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POTENTIAL FOR PRODUCTION AND PROCESSING OF AROMATIC AND MEDICINAL PLANTS

DU/BOL/84/405

BOLIVIA

Technical report: Findings, work performed and recommendations*

Prepared for the Government of Bolivia
by the United Nations Industrial Development Organization

Based on the work of Mr. Patricio Castro-Boisier,
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* This document has not been edited.

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C O N T E N T S

INTRODUCTION

UNIDO's Project DU/BOL/84/405 is a component of the much bigger AGROYUNGAS and AGROCHAPARE rural development projects sponsored by UNFDAC. Its purpose is to contribute to the effort of finding valuable alternative cultures and processing activities to diversify the traditional agricultural activities of the Yungas and Chapare regions.

The intent of the project is to identify aromatic and medicinal plants for export as such and/or as their derivatives- and to a lesser extent to supply the local market- among those plants which grow already in these regions and also among those foreign species which might be introduced advantageously.

To carry out this task, a three-man team was assembled to examine the existing and potentially cultivated aromatic and medicinal plants from the points of view of available markets, land capabilities and processing requirements.

This interim report reflects the activities of the marketing team member and its interfacing with those of the agronomist leading up to the consensus list of candidate plants whose markets, marketing and processing characteristics will be developed in the following month.

DEFINITIONS AND PROCEDURES

It was agreed that "aromatic plants" designates those plants which are: sources of essential oils; the spices; other culinary plants; and food coloring plants or parts of plants. "Medicinal plants" were taken to designate those from which a recognized active pharmaceutical constituent is usually extracted; and related plants or products like ficin, pyrethrum extracts and rotenone resins which although not pharmaceuticals are nevertheless physiologically active. Plants for infusions and medicinal teas were excluded from consideration.

The procedures for candidate plant selection involved using as a general framework a selection of about 200 plants for which the markets are transparent, i.e. there exist official external trade statistics in the United State, the EEC and Japan, and for which list prices are periodically published.

On the basis of this master list and the botanist/agronomist's observations of plants growing in the Yungas and Chapare regions, it was possible to reduce the number of candidate plants to a few that might be advantageously exploited in the two regions.

Finally a small number of other plants, capable of growing in

either the Yungas or Chapare were added, completing the task of conforming a list of about twenty aromatic plants and a similar number of medicinal plants from which to make a selection of about half that number of species in Vienna when all reports are turned in.

Although the third member of the team has not yet come as of this date, it is believed that the list of candidate plants presented in this report will remain substantially the same after he has had a chance to analyze it.

MARKETS FOR AROMATIC AND MEDICINAL PLANTS

Tables 1 and 2 show the aromatic and medicinal and related plants for which external trade statistics are available, although for some of these the values are aggregated. For the latter an effort is being made to seggregate the statistics into their individual components. Already petitions to this effect have been sent to the statistical offices of the United States, the EEC and Japan. So far only the EEC has answered indicating its willingness to show the import quantities and values in greater detail for 1988 as they began to use the new trade statistical classification system known as the combined nomenclature of harmonized system (CN), which contains 8 digits rather than 6 digits at the old NIMEXE system and thus tends to be more detailed.

Further data regarding markets for individual plants and derivatives are contained in applicable specialized, market reports such as those prepared and issued by UNCTAD/GATT's International Trade Center, e.g. Essential Oils 1986, Spices, 1982 and Medicinal Plants, 1982 which although somewhat outdated still serve as a source of individual plant market information.

Periodic prices for both plants, parts of plants and derivatives can be obtained on a weekly basis from the Chemical Marketing Reporter (USA), Chemist & Druggist (UK) and the Public Ledger's Commodity Week (UK).

Finally, contacts with traders and procesors in New York will shed additional light on the individual markets and prices for the plants being considered and for their marketing.

At this stage it is appropiate to remark that three entrepreneurs from Cochabamba and La Paz showed an interest in the industrialization of medicinal plants to make herbal, medicinal teas. Most of the "active" components of these medicinal teas are European, imported plants, not local plants. Table 2 shows a list of plants incorporated in the medicinal teas sold in Bolivia, taken from the recently published ALIFABOL's Vademecum. The sheer number of plants and the small quantities reportedly imported -about 2 tons per year- convinced us that medicinal teas were not worth considering in the context of our work on medicinal plants.

