being carried out in Africa and South America.

(See list of publications and proposals, Annex 4.)

Regular consultations for planning and interchange of information were made throughout the duration of the project.

9 refereed publications
1 symposium paper
1 book chapter
At least 18 presentations or posters at conferences
At least 23 presentations and refereed publications were made within Brazil.

Inernational workshop on *Neozygites*.

Annex 4.

LIST OF PROJECT PUBLICATIONS, PRESENTATIONS, AND PROPOSALS GENERATED

PROFISMA Annual Report 1994

PUBLICATIONS

Bento, J. M. S.; Delalibera, I.; Moraes, G. J. de; Bellotti, A. C.; Lapointe, S. L. Distribuição da cochonilha da mandioca *Phenacoccus herreni* Cox & Williams (Homoptera:Pseudococcidae) no Nordeste do Brasil. Congresso Brasileiro de Mandioca, 8., Salvador-BA, 1994. Resumos, Salvador, SBM, 1994. p. 91.

Bento, J.M.S., Lapointe, S. L. 1994. Occurrence of ectoparasitoids (Hymenoptera: Chalcidoicea) on the cassava gall midge Iatrophobia brasiliensis (Diptera: Cecidomyiidae) in northeastern Brazil. Abstract, IV Symposium on Biological Control (Siconbiol), Gramado, RS, Brazil, May, 1994.

PROFISMA Annual Report for 1995

PUBLICATIONS

Delalibera Jr., I, G. J. de Moraes, S. L. Lapointe, C. A. da Silva, e M. A. Tamai. 1995. Variabilidade temporal da incidência inicial de *Neozygites* sp em campos de mandioca na Bahia. Congresso Brasileiro de Entomologia. Resumos. Caxambu, MG.

Delalibera Jr. I.; M. A. Tamai e G. J. de Moraes. 1995. Método de produção in vitro de *Neozygites* sp. Congresso Brasileiro de Entomologia. Resumos. Caxambu, MG.

Farias, A. R. N. Uso de *Baculovirus erinnyis* para controlar o mandarová da mandioca (in press).

Lapointe, S. L. 1995. Cassava Plant Protection: Making it Ecologically Sustainable in West Africa and Brazil. Cassava Newsletter (CIAT) 19 (1): 1-4.

Lapointe, S. L. & M. S. Serrano. 1995. Ecology and control of the attine ant *Acromyrmex landolti* in neotropical savannas. Proc. 5th International Pest Ant Symposia and the 1995 Imported Fire Ant Conference (S.B. Vinson and B. M. Drees, eds.). San Antonio, Texas. pp. 45 - 49

Lapointe, S. L., M. S. Serrano, I. I. Corrales. 1996. Resistance to leafcutter ants and inhibition of their fungal symbiont by tropical forage grasses. J. Econ. Entomol. (in press).

Lima, J.A.A., L. A. Calvert, C. C. Vale e A.E.B.A. SOUSA. 1995. Confirmação da especificidade de anti-soro para o vírus do mosaico das nervuras da mandioca pela técnica de PCR. Fitopatol. bras. 20: 324. (Resumo).

Noronha, A. S., G. J. de Moraes e A. I. Ciocioloa. 1995. Biologia de *Ambliseius limonicus* Garman; McGregar s. l. sobre *Mononychellus tanajoa* (Bondar) (Acari:Phytoseiidae, Tetranychidae) em variedades de mandioca. Anais da Sociedade Entomologica do Brasil 24(2): 305-313.

Noronha, A. S., G. J. de Moraes e A. I. Ciocioloa. 1995. Biologia de *Mononychellus tanajoa* (Bondar) (Acari:Tetranychidae) em variedades de mandioca. Anais da Sociedade Entomologica do Brasil 24(3):489-494.

Noronha, A. S., G. J. de Moraes, P. C. L. de Carvalho, J. E. B de Carvalho e A. M. M. Eloy. Artrópodos associados as plantas daninhas na cultura da mancioca. Anais do XV Congresso Brasileiro de Entomologia (in press).

Noronha, A. S. e G. J. de Moraes. Observações preliminares sobre *Amblyseius manihoti* Moraes (Acari:Phytoseiidae) alimentando-se de mosca branca em mandioca. Anais da Sociedade Entomológica do Brasil (in press).

Noronha, A. S., G. J. de Moraes, e L. Smith. Introdução de ácaros predadores da família Phytoseiidae para o controle biiológico do ácaro verde da mandioca *Mononychellus tanajoa* (Bondar) no Nordeste do Brasil. Pesquisa em Andamento, EMBRAPA-CNPMF (in press).

Vale, C.C., J. A. A. Lima, L. A. Calvert e A. E. B. A. Sousa. 1995. Polymerase chain reaction for identification of plants infected with cassava vein mosaic virus. In: Virológica, Ribeirão Preto, Brasil. (Resumo).

Vale, C.C., J. A. A. Lima, L. A. Calvert e A. E. B. A. Sousa. 1995. Detecção do DNA do micoplasma do superbrotamento da mandioca através de polymerase chain reaction. Fitopatol. bras. 20: 325 - 326. (Resumo).

8 PUBLICATIONS

ACAROLOGY

Refereed Science Journals:

Bohórquez Chaux, A., L. Smith, G. Gallego & J. Tohmé. 1996. Estudios de Cepas del Hongo Entomopatógeno *Neozygites* sp. (Zygomycetes: Entomophthorales) Sobre Acaros de la Familia Tetranychidae. Resumenes XXIII Congreso de la Sociedad Colombiana de Entomología, 17-19 July, 1996, Cartagena, Colombia. p. 97.

