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22136

FINAL REPORT

TRAINING COURSE ON

"SCREENING TECHNOLOGIES FOR INDUSTRIAL EXPLOITATION OF MEDICINAL AND AROMATIC PLANTS"

UNIDO PROJECT TF/GLO/96/105

UNIDO CONTRACT No. 98/287

Report of Workshop sponsored by the International Center For Science and High Technology (ICS) / United Nations Industrial Development Organization (UNIDO), Trieste, Italy and Iberoamerican Program for Science and Technology for Development, CYTED, held at Panama, 30 November - 5 December 1998

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18 December 1998

SENACYT

UNIDO

IICS

CYTED

Training Course on Screening Technologies for Industrial Exploitation of Medicinal and Aromatic Plants

Panama, 30 November - 5 December 1998

CIFLORPAN
FACULTAD DE FARMACIA - UP

UNIVERSIDAD DE PANAMA

ABSTRACT

This report is rendered under the UNIDO Contract No. 98/287 to organize and execute a "*Training Course on Screening Technologies for Industrial Exploitation of Medicinal and Aromatic Plants*" for Latin american scientists in collaboration with the CYTED Program. This Report describes briefly the objectives of the course, its detailed programs of lectures, site visits, discussions and a financial statement of expenses as per the assigned budget. In addition, it appends all the handouts and lecture outlines compiled by the resource persons and the local faculty.

TABLE OF CONTENTS

INTRODUCTION

This report describes all activities carried out under the UNIDO Contract No. 98/287, based on the UNIDO Project No. TF/GLO/96/105 to organize and executive a *Training Course on Screening Technologies for Industrial Exploitation of Medicinal and Aromatic Plants*. The Terms of Reference of this Subcontract are described in Appendix 1.

This course shows how international cooperation between two organizations like the International Center for Science and High Technology (ICS/UNIDO, Trieste), and the Iberoamerican Program of Science and Technology for Development, CYTED can be beneficial.

This course took effect in Panama during the period 30 November - 5 December 1998 . About a month before the beginning of this course, the announcements along with the applications blank for a fellowship were sent to over 50 centers in Iberoamerica, mainly though the CYTED, Subprogram X. Fine Pharmaceutical Chemistry's focal points in 21 countries, Coordinators of 4 networks, and the Directors of 4 on-going research projects. Special effort was made to assure that the phytopharmaceutical industries of the region were informed of the course.

The Inaugural Ceremony held on 30 November 1998 was attended by Prof. Julio Vallarino, Vicerrector for Research and Graduate Studies of the University of Panama,

Lic. Maritza Salazar, National CYTED Coordinator in SENACYT, Office of the President of Republic of Panama, Dr. Angela B. Aguilar, Dean of the College of Pharmacy, Dr. Karan Vasisht, ICS/UNIDO, and Prof. Mahabir P. Gupta, International Coordinator of the Subprogram X. Fine Pharmaceutical Chemistry, CYTED. The Vicerrector of the University of Panama officially inaugurated the course. The Illustration 1 gives a view of the Inaugural Ceremony. Resident Representative of UNDP was invited, but she could not attend.

The University of Panama, through the Pharmacognostic Research Center on Panamanian Flora (CIFLORPAN) of the College of Pharmacy, provided with all necessary facilities for the course. SENACYT also supported the course.

CONCLUSIONS

1. A total of 30 applications were received. Final selection was made in consultation with Ms. Elisa Sarti de Roa of ICS/UNIDO, Trieste.

2. A total of 34 participants attended the course, 17 foreign and 17 local Panama scientists. Financial Support was provided to 17 foreign participants, marked with one (*) asterisk in the list of participants, representing 12 countries. The participation of the candidate from Spain, Chile, Mexico and one from Guatemala was made possible through the financial support of the CYTED program (Appendix 2)(**).

3. A total of 17 Panamanian scientists from academic institutions, industry and Government sector also participated.

Academia	12 (71 %)
Industry	--------
Government	5 (29 %)

4. The 17 foreign participants belong to the following sectors:

Academia	8(47 %)
Industry	7 (41 %)
Government Sector	2 (12%)

Thus it can be seen that these was a significant participation from the industrial sector.

5. Illustration 2 shows the participants. Appendix 3 shows the detailed program of the course. Prof. Arnold Vlietinck of the University of Antwerpen, served as the overall Coordinator of the technical program. Drs. K. P. Odenthal, Madaus Pharmaceutical, Patrick Vanderheyden from Free University Brussels also served as the visiting Faculty.

6. A field trip to a farm of the Spanish Agency for International Cooperation in Chorrera was organized to observe *in situ* the cultivation of medicinal plants.

7. The course was very intensive and covered 40 hours of lectures and discussions sessions. The students were grounded in the different aspects of screening technologies for industrial exploitation of medicinal and aromatic plants, quality control and registration of herbal medicine products. All the topics of the project document were amply covered.

8. The course was evaluated at the end, using ICS-UNIDO questionnaire. Evaluation was also made according to the CYTED questionnaire. Appendices 4 and 5, show the results of the course evaluation. In general, all the objectives were accomplished and the participants were extremely pleased with the organization, efficiency and the high academic level of the course.

9. Appendix 6 compiles all the handouts and literature given to the participants. This is provided in an abrdged file for easy perusal.

10. During the course, the participants were also informed about the activities of CYTED. Through the presentations of Dr. Armando Cáceres, International Coordinator of Network X.C: RIPROFITO and Dr. Mahabir P. Gupta, International Coordinator, Subprogram X. CYTED. The participants showed keen interest in its activities.

12. Dr. Karan Vasisht's presentations about the ICS was highly appreciated by the participants.

13. Resource Persons and the local Faculty who participated in the course are marked with the superscript 1 in the list of Participants (Appendix 2). Brief *Curriculum Vitae* of the Resource Persons are provided in Appendix 8.

14. The country reports are presented herewith in Appendix 8.

RECOMMENDATIONS

1. The ICS/UNIDO should continue to hold further workshops in Latinamerica in the field of industrial utilization of medicinal and aromatic plants. In addition, it should explore the possibilities of identifying donor countries to support regional projects in the area of medicinal and aromatic plants. The approach should be proactive capacity building and technology transfer.

2. The Latin american countries must expedite enactment of appropriate and adequate legislation for registrations of herbal medicinal products. This is a bottleneck for the region, at the present time.

3. Latin american countries must take urgent action to ensure adequate capability and capacity building of human resources. Special effort should be made towards increasing public awareness on the importance of medicinal plants and their conservation and training seminars should be organized on the Intellectual Property Rights (IPR) issues within the local populations. Courses on Phytotherapy should also be organized.

4. Models of various aspects of bioprospecting including benefit sharing and commercial utilization should be studied during the process of developing national

policies on conservation and sustainable utilization of biodiversity. Workshops on business development using biodiversity should be encouraged.

5. The workshop made it explicit the concern for lack of facilities for carrying out standardization and toxicological evaluation of medicinal and aromatic plants in Latinamerica. The workshop recommends the U.N. and other multilateral agencies, specially the W.H.O. and the UNIDO to offer technical assistance to this region.

6. The workshop notes with great concern the lack of facilities and capacity in the region to undertake cultivation of medicinal plants. Efforts should be made, in cooperation with FAO and other international bodies to offer state of the art technology in this field and stimulate participation of private enterpreneurs.

7. The workshop clearly showed the need for further international cooperation among other programs such as the CYTED, UNESCO, FAO and the IFS to maximize the efficiency and use of available resources.

8. Latin american countries are urged to take appropriate actions to inventory and study their biodiversity of medicinal and aromatic plants, as soon as possible.

1.


2.


3.

ACKNOWLEDGMENTS

Thanks are due to the CIFLORPAN staff, Dr. Pablo Solís, Angela Calderón, Rosaura Jiménez, and Carlos Guerra for their tremendous support in the organization of the Course. Special thanks to the Dean of the College of Pharmacy of University of Panama, Angela B. de Aguilar for her generous support. Financial support of ICS/UNIDO, and CYTED is gratefullly acknowledged. Grateful thanks are given to Dr. Ceferino Sánchez, SENACYT for official patronage of the course.

APPENDIX 1

TERMS OF THE CONTRACT

CONTRACT NO. 98/287 COPY CONTRACTOR

between

THE UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
located at
Vienna International Center
Wagramerstrasse 5, P.O. Box 300, A-1400 Vienna, Austria
Tel.: 43-1 26026, Telex: 131218 pac a, Fax: 269 2669, PAC Fax: 43-1-26026 6815/6

and the

FINE PHARMACEUTICAL CHEMISTRY
IBEROAMERICAN PROGRAMME OF SCIENCE AND TECHNOLOGY
FOR DEVELOPMENT (CYTED)
UNIVERSITY OF PANAMA
Estafeta Universitaria, Panama, Republic of Panama

for the
provision of services relating to the

Training Course on
"SCREENING TECHNOLOGGIES FOR INDUSTRIAL EXPLOITATION OF MEDICINAL AND AROMATIC PLANTS"
30 November - 5 December 1998, Panama City, Panama

UNIDO Project No.: TF/GLO/96/105
Purchase Order No.: 15-8-1287X

VK/IR
23 November 1998

1. **Contractor's Responsibilities**

In accordance with the terms and conditions stated herein and in the Annexes hereto the **FINE PHARMACEUTICAL CHEMISTRY/CYTED/UNIV. OF PANAMA, REPUBLIC OF PANAMA,** hereinafter referred to as "The Contractor", shall provide for the full and proper performance of its obligations under this Contract, all the services described in the Terms of Reference dated 18 November 1998. A copy of the Terms of Reference is attached hereto as Annex B and made a part hereof. All work required under this Contract shall be completed no later than 31 December 1998.

2. **Contract Price and Payment**

UNIDO shall pay the Contractor for the full and proper performance of all obligations hereunder the sum of United States Dollars twenty-nine thousand seven hundred and twelve (US$ 29,712). This sum shall cover all expenses incurred by the Contractor including, but not limited to, salaries, indemnities, social charges, overheads, technical assistance and supervision costs. The Contractor shall not do any work which may result in any charges to UNIDO over and above the sum of United States Dollars twenty-nine thousand seven hundred and twelve (US$ 29,712) without prior written consent of UNIDO and a formal amendment to this Contract.

It is understood that, in case the actual number of the participants is smaller than stated in the Terms of Reference, the Contract price shall be adjusted accordingly.

3. **Entry into Effect of the Contract**

This Contract shall be deemed to be effective from the date of its signature by both Parties.

4. **Reports**

The Contractor shall submit to UNIDO, Vienna, a Final Report in English, in five (5) copies each, covering the work done in accordance with paragraph 1, including a Financial Statement of expenses incurred, not later than 31 December 1998.

The Report shall be prepared in accordance with the "Basic Principles of Scientific Report Writing" (Annex C) and dispatched according to the "Instructions to Contractors for the Dispatch of Reports" (Annex D).

5. **Payments**

Payment on account of the Contract price set forth in paragraph 2. hereinbefore shall be made on the basis of the Contractor's invoice sent to UNIDO Vienna, as follows:

a) upon signature of the Contract by both Parties,
the sum of ..... US$ 25,800

b) upon UNIDO's receipt and acceptance of the Final Report as referred to in paragraph 4. hereinabove,
the sum of ..... US$ 3,912

TOTAL **US$ 29,712**

The Contractor shall pay at his own cost all the taxes, assessments, liens and charges which fall due and be payable by the Contractor as a result of this Contract.

The making of any payment hereunder by UNIDO shall not be construed as an unconditional acceptance by UNIDO of the work accomplished by the Contractor up to the time of such payment.

All payments under this Contract shall be made, subject to receipt by UNIDO of the Contractor's invoice in one (1) original and one (1) copy, by electronic transfer to the accounts indicated in the invoice.

6. **Transmission of Reports, Invoices and Notices**

All reports, invoices and notices submitted or given hereunder shall be addressed to the Purchase and Contracts Section, General Services Branch, Administrative and Financial Control, Field Operations and Administration Division, Wagramerstr. 5, P.O.Box 300, A-1400 Vienna, Austria.

7. **Contract Amendment**

No modification of, or change in, this Contract, or waiver of any of its provisions, or additional contractual relationship with the Contractor shall be valid unless approved in the form of a written amendment to this Contract, signed by the Contractor and the UNIDO, Officer-in-Charge, Purchase and Contracts Section, General Services Branch, Administrative and Financial Control, Field Operations and Administration Division, or his representative.