POSSIBLE LOCAL SUPPLIES AND CONSTRAINTS

Tables 4 and 5 show those plants which C. Franz (botanist and agronomist) initially thought might be supplied by the two regions under consideration after his exploration trip to the Yungas but before visiting Chapare.

As can be seen from these and tables 1 and 2, the number of candidate plants was reduced to approximately one half after taking into account field observations and climatic, altitude and soil conditions.

In addition to which two other factors constrain the number of valuable species which might be grown in these regions.

In the Yungas these are the unevennes of the terrain - where almost none of these tillable land is flat- and where extremely steep slopes are the norm; and the small size of the individual properties - about 7 hectares of which 44% under cultivation, 25% fallow and 31% not cultivated.

In Chapare the constraint is mostly the small size of the individual land holdings.

After the botanist/agronomist's visit to Chapare a further reduction of the number of candidate plants was done resulting in the following comprehensive list (Table 6) which includes both indigenous plants and suggested new cultures.

After giving careful consideration to the known factors affecting the probable performance of the various candidate plants, Table 7 was prepared showing, separately, the possibilities visualized for the Yungas and for Chapare.

PROSPECTIVE DEVELOPMENTS AT THE YUNGAS

Aromatic and related plants

The possibilities for developments lie mostly in the areas of production of essential oils, spices and food and feed colors.

Essential oils

Regarding essential oils, the most likely candidates are orange and grapefruit oils and perhaps lime and lemon oils. Cold-pressed orange oil production can be implemented in the next few months if the existing juice expressing installations are modified to separate the oil from the orange skins. It may be possible to modify the procedures to actually peel the oranges before expressing the juice to ease the separation of the oil and/or to sell the peels themselves. The same holds for any

grapefruit processed in the existing orange oil installations, and for the grapefruit processing plant currently being considered for La Asunta, where grapefruit is the predominant citrus crop.

Lime oil is being successfully produced and exported from Perú. The same lime is produced in La Plazuela and La Banda (Irupana, Sud Yungas). Consequently the techniques used in Perú could conceivably be applied in a short time.

Lemon oil production will hinge on production of the lemon (Citrus limonum Riss.) on a sufficiently large scale and will be viable only insofar as the juice finds a market either in the food industry or could be profitable converted into calcium citrate for export to citric acid manufacturing plants or, if the volume is sufficiently large, for local conversion into this acid.This type of lemon reported by grows at Caranavi and is more expensive than the small limes usually consumed in La Paz.

From an agronomical point of view, production of star anise (badian), cardamoms, cinnamom, cassic cinnamon, nutmeg and mace have been recommended as new crops for the Yungas. All of these spices yield essential oils whose production may be tackled once there is sufficient production of these crops. Vetiver has also been recommended for Los Yungas as an erosion control grass, and will serve as a source of valuable vetivert oil and its derivative vetiverol once this recommendation is implemented.

Spices

Star anise, cardamom, cinnamom, cassia cinnamom, nutmeg and mace have been recommended for growth at the Yungas. The onset of their production, will take some time, if this recommendation is followed up. Meanwhile, one farmer is growing and processing paprika at the Yungas, using seeds originally brought in from Hungary. Total area under cultivation is small and current export capacity unknown.

Medicinal Plants and Derivatives

Of these, only cinchona bark, cocillana bark, and ficin powder may be available for immediate exports. Caffeine production will depend on the previous installation of a coffee bean decaffeination plant and copaiba and tolu balsam production on the location of these balsam trees.

a) Cinchona bark

By far the most important medicinal plant is Cinchona. Fábrica Nacional de Quinina -a government enterprise- owns 10 ha. with 24.000 trees at Bolinda and 30 ha at Illimani with a total of 720.000 trees originally. The plantations at Illimani were abandoned in 1921 for lack of funds for their upkeep. It is estimated that 20% of the original trees could still serve as a

source of bark, that is 210.000 trees. Both of these sites could be exploited for bark if Fábrica Nacional de Quinina were willing. Yet they state that they are not, as they want all the bark that can be had to feed their quinine sulfate plant.