Bóhorquez-Chaux, A., A. R. Braun, G. Gallego, L. Smith and J. Tohmé. submitted. Characterizing Populations of Cassava Green Mite by Molecular Techniques. Molecular Ecology.

Brower, J. H., L. Smith, P. V. Vail and P. W. Flinn. 1995. Biological Control, pp. 223-286. *In* B. Subramanyam and D. W. Hagstrum (eds.), Integrated Management of Insects in Stored Products. Marcel-Dekker, New York.

Burbano M., E. G., P. Chacón de Ulloa & L. Smith. 1996. Efecto de Variedades de Yuca Sobre el Acaro Verde *Mononychellus tanajoa* (Bondar) (Acari: Tetranychidae). Resumenes XXIII Congreso de la Sociedad Colombiana de Entomologia, 17-19 July, 1996, Cartagena, Colombia. p. 43.

Cuéllar, M. E., R. Zúñiga, T. Agrono & L. Smith. 1996. Efecto de Diferentes Dietas Sobre el Desarrollo y la Fecundidad de Cinco Especies de Acaros Predadores de la Familia Phytoseiidae. Resumenes XXIII Congreso de la Sociedad Colombiana de Entomologia, 17-19 July, 1996, Cartagena, Colombia. p. 41.

De Moraes, G. J., E. L. Melo & M. G. C. Gondim Jr. 1997. Description of a new species of phytoseiid mite from northeastern Brazil and redescription of Neoseiulus gracilis (Acari: Phytoseiidae). Florida Entomologist 80(3): 319-324.

Edwards, E., E. L. Melo, L. Smith & M. A. Hoy. 1997. Discrimination of Three *Typhlodromalus* species (Acari: Phytoseiidae) Using Random Amplified Polymorphic DNA (RAPD) Markers. Exp. Appl. Acarol. 21: __-__.

Guerrero, J. M., A. C. Bellotti and L. Smith (presenter). 1996. Survey of Presence of *Neozygites* (Zygomycetes: Entomophthorales) in Phytophagous Mites Associated with Cassava in the Neotropics. Annual Meeting of the Society for Invertebrate Pathology, 1-7 September, 1996, Cordoba, Spain. p. 33.

Leite, L. G., L. Smith, G. J. de Moraes & D. W. Roberts. 1996. Production of Hyphal Bodies of the Fungus *Neozygites* nr. *floridana* "in vitro". V SICONBIOL, Simpósio de Controle Biológico, 9-14 June, 1996, Foz do Iguaçu, Brazil. Anais: Sessão de Posters. p. 448.

Noronha, A. C. S., G. J. de Moraes and L. Smith. 1995. Introdução de ácaros predadores da família Phytoseiidae para o controle biológico do ácaro Brasil. Pesquisa em Andamento, CNPMA, EMBRAPA 34 (nov 95): 1-3.

Osorio, L., M. E. Cuéllar & L. Smith. 1996. Estudios Basicos Sobre la Biologia y Produccion en Colonias de *Typhlodromalus tenuiscutus* McMurtry & Moraes (Acarina: Phytoseiidae) Tendientes a la Optimización de un Metodo de Cria. Resumenes XXIII Congreso de la Sociedad Colombiana de Entomologia, 17-19 July, 1996, Cartagena, Colombia. p. 40.

Smith L., J. S. Yaninek, G. J. de Moraes, A. C. S. Noronha. 1966. Classical Biological Control of Cassava Green Mite *Mononychellus tanajoa* (Bondar) in Africa and South America by Phytoseiid Mites (Acari: Tetranychidae, Phytoseiidae). International Congress of Entomology, Florence Italy. 26 Aug., 1996. p. 661.

Smith, L. 1966. Modelling Population Dynamics of the Maize Weevil *Sitophilus zeamais* Motschulsky (Coleoptera: Curculionidae) and Its Hymenopteran Parasitoid *Anisopteromalus Calandrae* (Howard) (Hymenoptera: Pteromalidae). International Congress of Entomology, Florence Italy, 26 Aug., 1996. p. 561.

Smith, L. 1996. Classical Biological Control Activities at the International Center of Tropical Agriculture, Cali, Colombia. V SICONBIOL, Simpósio de Controle Biológico, 9-14 June, 1996, Foz do Iguaçu, Brazil. Anais: Conferências e Palestras. p. 414-418.

Smith, L. and A. C. Bellotti. 1996. Successful Biocontrol Projects with Emphasis on the Neotropics. Proceedings of Cornell Community Conference on Biological Control, 11-13 April, 1996, Cornell University, Ithaca, New York. at World Wide Web site: http://www.nysaes.cornell.edu/ent/bcconf/talks/bellotti.html

Smith, L., D. K. Weaver and R. T. Arbogast. 1995. Suitability of the Maize Weevil and Angoumois Grain Moth as Hosts for the Parasitoids *Anisopteromalus calandrae* and *Pteromalus cerealellae*. Entomol. Exp. Appl. 76: 171-177.

Smith, L., E. L. Melo, J. R. Escobar, and G. J. de Moraes. 1996. Biodiversity of Phytoseiid Mites Associated with Biological Control of Cassava Spider Mites *Mononychellus* Spp. in Northern South America [Acari: Phytoseiidae, Tetranychidae]. IOBC International Conference, "Technology Transfer in Biological Control: from Research to Practice", 9-11 September, 1996, Montpellier, France. p. 268.