8. **Covenant against Contingent Fees**

The Contractor warrants that:

a) no person or selling agency has been employed or retained by him to solicit or secure this Contract upon an agreement or understanding for a commission, percentage, brokerage, contingent fee or retainer, except regular employees or bona fide and officially established commercial or selling agencies maintained by the Contractor for the purpose of securing business;

b) no official or servant or retired employee of UNIDO, the United Nations, the UNDP and the Participating and Executing Agencies of the UNDP or the Government and/or its co-operating Agency(ies), who is not a bona fide employee of the Contractor, has been or shall be admitted by the Contractor to any direct or indirect benefit arising from this Contract or the award thereof.

For breach of these warranties, UNIDO shall have the right to deduct from the Contract price, or otherwise recover from the Contractor, the full amount of any such commission, percentage, brokerage, contingent fee or retainer so paid.

9. **Default by the Contractor**

In case the Contractor fails to fulfil his obligations and responsibilities under this Contract, and provided the Contractor has not remedied such failure(s) within thirty (30) days of having been given UNIDO's express written notification of the nature of the failure(s), UNIDO may, at its sole option and without prejudice to its right to withhold payment(s) as hereinbefore provided, hold the Contractor in default under this Contract.

When the Contractor is thus in default, UNIDO may, by giving written notice to the Contractor, terminate the Contract as a whole or such part or parts thereof in respect of which the Contractor is in default. Upon such notice, UNIDO shall have the right to seek completion, at the Contractor's expense, of that part or those parts of the Contract with respect to which the Contractor is in default. The Contractor shall, in this case, be solely responsible for any reasonable costs of completion, including such costs which are incurred by UNIDO over and above the originally agreed Contract price stipulated hereinbefore.

10. General Conditions

The Parties hereto agree to be bound by the UNIDO General Conditions of Contract a copy of which is attached hereto as Annex A.

IN WITNESS WHEREOF, the Parties hereto have executed this Contract.

FINE PHARMACEUTICAL CHEMISTRY CYTED/COLLEGE OF PHARMACY UNIVERSITY OF PANAMA

By Mahabir P. Gupta

Estafeta Universitaria
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Date 23. 11. 1998

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

By .....
V. Koloskov
Contracts Officer
Purchase and Contracts Section
General Services Branch/AFC
Field Operations and Administration Div.
P.O.Box 300
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Date 23.11.1998

Enclosures

Annex A : General Conditions of Contract
Annex B : Terms of Reference dated 18 November 1998
Annex C : Basic Principles of Scientific Report Writing
Annex D : Instructions to Contractors for the Dispatch of Reports

APPENDIX 2

LIST OF PARTICIPANTS

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APPENDIX 3

DETAILED PROGRAM OF THE COURSE

CYTED

UNIDO

ICS

CIFLORPAN
FACULTAD DE FARMACIA - UP

SENACYT

Training Course on Screening Technologies for Industrial Exploitation of Medicinal and Aromatic Plants
Panama : 30.11. - 05.12.1998

Monday 30 November
Auditorium Bernardo Lombardo

09.00-10.00h	Inauguration	
10.00-12.30h	Introductory Lecture	A. Vlietinck
14.30-16.00h	Sections 1.1 & 1.2	
16.30-18.00h	Sections 1.1 & 1.2 Contd.	

Tuesday 1 December
Auditorium Carmen de Herrera (Simón Bolívar Library)

09.00-12.30h	Section 1.3	P. Vanderheyden
14.30-18.00h	Section 1.3 Contd.	

Wednesday 2 December
Auditorium Bernardo Lombardo

09.00-12.30h	Sections 2.1 & 2.2	A. Vlietinck
14:30	Visit to Panama Canal and Touristic Places	

Thursday 3 December
Auditorium Bernardo Lombardo

09.00-12.30h	Sections 3.1 & 3.2	K. Odenthal
14.30-16.00h	Sections 3.1 & 3.2 Contd.	
16.30-18.00h	Presentation of CYTED Program	M. Gupta and O. Cáceres

Friday 4 December
Auditorium Bernardo Lombardo

09.00-12.30h	Sections 3.1 & 3.2 Contd.	K. Odenthal
14.30-18.00h	Strategies for Joint UNIDO Projects and Evaluation of Training Course Country Reports and Round Table Discussion	

Saturday 5 December

08.00 - 15.00h	Visit to a cultivationfarm of a medicinal plants in Chorrera

CYTED CIFLORPAN FACULTAD DE FARMACIA - UP UNIDO ICS SENACYT UNIVERSIDAD DE PANAMA

Training Course on Screening Technologies for Industrial Expoitation of Medicinal and Aromatic Plants
Panama : 30.11. - 05.12.1998

Introductory Lecture

Medicinal plant preparations as health products and/or phyto-medicines

* Definitions: phytomedicines, pharmafoods, neutraceuticals, health products, phytopharmaceuticals
* Legal status in different countries: notification versus registration
* Economic importance of health products and phytomedicines
* Efforts for world-wide harmonisation

Section 1. Bioassay-guided isolation and identification of industrially useful phytoconstituents

1.1. Screening procedures for the evaluation of medicinal and aromatic plants

* Methods of selection of plants for screening
* Principles of bioassay-guided isolation
* Roles of bioassays
* Classification of bioassays
* Examples of bioassays
  - General screening bioassays: broad and primary screening bioassays
  - Specalised screening bioassays:
    Lower organisms, isolated subcellular systems, isolated cellular systems, isolated organs of vertebrates, whole animals
* Advantages and disadvantages of different bioassays

1.2. Isolation of industrially useful phytoconstituents

* Approach of bioassay-guided isolation
* Initial extraction and product capture= extraction schemes and the concept of dereplication
* Preparative separation methods for plant constituents•
  - Solid phase chromatography: preparative TLC (PTCL), centrifugal TLC (CTLC), overpressure-layer chromatography (OPCC), vacuum liquid chromatography (VLC), pressure liquid chromatography (FC, LPLC, MPLC, HPLC): supercritical fluid chromatography (SFL)
  - Liquid-liquid chromatography: Droplet counter current chromatography (DCCC), high speed counter current chromatography (HSCC)

• These methods will be illustrated by examples worked out at research group of Pharmacognosy and Phytochemistry of the University of Antwerp in the fields of Chemotherapy (antibacterial-antifungal, antiviral, antimutagenic, antiparasitic and insecticidal active plant products) and pharmacology (antioxidative-immunological, antihistaminic, antiplatelet aggregating, serotoninergic, anticomplement and cardiovascular plant products).

1.3 Introduction to Molecular Biology of screening methods: Ligand binding studies

* Molecular Pharmacology of Hormone-and neurotransmitter

Section 2. Production of quality medicines

2.1. Industrialisation of medicinal plants

* Plant material collected from the environment:
  Special problems: proper identification, adulteration and admixtures; quality assurance
* Plant material from cultured species:
  Special problems: microbial contamination, pesticides, agrochemicals, conformity with established specifications
* Guidelines for good agricultural practice (G.A.P.) of medicinal and aromatic plants

2.2. Quality control of starting materials, plant preparations and finished herbal medicinal products

* Analytical methods used for the quality control: spectroscopic methods, chromatographic methods, titrimetric methods and gravimetric methods; elaboration of Pharmacopoeia monographs of starting materials and plant preparations
* Control of starting materials including plants, excipients, primary packaging material and of intermediate plant preparations such as extracts and tinctures.
  Specification and routine test including charcteristics, identification tests such as macroscopic and microscopic description, qualitative chemical profile, chemical identity tests, detection of adulterants, determination of contamination by microorganisms, products of microorganisms, pesticides, toxic metals, radioactivity, fumigants, assays of the active ingredients and/or markers
* Overview of validation studies
  Validation of the methods required for identity, tests and assays of starting materials and finished herbal medicinal products: analytical performance, parameters such as linearity, precision, accuracy, limit of detection, limit of quantitation, selectivity, range and ruggedness

* Control of finished herbal medicinal products and stability test on active substances or markers:
  Specification and routine testing including product specifications, control metods including identification, assay and other tests; pharmaceutical tests; identification and determination of excipients; scientific data including analytical validation and batch analysis; stability testing including normal test conditions and accelerated test conditions discussion; interpretations and conclusions; shelf-life and storage conditions

Section 3. Industrial utilisation of medicinal and aromatic plants

3.1. Applications for a marketing authorisation of finished herbal medicinal products as drugs

* Toxicological and pharmacological evaluation
  - Single dose and repeated dose toxicity; repeated dose tissue distribution studies, reproduction studies, testing for mutagenic and carcinogenic potential, specific aspects of regulatory genotoxicity tests
  - Pharmacokinetics and metabolic studies in the safety evaluation in animals, non-clinical local tolerance testing and preclinical biological safety testing
  - Abridged toxico-pharmacological dossier of phytomedicines: Bibliographical applications for well-established medicinal products: ESCOP and WHO monographs
* Clinical evaluation
  - Good clinical practice
  - Pharmacokinetic studies in men, dose-response information, clinical investigation for long term use, biostatistical methodology in clinical trials, fixed combination products, clinical testing of prolonged action, clinical requirements for locally acting drugs, clinical safety data management
  - Investigation of bioavailibity and bioequivalence
  - Abridged clinical dossier of phytomedicines: Bibliographic applications for well-established medicinal products: documentation on experience in the form of epidemiological studies
  - Post-marketing experience

3.2. Applications for a marketing authorization of finished herbal medicinal products as health products or foods

* Requirements in different countries

APPENDIX 4

RESULTS OF OVERALL COURSE EVALUATION

APPENDIX 4

RESULTS OF COURSE EVALUATION

ICS WORKSHOP EVALUATION QUESTIONNAIRE[1,2,3]

A	ORGANIZATION					
		CYTED				
1	How did you obtain information about this workshop/course?	100				
		Excellent	**Very Good**	**Good**	**Fair**	**NA**
2	The information process was	44.3	50	.07	-	-
3	The announcement and pre-course material was:	31	38	12	7	12
Describe the content of the workshop/course Screening Technologies of Medicinal Plants, legislation (ESCOP, Pharm. Europea, etc.) Analytical Methods for Quality control and Pre clinical and clinical trials. Legislation, Biological, molecular GMP and Analytical control of plants products.(Please see the questionnaires)						
		Excellent	**Very Good**	**Good**	**Fair**	**NA**
4	I found the scientific programme	63	25	12	-	-
4.1	Applied Lecture/Workshop	19	36	19	-	7
4.2	Use of small working groups	36	19	6	-	38
4.3	Case studies	25	25	38	6	6
4.4	The time spent by lectures in class and after class on specific questions/examples	50	44	-	-	6
		Balanced	**Unbalanced**	**NA**		
4.5	Students scientific knowledge was	94	6	-		
B	**Duration of Programme**	**Just Right**	**Too Long**	**Too Short**		**NA**
1	Number of days	94	-	6		-
2	Length of working	94	-	-		6
C	**Training facilities & Hotel**	**Excellent**	**Very Good**	**Good**	**Fair**	**NA**
1	Lecture/Training Rooms	63	12	25	-	-
2	Break/refreshments	42	50	6	-	-

		Excellent	Very Good	Good	Fair	NA
3	Hotel accomodation	69	25	6	-	-
4	Meals at the hotel	50	19	19	12*	-
* The treatment from the people in the breakfast time was terrible.						
D	**Organizer's response to participants needs**	**Excellent**	**Very Good**	**Good**	**Fair**	**NA**
		69	12	-	-	19
E	**Overal programme organization**	69	12	-	-	19
F	**Would you recommend to others from your institution/country to attend a similar activity in the future?**	**Yes**	**Maybe**	**No**	**NA**	
		82	6	6	6	

1	**Which part of the Activity did you find most useful?** R: Vlietnick's lecture. Dr.Odenthal's lectures. Receptor subjects. Pharmacological aspects. Industrialization, clinical and toxicological assays,norms GMP and quality control procedures.Discussions with the participants. Molecular biology. Screening procedures for the evaluation of medicinal plants.
2	**Which part of this activity do you think should be expanded?** R: Analytical methodologies, pharmacodinamics studies on bioequivalence applied to the herbal remedies. Latinoamerican legislation's point of view. Industrializaion of medicinal plants. Round table and discussions practices.
3	**Which part of the activity do you think should be dropped?** R: Old techniques and legislations. Production of quality medicines.
4	**Any other suggestions for future** R: Production of phytomedicines. Treat only a very concrete aspect and going deep on it. More studies about cases. Include aromatic plants and essenciat oils. More isolation techniques. *In vitro* cultivation trials in medicinal plants.
5	**Do you think that the topics/tools you studied during the course could be used by industries in you country? If so, how? If not, why not?** R: Validation of extraction methods. Clinical studies. Industrialization, quality control, Norms GMP. Knowledge about the requirements to obtain natural products.
6	**Can You suggest any programme and future activities which ICS could pursue in order to help with the technological and scientific advancement of your country?** R: First of all the most of the latinoamerican countries don't have the adequate infrastructure to try to develop a project. Round table with authorities. Quality controls for finished products. Stablity tests for natural products. Help to develop research in tropical diseases as Malaria and Leishmaniasis.