On the other hand, private colonists own enough cinchona trees in Caranavi at Cóndor Calvario, Chúa, Boquerón and Choknia Alto, to yield 46 tons of bark per year containing 3,5-4,5% total alkaloids. Yet again this bark reportedly cannot be exported as, according to the administrator of Fábrica Nacional de Quinina, all bark from this source should, by law, be sold to Fábrica Nacional de Quinina until its capacity of 6.000 tons per annuum of quinine sulfate is satisfied. This requires 150.000 kg. of bark per year, a figure which is nearly three times the output of the private growers. Consequently, a situation has been reached in which Fábrica Nacional de Quinina cannot operate its plant for lack of sufficient raw material and in which the law does not permit the private growers to sell their bark to whoever they want.

The quinine sulfate plant is old -operations begun in 1934- and small vis-a-vis the world trade of about 40 million dollars per year in quinine and quinidine alkaloids and their salts. The price they are getting from a European trader for quinine sulfate heptahydrate is US$ 35 FOB La Paz per kg.; so even at peak capacity, this plant would have a turnover of just over US$ 200.000 per year - hardly enough to justify its monopolistic status not only in the field of alkaloid production but also as an obstacle to free trade in plain bark.

The position of Fábrica Nacional de Quinina is that any bark produced over and above the 150.000 Kg. per year they need to run the plant at capacity they could release, with permission of the Ministry of Defense for export of the bark, a situation hardly conducive to establishing new plantations and possibly a modern efficient cinchona alkaloid industry.

In view of the above it seems advisable to take a comprehensive look at the possibility of a joint venture involving locally owned new plantations with the best genetic material available and a modern extraction, fractionation and quinine isomerization facility owned by a private foreign company which might guarantee the export of the products. This calls for a specific project which UNIDO could handle efficiently.

A meeting was held at Agroyungas on August 3 with Colonel Ricardo Ardiles, former General Manager of Fábrica Nacional de Quinina to test these ideas and to clarify the legal status of the cinchona industry monopoly held by COSSMIL. Colonel Ardiles stated that a large scale cinchona industry should be a private enterprise and in partnership with a foreign company supplying modern technology and markets. He considers feasible the modification of the existing law to allow this. Regarding exports of cinchona bark from Caranavi he said a permit from MACA can be obtained at the

quinine sulfate plant is not operating.

b) Cocillana bark

Guapi (Guarea rusbyi Britt. Rusby, Meliaceae) is a tree that grows near Guanay. Its bark used to be exported to Parke Davis to make an expectorant syrup. If enough trees still subsist, this bark could be exported as of now and an inventory of Guapi trees in the Yungas instituted as soon as feasible, patterned perhaps after the Forestry Inventory by "Point Sampling" carried out by Hidroservice-IPA in 1978 for Corporación Regional de Desarrollo de La Paz for the Northeastern part of the Department of La Paz, just north of the Yungas. Said inventory showed 44.000 cubic meters of Guapi in that region in an area of 180.000 has. so chances are reasonably good of having a large number of Guapi trees in the Yungas themselves.

c) Ficin powder

Ficin -together with bromelain and papain- is one of the three plant proteolytic enzymes used almost interchangeably in chill-proofing beer, leather treatment, bakery operations and specialized end uses involving the digestion of gelatin, such as treating exposed film to recover silver.

The source of ficin has been traditionally the sap from the wild fig tree Ficus glabrata HBK and other Ficus species.

The inventory mentioned above lists 180.000 cubic meters of this tree, called Bibosi, in Notheastern La Paz so it should be available in the Yungas. At least the related Ficus matapalo grows around Cota Pata, near La Asunta. Tapping tests to show the yield of sap per day are currently underway at Chimoré.

d) Caffeine

World trade in natural caffeine is substantial. Just the United States, the European Economic Community and Japan together, imported about 150 million dollars worth of caffeine in 1987. The major source of caffeine is the byproduct of coffee decaffeination, which is a non-aqueous solvent extraction process demanding clean, dry coffee beans. Currently, coffee from the Yungas is not uniform in quality, badly cleaned of its pulp and mostly wet. A decaffeination plant at a carefullly chosen location in the Yungas might take care of the cleanliness, humidity and uniformity problems of the regionally produced coffee and yield a premium-price decaffeinated coffee and caffeine as its byproduct. This possibility merits in-depth investigation by the expert on coffee processing scheduled to assist the AGROYUNGAS Project.

e) Copaiba balsam

C. Franz saw the Copaiba balsam trees growing in the Yungas

during his exploratory trip. However, it is necesary to locate and take an inventory of this species (Copaifera coriaceae Mart., Leguminosae) before a real effort can be made.