Smith, L., J. R. Escobar & E. L. Melo. 1996. Distribucion Geografical y Asociaciones Climaticas de Acaros Fitoseidos Asociados con Yuca en Colombia, Venezuela y Ecuador. Resumenes XXIII Congreso de la Sociedad Colombiana de Entomología, 17-19 July, 1996, Cartagena, Colombia. p. 42.

Smith, L., M. E. Cuellar and E. L. Melo. 1996. Evaluating Prey Preference by Several Phytoseiid Predators for *Mononychellus tanajoa* (Bondar) and *M. caribbeanae* McGregor (Acari: Tetranychidae) in Cassava. Biological Control in press.

Smith, L., M. E. Cuellar, & E. L. Melo. 1996. Comparative Preference of Several Phytoseiid Predators for *Mononychellus tanajoa* and *M. caribbeanae* (Acari: Tetranychidae) in Cassava. V SICONBIOL, Simpósio de Controle Biológico, 9-14 June, 1996, Foz do Iguaçu, Brazil. Anais: Sessão de Posters. p. 239.

Papers at Conferences:

Augmentative Biological Control in Colombia. L. Smith. Workshop on Augmentative Biological Control in the Tropical and Subtropical Americas, 14-18 August 1995, CATIE, Turrialba, Costa Rica.

Classical Biological Control Activities at the International Center of Tropical Agriculture, Cali, Colombia. L. Smith. Simpósio de Controle Biológico, 9-14 June, 1996, Foz do Iguaçu, Brazil.

Classical Biological Control of Cassava Green Mite in Africa and Northeast Brazil. L. Smith. Simpósio de Controle Biológico, 9-14 June, 1996, Foz do Iguaçu, Brazil.

Comparative Preference of Several Phytoseiid Predators for *Mononychellus tanajoa* and *M. caribbeanae* (Acari: Tetranychidae) in Cassava. L. Smith, M. E. Cuellar, & E. L. Melo. SICONBIOL Simpósio de Controle Biológico, 9-14 June, 1996, Foz do Iguaçu, Brazil.

Efecto de Diferentes Dietas Sobre el Desarrollo y la Fecundidad de Cinco Especies de Acaros Predadores de la Familia Phytoseiidae. María Elena Cuéllar, Rodrigo Zúñiga, Tomás Agrono, Lincoln Smith. SOCOLEN, Sociedad Colombiana de Entomología, 17-19 July, 1996, Cartagena, Colombia. p. 41.

Efecto de Variedades de Yuca Sobre el Acaro Verde *Mononychellus tanajoa* (Bondar) (Acari: Tetranychidae). Elsie Gladys Burbano M., Patricia Chacón de Ulloa, Lincoln Smith. SOCOLEN, Sociedad Colombiana de Entomología, 17-19 July, 1996, Cartagena, Colombia. p. 43.

Estudios Basicos Sobre la Biologia y Produccion en Colonias de *Typhlodromalus tenuiscutus* McMurtry & Moraes (Acarina: Phytoseiidae) Tendientes a la Optimización de un Metodo de Cria. Liliana Osorio, Maria Elena Cuéllar, Lincoln Smith. SOCOLEN, Sociedad Colombiana de Entomología, 17-19 July, 1996, Cartagena, Colombia. p. 40.

Estudios de Cepas del Hongo Entomopatógeno *Neozygites* sp. (Zygomycetes: Entomophthorales) Sobre Acaros de la Familia Tetranychidae. Adriana Bohórquez Chaux, Lincoln Smith, Gerardo Gallego, Joe Tohme. SOCOLEN, Sociedad Colombiana de Entomología, 17-19 July, 1996, Cartagena, Colombia. p. 97.

Population Dynamics During Establishment of Phytoseiid Mites in Biological Control of Tetranychid Mites in Cassava. L. Smith. Third International Symposium on Population Dynamics of Plant-inhabiting Mites, 26-29 June, 1995, Gilleleje, Denmark.

Preferencia de especies de ácaros predadores de la familia Phytoseiidae por las presas *Mononychellus tanajoa* (Bondar) y *Mononychellus caribbeanae* McGregor (Acari: Tetranychidae) plagas del cultivo de la yuca. L. Smith, M. E. Cuéllar & E. L. Melo. SOCOLEN, Sociedad Colombiana de Entomología, Bogotá, Colombia, 27 July, 1995.

Successful Biocontrol Projects with Emphasis on the Neotropics. L. Smith & A. C. Bellotti (presenter). Cornell Community Conference on Biological Control, 11-13 April, 1996, Cornell University, Ithaca, New York.

Papers at NARS Meetings:

Activities at CIAT in support of classical biological control of cassava green mite in northeast Brazil. L. Smith. CNPMF, Cruz das Almas, Brazil, 7 Nov, 1995.

Presentations to Farmers and Other Agricultural Specialists:

Biological control of the cassava green mite. L. Smith. International Center for Tropical Agriculture, Cali, Colombia, 1 June, 1995.

Control Biológico de Insectos Plaga de Cultivos en Colombia. L. Smith. Asocaña, Cali, Colombia, 23 Oct., 1996.

Articles in the Popular Press:

A Research Culture is Born. Affinities, Oct. 1996. International Center for Tropical Agriculture, Cali, Colombia.