7	**Do you think you have benefited from participation in this course/workshop? If so, how? and your Institution?** R: Yes, my company is very interested on the registration procedure of medcinal remedies. New techniques on quality control and industrialization of medicinal plants. Yes, now I have a better point of view on how the registration, validation and clinical procedures.
8	**How do you intend to disseminate the information you have acquired during the activity once back in your own country?** R: Arrange meetings with the health officials in my country. Make a little conference work and writing abstracts in the work's bulletin. Reproducing the seminar in my country. Given Speech and lectures with all the material to my colleagues and students.

G	Evaluation of Lectures and Speakers	Excellent	Very Good	Good	Fair	NA
1	Course material	88	12	-	-	-
2	Resident Lecture presentation	69	25	-	-	6
3	International Lecture presentation	69	31	-	-	-
4	Ability of lecturers to answer specific questions	69	25	-	-	6

Any Comments

R: The participants wish to emphasize that all the experts gave excellent lectures. This course gave a multidisciplinary approach to medicinal and aromatic plants.They acknowledged ICS/UNIDO for the unique opportunity in participating in such an ambicious multidisciplinary training course, whose goals were completely achieved, The Course overall was excellent, and should be repeated. It was completely excellent, interesting was know the realities of the neighbors countries.

1 The number of questionnaires answered was 21.

2 The figures in the Table of Appendix 4 represent the answers in percentage.

3 NA No Answer

APPENDIX 5

COURSE EVALUATION CYTED

APPENDIX 5
OVERALL COURSE EVALUATION[1,2]

Describe briefly about the follows aspects of the Training Course:

		Excellent	Very Good	Comments	
1	Organization	68	32	See questionnaires	
2	Content	Excellent	Very Good	Fair	
		56	40	4 (far from medicinal plants aspects)	
3	Academic Level	Excellent	Very Good	Good	Comments
		60	36	4	Interesting
4	Adequate Documentation	Excellent	Very Good	Comments	
		88	12	all lectures copies received	
5	Course Objectives Achieved	100%	99-90%	80 - 50 %	Comments
		44	36	8	Questionnaires
6	Future Suggestions	Clinical evaluation	None	Practice	Documentation time before
		8	20	20	20
7	Difficulties	None	No Answer	Language	Comments
		48	40	4	too much information
8	Additional Comments	Comments			
		Congratulations, Well organized; excellent organization; successful course			

1 The number of questionnaires answered was 25.
2 The figures in the Table of Appendix 6 represent the answers in percentage.

APPENDIX 6

HANDOUTS AND THE LITERATURE OF THE COURSE

(Please see The Abridged Folder)

APPENDIX 7

BRIEF CURRICULUM VITAE OF RESOURCE PERSONS

BRIEF CURRICULUM VITAE OF RESOURCE PERSONS

1. Prof. Arnold Vlietnick

Professor and Head of the Department of Pharmacognosy, University of Antwerp, Belgium.

Ph.D. Pharmaceutical chemistry; Postdoctoral work at the University of Wisconsin. Chairman Gr XIII Expert Group, European Pharmacopoeia; Member, Commission of Belgian Pharmacopeia. WHO Collaborating Center on Tropical Medicine. Research on isolation and characterization of natural bioactive principles. Over 200 original publications and book chapters.

1. Prof. Karl Peter Odenthal Med. Vet.

1945, born near Düsseldorf/Grevenbroich/Westphalie. 1966 grammar school, "Abitur" (A level equivalent. 1966, study of veterinary medicine at the Justus Liebig Universität. 1971, Research scholarship at the Veterinary Medical School, Hannover. 1972, Scientific assistant at the Medical School of Hannover, Center for Laboratory Animals. 1972, doctorate in veterinary/laboratory animal medicine confered by the Veterinary Medical School of Hannover. 1972, member of scientific staff of Madaus AG, Köln, department of pharmacology. Since 1982, Head of Department of Pharmacology of Madaus AG, experimental work and scientific communications on general pharmacology, cardiovascular, urogenital and gastrointestinal pharmacology of herbal drug preparations, drug derived constituents and chemical compounds thereof.

2. Patrick Vanderheyden, Ph.D.

Born 12 October 1958 in Hasselt, Belgium. Graduate studies in Biology. 1978 University of Ghent Belgium. Molecular Biology and Biochemistry. Thesis on RNA replicase activity of a RNA virus (MS2), Lab of Prof. Fiens Ghent. Master Degree of Molecular Biology and Biotechnology, 1980, University of Brussels, Belgium. 1987, Ph. D. University of Brussels, Belgium on Molecular Pharmacology of Muscarinic Receptors. 1988-1991, Post Doc at University of Frasbong (France) in Electrophysiology activity of GABA receptors. 1991-1995, In vitro Screening group at Organon (Pharmaceutic Company) OSS Netherlands. 1995-now Research Scientist at Molecular and Biochemical Pharmacology University of Brussels, Head Prof. G. Vorrynelin.

APPENDIX 8

COUNTRY REPORTS

A. Argentina
B. Bolivia
C. Brazil
D. Chile
E. Colombia
F. Costa Rica
G. Cuba
H. Ecuador
I. Guatemala
J. Honduras
K. Panama
L. Peru
M. Republica Dominicana
N. Spain
O. Country presentations, Expert Group Meeting, held in Panajachel,Guatemala in 1993.

COUNTRY: **ARGENTINA**

NAME: **JULIANA PARSONS**

In the Republic of Argentina we have very important advances about phytoterapeutics and herbal remedies's laws, but we are still working on it. This job is made by the way of the Instituto Nacional de Medicaments (INAME/Medicaments National Institute). For this, participants come from Health Public Bureau of the Nation, from several industries and the Universities.

In Argentina, specially in the inner part of the country, infusions of aborigine medicinal plants are massive use by the local people. The elaboration of extracts and "tisanas", are made in all cases under supervision of a Pharmacist and its sale are done in drug stores and herbal stores. At the same way several extracts that come from national and foreign sources are commercialized, mainly for the production of medicinals specialities. Some of them are: *Boldo* dried leaves, *Fucus*, *Ginseng*, *Gingko*, *Hypericum*, Liquid extracts of *Aloe vera*, etc.

The way to get the medicinal plants is going on natural environment with the risk of the over exploitation of the several species. As one consequence of this labor is the extinction from natural habitats of several species and others are in extinction or are endangered For this reason there are numerous projects to try to obtain medicinal plants from cultivation and agriculture methods. Serrana zone (Mendoza, Cordoba) are places where that kind of projects are developed. In the Pampa zone Chamomilla is a very important cultivation, and the Northwest zone is the focus for aromatic species.

One project at this time is the micro propagation of medicinal plants in order to obtain uniform pathogen free material. This biotechnological tool is the most utilized on the modern agricultural system. In Argentina there are species which are already grown by this method for example: *Silibum*, *Baccharis*, *Erythrina* and others. The Ecophysiological Vegetal Center and our group (Industrial Microbiology and Biotechnology from School of Biochemistry and Pharmacy of the University of Buenos Aires) is already working in *Silybum* and *Gingko biloba*.

Some industries in the country are dedicated to obtain essentials oils for the seasoning and cosmetics industries.

About the research work on medicinal plants in Argentina there exist civil associations and university associations that get the ethnobotanic information from several aborigine cultures. One of the main investigator is Dr. Pastor Arena who work in the Northwest zone of the country.

Our group is mainly dedicated in projects: Secondary metabolites production from vegetal cultivates *in vitro* plant tissue-culture and the second is phytoremediation. We utilize *Solanum eleagnifolium* to obtain steroidals alkaloids, *Tagetes spp.*, to obtain biological insecticides *Artemisia annua*, and others plants as *Armoracia lapathifolia*, *Brugmansia candida*.

PROYECTO DE INTEGRACION

COUNTRY: ARGENTINA

DRA. ANA M. GIULIETTI Y JULIANA PARSONS

Conservación de germoplasma de especies medicinales nativas y naturalizadas de la región Sur de Surámerica.

Muchas de las especies vegetales usadas en la medicina o con potencial farmacológico son malezas (*Datura ferox, Silybum marianum, Solanum eleagnifolium,* etc.), que afectan cultivos extensivos (trigo, maíz, etc.). El empleo de métodos químicos de control de malezas pone a estas especies en riesgo de extinción.

Muchas de las especies naturalizadas (*S.marianum*) han desarrollado ecotipos que las diferencian de la especie típica de su lugar de origen, las que presentan ventajas farmacológicas, por lo que su conservación resulta de gran valor comercial.

Por otro lado, la explotación irracional de las especies medicinales autóctonas a través de una recolección no sustentable ya ha producido su casi extinción y pone muchos otras cosas en riesgo de extinción (pepermint, *Baccharis spp.*, etc.).

A fin de conservar este germoplasma, garantizando así la biodiversidad de está región de Surámerica, que a diferencia de otras no es megadiversa, se propone la creación de un banco de germoplasma de estas especies. Para garantizar la fidelidad génica de las especies conservadas se recurrirá al empleo de marcadores bioquímicos uy moleculares.

Para lograr los objetivos propuestos se propone realizar las siguientes actividades:

- Relevamiento de las especies medicinales a través del conocimiento etnobotánico existente de especies usadas en la medicina popular.
- Identificación botánica.
- La conservación se llevará a cabo mediante métodos de cultivo in vitro (micropropagación, cultivos de callos, embriones, etc) los cuales se iniciarán a partir de extractos seleccionados.
- El mantenimiento de los cultivos se efectuará mediante:
  a. Crecimiento retardado en medios de cultivo con el agregado de compuestos retardantes del crecimiento.
  b. Crioprospección.
- Caracterización de la fidelidad génica de los tipos conservados mediante el empleo de marcadores bioquímicos (isozimas) o moleculares RADP(Random Amplified Polymorphyc DNA), AFLP (Amplified Fragment Length Polymorphism), etc.

COUNTRY: **BOLIVIA**

NAME: **LIALIANA RUTH VARGAS**

LABOR PLACE: **UNIVERSIDAD JUAN MISAEL SARACHO**

DIRECCION DE POST GRADO

IN GENERAL, THE DEVELOPMENT OF PLANT-BASED INDUSTRY IS POOR. PROMENAT IS ONE OF THE SMALL SCALE INDUSTRY THAT PRODUCES PLANT EXTRACTS IN SIMPLE DOSAGE FORMS. THERE HAS BEEN A UNIDO MISSION ON THE FEASIBILITY OF PRODUCTION OF ESSENTIAL OILS.

COUNTRY: **Brazil**

NAME: **KARLA FABRES DEUD JOSE**

INDUSTRIAL PHARMACIST/PHARMACOGNOSY PROFESSOR

In Brazil the Phytomedicines since 1995, are under a new legislation. During a long time they were considered not a pharmaceutical products, but a second class products -natural products- only for poor people that hadn't any money to buy the others.

The new legislation put that products in a "Limbus" (wait stage) divided in two steps:

1. That will be finished in January / 2000.

2. That will be finished in January / 2005

But they have to win the first step to receive the second one. The first step means to prove all pre-clinical tests. And if they could pass the second step means all clinical tests. But if they couldn't pass in the first step their licenses will be withdrawn.

The problem now is that only a few industries believe in this legislation, and they think that it will be annuled.

In my case I work for 5 industries and my job is to put their products in accordance with the new legislation. For those reasons I have to know more and more research centers, to make contacts and do all the things that the labs industries need and couldn't do in their places.