The above mentioned inventory for Northeastern La Paz showed 20.000 cubic meters of these trees, so chances are they could be numerous in the Yungas region.

f) Tolu Balsam

The same comments hold for the Tolu balsam trees (Toluifera balsamum L., Leguminosae), with the difference that this species is not individualized in the 1978 forestry inventory for Northeastern La Paz. This serves to emphasize the need for an ad-hoc inventory of the trees that have been mentioned above to serve as a basis for immediate exploitation in the Yungas proper.

Condurango, ipepac, ginseng and Solanum marginatum have been suggested as new crops that might do well in the Yungas and yield valuable products. Condurango bark, ipecac root and emetine and ginseng roots and extracts are well established in international trade. Solasodin from Solanum marginatum may compete with diosgenin for the production of 16-dehydropregnenolone and the hormones and corticoids derived from this intermediate raw material: its trade will be discussed in New York.

Other related plants

(a) Annatto

Annato seed production is well established in Caranavi and can be expanded. Partly, it is exported to Argentine and thence to other countries. Current retail price for the seed in the markets of La Paz is Bs. 2 per pound (about US$ 0.75 per Kg.); Bs 60 per Spanish quintal (46 Kg.) at Caranavi (US$ 490 per ton); and US$ 1.500 per ton FOB the Bolivian-Argentinian border at Villazón. Thus this product is well established and can be marketed now.

One private entrepreneur has evinced an interest in replanting existing annatto trees in Choro, near Caranavi to produce 160 tons of seed per annuum within the next two years and up to 500 afterwards if the market holds well. This is contingent on assistance from Agroyungas to provide a US$ 40.000 line of credit to small farmers at Choro to replant and cultivate the new trees. Annatto also grows wild in the Yungas as evidenced by observations near La Asunta.

As a reference, it can be said that Perú exported in 1987 almost two million dollars worth of annatto seed at an average value of US$ 2.300 per ton FOB Callao. Further value could be added to this crop by exporting what is called "annatto color", that is, the powder covering the seeds (about 2% by weight) which sells for US$ 80-120 per Kg. or more depending on quality and purity

commercial conditions.

Current production capacity at the Yungas is 150 tons of seed per annuum.

Yield is 2-4 tons of seed per ha. per year in present conditions. Better genetic plant material might increase the yield and also improve the color.

There is no premium for increased bixin content because the exporters do not know how to measure the quality parameters, nor do they know their comparative impact on prices.

b) Marigold

Marigold flowers are currently produced at Coroico, in the Yungas for use in the poultry feed industry. Total area under cultivation is less that one hectare which could be expanded fairly rapidly if there are prospects for further local use or exports. Exports of marigold flowers flour peaked in Perú in 1985 reaching that year about five million dollars and have stabilized at the two million dollars per year level, the decrease being due mostly to an undervalued dollar for exports. Representative FOB values will be shown in the final report on markets and marketing.

c) Turmeric

Although not mentioned in the list of candidate plants at the Yungas, nevertheless this plant grows in Caranavi and shows a certain promise because of the vivid yellow color the ground powder imports to cooked rice. The product retails for Bs 2 per pound at the markets of La Paz, on a par with annatto.

The shade of yellow and the pungency measured in Alleppey units are the two main characteristics of turmeric that determine the price and volume of its sales. If the Alleppey value is right, it is the light yellow shade that makes it easier and more profitable to sell turmeric, as seems to be the case with the product from Caranavi. The explanation may be that the rhizomes are cut up for drying instead of being first boiled, as is the custom in Perú.

Therefore, Caranavi turmeric should be characterized to be offered in the export markets and priced according to its shade when ground up.