Article for Cassava Newsletter, 1996. International Center for Tropical Agriculture, Cali, Colombia.

Global collaboration and farmer empowerment for sustainable Cassava Plant Protection. *In* R. Markham (ed.), brochure for System-wide Project on Integrated Pest Management. 1996. CGIAR. Also at World Wide Web site: http://www.cgiar.org:80/spipm/escapp.htm.

ENTOMOLOGY

Caicedo, V., A.M. and A.C. Bellotti. 1996. Reconocimiento de Nematodos Entomopatógenos Nativos Asociados con *Cyrtomenus bergi* Froeschner (Hemiptera: Cydnidae) en Ocho Localidades de Colombia. Rev. Col. Entomol. Vol. 22. No. 1. Pp. 19-24.

PATHOLOGY

Alvarez, E., Loke, J.B. and R. Mayer. 1996. Progress towards biological control of Cassava Stem and Root Rots. Poster presented at the Workshop Sobre Podridões Radioculares no Cultivo da Mandioca. Cruz das Almas, Bahia, Brasil, 1996.

Alvarez, E., Valencia, M., Loke, J.B. and E. Rosero. 1996. A new approach to characterize cassava root rot pathogens. Poster presented at the Workshop Sobre Podridões Radioculares no Cultivo da Mandioca. Cruz das Almas, Bahia, Brasil, 1996.

VIROLOGY

Calvert, L.A., Cuervo, M., Ospina, M.D., Fauquet, C., & Ramirez, B.C. 1996. Characterization of cassava common mosaic virus and a defective RNA species. Journal of General Virology 77: 525-530.

Calvert, L.A., Ospina, M.D., & Shepherd, R.J. 1995. Characterization of cassava vein mosaic virus: a distinct plant pararetrovirus. Journal of General Virology 76: 1271-1278.

Harrison, B.D., Lui, Y., Zhou, X., Robinson, D.J., Calvert, L. & Otim-Nape, G.W. 1996. Properties, differentiation and geographical distribution of geminiviruses that cause cassava mosaic. In Abstracts of the Third International Meeting, Cassava Biotechnology Network (CBN III) 26-31 August 1996, Kampala, Uganda, p.16.

CNPMF

Bento, J. M. S.,;A. C. Bellotti; J. A. Castillo; G. J. de Moraes & S. L. Lapointe. 1996. Introduction of parasitoids for control of cassava mealybug in northeastern Brazil. Fla. Entomol. (in press).

Bento, J. M. S.; G. J. de Moraes; A. C. Bellotti; S. L. Lapointe & J. F. Warumby. 1996. Sucesso no Controle Biológico de *Phenacoccus herreni* (Hem.: Pseudococcidae) pela Introdução de Parasitóides Exóticos (Hym.: Encyrtidae). SICONBIOL (Resumos). Foz do Iguaçú-PR.

Bento, J. M.. S.; A. C. Bellotti; G. J. de Moraes & J. F. Warumby. 1995. Introduçao de parasitóides exóticos para o controle biológico da cochonilha da mandioca *Phenacoccus herreni* Cox & Williams (Homoptera: Pseudococcidae) no Nordeste do Brasil. Congresso Brasileiro de Entomologia, 15, Resumos, Caxambú-MG, p. 412.

Bento, J.M.S.; I. Delalibera Jr.; G. J. De moraes; A. C. Bellotti; & S. L. Lapointe. 1994. Distribuição da cochonilha da mandioca *Phenacoccus herreni* Cox & Willians (Homoptera: Pseudococcidae) no Nordeste do Brasil. Congresso Brasileiro de Mandioca, 8, Resumos, Salvador-BA, p. 91.

Canto, A. M. M. E. Uma viabilização do MIP: pesquisa participativa. In: V Simpósio de Controle Biológico. Anais. Foz de Iguaçu-PR. p 17. 1996.

Canto, A. M. M. E.; A. P. de Matos & H. P. Santos Filho. Impacto do agente biocontrolador Cladosporium sp. em organismo não alvo na cultura da mandioca. In: V Simpósio de Controle Biológico. Anais. Foz de Iguaçu-PR. p. 16. 1996.

Cequeira, J. H. A.; C. Fukuda; W. M. G. Fukuda & C. da S. Mendes. Validação de cultivares de mandioca: uma experiência participativa. I Congresso Latino Americano de Raízes Tropicais IX Congresso Brasileiro de Mandioca. Anais. São Pedro-SP. p. 139. 1996.

Delalibera Jr., I. & G. J. de Moraes. Produção "in vitro" de *Neozygites* sp. (Zygomycetes: Entomophthorales) patógeno de Mononychellus tanajoa. In: V Simpósio de Controle Biológico. Anais. Foz do Iguaçu - PR. p.171 1996.

Delalibera JR., I Produção, distribuição geográfica e epizootiologia de *Neozygites* sp., patógeno de Mononychellus tanajoa. Piracicaba, 1996. 93p. (Mestrado - Escola Superior de Agricultura Luiz de Queiroz).

Delalibera JR., I.; R. A. Humber; J. M. S. Bento & A. P. de Matos. First record of the entomopathogenic fungus *Neozygites* fumosa on the cassava mealybug *Phenacoccus herreni*. Journal of Invertebrate Pathology (accepted for publication in September, 1996).