Now the plants that are collected in Brazil are wild plants, and my industries are doing contacts with farmers to cultivate their plants under GAP.

The five industries are:

- Laboratory WESP Ltd.
- Laboratory QUIMSOL Ltd.
- Laboratory KLEIN Ltd.
- Laboratory VITAMED Ltd.
- SIBRAS Laboratory Ltd. Which have PNIFF*

*(National Program of Pharmacy Industry and Pharmochemistry Inspection) This means that they follow GMP and are approved from Health Ministry from Brazil

COUNTRY: **CHILE**

NAME: **PATRICIA CARMONA**

During the past 30 years exists on the Chilean population has had interest in the use of natural products.

In Chile there are industries that work exclusively with natural products production for local and foreign customers. The faster increase of this market has been supported by the sustained production and therapeutics alternatives for all kind of illness with an aggressive publicity campaign. However adulterated products were discovered and false claims were made for the products.

Based on the people demand, a legal regulations was enacted in1995 (Resolución exenta No. 758) which determined that all products has to be regulate as a pharmaceutics products.

Several others regulations have been approved since 1995.

At the present time, there is a new project to enact a law which will regulate the registration of phytopharmaceutical natural products.

Industries which produce these types of products are taking several ways to introduce in the market new products under different name not stipulated under laws as example "Health Foods" and try to skip the regulations, but several modifications have been made in the laws and now the government says that the "Health Foods" also have to pass the regulations because they are included in the new category Complementary Pharmaceutic Products. Inside this category, products such as indicated below will be included:

Vitamins which doses are between 0.25 y 2 DDR (daily doses recommended).

Natural Products used for the chemo-preventions (*Vitis vinifera* and other antioxidants), Ubiquinone Q_{10}.

COUNTRY: **COLOMBIA**

NAME: **LUZ MARINA JARAMILLO P.**

I am working at the University of Antioquia, on the Program of Natural Products, At this moment our research aims to study natural products with antileishmaniasis activity.

We are in the first step, which is the development of biossays evaluation for this activity and we are setting up two techniques, which are MMT method and electronic counter. We are going to use two kinds of Leishmania straims: panamensis (UA140) and braziliensis (UA301).

The MMT method consists on the change of tetrazolium salts in a product which is Formazon by mitochondrial dehydrogenases using an ELISA reader at 570 nm.

In the Coulter Counter method we are using a counter z2 which consists in the detection and measurement of change in electrical resistance by cells suspension in a conductive liquid by a small alfa catechol.

The plants studies are from endemics zones of Colombia this research is financied by National Sciences Office COLCIENCIAS.

THE PHYTOPHARMACEUTICAL INDUSTRY IN COSTA RICA

NAME: RUZICKA, JOSE

Costa Rica has around ten thousand (10 000) species of native plants of which close to four hundred are used by man.

The few phytopharmaceutical laboratories which exist in this country have dedicated themselves mainly to the production of aromatic "teas" for popular use, making a simple "tea-bag" of ground dried leaves. Some laboratories even import the raw material to make fill the tea-bags or to pack cans or capsules in blisters.

It is not until very recently that these small industries have had to register their products at the Ministry of Health as medicaments and not simply as food supplements or additives, because a set of regulations have been specifically created for the production and commercialization of phytomedicines. Registration as food supplements was an open door that allowed industrialization of any plant without demonstrating its effectiveness for the intended use. It is my belief that this is the main goal to achieve: giving these laboratories the scientific tools to strongly support their products with hard pharmacological and chemical data. They need access to validation methods and quality control procedures and norms to make sure that the phytomedicaments can be commercialized for the proper use and without endangering the customer with toxic substances or side effects of the medicinal plants used. All this with the idea of not closing the doors to the small industries and to help preventing their extinction.

The rules have been set and we now enter the process of adaptation to the change, which will be achieved slowly but surely.

As said before, most of the few laboratories dealing with plants in Costa Rica dedicate themselves to the production of "aromatic teas" for popular use. This is the case of laboratories like Manza-té, Mondaisa and Kábata. Another laboratory, called San Silvestre, imports the raw material and pack it.

RUTA, S.A. specializes in the preparation of extracts of *Senna alata* and *Lippia alba* and the production of several formulations containing these extracts. At the present time we are developing and agreement with an enterprise called Vougainvillea, S.A., dedicated to the cultivation and improvement of medicinal plants. The idea of this agreement is to join the technical part of cultivation with the industrial part of extraction; in such a way as to guarantee the whole process: going from the cultivation, to the recollection and the extraction and, finally, the obtainment of the end product, with more value added due to a controlled process.

RUTA, S.A. has been working with "Saragundí" (vernacular name for *Senna* alata and *Senna reticulata)* which, together with *Lippia alba,* conform the ingredients of several products with anti-inflammatory activity which, for this reason, are used to treat rheumatism, arthritis, concussions, etc.

This enterprise also contacted CIPRONA for the chemical and pharmacological study of the plants used in its preparations.

This year the laboratory is starting a new project, involving the preparation of an antirheumatic liniment which incorporates *Senna alata, Senna reticulata, Lippia and Capsicum annum.*

Another activity of this enterprise is the cultivation of the medicinal plants we use under organic conditions, free of insecticides and other pesticides, to ensure the safety and quality of the plants used to prepare our products.

Several institutions or centers are dedicated to research on medicinal plants or related natural products. These could help the small industries with scientific support for chemical and biological testing.

The most known are:

1. CIPRONA-UCR, the Center for Research on Natural Products of the University of Costa Rica (UCR). Most of the work here is related to phytochemistry and possible industrial utilization of natural products.

2. The Institute for Pharmaceutical Research (INIFAR), of the School of Pharmacy of UCR. Most of the work here has to do with pharmacology and toxicology.

3. The Center for Agronomic Research (CIA-UCR). Most of the work is agronomic, with a lot of emphasis on biotechnology and soil sciences.

4. The Center for Research on Cellular and Molecular Biology (CIBCM). Most of the work here has to do with viruses, parasites and cancer.

5. The School of Microbiology of the UCR. Most of the work here has to do with viruses, parasites and cancer.

6. The School of Chemistry. Most of the work here is related to phytochemistry and possible industrial utilization of natural products.

7. The Clodomiro Picado Institute of the University of Costa Rica. Most of the work has to do with immunology and snake poisoning but also relates to cancer.

8. The Laboratory for Biological Assays (LEBI). Most of the work has to do with toxicity of the extracts but they also test other activities, like antidiabetic and cardiovascular ones.

9. The Department of Physiology of the School of Medicine of the University of Costa Rica. Most of the work has to do with validation of cardiovascular and central nervous system activity of plant extracts.

10. The Department of Chemistry of the National University of Costa Rica. Most of the work here has to do with chemistry.

11. The Santa Clara Seat of the Technological Institute of Costa Rica. Most of the work here is with biotechnological means for micropropagation of medicinal and aromatic plants, like Ipecac and Curcuma.

12. The Tropical Agronomic Center for Research and Teaching (CATIE). Most of the work is biological. Some work is starting in the chemical area, with the help of CIPRONA-UCR and other center from Central America.

13. INBio. Very well Known for their work with biodiversity prospecting.

In conclusion, in CostaRica we find a large diversity of plants, very few phytopharmaceutical laboratories and a new set of rules for the commercialization of natural products for medicinal purposes. The few laboratories in existence will need a lot of support form the research centers in order to subsist as such or to improve their activities to produce better phytomedicaments.

PROJECT:

Validation of medicinal plants for the most common use.

BASIC PROJECT:
Development of capacity for the quality control

1. Extraction and purification of markers substances that can be active beginners.

2. Development of methods of quali-quantitive analysis of markers.

3. Establishment of norms.
4. Legalization of Norms.

COUNTRY: **CUBA**
NAME: **Jorge Enrique Rodríguez Chanfrau**

ACADEMIC LEVEL: M. Sc. Pharmaceutical Chemistry
WORK IN: Medical Development and Investigation Center (CIDEM)
This Center is divided in departments:

- Experimental Farm
- Department of technology of Natural Drugs
- Department of Finished products
- Department of Toxicology and Pharmacology
- Department of Microbiological Research
- Department of Analysis and Stability

I work in the Department of Analytical and Stability.

This department is in-charge of:

a. Isolation and Characterization of several natural products (animal, mineral and vegetal source)
b. Development of different analytical methods for quality control and stability studies of drugs, extracts, crude and finished products.
c. Development of stability studies of drugs, extracts, crude and finished products.
d. Development of different analytical methods for pre-clinic studies.

The Main Projects are:

- Nutritional Supplements
- *Justicia pectoralis*
- *Aloe vera*

The main medicinal plants which are under study are:

- *Aloe vera*
- *Justicia pectoralis*
- *Cymbopogon citratus*
- *Pimenta dioica*
- *Morinda rojoc*
- others

COUNTRY: **ECUADOR**

NAME: **SANDRA ARCOS**

Ecuador has a very large flora which is already used for research and as phytomedicines producer. The research on medicinal plants is carried out in Ecuador at the Universities, which obtain international grants are obtained.

At this moment a new law about natural products is on discussion. It proposes to have norms to obtain sanitary registration of the herbal products which exists in the stores.

RENASE laboratory is where I work we are dedicated to:

- Elaboration Phytomedicines of from species of Ecuatorian Amazonia.
- Phytochemical control of raw materials.
- Implementation of good practices of manufactures, elaboration and standardizationl of natural products.
- Guide and serve as tutor of students in their professional practices as a prerequisite to obtain their degree.

We produce in the laboratory liquid and semi solids products. We work with Sangre de Drago (*Coton lechleri*), used for some affections of the skins. The commercialization of the products are made in the interior part of the country. Some part of the production of Sangre de Drago is exported to Colombia.

General Situation of Guatemalan Phytopharmaceutical Industry

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1. Introduction

Medicinal plants constitute a wide range of biological resource and important cultural patrimony of the latinoamerican countries, that could be of great utility to contribute towards health of the population. Nevertheless, the practice of natural medicine has been relegated to an empirical practice, although during the last years some advances have been realized by proposing regulation projects in order to legalize these practice. The process is slow and still has not formalized the legalization for the Phytopharmaceutical products in Guatemala.

2. Scope

The popular utilization of medicine plants is an old practice transmitted from generation to generation, and has been the base for the actual validation studies. Its study has permitted to guarantee the utilization of plants for medical preparations through laboratories fortifying, that since some time ago have been dedicating themselves to the phytolagenic production. Since last century these kind of industry has been growing and developing in Guatemala. In 1868 "Sierra laboratory" was found and dedicated ever since to manufacture of pharmaceutical products and natural cosmetics.

The Guatemalan Industry is divided in three types:

1. Artisan, in which simple products are prepared based on tradition, activity that is realized in the rural area by "quacks, midwives" and some times even by workers from the Health Center.

2. Microindustrial: It refers to middle and small Laboratories that manufacture and distribute products. That laboratories have a certain physical infrastructure.

3. Industrial, in which big pharmacochemical production Laboratories have a small line of imported Phytoterapeutics products or they manufacture with imported products.

From the three above mentioned levels it is of big importance to mention that between the, pre-industrial and micro-industrial standards, is where the mayor utilization of medicinal plants is located.

Actually nine registered Laboratories by the DRCAM (División de Registro y control de Alimentos y Medicamentos) are functioning. From this Laboratory only "Laboratory Sierra" and FARMACAPS count with an industrial production. They have a monthly sales production from

more of 50,000 units. Some of its pharmaceutical products, and more popular brands are shown in the following list:

PHYTOPHARMACEUTICAL LABORATORIES AND PRINCIPAL PRODUCTS

BIOLAB: Biogel, Bioinsol, Bioseal.

FARMAYA: AntibactoL, Bronquiol, Diabetol, Jacamed, Mayaderm, Tagedol.

IMPRO: Aloederm

PROVINAT: Alcovinat, Altrinan, Te dormir Ben, te de adelgazar, te digestion.

QUIMICA: Prime material, (boldo, sen, tilo), extract and oil.

SIERRA SUCS: electric balsam, Currant, essence crooned, Ferine, Moore

THOMAE Dr MANN: Alil-Hervall, antireumatico, Hepaplus, Hepatres, Nervoplus.