POSSIBILITIES IN CHAPARE

Aromatic and related plants

As in the case of the Yungas, the potential for development lie in the production of essential oils, spices and food and feed colors, plus [illegible] plants which although not strictly

either aromatic nor medicinal are closely related to the processing of the former two classes of plants.

Essential oils

Production of eucalyptus, lemongrass and cornmint oils is already underway in Chapare on a small scale, as well as cineol, citral and menthol.

Anise oil and anethole, cardamom, cinnamon bark, cinnamon cassia bark, citronella, palmarosa and vetivert oils plus clove oil and eugenol and fennel oil and anethole have been suggested as new possibilities, some of which are already under consideration by the Agrochemical Project staff at Cochabamba (*), like fennel and anethole-citronella oil and citronellol having been discarded because of not too promising initial agronomic trials.

a) Eucalyptus

The Agrochemical Project owns 5 one-cubic meter eucalyptus leaves steam distillation plants and 2 four-cubic meters plants in the Cochabamba highlands. These so called "satellite" plants feed a 4-inch rectification column located at the site of the Agrochemical Project where eucalyptus oil is split into cineol and a bottom product that is used to formulate a floor wax with insecticidal properties. Part of this production is sold as raw eucalyptus oil at US$ 10 per kg. Sales in 1989 are expected to amount to US$ 80.000 on the basis of eight tons for the year, which will increase to 100 tons of cineol per year by 1991.

A larger eucalyptus oil production plant is located near Quime at Camillaya in the Department of La Paz, close to Cochabamba, but neither in the Yungas nor in the Chapare. This plant is privately owned and is rated for 30 tons of raw eucalyptus oil per year. Currently production is limited to only 20 tpy. on the basis of 4 three-cubic meter steam distillation units on one shift. The plant was designed by the owners and built in La Paz at a cost of US$ 24.000. As soon as the electrical power distribution network reaches the plant site during the next few months, two more three-cubic meter stills will be added and three shift work will begin to reach the rated capacity. A fractionation installation to separate cineol is being considered, to be located at either La Paz or adjacent to the steam distillation units. The estimated cost of this installation is US$ 25.000 and most of the equipment will be built in La Paz. The crude oil is being sold locally but as soon as the plant reaches its rated capacity it will be exported in 55-gallon steel

(*) This is joint venture between Coorporación de Desarrollo de Cochabamba (CORDECO) and Universidad Mayor de San Simón.

drums containing 200 kg. each, in 2.000 Kg. lots, to the United States at US$ 8,5 per kg. CIF New York. Cineol content of the raw oil is 80-85%. Rectified cineol, to be made from this source is expected to be sold for US$ 14-15 per Kg. on the same basis and for a guaranteed 98,5% cineol content.

The design of this plant was based on the experience of Rafael Guevara -one of the owners- in vetivert oil distillation in Africa while serving a UNIDO contract. The owners of this plant would possibly capitalize on their experience to set up a unit for processing various essential oil- bearing materials, as soon as they become available. Rafael Guevara's experience in vetivert oil distillation will be an added asset in this case.

The species they are using is the same as that employed in Chapare, namely Eucalyptus globulus Labillardiere, which yields about 1% of oil on the weight of leaves charged into the stills. There are, however, other Eucalyptus species which yield more oil, like Eucalyptus dives Schau (4% oil in the leaves), Eucalyptus radiata Sieb. ex DC. (3 to 3.5% oil) or Eucalyptus fruticetorum F. Muell. (1.5 to 2,5% oil), which might be introduced in Chapare along with Eucalyptus citriodora which is already being evaluated.

b) <u>Lemongrass</u>

CORDECO owns a battery of 3 five-cubic meter steam distillation units at Senda D, near Chimore, in Chapare. Rated capacity for the plant is 50 tons per annuum of lemongrass oil with a minimum 85% citral content. Actual capacity of the plant visited in Chimoré can be calculated as follows: up to 8 charges per still, round the clock (2 to 3 hours per charge), at 1.000 kg. of grass per charge yielding 6 liters of crude oil per charge means up to 48 liters of oil per day or roughly 12.700 liters of oil per year on the basis of 12 twentytwo-day months. Which is about one fourth of the projected capacity. This figure agrees with the 12 tons per year current capacity indicated at the 20 July, 1989 meeting with Agrochemical Project personnel in Cochabamba.