Delalibera Jr., I; G. J. de Moraes; S. L. Lapointe; C . A. da Silva & M. A. Tamai. Variabilidade na incidência de *Neozygites* SP. (Zygomycetes: Entomophthorales) em campos de mandioca. In: V Simpósio de Controle Biológico. Anais. Foz do Iguaçu - PR. p.76 1996.

Delalibera Jr., I; R. A. Humber; J. M. S. Bento & A. P. de Matos. Infecção de *Neozygites* fumosa (Zygomycetes: Entomophthorales) em *Phenacoccus herreni* (Hemiptera: Pseudococcidae). In: V Simpósio de Controle Biológico. Anais. Foz do Iguaçu - PR. p.170 1996.

Eloy, A. P.; A. P. de Matos & C. Fukuda. Efeito antagônico de *Trichoderma* spp. sobre Phytophthora drechsleri e Scytalidium sp. "in vitro". In: V Simpósio de Controle Biológico. Anais. Foz de Iguaçu-PR, p. 36. 1996.

Fukuda, C.; W. M. G. Fukuda; L. F. Cavalcanti Filho; A. P. de Matos & P. L. P. de Mattos. Avaliação de resistência de cultivares e híbridos de mandioca à podridão radicular no estado da Paraíba. In: I Congresso Latino Americano de Raízes Tropicais IX Congresso Brasileiro de Mandioca. Anais. São Pedro-SP. p. 106. 1996.

Fukuda, C.; W. M. G. Fukuda; M. L. Cavalcanti & C. Lozano. Híbridos de mandioca resistentes ao superbrotamento. In: I Congresso Latino Americano de Raízes Tropicais IX Congresso Brasileiro de Mandioca. Anais. São Pedro-SP. p. 064. 1996.

Fukuda, W. M. G.; J. Cavalcanti.; S. L. de Oliveira; I. Delalibera JR.; C. Iglesias & R. C. Caldas. Efeito do estresse hídrico e do ácaro verde (Mononychellus tanajoa) sobre variedades de mandioca sob condições semi-áridas. In: I Congresso Latino Americano de Raízes Tropicais IX Congresso Brasileiro de Mandioca. Anais. São Pedro-SP. p. 063. 1996.

Matos, A. P. de; S. L. Lapointe; C. Fukuda; Cerqueira, J. H. A. & Ospina, B. PROFISMA: Um projeto global para o manejo integrado sustentável da cultura da mandioca. I Congresso Latino Americano de Raízes Tropicais IX Congresso Brasileiro de mandioca. Anais. São Pedro-SP. p. 116. 1996.

Moraes, G. J. de; I. Delalibera Jr.; S. Elliott & C. A. D. da Silva. Natural fluctuations of populations of *Neozygites* cf. floridana and Amblyseius idaeus, natural enemies of Mononychellus tanajoa. In: V Simpósio de Controle Biológico. Anais. Foz do Iguaçu - PR. p.143 1996.

Noronha, A. C. S. & G. J. Moraes. Observações preliminares sobre Ambliseius manihoti Moraes (Acari:Phytoseiidae) alimentando-se de mosca branca em mandioca. Anais da Sociedade Entomológica do Brasil (in press).

Noronha, A. C. S. Criação massal de Neoseiulus californicus (Acari:Phytoseiidae). In: I Congresso Latino Americano de Raízes Tropicais IX Congresso Brasileiro de Mandioca. Anais. São Pedro-SP. p. 254. 1996.

Noronha, A. C. S.; G. J. Moraes & A. I. Ciociola. Preferência de Mononychellus tanajoa (Bondar, 1938) (Acari:Tetranychidae) por diferentes varieades de mandioca. Ciência e Prática, 19(4):425-428, 1995.

Noronha, A. C. S.; G. J. Moraes & L. Smith. Introdução de ácaros predadores da família Phytoseiidae para controle biológico do ácaro verde da mandioca Mononychellus tanajoa (Bondar) no nordeste do Brasil. In: V Simpósio de Controle Biológico. Anais. Foz de Iguaçu. p/ 358. 1966.

PROPOSALS ELABORATED DURING 1997 - EMBRAPA/CNPMF

- Training of traniners in farmers participatory research methods in Northeastern Brazil
- Integrated management of the cassava root rot
- Development and transfer of cassava plan ting systems in Northeastern Brazil
- Development and diffusion of improved cassava germplasm for different exosystems in Brazil
- Development of cassava-based processes, products and markets in Northeast Brazil

PUBLICATIONS

DELALIBERA Jr., I Produção, distribuição geográfica e epizootiologia de *Neozygites* sp., patógeno de *Mononychellus tanajoa*. Piracicaba, 1996. 93p. (Mestrado - Escola Superior de Agricultura Luiz de Queiroz).

DELALIBERA Jr., I.; HUMBER R.A.; BENTO J.M.S. and Matos, A.P. de First record of the entomopathogenic fungus *Neozygites fumosa* on the cassava Mealybug *Phenacoccus herreni*. **Journal of Invertebrate Pathology**. 69: 276-278. 1997

DELALIBERA Jr., I; HUMBER, R.A.; BENTO, J.M.S. & MATOS, A.P. de INFECÇÃO DE *Neozygites fumosa* (ZYGOMYCETES: ENTOMOPHTHORALES) EM *Phenacoccus herreni* (HEMIPTERA: PSEUDOCOCCIDAE). In: V Simpósio de Controle Biológico. **Anais**. Foz do Iguaçu - PR. p.170 1996.