VIDA: Artinella, Capsulas de ajo, Gastronela, Te digestivo

Quality aspects for companies with pre-industrial level are being taken in order to fulfill the DRCAM norms and requirements. This regulations refer to a good practice of manufacture the adequate conditioning of equipment such as mills, scales, pre-strainers, some of them with filtration systems and sterilization equipment. The encapsulating, filling, and packaging process is made by hand. The Laboratories count with a complete working source, constituted by Botanist, Chemist, Microbiologist and Pharmamacologist.

We could estimate the national market commercializes around 112 Phytopharmaceutical products from this Laboratories. This products are distributed, across nation through drugs stores, groceries and medical clinics. Some references proportionated by DRCAM today, indicate that only 15 products are registered and 30 of them have already an expired register . Furthermore, there are 3 laboratories with a wide plant tinctures production that haven't been registered.

A market study realized by a commercial firm refers that the pharmaceutical market in Guatemala is from around of $27 millions per year, from which 5 % could correspond to phytotherapeutics products. Also, the same study demonstrated, the phytotherapeutics market is highly competitive and could take possession between 10 % to a 15 % in the next 3 to 5 years depending on the advertising campaign. Another data provided by the registered products from the DRCAM in 1991, indicates that 0.66 % from the pharmaceutical products are from vegetal origin.

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PRODUCTION OF ORGANIC PESTICIDES

FROM PLANT EXTRACTS

BIBIANA ZUNIGA
HONDURAS
EXTRACTOS VEGETALES DE CENTROAMERICA

Approximately one third of the world food crop is damaged or destroyed by insect pests during growth, harvest and storage. Losses are considerably higher in many underdeveloped countries. The monetary loss due to feeding by larvae and adults of pest insects amounts to billions of dollars each year. Furthermore, the comfort and well being of humans and beneficial animals are affected directly by household and environmental pests such as lice, ants, roaches, ticks, wasps and mosquitoes, some of which are disease carriers and transmitters. Any of the synthetic pesticides previously used for insect control have been banned because of concern about health and environmental effects. Also, the adaptability of insects threatens to determine the effectiveness of existing pesticides. It is, therefore, imperative that safe, biodegradable substitutes for synthetic pesticides be discovered.

The inappropriate use of chemicals for plague control in our country has caused the contamination of rivers and watersheds that provide water to different communities. The intoxication of people and animals because of these pesticides has turned to be unmanageable. Honduras has started the use of organic pesticides on banana, coffee, aloe, and pineapple, but these have to be imported from other countries in Central America and from the United States at very high prices. The need of organic products sold at a lower price has grown incredibly.

In order to satisfy this need we are trying to develop the appropriate technology for the production of botanical insecticides and fungicides. Considering the natural resources that our country can provide and the effectiveness of plants as insect repellents we decide to use the following plants:

- Garlic *Allium sativum* Insecticide
- Annona *Annona squamosa* Insecticide
- Hombre grande *Quassia amara* Insecticide
- Neem *Azadirachta indica* Insecticide
- Grapefruit seed Fungicide, bactericide
- Papaya leaf *Carica papaya* Fungicide, bactericide
- Soaps of fatty acids of African palm tree, Insecticide

Our project consists of three stages

1. Laboratory stage: Extraction and concentration of each plant. Determine if the extraction is feasible with the solvent chosen.
2. Handling of equipment with 15 - 20 kg of raw material. Preparation of formulated product and estimation of production costs. Preparation of literature for possible buyers.
3. Industrial stage: Extraction and concentration of the plant extract in large quantities. Production of the pesticides for public sale.

COUNTRY: PANAMA

In Panama, health care coverage is rather good. There are five Amerindian groups who use traditional medicinal plants for the treatment of their ailments. Country spends over US $60 million on drugs. However, phytomedicinals are not considered. There are 13 pharmaceutical manufacturing firms in Panama. Two local companies commercialize medicinal plants. *Hibiscus sabadariffa* and *Zingiber officinales*. Traditionally, ipecac has been exported from Panama, however, recent export statistics are not available. There is one local pharmacy that expends dried herbal drugs. Panamanian Flora is very rich (8,000 - 10,000 in total) and approximately 12% of the species are endemic.

Present status of research on Panamanian Flora was discussed. Pharmacognostic Research Center on Panamanian Flora in the School of Pharmacy of the University of Panama carries out multidisciplinary research aimed at isolating and characterizing bioactive principles from plants used in traditional medicine. Ethnobotanical inventories of Cuna and Guaymi Indians are available. Thirty new chemical compounds and 97 known compounds have been isolated from Panamanian Plants for the first time. Currently we are undertaking collaborative projects on bioprospecting and utilization of Central American Biodiversity with Smithsonian Tropical Research Institute. This research is funded by National Institute of Health, Fundacion Natura and Organizations of American States. The Center has organized many international training courses and offered its expertise to other centers. Panama has expressed an interest in receiving preparatory assistance from the UNIDO for designing a Technical Cooperation Project aimed at industrialization of medicinal plants. Assistance is needed in agrotechnology, unit processes and process technology, *in vitro* tissue cultures and formulation and production of phytopharmaceuticals products. Panama through the School of Pharmacy of the University of Panama, in an earlier UNIDO Mission, had expressed its desire to be the site for "Center for Information, Training, and Reference for the Pharmaceutical Industry for Central America". This possibility is still viable.

The Center is site for CYTED Subprogram X. International Coordination.

COUNTRY: **PERU**

NAME: **PABLO BONILLA**

STUDIES: MEDICINAL CHEMISTRY
WORK ON: UNIVERSIDAD NACIONAL MAYOR DE SAN MARCOS, LIMA
INSTITUTO DE QUIMICA ORGANICA APLICADA LA FARMACIA,
FAC. DE FARMACIA Y BIOQUIMICA, PROFESSOR
RESEARCH AREA: CHEMISTRY OF NATURAL PRODUCTS IN MEDICINAL PLANTS
EQUIPMENTS: HPLC, UV-VISIBLE, I.R.

PAPERS

- Estudio Fitoquímico de Gentianella alborosea (nitida) hercacampuri in association of IQOAF-UNMSM and the National Institute of Health Sciences Tokyo Japan.

Studies on the following plants:

Piper angustifolium: called matico. In collaboration of Dr. A. Arroyo. Antiinflamatory activity,

Peperomia spp.: Collaborator of Dra. Eleucy Perz, M. Sc. Domingo Iparraguirre.
Blood pressure activity.
Red algae: Collaborator of Pharmaceutic Chemistry César Fuentes R.
Sulphated Polysaccharid with activity against HIV.
Solanum spp. and Baccharis spp.: Saponins and steroids studies.

- Laboratories INDUQUIMICA:Production of lyophilized extracts from Cat claw-Uña de gato. Collaborator of Dra. Elena Li Pereyra.

Chemical components of Peruvian Folk Medicine " Hercampri"
(Gentianella alborosea)
Nobuo Kawahara, Masato Nozawa, Diana Flores, Pablo Bonilla, Sestuko Sekita, Motoyoshi Satake

Gentianella alborosea (Gentianaceae), a biennial medicinal plant growing, in the Amazonic area, is commonly known as "Hercampuri" or "Hircampure". The aqueous extract of the whole plant has been used in traditional Peruvian medicine as a remedy for hepatitis, as a cholagoge and in treatment of obesity.

In the course of our searching, bioactive metabolites from the above medicinal plant, we isolated seven xanthones and. three phenolic compounds from the chloroform extract of the whole plant, and further investigation of this extract led us to isolate novel sesterterpenoid with a new skeleton designated as alborosin.

The structures of these compounds were determined on the basis of the spectroscopic methods, including a variety of two-dimensional NMR techniques.
A large number of xanthones and flavonoids have been isolated from Gentianaceae family. However. alborosin is the first example of sesqueterpene with a new skeleton. Detail of the exact structural elucidation of alborosin and its biological activities are now under investigation.

The Development of Phytomedicines based on Medicinal Plants of the Dominican Flora.

Executive institutes: Instituto de Medicina Dominicana and Dep. of Pharmacy, School of Medicine, Universidad Autónoma de Santo Domingo.

Responsible: Carles Roersch, Ph.D.

Address: Apartado Postal 160
Santo Domingo
Dominican Republic
Tel./Fax: (809) 681 5373
E-mail: croersch@codetel.net.do

Duration: 5 years

Estimated costs: US$1,000,000.00

Collaborating institutes (interested): College of Pharmacy, University of Illinois at

Chicago, USA; University of Utrecht, The Netherlands; University of Antwerp, Belgium
The Drug Research and development Center, Cuba; CYTED Sub program X-B.

PROJECT OUTLINE

The project can be divided into four phases:

Phase I: The systematization of the medicinal plants in the Dominican Republic.

The systematization of the medicinal plants is fundamental for the development of phytomedicines. In the Dominican Republic hardly exists literature on the traditional use of medicinal plants. The high presence of endemic plants (more than 30 %) in the Dominican flora makes it very interesting to explore this flora.

Phase II: The selection of the medicinal plant(s).

The medicinal plants will be selected using the following criteria:

- A well describes use in Traditional Dominican Medicine.
- The frequency of the illness or disease for which the plant is applied.
- The plants should be innocuous.
- The availability of the plants.

Phase III: The elaboration of the phytomedicine.

The following investigations will enter in this phase:

- Phytochemical research: determination of active components and the elucidation of its molecular structure.
- Microbiological research: biological and pharmacological assays to determine biological activity.
- Toxicological research: acute and chronic toxicity (when necessary).
- Clinical research: when needed clinical trials should be effectuated.
- Quality control: effective methods for quality control should he developed.

Phase IV: The production, registration and marketing of the phytomedicine.

The production of the phytomedicine should subscribe the international standards of "Good Manufacturing Practice". Also the product information must include all the necessary information for the consumer. The proposed guidelines of WHO will be followed.

INSTITUTO DE MEDICINA DOMINICAN (IMD)

Our main objective is to contribute to the formulation of a health system that is within the reach of the people, culturally as well as economically. It is very important to idealize that a health system should have its roots in the culture of the population, people should feel themselves at home in their health system.

The Instituto de Medicina Dominicana (IDM) does research on the Traditional Dominican health system. The Institute conducts research into the social and medicinal aspects of the traditional practices. A specialized library and herbarium has been developed. The Institute is also involved in education, working closely with local health groups and other organizations active in this field. Research focuses on documenting the plants and their medicinal properties. The results are compared between different communities, and with the international literature. By promoting the use of those remedies known to be effective, the Institute seeks to strengthen the traditional health system. The results of its work are returned to the communities through meetings and also in its publications. Lately the IMD has started to explore the possibilities to produce phytomedicines based on native Dominican plants.

A range of leaflets and booklets has been produced for the use by local people, as well as more technical works aimed at health professionals. The Institute offers consultancies in a wide range of topics related to traditional medicine, health-system interactions and medicinal and aromatic plants and essential oils. (For example, it has previously advised on medical-anthropological studies. production protocols for medicinal plants and their derivatives, and environmental impact studies).

MEDICINAL AND AROMATIC PLANTS THE DOMINICAN REPUBLIC

12. Medicinal plants market

Medicinal plants are widely used in the Dominican Republic. However literature data isn't very abundant. In our Institute we have elaborated a bibliography of the traditional Dominican Medicine (Roersch, 1997). Within this bibliography the publications concerning medicinal plants are mentioned. Botanist or physicals (biblio) make the majority of the publications. In the some, publications. In the eighties some publications arise from private institutions or universities (Bonelly de Calventi et al., 1985a, 1985b, Robineau, 1986). Lately some monographs of medicinal plants were published in the home page of the Dominican Academy of Science in a local newspaper (Roersch, 1996). However articles about the economic aspects of medicinal plants or markets place and in the countryside the farmers have them cultivated in their backyard.

1.1_ Export of medicinal plants in the Dominican Republic

Like in so many other countries in the Dominican Republic the medicinal plants aren§t classified with a separate code in the export lists of products. In the Dominican Center of Export Promotion (CEDOPEX), medicinal plants are, classified with the code 1207. This code holds: plants, parts of plants, seeds, and fruits of the specie, used in perfumery, medicine, or as insecticide, pesticides and analogs, fresh, dried, cut, triturated, or ground. This description makes it very hard to distinguish medicinal plants in the export data. In table 1, are mentioned the plants which are exported from the Dominican Republic who also have a medicinal value. Sábila (*Aloe vera*) and its derivates is the main export product. The main destination is the USA. Hojas de plants (Plants Leaves) is the second most important export product. However we don{t know which " leaves " are exported. "Oregano" (*Lippia micromera* var. *Helleri*) is mainly to Puerto Rico and the USA.