Total area under cultivation at present is 46,2 ha. which will increased to 350 ha. by 1991.

The crude oil from the Chimore unit is fractionated at Cochabamba to yield citral which is sold locally.

During the visit to the plant, the colonists who supply the grass wanted to know what other oils they could make and stated their wish to have the fractionation unit at the same site. C. Franz suggested citronella and palmarosa as additional oils and the undersigned, vetivert oil. Regarding their wish to do the complete processing at the plant site, G. Quaglia -UNFDAC's Field Adviser- has indicated his intention to comply with this request, as well as to replace the locally designed steam distillation unit with an imported, modern prototype that could be later

copied if it proves to be better than the existing plant.

c) **Menthol**

This material is being produced on a trial basis from cornmint oil (Mentha arvensis L., Labiatae) steam distilled from mint leaves from small plots. The product is organoleptically satisfactory so the decision has been made to increase the cornmint plots to 2 ha. as soon as possible and up to 240 ha. by 1991 when menthol capacity will reach 20 tons per year.

Spices

Paprika, i.e. red, bland-tasting pepper used mainly to impart color to food preparations, may be grown in Chapare. Black pepper of the Balacatta variety from Costa Rica and cardamoms and turmeric plantlets are being reproduced and readied for distribution at IBTA's La Jota Experiment Station near Chimoré: they will be sold as of the end of 1990. Vanilla grows wild although it is not known how many plants are available for bean harvesting.

The role of the Agrochapare project regarding this group of spices could be to set up a purchasing power with a view to develop rapidly an exportable supply of good quality products. And in the case of vanilla, to introduce appropiate cultivars to improve the acceptance and netback from sales over that from the wild species. As this latter spice is being imported by the United States, the EEC and Japan at a rate of nearly 170 million dollars per year, there is ample margin for taking a risk in the implantation of this resource in Chapare.

Cinnamon cassia, true cinnamon (Cinnamomum zeylanicum, Lauraceae) and cloves are other new, suggested spices that could be grown advantageously in Chapare according to the botanist/agronomist C. Franz. If the Agrochapare project authorities concur, then the classical developmental scheme should be used as soon as feasible. That is, within the framework of the cooperation agreement with IBTA, this organization should supply the plants, fertilizer and technical assistance to the farmers willing to cultivate the new species and, later, set up revolving funds for the operation and stocking on the spices as a prerequisite to finding either interested exporting companies to handle the new trade or setting up cooperatives which would export directly.

Medicinal Plants

American wormseed (Chenopodium ambrosioides L., Chenopodiaceae) is a common weed in the Yungas and should grow well in Chapare. Cocillana (Guarea rusbyi (Britt.) Rusby, Meliaceae) also grows in the wooded parts of Chapare, perhaps even better than in the Yungas due to the warm climate. Regarding Copaiba balsam trees C. Franz saw specimens during his field trip to this region; this tree also figures prominently in the forestry inventory referred

to above in the region between San Buenaventura and Ixiamas, north of the Yungas, where climatic conditions should parallel those of the Chapare lowlands.

Wild fig trees deserve a special mention as Manuel de Lucca, who guided C. Franz in his reconaissance trips to Yungas and Chapare, was kind enough to show us two healthy, adult specimens at the IBTA Experiment Station at La Jota: one Ficus glabrata HBK and one Ficus matapalo. Both of these species yield a latex, or sap, containing about 8% enzimatic solids in the aqueous phase. On 25 July, Jairo Morales, CTA for the Agroyungas Project and a.i. CTA of the Agrochapare Project requested a latex yield test on both the above mentioneds specimens to estimate the potential production of ficin per tree and the total in the region on the basis of a survey of existing Ficus glabrata and Ficus matapalo trees in Chapare.

Any future exploitation should be done under the surveillance of either IBTA or Agrochapare personel, to avoid the common practice observed in Perú of cutting down adult trees to obtain about 5 gallons of lates per each felled tree instead of tapping them for years to come.