DELALIBERA Jr. I & MORAES, G. J. de PRODUÇÃO "IN VITRO" DE *Neozygites* SP. (ZYGOMYCETES: ENTOMOPHTHORALES) PATÓGENO DE *Mononychellus tanajoa*. In: V Simpósio de Controle Biológico. Anais. Foz do Iguaçu - PR. p.171 1996.

DELALIBERA Jr., I; MORAES, G. J. de; LAPOINTE, S. L., SILVA, C. A. da & TAMAI, M. A. Variabilidade na incidência de *Neozygites* sp. (Zygomycetes: Entomophthorales) em campos de mandioca. In: V Simpósio de Controle Biológico. **Anais**. Foz do Iguaçu - PR. p.76 1996.

DELALIBERA-JR., I & G. J. DE MORAES. Sobrevivência de *Neozygites* cf. *floridana* em diferentes condições de armazenamento Congresso Brasileiro de Entomologia, **Resumos**, Salvador-BA. 1997 p. 151.

DELALIBERA-JR., I; G. J. DE MORAES & L. SMITH. Patogenicidade de isolados de *Neozygites* cf. *floridana* aos ácaros *Mononychellus tanajoa* e *Tetranychus urticae*. Congresso Brasileiro de Entomologia, **Resumos**, Salvador-BA. 1997 p.151.

DELALIBERA JR., I. Importância de fungos Entomophthorales no controle de ácaros fitófagos. Congresso Brasileiro de Entomologia, **Resumos**, Salvador-BA. 1997 p.20.

DONZELI, V.P.; MESSIAS, C.L.; MORAES, G.J. DE; DELALIBERA-JR., I. & MAIA, A. DE H. N. Resistência de conídios do fungo *Neozygites* sp. à luz ultravioleta. Congresso Brasileiro de Entomologia, **Resumos**, Salvador-BA. 1997 p147.

MORAES, G. J. de; DELALIBERA Jr.; ELLIOTT, S. & SILVA, C.A.D. da Natural fluctuations of populations of *Neozygites* cf. *floridana* and *Amblyseius idaeus*, natural enemies of *Mononychellus tanajoa*. In: V Simpósio de Controle Biológico. Anais. Foz do Iguaçu - PR. p.143 1996.

NORONHA, A.C.S.; MORAES, G.J.; CIOCIOLA, A.I. Preferência de *Mononychellus tanajoa* (Bondar, 1938) (Acari: Tetranychidae) por diferentes variedades de mandioca (*Manihot esculenta* Crantz).
Resumos...16ª Reunião Anual do Instituto Biológico, IB, 1993, N.084
Ciência e Prática, v.19, n.4, p.425-428, 1995.

NORONHA, A.C.S.; MORAES, G.J.; CIOCIOLA, A. I. Biologia de *Mononychellus tanajoa* (Bondar) (Acari: Tetranychidae) em variedades de mandioca.
Resumos...7° Congresso Brasileiro de Mandioca, EMBRAPA-CNPMF, Salvador, 1994. p.49
Anais da Sociedade Entomológica do Brazil, v.24, n.3, p.489-494, 1995.

NORONHA, A.C.S.; MORAES, G.J.; CIOCIOLA, A.I. Biologia de *Amblyseius manihoti* Moraes sobre *Mononychellus tanajoa* (Bondar) (Acari: Phytoseiidae, Tetranychidae) em variedades de mandioca.
Anais...4° SICONBIOL, EMBRAPA-CPATC, Gramado, 1994. p.222
Anais da Sociedade Entomológica do Brazil, v.24, n.2, p.305-313, 1995.

NORONHA, A.C.S.; MORAES, G.J. Sobrevivência e desenvolvimento de *Amblyseius manihoti* (Acari: Phytoseiidae) alimentando-se de *Aleurothrixus aepim* (Hemiptera: Aleyrodidae).
(Submetido aos Anais da Sociedade Entomológica do Brazil)

NORONHA, A.C.S. Criação massal de *Neoseiulus californicus* (Acari: Phytoseiidae).
Resumos...15° Congresso Brasileiro de Mandioca, CERAT, S. Pedro,1996. N°033
(Submetido aos Anais da Sociedade Entomológica do Brazil, em 19/05/1997)

NORONHA, A.C.S. Ácaro verde da mandioca: Fator limitante da produção no Nordeste, especialmente na Bahia.
Resumos...16° Congresso Brasileiro de Entomologia, EMBRAPA-CNPMF, Salvador, 1997. p. 26.

NORONHA, A.C.S.; MORAES, G.J.; SMITH, L. Introdução de ácaros predadores da família Phytoseiidae para o controle biológico do ácaro verde da mandioca *Mononychellus tanajoa* (Bondar) no Nordeste do Brazil.
Pesquisa em Andamento N° 34, nov./95. p.1-3

Resumos...V SICONBIOL, EMBRAPA-CNPSo, Foz do Iguaçu, 1996. p. 358
(Submetido aos Anais da Sociedade Entomológica do Brazil, em 26/08/1997)

NORONHA, A.C.S.; MORAES, G.J. Ácaros associados à cultura da mandioca em três municípios da região semi-árida do Nordeste do Brazil.
(Submetido ao CLP-CNPMF em 15/05/1997)
Resumos... 10ª Reunião Anual do Instituto Biológico, S. Paulo, 1997. p.76.