1.2 Import of medicinal Plants in the Dominican Republic

Specific data about the import of medicinal plants are not available. In the table 2 the medicinal plants are placed in the category of "las demas plantas, partes de plantas, de las utilizadas principalmente en perfumeria y medicina". The Oregano mentioned is the European specie and possible used in restaurants in the country.

In the table 3, the export and import of medicinal plants from Germany is mentioned. In Germany exists a more precise registration of the medicinal plants. Quassia wood extract, manna, liquorice roots, linden flowers and leaves and quina bark are the medicinal plants imported from Germany.

Chamomile is also imported but in very small quantities. The main users of these imports are the pharmaceuticals industry.

II The Aromatic Plants market.

In the Dominican Republic a considerable amount of aromatic plants are commercialized on the local market. The local flavor industry like BALDOM (sauces, ketchup, etc.) Is the main consumer. We divided the aromatic plants in spices, seasonings and essential oils.

II.1. Spices

The spices are a intrinsic part of the Dominican cuisine. Nutmeg, clove and various peppers are widely used. The plants are sold in small plastic bags in mainly supermarkets and small shops.

II.1.1. The import of Spices

In table 2 the import spices in the Dominican Republic are mentioned. The main spice imported is clove. In table 9 we have resumed the import of the spices between 1993.

Table 9. Total import in US $ of Spices in the Dominican Republic between 1993 and 1996.

SPICES	VALUES (US $)	VALUE (RD $)
Clove and derivates	2,293,000.00	32,102,000.00
Nutmeg (triturated or not)	1,039,000.00	14,546,000.00
Aniseed or badiana	306,000.00	4,284,000.00
Others	4,735,000.00	66,290,000.00

1 US $ ~ 14 RD $

In table 4 the import of spices from the United States are mentioned.

II.1.2. Export of spices from the Dominican Republic

In table 5 the different spices which are exported are mentioned. Traditional spices like clove and nutmeg are exported since 1994. They are mainly exported to Haiti.

II.2 Seasonings

The seasoning are sold fresh or dried. In every shop or supermarket you can buy them like coriander (*Coriandrum sativum*), basil (*Ocimum*), garlic, (*Allium Sativum*), Oregano (*Lippia micromera* var *Helleri*), and various types of peppers (*Capsicum sp.*). The local production is sufficient to supply the local market. Oregano is produced in large quantities (180 - 205 tons annually). The main consumer is BALDOM, a flavor industry.

II.2.1. **The import of seasonings**

In table 2 you can see that there is one herb mentioned: oregano. All the seasonings like curry, which are not cultivated in the Dominican Republic, must be included in the file " others " in table 9.

II.2.2. **The export of Seasonings**

In table 5 the export of seasonings from the Dominican Republic are mentioned. Coriander seeds are most important export products. The main destiny is the USA and Puerto Rico. In table 5 the import of seasonings in the USA from the Dominican Republic is mentioned.

III. The essential oil market

Introduction

The Dominican Republic has an old local essential oil industry. Three products have a large history: bitter orange (*Citrus aurantium*), bay rum (*Pimenta racemosa*), and Ozua (*Pimenta sp.).* These three oils are produced in a rather rustic manner. Only the main producers of juices have more sophisticated equipment.

The Dominican Republic is considered as an essential oil producing country. The export is estimated to be around US $ 1 million a year (Verlet, 1993).

III Import of essential oils

Until 1971 in the national statistics essential oils were mentioned with their own code. In 1969, 71.1 tons of lemon oil was imported and 111.3 tons in 1971. In table 10 the import of essential oil and derivates are mentioned.

PRODUCT	1993	1994	1995	1996	1997
Essential and derivates	2,161	1,301	1,666	1,198	905
Mixtures of odoriferous substances used in cosmetics, etc	2,655	2,114	2,073	2,521	1,671
Total	4,816	3,415	3,739	3,739	2,576

* Value in thousands of US $.

III Export of essential oils

The principal essential oil, which the Dominican Republic exports, is bitter orange oil. The main destination is th USA. The volumes of the oils are low. When we compare these data with the import data of essential oils imported by the USA from the Dominican Republic we see another

picture. In table 8 one can observe that the Dominican exports almost US $ 800,000.00 inessential oils to the USA. The data presented by Verlet (1993), that the Dominican Republic exports almost one million dollar in essential oils practically confirmed with the export to only the USA.

The main industries that use essential oils in the Dominican Republic are the pharmaceutical Industry, the flavor and food sector and perfumery and cosmetics.

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TABLE No. 1

PRODUCTO	1990		1991		1992		1993		1994		1995		1996	
	PESO KG.	VALOR* US$	PESO KG.	VALOR US$	PESO KG.	VALOR US$	PESO KG.	VALOR US$	PESO KG.	VALOR US$	PESO KG.	VALOR US$	PESO KG.	VALOR US$
Sábila	3,424,244	598,274	4,326,206	610,893	1,021,383	353,925	53,149	97,342	70,599	33,556	34,545	4,560	190,379	225,080
Cristal de Sábila	341,706	174,266	326,381	171,397	2,357,940	756,027	1,888,823	701,837	4,520,749	1,383,889	5,456,806	1,386,332	4,533,952	1,545,570
Cáscara de Sábila molida	-	-	-	-	-	-	-	-	249	290	3,494	4,578	1,333	1,508
Orégano	32,998	15,971	26,353	14,576	23,030	15,776	44,779	37,987	43,880	26,286	79,884	59,168	53,860	39,382
Hojas de Limoncillo	-	-	-	-	20,981	3,775	38,820	9,584	65,736	12,594	66,496	15,353	69,725	15,440
Jugo de Sábila	18,371	15,015	96,143	73,840	74,098	46,758	-	-	-	-	13,555	33,907	13,769	12,617
Sábila molida	448,251	74,146	240,013	53,962	516,878	314,119	68,919	53,809	32,052	93,695	21,890	6,428	19,106	8,302
Sábila molida (en polvo)	-	-	-	-	-	-	-	-	754	876	1,348	1,566	5,629	3,316
Flores de Tilo	-	-	318	73	-	-	97	26	455	166	83	16	-	
Raices de Pachuli	241	91	-	-	1,780	403	85	33	1,620	427	256	137	82	25
Hojas de plantas***	164,598	43,484	255,000	105,009	151,930**	116,205**	63,408	42,957	62,742	113,849	56,631	66,483	18,823	9,460
Bejuco de Indio	-	-	-	-	91	80								
Polen procesado	7,422	12,145	23,162	16,675	3,235	11,177	-	-	2,850	6,442	4,656	13,048	747	8,195
TOTAL	4,437,831	933,392	5,293,576	1,046,425	4,171,346	1,618,245	2,158,080	943,575	4,801,688					

Exportación de varios productos no-tradicionales , entre 1990 y 1996.
*Valor FOB en US$
**La suma de los rubros "Hoja de Planta" y "Hojas de Plantas"
Fuente: CEDOPEX.

TABLE No. 2 *Importaciones Nacionales fob. de la República Dominicana, de plantas, especias, aceites esenciales y sustancias odoríferas del tipo de las utilizadas en las industrias farmacéuticas o de cosméticos * 1993-1997*

Concepto	(En miles de US$) 1993	1994	1995	1996	1997**
- Orégano (Origanum vulgare) incluso cortado en ramas o pulverizado *País : Estados Unidos*	-	3	-	-	2
- Las demás plantas, partes de plantas de las utilizadas principalmente en perfumería y medicina. *País : Estados Unidos*	15	57	63	62	13
- Canela y flores del canelero, triturada o no. *Países : Estados Unidos, Honduras*	636	794	338	525	346
-Nuez moscada, triturada o no. *País : Estados Unidos*	520	209	90	220	140
- Semillas de anis o de badiana *País: Estados Unidos*	70	123	41	72	19
-Las demás especias: Vainilla, clavo dulce, laurel etc. *Países : Estados Unidos, China, España, Singapur*	1,200	1,329	997	1,209	416
- Aceites esenciales y subproductos residuales (Destilados acuosos aromáticos). *Países : Estados Unidos, España, Puerto Rico, Brasil, Perú Alemania.*	2,161	1,.301	1,666	1,198	905
- Muelas de sustancias odoríferas, de las utilizado en las industrias de jabón, perfumería o cosméticos incluso las disoluciones alcohólicas. *Países: Estados Unidos, España, Puerto Rico, Brasil Alemania, México, Panamá, Francia, El Salvador, Suiza.*	2,655	2,114	2,073	2,521	1,671

TABLE No. 3	1991		1992		1993		1994	
PRODUCTO	PESO KG.	VALOR DM.*	PESO KG.	VALOR DM.	PESO KG.	VALOR DM.	PESO KG.	VALOR DM.
Plantas,partes de plantas ,semillas y otros	4,700	18,000	7,500	31,000	5,600	30,000	14,300	64,000
Raiz de Regaliz	0	0	0	0	200	1,000	0	0
Corteza de Quina	500	2,000	1,000	4,000	no data	no data	no data	no data
Flor y hoja de Tilo	no data	no data	no data	no data	700	5,000	1,900	16,000
Extracto de Quasia, Aloe, Maná	no data	no data	no data	no data	300	3,000	0	0
TOTAL	5,200	20,000	8,500	35,000	6,800	39,000	16,200	80,000

Importación de plantas medicinales en la República Dominicana desde Alemania entre 1991 y 1994.
* El valor de las importaciones esta expresado en Marcos Alemanes.
Fuente: Lange, Schippmann, 1997.

	1991		1992		1993		1994	
PRODUCTO	PESO KG.	VALOR DM.*	PESO KG.	VALOR DM.	PESO KG.	VALOR DM.	PESO KG.	VALOR DM.
Plantas ,partes de plantas semillas y otros	0	0	0	0	0	0	6,700	6,000
TOTAL	0	0	0	0	0	0	6,700	6,000

Exportación de plantas medicinales desde la República Dominicana hacia lAlemania
* El valor de las exportaciones está expresado en Marcos Alemanes.
Fuente: Lange, Schippmann, 1997.

TABLE No. 4	1992		1993		1994		1995		1996	
ESPECIAS HIERBAS CULINARIAS	PESO KG.	VALOR US$	PESO KG.	VALOR US$	PESO KG.	VALOR US$	PESO KG.	VALOR US$	PESO KG.	VALOR US$
Anis (semillas)	0	0	0	0	544	3,950	0	0	0	0
Pimienta (Capsicum)	3,300	7,300	4,800	14,700	41,728	120,968	0	0	0	0
Cardamomo	0	0	0	0	0	0	506	6,352	0	0
Clavo de Olor	0	0	0	0	384	4,202	0	0	0	0
Cilantro (semillas)	12,700	15,100	4,500	6,800	0	0	17,005	15,290	21,058	23,525
Ajo, (dehidratado)	2,000	4,900	1,000	2,900	21,680	26,942	0	0	960	3,066
Macis	200	3,500	0	0	0	0	0	0	0	0
Nuez moscada	19,300	28,800	21,300	31,900	20,320	30,480	35,553	23,100	0	0
Mostaza (semillas)	0	0	0	0	0	0	11,165	7,325	7,865	6,410
Mostaza (preparada y polvo)	0	0	3,000	3,100	3,296	7,750	0	0	847,658	816,609
Cebolla (dehidratada)	8,000	19,900	4,000	12,900	62,870	149,019	103,729	157,497	61,576	53,278
Pimienta (blanca y negra)	1,600	6,500	3,200	7,500	12,983	29,407	5,121	28,851	8,052	37,219
Tomillo (hojas)	700	3,300	0	0	0	0	0	0	0	0
Curcuma	0	0	0	0	2,443	8,640	4,083	13,830	4,083	14,700
Otras especias y condimentos	31,600	50,700	34,800	52,600	46,017	114,655	92,243	266,688	45,299	164,031
TOTAL	79,600	140,000	76,600	132,400	212,265	496,013	269,405	518,933	996,551	1,118,838

Exportaciones de especias y hierbas culinarias desde los Estados Unidos de America hacia la República Dominicana.
* Valores FOB en US$
Fuente: Tropical Products, 1995, 1996, 1997