If and when an aerial photogrammetry program for the Chapare is launched, these trees should be included among those to be tallied, as the market for ficin is supply-limited and its properties (mainly the fact that it acts 10 to 20 times faster than papain) makes it a very valuable phytochemical.

Agronomic considerations permit the suggestion of growing Condurango (Marsdenia condurango Reichemb. f., Asclepiadaceae), Ephedra spp., senna (Cassia senna L., Leguminosae), and Solanum eleagnifolium Gay as new cultures.

In the special case of Solanum eleagnifolium its introduction and subsequent trials for the production of either solasodine or 16-dehydropregneniolone, it is strongly recommended that the staff of the Projecto Agroquímico take the lead, with the assistance of Raúl Estrada, a Chemical Engineer who developed the production of solasodin from Solanum marginatum in Ecuador. R. Estrada is currently acting as a consultant on extraction of medicinal phytochemicals in Guatemala and other Central American countries and can be reached thru either the undersigned or the Junta del Acuerdo de Cartagena at Lima, Perú.

Other related plants

a) Annatto

This plant grows wild in Chapare. No plantations are known. The only motive power behind its regional production at the moment seems to be the interest of the Agrochemical Project to make bixin from annatto.

Depending on the outcome of the marketing efforts for annatto seeds and color, Agrochapare should promote its cultivation in the region.

b) Marigold

Marigold for poultry feed production is already being cultivated near Cochabamba in four zones totalling 20 has., owned by Duane Anderson. The Agrochemical Project has been helping this entrepreneur make the extract (xanthophyllin). This private initiative might be fanned into a much bigger operation with economic or technical help from Agrochapare.

c) Pyrethrum

Although not strictly a Chapare crop, it is part of the budding phytochemical industry started by the Agrochemical Project and as such was felt to be a valid plant for consideration in this mission.

The Agrochemical Project had initially 4 ha. of Chrysanthemum cinerariafolium under cultivation, Currently they have 50 ha. of pyrethrum fields and aim at 1.500 Ha. for the future.

The dried flowers are being extracted with hexane and the recovered pyrethroids are sold as an insecticidal spray using butane as the propellant.

This activity could benefit greatly from the experience of Raúl Estrada in this field, as he started the industry in Ecuador for INEXSA and developed a complex-solvent process that makes it possible to extract the pyrethroids from freshly-cut-not previously dried-flowers which speeds up the process and cuts down the costs.

d) Cubé

This is Lonchocarpus nicou DC., a Leguminosae that does well in the Andes as in the Amazon basin. The mature, shade-dried ground up roots contain usually up to 9% rotenone and are traditionally exported with a guaranteed 6% rotenone content. A comparatively simple extraction process yields an extract which can be used locally as such as a biodegradable insecticide or evaporated to yield a 35% rotenone, solid resin.

A search for the wild plants should be instituted if desired-However, plantations from 13% rotenone selected plants could be more profitably be started by Agrochapare and be ready for harvesting 2 to 3 years afterwards.

Processing is simple. Shade-drying, shredding and pulverizing to minus 200 mesh is all it takes. Plus good analytical control of the rotenone content as the powder can be priced on the basis of contained rotenone.

In addition to which the product might be sold locallay as a biodegradable insectSicide on an inert powder base at 1 to 2% rotenone concentrations; or be used as a fish poison to control or wipe out undesired fish moieties in those places where either tilapia or carp is being reproduced.

It is worth nothing that this market is strongly supply-limited as its nearest competion- Derris elliptica- is no longer available from Southeast Asia. And the export price can be nearly US$ 2.000 per ton FOB place of origin is the roots are high in rotenone. Besides which, good promotion in the markets for organic producers supplies might secure a steady growth foothed because (a) it is a "natural" insecticide; (b) the residues degrade after one week exposure to sunlight end oxygen; and (c) is non-toxic to human beings.

OVERVIEW OF CANDIDATE PLANTS FOR INDUSTRIALIZATION AND EXPORT

Table 6 lists 22 aromatic plants, 15 medicinal plants and 4 other, related plants which are recommended for selection of some 10 aromatic and 10 medicinal and other physiologically active plants for in-depth project execution.