NORONHA, A.C.S.; MORAES, G.J.; BONATO, O.; NASCIMENTO, S.M.; MEDEIROS, A. Dinâmica populacional de *Typhlodromalus manihoti* (Moraes) (Acari: Phytoseiidae) em mandioca.
(Submetido ao CLP-CNPMF em 13/10/1997)

NORONHA, A.C.S.; MORAES, G.J.; CARVALHO, P.C.L.; CARVALHO, J.E.; ELOY, A.M.M. Acari and other arthropods associated with weeds in cassava (*Manihot esculenta*) in northeastern Brazil.
Anais...15° Congresso Brasileiro de Entomologia, UFLA, Caxambú, 1995. p.695.
(Submetido ao International Journal of Pest Management em 24/04/1997)

NORONHA, A.C.S.; MORAES, G.J.; SILVA, E.S. Acarofauna em área de Mata Atlântica no município de Cruz das Almas, Bahia.
Anais... 7° Congresso Nordestino de Ecologia, Ilhéus, 1997. p. 28 (AT10)

NORONHA, A.C.S.; SILVA, E.S. Flutuação populacional de *Typhlodromalus aripo* (DeLeon) (Acari: Phytoseiidae) em mandioca.
Pesquisa em Andamento (Submetido ao CLP-CNPMF em 04/11/1997)

SMITH, L; YANINEK, J.S.; MORAES, G.J.; NORONHA, A.C.S. Classical biological control of cassava green mite *Mononychellus tanajoa* (Bondar) in Africa and South America by phytoseiid mites (Acari: Tetranychidae, Phytoseiidae).
Proceedings...XX International Congress of Entomology, Italy, 1996. p.661.

PROPOSALS ELABORATED DURING 1997 - CIAT

- Ecologically Sustainable Plant Protection and Postharvest Processing of Cassava in Cuba
- Sustainable Development and Valorization of Cassava in Paraguay: Integration of User-oriented Crop Production, Plant Protection and Postharvest Processing
- Ecologically Sustainable Cassava Plant Protection: A Global Strategy

PUBLICATIONS

Bellotti, A. C., L. Smith and S. L. Lapointe. 1999. Recent advances in cassava pest management. Annual Review of Entomology. In press.

BERTSCHY, C., T.C.J. TURLINGS, A.C. BELLOTTI AND S. DORN. 1997. Chemically-mediated attraction of three parasitoid species to mealybug - infested cassava leaves. Florida Entomologist. 80(3), pp. 383-395.

BURBANO-M., E. G. AND L. SMITH. submitted. Effect of Resistant Cassava Varieties on Life History Characteristics of Cassava Green Mite *Mononychellus tanajoa* (Bondar) (Acari: Tetranychidae). Experimental and Applied Acarology.

CALVERT, L.A., CUERVO, M., OSPINA, M.D., FAUQUET, C., & RAMIREZ, B.C., 1996. Characterization of cassava common mosaic virus and a defective RNA species. Journal of General Virology 77: 525-530.

DE MORAES, G. J., E. L. MELO & M. G. C. GONDIM JR. 1997. Description of a new species of phytoseiid mite from northeastern Brazil and redescription of *Neoseiulus gracilis* (Acari: Phytoseiidae). Florida Entomologist 80(3): 319-324.

DE MORAES, G.J., E.L. MELO AND M.G.C. GONCLIM, JR. 1997. Description of a New Species of Phytoseiid Mite from Northeastern Brazil and Redescription of *Neoseiulus gracilis* (Acari: Phytoseiidae) Florida Entomologist 80(3); pp 319-314

EDWARDS, E., E. L. MELO, L. SMITH & M. A. HOY. In press. Discrimination of Three *Typhlodromalus* species (Acari: Phytoseiidae) Using Random Amplified Polymorphic DNA (RAPD) Markers. Exp. Appl. Acarol. 21: __-__.

NORONHA, A. C. S., G. J. DE MORAES & L. SMITH. In press. Introdução de ácaros predadores da família Phytoseiidae para o controle biológico do ácaro verde da mandioca, *Mononychellus tanajoa* (Bondar), no Nordeste do Brasil. Pesquisa em Andamento, CNPMA, EMBRAPA. [Introduction of mite predators of the family Phytoseiidae for biological control of the cassava green mite*Mononychellus tanajoa* (Bondar), in Northeast Brazil].

OSORIO-RIOS, L., M. E. CUELLAR -JIMENEZ, L. SMITH. submitted. Estudios Básicos Tendientes a la Optimización de un Sistema de Cría Masiva de *Typhlodromalus temuiscutus* McMurtry & Moraes (Acari: Phytoseiidae) un Depredador de Acaros de Yuca. Revista Colombiana de Entomología.

ZHOU, X., LUI, Y., CALVERT, L., MUNOZ, C., OTIM-NAPE, G.W., ROBINSON, D.J. AND HARRISON, B.D., 1997. Evidence that DNA-A of a geminivirus associated with severe cassava mosaic disease in Uganda has arisen by interspecific recombination. Journal of General Virology, 78:2101-2111.

Book Chapter

BELLOTTI, A. 1996. Las plagas de la yuca y su manejo. In. La Yuca Fuente al Hambre del Mundo Tropical. Ed. A. Montaldo. Universidad Central de Venezuela. Talleres de Anauco Ediciones, C.A. Caracas, Venezuela.