TABLE No. 5	1990		1991		1992		1993		1994		1995		1996	
ESPECIAS y/o CONDIMENTOS	PESO KG.	VALOR* US$	PESO KG.	VALOR US$	PESO KG.	VALOR US$	PESO KG.	VALOR US$	PESO KG.	VALOR US$	PESO KG.	VALOR US$	PESO KG.	VALOR US$
Semillas de Cilantro	168,539	72,879	130,437	79,863	149,783	102,698	178,917	97,129	165,669	81,249	169,332	81,822	63,354	52,752
Semillas de Anis común	-	-	46	37	-	-	-	-	-	-	-	-	30	54
Jengibre	170,499	57,437	83,497	37,132	24,331	14,014	36,776	14,992	96,659	32,662	18,699	8,233	16,309	8,568
Pimienta sin triturar o pulv.	-	-	-	-	-	-	-	-	3,000	5,520	8,022	11,810	30,939	16,937
Especies en lata	-	-	-	-	97	20	139	116	2,106	2,093	-	-	465	850
Moscada (Enamoscada)	-	-	-	-	-	-	-	-	6	23	208	797	30	54
Clavo dulce	-	-	-	-	-	-	-	-	2,608	3,226	14,343	13,370	20,416	16,085
Canela sin triturar ni pulve	-	-	-	-	-	-	-	-	573	863	2,345	2,532	487	416
Malagueta	-	-	-	-	-	-	-	-	-	-	-	-	30	54
TOTAL	339,038	130,316	213,980	117,032	174,211	116,732	215,832	112,237	270,621	125,636	212,949	118,564	132,060	95,770

Exportaciones de especias y/o condimentos entre 1990 y 1996
*Valor FOB en US$
Fuente: CEDOPEX

TABLE No. 6	1992		1993		1994		1995		1996	
ESPECIAS HIERBAS CULINARIAS	PESO KG.	VALOR US$	PESO KG.	VALOR US$	PESO KG.	VALOR US$	PESO KG.	VALOR US$	PESO KG.	VALOR US$
Capicum or red pepper	0	0	0	0	2,913	1,752	2,789	1,677	0	0
Capsicum (otros) no en polvo	0	0	0	0	993,542	193,940	403,208	101,701	30,032	24,788
Cilantro	2,400	1,800	2,400	2,300	3,919	1,728	14,379	19,137	65,856	80,590
Jengibre, no en polvo	17,000	4,200	5,200	1,400	5,874	5,010	0	0	18,813	30,411
Orégano	3,900	3,400	0	0	0	0	16,216	23,205	0	0
Orégano, no crudo	0	0	2,500	1,700	2,500	2,679	17,900	13,295	14,357	15,189
Pimienta,blanca y negra,polvo	0	0	2,600	4,100	0	0	0	0	0	0
Otras especias	46,500	31,100	16,100	17,100	58,200	80,760	22,835	36,250	2,858	3,065
TOTAL	69,800	40,500	28,800	26,600	1,066,948	285,869	477,327	195,265	131,916	154,043

Importación de especias y hierbas culinarias en los Estados Unidas desde la República Dominicana entre 1992 y 1996
*Valores FOB en US$
Fuente: Tropical Products, 1995, 1996, 1997

TABLE No. 7	1990		1991		1992		1993		1994		1995		1996	
ACEITE ESENCIAL	PESO KG.	VALOR* US$	PESO KG.	VALOR US$	PESO KGG.	VALOR US$	PESO KG.	VALOR US$	PESO KG.	VALOR US$	PESO KG.	VALOR US$	PESO KG.	VALOR US$
Aceite naranja agria	12,069	123,750	10,709	87,845	14,049	149,520	8,740	83,315	8,189	118,156	3,982	61,451	6,437	70,223
Aceite de cítricos	5,645	40,855	-	-	901	14,717	327	1,544	-	-	-	-	-	-
Aceite de lima	2,219	15,920	-	-	1,222	19,344	1,442	8,418	-	-	-	-	-	-
Aceite de veliver	-	-	-	-	-	-	1,689	662	-	-	-	-	-	-
Aceite esencial (otros)	-	-	-	-	800	2,816	75	20	55	6,047	-	-	-	-
TOTAL	19,933	180,525	10,709	87,845	16,972	186,397	12,273	93,959	8,244	124,203	3,982	61,451	6,437	70,223

Exportación de aceites esenciales en la Rep. Dominicana en los años 1990 hasta 1996.
*Valor FOB en US$
Fuente: CEDOPEX

TABLE No. 8	1992		1993		1994		1995		1996	
ACEITE ESENCIAL	PESO KG.	VALOR* US$	PESO KG.	VALOR US$	PESO KG.	VALOR US$	PESO KG.	VALOR US$	PESO KG.	VALOR US$
Aceite de Naranja	12,182	199,000	4,133	49,100	8,372	159,629	7,973	127,090	7,244	122,047
Aceite de Lima	1,822	30,900	0	0	0	0	0	0	0	0
Otros aceites esenciales	11,028	473,400	18,832	602,500	11,618	483,679	11,430	539,910	13,730	566,096
TOTAL	25,032	703,300	22,965	651,600	19,990	643,308	19,403	667,000	20,974	688,143

Importación de aceites esenciales en los Estados Unidos de America desde la República Dominicana entre 1992 y 1996

COUNTRY: **SPAIN**
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In Spain, there are many cosmetic, pharmacy and food industries dedicated to plant extraction.
Most of these industries are in the food branch, and their main product is the sweet paprika and capsicum resins. They are located mainly in the Murcia region.
The cosmetic and pharmacy industries are located in Barcelona and Murcia and although they are young industries they have a good international prestige.

DESHIDRAFARM,S.A., is a spanish company integrated in the pharmaceutical group named ASAC PHARMA, and is located in Murcia.
The objectives of DESHIDRAFARM are the research and development of plant extracts in industrial scale, that are comercialized as phytomedical drugs by the pharmaceutical laboratories belonging to ASAC group and by other external labs.
Despite of been a young industry (only 4 years) we already have developed and comercialized many powdered extracts, as *Polypodium aureum*, *Capsicum annum*, *Hipericum perforatum*, *Curcuma longa*, *Smilax officinalis*, *Medicago sativa*, *Urtica dioica*, *Tanacetum parthenium*,..etc.
Beware, we have investigated their chemical composition and we have isolated several active ingredients as capsaicin, curcumin, unkonan, phytoecdysones and more.

DESHIDRAFARM has participated in the development of two IBEROEKA projects, one for the screening of pharmacological active ingredients of Iberoamerican plants, and the other for the technological development of *Hypericum perforatum*.

We have a quality control lab that using HPLC and GC technics assure the quality of our products, as well during the manufacturing process as in the final product.
That is the reason that DESHIDRAFARM holds the quality system certificate AENOR ER-0549/2/97 for the "Production of plant extracts" and for the standard ISO 9002.
Nowadays we are trying to increase our quality system introducing the Good Manufacturing Practices.

For all of this and due to the great development that are suffering the phytopharmaceuticals in the world, the perspectives to long and short terms are extraordinary.

A COPY OF THE COUNTRY PRESENTATION HELD AT PANAJACHEL, GAUTEMALA IN 1993, DURING THE EXPERTS GROUP MEETING IS ALSO ATTACHED HEREWITH FOR COMPARISON PURPOSES

COUNTRY PRESENTATIONS

Argentina

In Argentina there are over 700 medicinal and toxic plants. Plant-based industries are very few, even though in Argentina there are over 150 pharmaceutical companies. Argentina imports around 500 tons of plant extracts for medicinal uses (estimated in US $ 8 million) and some 20 tons of vegetable heterosides (US $ 15 million), while it exports around 460 tons of plant extracts (US $3000,000) and 11 tons of plant heterosides (US $1.5 million). This excludes aromatic plants. German chamomile (*Matricaria recutita*) is an important aromatic plant, whose export is estimated at US $20 million.

Argentinean Pharmacopeia lists 57 plant species, of which 20% are native. Argentina still does not accept patents. There are serious attempts towards, establishing the guidelines for the national legislation on the use of herbal products.

Information on research and development centers in Argentina was also provided.

Bolivia

In general, the development of plant-based industry is poor. PROMENAT is one of the small scale industry that produces plant extracts in simple dosage forms. There has been aa UNIDO mission on the feasibility of production of essential oils.

Brasil

The pharmaceutical market in Brazil is estimated at US $3 billion per year and 2/3 of the population has no access to modern drugs. The participation of phytopharmaceutical products in the total market is estimated at less than 2%. The import of medicinal plants, plant extracts, essential oils, glycosides, alkaloids and steroidal hormones in 1991 reached a figure of US $ 46 million.

Insofar as the export of medicinal plants, plant extracts and pure phytochemicals, pilocarpine (10,000 kg @ US $ 1,300/kg) and rutin (250-300 tons @ US $ 23.00/ton) are the most important. The other plant extracts that are produced in large scale are extracts of *Cynara scolymus*, *Glycyrrhiza glabra*, *Atropa belladonna*, *Rheum palmitatum*, *Rhamnus purshiana*, *Solanum paniculatum*, *Paullinia cupara* and *Cymbopogon citratus*.

There are six medicinal plants, which have been validated scientifically and can be recommended for use: *Ageratum conyzoides* (antiinflammatory), *Cecropia glaziovii* (Hypotensive), *Maytenus ilicifolia* (Antiulcer), *Mikania glomerata* (Bronchodilator), *Passiflora edulis* (Sedative) and *Phyllanthus niruri* (Kidney stones). These plants are being studied from the agronomic point of view so that they can be cultivated in large scale. Medicinal Plants Germplasm Center in Brazil maintains many accessions of medicinal plants. Brazil, in addition, is developing cultivation of introduced plants such as *Digitalis lanata*, *Duboisia myoporoides*, *Duboisia leidtschardtii*, *Atemisia annua*, and *Papaver bracteatum*.

There are many excellent Centers of research in Brazil, which carry out different aspects of medicinal plants research. Paulista School of Medicine, University of Sao Paulo, Federal University of Rio de Janeiro, and the University of Campinas among others are worth mentioning. It has recently signed a contract with a foreign drug company (Rhone Poulanc) to develop 5 phytopharmaceutical products with bronchodilator, antiulcer, analgesic, antiinflammatory and anorexic properties. This represents a joint - venture of over US $ 1.0 million.

Chile

Chile exported over US $2.5 million worth of medicinal plants in 1992, of which Quillaia amounted to US $ 715,654. *Melissa officinalis*, *Peumus boldus*, *Matricaria chamomila*, *Lippia citriodora*, *Rosa perruna*, *Foeniculum vulgare*, *Smilax medica*, *Buddleja globosa* and *Polygonum sanguinaria* are also important export items.

Phytopharmaceutical industry is not so well developed. Recently, the Ministry of Health has created a Traditional Medicine Unit to look into all aspects of alternative medicine. Interinstitutional committees have been set up to look into the registration of herbal products.

Colombia

There is no well defined governmental policy on the industrial uses of medicinal and aromatic plants. There are small scale companies that prepare phytomedicinals, the quality of the products is, in general, poor. The following medicinal plants were noted as important: *Brugmansia sanguinea*, *Brugmansia arborea*, *Brugmansia candida*, *Cinchona officinalis*, *Cinchona ledgeriana*, *Cephaelis ipecacuanha*, *Solanum marginatum*, *Aloe vera*, *Myroxylon toluifera*, *Salvia palaefolia*, *Calendula officinalis*, *Ocimum basilicum*, *Anacardium occidentale*, *Urtica urens*, *Spilanthes americana*, *Curatella americana*, *Ilex guayusa*, *Physalis peruviana*, *Ruta graveolense*, *Portulacea oleracea*, *Senna spectabilis*, *Bidens pilosa*, *Palicourea ovalis* and *Bauhinia picta*. Among the important aromatic plants which are cultivated are: *Eucalyptus globulus*, *E. citrodora*, *Mentha arvensis*, *M. spicata*, *Illicium verum*, *Pimpinella anisum*, *Foeniculum vulgaris*, *Pelargonium graveolens*, *Cananga odorata*, *Rosmarinus officinalis*, *Elettaria cardamomum*, *Laurus nobilis*, *Citrus reticulata*, *aurantifolia*, *limonus* an *Coridothimus capitatus*. Lemongrass is collected from wild sources.