Conferences and Posters

ALVAREZ, E. 1997. Characterization of *Phytophthora* spp. Hand out presented at symposium at CIAT. April 23th.

ALVAREZ, E. AND M. L. MOLINA. 1997. Caracterización Morfológica y Molecular de Aislamientos de Sphaceloma manihoticola (Bitancourt & Jenkins) en Colombia. ASCOLFI Congress at the International Center for Tropical Agriculture (CIAT), Cali, Colombia, August 1.t

ALVAREZ, E., CHACÓN, M.I., LOKE, J.B., N. J. SÁNCHEZ. 1997. Genetic variation in strains of *Phytophthora* spp. affecting cassava. Phytopathology Vol. 87, No. 6, p. S3 - S4. Abstract presented at APS-Annual Meeting, 9-13 August, Rochester, N.Y., USA.

ALVAREZ, E., CHACÓN, M.I., SÁNCHEZ, J. AND J.B. LOKE. 1997. Molecular Characterization of Phytophthora species from Cassava in Colombia. Poster presented during two training courses titled *Training in Molecular Biology with Emphasis on the Characterization of Phytopathogenic Fungus*. October 5-10 and 13-18, 1997, at the International Center for Tropical Agriculture (CIAT), Cali, Colombia.

ALVAREZ, E., J. LOKE AND R. MAYER. 1996. Progress towards biological control of Cassava Stem and Root Rots. Poster presented at the Workshop Sobre Podridões Radiculares no Cultivo da Mandioca. Cruz das Almas, Bahía Brazil, 1996.

ALVAREZ, E., M. VALENCIA, J.B. LOKE AND E. ROSERO. 1995. A new approach to characterize cassava root rot pathogens. CIAT Internal Review (Plant Breeding for Sustainable Agriculture).

ALVAREZ, E., RAMIREZ, J.A. AND J.B. LOKE. 1997. Termoterapia en Semilla Asexual de Yuca para el Control de *Phytophthora* spp. ASCOLFI Congress at the International Center for Tropical Agriculture (CIAT), Cali, Colombia, August 1.

BEDOYA, F.A., ALVAREZ, E. AND J.B. LOKE. 1997. Control Biológico de la Pudrición Radical en Yuca: Selección *In Vitro* de Aislamientos de *Trichoderma* spp. ASCOLFI Congress at the International Center for Tropical Agriculture (CIAT), Cali, Colombia, August 1.

BURBANO, E.G., P. CHACÓN DE U., L. SMITH. 1997. Relación Tritrófica entre *Neoseiulus californicus* (McGregor), y su Presa *Mononychellus tanajoa* (Bondar), Sobre Variedades Resistentes de Yuca. 24° Congresso de SOCOLEN, Sociedad Colombiana de Entomología, 16-18 July, Pereira, Colombia.

GUERRERO, J.M., L. SMITH, A. C. BELLOTTI. 1997. Distribución Geográfical del Hongo *Neozygites* sp. (Zygomycetes: Entomophthorales) en Acaros de la Familia Tetranychidae, Especialmente Colectados Sobre Yuca, *Manihot esculenta* Crantz. 24° Congresso de SOCOLEN, Sociedad Colombiana de Entomología, 16-18 July, Pereira, Colombia.

MELO, E.L, G. DE MORAES, L. SMITH. 1997. Desarrollo de una Clave Taxonómica de Fitoseidos Encontrados en Yuca para un Programa de Control Biológico. 24° Congresso de SOCOLEN, Sociedad Colombiana de Entomología, 16-18 July, Pereira, Colombia.

SÁNCHEZ, J., ALVAREZ, E., CHACÓN, M.I. AND J.B. LOKE. 1997. Avances en la Caracterización de Aislamientos de *Phytophthora* spp. el Agente Causal de Pudriciones de Raíces en Yuca. ASCOLFI Congress at the International Center for Tropical Agriculture (CIAT), Cali, Colombia, August 1.

SMITH, L. , M.E. CUELLAR J. AND E.L. MELO. 1997. 16° Congresso Brasileiro de Entomología, 2-7 March, Salvador, Brazil. Suitability of Different Types of Food for Several Phytoseiid Predators Being Evaluated for Biological Control of *Mononychellus tanajoa* (Acari: Tetranychidae) in Cassava.

SMITH, L., E.L. MELO, J.R. ESCOBAR, M.E. CUELLAR AND J.M. GUERRERO. 1997. Foreign exploration for phytoseiid mites in northern South America for classical biological control of the cassava green mite in Africa. Entomological Society of America National Conference, Louisville, KY.

SMITH, L., J. S. YANINEK, G. J. DE MORAES. 1997. Establishment and Success of Phytoseiid Mites Introduced from South America to Africa for Biological Control of Cassava Green Mite. USDA/ARS/NPA, Sidney, Montana.

SMITH, L., J. S. YANINEK, G.J. DE MORAES. 1997. Establecimiento y Exito de Acaros Fitoseidos Introducidos de Sur América a Africa para el Control Biológico del Acaro Verde de la Yuca. 24° Congresso de SOCOLEN, Sociedad Colombiana de Entomología, 16-18 July, 1997, Pereira, Colombia.

SMITH, L., J.R. ESCOBAR AND E.L. MELO. 1997. 16° Congresso Brasileiro de Entomología, 2-7 March, Salvador, Brazil. Geographical Distribution and Climatic Associations of Phytoseiid Mites Associated with Cassava in Colombia, Venezuela and Ecuador.