Colombia expects UNIDO to offer technical assistance in technology transfer, training of its personnel in the manufacture and quality control of phytomedicinals, genetic improvements of crops, and feasibility and marketing studies.

Costa Rica

Costa Rica has a very rich biodiversity per km^2. Government has not established sound policies in the use and industrialization of medicinal plants. Steps are being taken towards settling up of a National Committee for Medicinal Plants, similar to the one in Guatemala. Central American Tropical Research and Education Institute (CATIE) has expertise in different aspects of cultivation and propagation. Because of the lower prices of traditional crops like coffee and sugar cane, there is an expressed interest on part of agriculturists to look for alternate crops. Micropopagation studies on *Cephaelis ipecacuanha* and *Smilax* sp. have been carried out.

Natural Products Research Center (CIPRONA) at the University of Costa Rica is a leading institution that carries out research on medicinal plants. The Center needs to strengthen its capacity for bioassays and pharmacological evaluations. Infrastructure for chemical work is very good. A UNIDO technical assistance project is in the pipe line. Costa Rica has expressed its needs in relation to market analyses and prospects for commercialization.

Mention was made of the much discussed contract between the National Institute of Biodiversity and the Merck & Co to search for drugs in its biodiversity.

Turmeric, ginger, and chillies are important in the international market. Costa Rica has evaluated the following aromatic plants: lemongrass, vetiver, thyme, *Ocimum* and *Rosmarinus officinalis* etc. Among insecticidal plants which are worth mentioning are: *Quassia amara*, *Ryania speciosa*, *Annona muricata* and *Pachyrrisus erosus*; and among the medicinal plants *Hibiscus sabadariffa*, *Tecoma stans*, *Petiveria alliacea*, *Senna reticulata* and *Neurolaena lobata*.

Cuba

There is a National Program on Natural products, which comprises the following aspects:

a. National Plan for the Research on Medicinal Plants.
b. Stratification of the production and distribution of herbal drugs and other formulations from natural products.
c. Therapeutic guide lines of herbal drugs
d. Guide-lines for drugs of vegetable origen, crude drugs, fluid extracts and tinctures.
e. Guidelines for pharmaceutical specialities for the usage of herbal drugs
f. Information systems: FITOMED I TO IV, FITOTOX and data bases
g. Training pograms on medicinal plants for professional and technical personnel in the health system.
h. Dissemination Programs

In Cuba, there are about 8000 plant species, of which about 45-50% are endemic. The pharmaceutical industry is well advanced and produces high quality products. The use of phytopharmaceutical products amounts to about 5% of the total pharmaceutical market. Many plants are cultivated and the Experimental Station Tomás Roig deserves a special mention for propagation and research on cultivation of medicinal plants.

Dominican Republic

Import of the finished phytopharmaceutical products represents only about 0.5% of the total imports. There are a very few local concerns which prepare simple syrups and pack capsules with dried medicinal plants. In 1992, US $114,000 worth of medicinal plants were exported. Some of the important medicinal plants reported are: *Aloe vera*, *Lippia micromera*, *Mentha piperita*, *Cymbopogon citratus*, *Ocimum basilicum*, *Agave* sp. and *Bixa orellana*. Research on Dominican medicinal plants is carried out mainly at the Natural Products Chemistry Laboratory of the Autonomous University of Santo Domingo. Enda Caribe, an international organization supported by the French Government has been very active in the documentation of popular uses of medicinal plants (TRAMIL) and has published a Caribbean Pharmacopeia.

Ecuador

Ethnobotanical uses of medicinal plants in Ecuador were provided. The use of plants in native populations is widespread. A list of aromatic and medicinal plants in local names was provided. Research on medicinal plants is carried out at the Central University of Ecuador and the Polytechnical School of Riobamba.

Grenada

An extensive list of medicinal and aromatic plants, none of which are indigenous to Grenada, was provided. Mace and nutmeg are the major plants that are exported. Grenada is the number one exporter of mace. Potential for commercialization of herbal veterinary products was suggested.

Grenada's participation in the Organization of American States sponsored EBUTROP (Economic Botany of Underexploited Tropical Plants) project was mentioned. An ethnobotanical inventory of Grenada has been prepared.

Guatemala

The phytopharmaceutical industry in Guatemala is very new. The first steps towards its strengthening were through a UNIDO sponsored National Program with multidisciplinary activities organized in three components for systematization and development: Ethnobotany-Agronomy, Pharmacology - Phytochemistry and Industrialization - Commercialization. There are eight laboratories dedicated to phytopharmaceutical production and commercialization through drug stores, clinics, naturalist centers and supermarkets. These companies manufacture around 115 products, three of them have a wide variety of tinctures made from individual plants. There is a multisectorial Commission to advise the Ministry of Health on legal aspects. It is expected that on a medium-term industrial products of medicinal plants will be incorporated into the national health care system, while strengthening the national phytopharmaceutical industry.

Guatemala has gained experience in the handling of a multifunctional pilot plant. Agrotechnological studies are underway to cultivate *Nerurolaena lobata*, *Smilax* sp., *Tagetes*

lucida, etc. A good infrastructure for the pharmacological and biological evaluation of medicinal plants exists at the University of San Carlos and Farmaya. A medicinal plants garden is maintained in Guatemala.

Honduras

The important medicinal plants which are exported are: Chamomile, Calaguala (*Polypodium leucotomos*), ginger, and aloe. There are a few companies that are interested in producing concentrated plant extracts for cosmetic purposes and for the formulation of phytopharmaceuticals. At the present time, the National Autonomous University of Honduras is making a diagnosis of the state of the art of the phytopharmaceutical industry in Honduras. Three to 5% of the total consumption of drugs is estimated to be phytopharmaceutical products. There are 7 companies dedicated to the production of phytopharmaceuticals, two of which have annual sales ranging from US $100,000 to US $ 400,000 and one is considered a large company; its exports are over US $ 800,000. Only two companies have advanced technology of extraction, purification and concentration of medicinal plant extracts.

Research on medicinal plants is done at the National University, even though it is not organized in a multidisciplinary fashion. Pan American Agricultural School carries out research on the propagation of chamomile and neem. "Helechos Internacionales" exports an ointment made from calaguala for the treatment of psoriasis.

Jamaica

Status of medicinal plants research in Jamaica, carried out at the Pharmacology Department of the University of the West Indies, was presented. Research on *Catharanthus roseus*, *Bixa orellana*, and *Trophis* was mentioned. Canasol has been isolated from *Trophis* which is an effective antiglaucoma drug. A chemical modification of this compound has resulted in anasol for chest colds, wheezing and bronchial asthma. This compound is registered and is on the market. Another product is canavert, which is effective in controlling Meniere's disease and travel sickness. It is registered and awaiting the "art work" to go on the market.

Mexico

It is estimated that around 15 to 20 million Mexicans use traditional medicine. The exact figures are difficult to obtain, as a large percentage of the population covered by the Social Security system also uses traditional medicine. There are over 13000 traditional healers, of which 53% are midwives, 24% witch doctors ("curanderos"), 17% bone setters and 6% herbalists.

The Secretary of Health has manifested a clear interest in supporting the development of new biotechnological processes with application in the pharmaceutical industry. The following plants are used most frequently: Digestive Tract (*Telosys ambrosoides*, *Artemisia ludoviciana*, *Matricaria recutita*, *Psidium guajava*, *Marrubium vulgare*, *Foeniculum vulgare*, *Persea americana*); Circulatory Tract (*Casimiroa edulis*, *Sechium edule*, *Talauma mexicana*,

Chirantodendrom pentadactylum); Nervous System (*Citrus aurantifolia, Agastache mexicana, Tilia mexicana, Chirantodendrom pentadactylon*); respiratory tract (*Gnaphalium* sp., *Sambucus mexicana, Bouganvilea glabra, Thymus vulgaris*); Female Reproductive System (*Montanoa tomentosa, Rosmarinus officinalis, Lippia dulcis, Ruta chalapensis, Tagetes lucida, Justicia spicigera*); Skin affections and Trauma (*Heteroteca inuloides, Oenethera rosea, Cuphea aequipetala, Solanum chrysotrichum* an *Aloe barbadensis*).

Senna, valerian, and *Passiflora* sp. have been registered in the Public Health Department. MIXIM, the most important company, which manufactures raw materials for the production of drugs, imports 15% of the medicinal plants and the rest are of national origin. Mexico exports *Uva ursi, Valeriana mexicana, Mimosa tenuiflora* and *Opuntia* sp., while *Peumus boldo, Arnica montana, Atropa ballandonna* and artichoke leaves are imported. *Dioscorea* is of course one of the most important source of diosgenin which Mexico has used to set up steroid industries.

Panama

In Panama, health care coverage is rather good. There are five Amerindian groups who use traditional medicinal plants for the treatment of their ailments. Country spends over US $60 million on drugs. However, phytomedicinals are not considered. There are 13 pharmaceutical manufacturing firms in Panama. Two local companies commercialize medicinal plants. *Hibiscus sabadariffa* and *Zingiber officinales*. Traditionally, ipecac has been exported from Panama, however, recent export statistics are not available. There is one local pharmacy that expends dried herbal drugs. Panamanian Flora is very rich (8,000 - 10,000 in total) and approximately 12% of the species are endemic.

Present status of research on Panamanian Flora was discussed. Pharmacognostic Research Center on Panamanian Flora in the School of Pharmacy of the University of Panama carries out multidisciplinary research aimed at isolating and characterizing bioactive principles from plants used in traditional medicine. Ethnobotanical inventories of Cuna and Guaymi Indians are available. Thirty new chemical compounds and 97 known compounds have been isolated from Panamanian Plants for the first time. The Center has organized many international training courses and offered its expertise to other centers. Panama has expressed an interest in receiving preparatory assistance from the UNIDO for designing a Technical Cooperation Project aimed at industrialization of medicinal plants. Assistance is needed in agrotechnology, unit processes and process technology, *in vitro* tissue cultures and formulation and production of phytopharmaceuticals products. Panama through the School of Pharmacy of the University of Panama, in an earlier UNIDO Mission, had expressed its desire to be the site for "Center for Information, Training, and Reference for the Pharmaceutical Industry for Central America". This possibility is still viable.

Paraguay

Plant-based pharmaceutical industry is poor. There are only a few small scale local phytopharmaceutical companies. Ethnobotanical inventories of Paraguayan plants are available. The Schools of Chemistry, Natural and Exact Sciences and the Research Institute in Health

Sciences, in the National University of Asuncion carry out research on medicinal plants. Previously, a UNDP/UNESCO assisted project has been successfully executed in Paraguay. The Japanese International Cooperation Agency has also supported research on Paraguayan medicinal plants.

Lippia citriodora, *Mentha piperita* and *Bulnesia sarmientoi* are being cultivated. In addition, there is an interest in *Stevia robaudiana*.

Uruguay

In Uruguay, there is very little use of traditional medicinal plants. Ministry of Health has published guide-lines on the use of medicinal plants. The industrial development of this plant-based drugs does not seem to be a very viable option, as the health coverage with modern drugs is satisfactory. The guidelines gives specific common names of medicinal plants, which can be used as herbal drugs.

Venezuela

Venezuela has 56 manufacturing companies with installed capacities to produce all modern pharmaceutical dosage forms of high quality. There is some use of medicinal plants by the natives. There is no agroindustrial development in this sector. Since 1980 there is a special regulation which controls registration, production, and marketing of natural products. There is only one laboratory which manufactures phytomedicinals. Research on medicinal plants is carried out at the schools of pharmacy in the two state universities in Caracas and Mérida and at the Venezuelan Institute of Scientific Research (IVIC). A Postgraduate program in Medicinal Chemistry leading to a M.S. is available at the Central University of Venezuela.

Representatives from El Salvador, Nicaragua and Peru did not attend the meeting, even though they were invited.

APPENDIX 9

SUMMARY OF EXPENSES

Training course on "Screening Technologies for Industrial Exploitation of Medicinal and Aromatic Plants"
Panama, Nov. 30 - Dic. 5 1998

SUMMARY OF EXPENSES

			US $
TRAVEL			14,341.10
	International air Travel	12,957.49	
	Local transportation	1,383.61	
LODGING			5,740.00
BOARDING			5,630.50
LECTURER'S FEES			4,000.00
	TOTAL		29,711.60

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CYTED