On closer inspection, only 11 aromatic plants, 8 medicinal plants and one other, related plant are truly new suggested cultures. Consequently Table 6 as such may be acceptable, in toto, as the basis for the final project document, without further ado. This is all the more true when it is realized that the operating mechanisms being used by Agroyungas to develop the most promissing productions can be used by this project and Agrochapare to accelerate the growth of the agroindustrial activities relating to the established species listed in Table 6.

Looking again at this table from another point of view, some of the plants, their parts or derivatives stand out as candidates for immediate commercialization, even before the final report and project document are prepared and released. Indeed, sales promotion of eucalyptus and lemongrass oil, as well as their derivatives cineol and citral, plus paprika, turmeric, cinchona and cochillana barks, ficin, annatto seed, marigold flowers flour and pyrethrum extracts can proceed right now. The production of all of which can be stepped up by using the conventional incentives granted by both Agroyungas and Agrochapare to conventional food raising agroindustrial projects.

AGENTS FOR THE INDUSTRIALIZATION OF CANDIDATE PLANTS

Exposure to entrepreneurs during the first month of this mission has been minimal in the case of the undersigned.

However, it can be pointed out that R. Guevara and his partner J. Portato can lead to way to essential oil production at the

Yungas, whereas in Chapare, although the Agrochemical Project has taken the lead in this field, CORDECO should pass on to private entrepreneurs their experience as per its mandate.

Regarding spices, it is really Agroyungas and Agrochapare which could effectively develop their production to export- sized volumes by giving individual farmers help through IBTA for the implantation of the various cultures and then setting up revolving lines of credit for the accumulation of stock for export. A start can be made with the current annatto, turmeric and paprika producers at the Yungas, with the marigold flower flour at the Yungas and in Chapare. And seeing to it that the pepper and cardammom plantlets being readied at la Jota Experiment Station are passed on as soon as possible to interested farmers. News about investment opportunities in agroindustry seem to travel fast via the grapevine in Bolivia, so just a directed effort along the lines suggested above will generate sufficient takers if they are assured that here will be a purchaser for their products.

The field of medicinal plants is at present limited to the extraction of cinchona bark, cocillana bark and late from Ficus glabrata and Ficus matapalo. Regarding cinchona bark Agroyungas could begin purchasing material from the trees in the colonies at Caranavi, using as an intermediate agent somebody knowledgeable about the cinchona trade, like Ricardo Ardiles and/or Gerardo González, both former employees of Fábrica Nacional de Quinina. Cocillana bark could be bought from the farmer producers at Guanay. And latex from the Ficus spp. bought directly by Agroyungas and Agrochapare and assayed at two convenient points, perhaps La Asunta and Villa Tunari, until a private exporter takes over the purchases and the testing and/or processing of the latex.

CONTACTS WITH FOREIGN TRADING AND PROCESSING COMPANIES

The undersigned will contact nine New York/New Jersey based companies active in the fields of essential oils, spices and medicinal plants in the week August 7-11 to discuss:

- Prices and pricing bases;
- Specifications;
- Minimum and regular lot sizes;
- U.S. Customs and USDA regulations for admission into the United States;
- Medium and long term purchase contracts; and
- Other related topics.

The list of companies and the subject products for discussion are shown in the Annex. This represents only a limited selection of the companies engaged in these activities in the United States, of course, but is expected to yield results of universal application.

In the special case of Merck, the intention is to discuss opportunities for setting up plantations of established and newly introduced phytopharmaceutical source plants, and to identify the likely candidate companies for this type of activity.

CONCLUSIONS AND RECOMMENDATIONS

For the purpose of this interim report the main conclusions are as follows:

1. There seem to be good conditions for developing the production of certain essential oils in both the Yungas and Chapare, as well as spices and food and feed coloring plants, plus a limited number of medicinal plants -notably cinchona- and also pest control plants.

2. There are almost no aromatic and medicinal plants and derivatives available for export at the moment. Although a few could begin to be extracted from the wild at short notice; and a few others whose production might be stepped up to yield significant quantities for export within a year or so from now if the pertinent recommendations are followed.

3. The gamut of plants suggested for consideration is not all-inclusive as the UNIDO team activities are confined to the Yungas and Chapare, whereas even in regions bordering these two there are even better gowth conditions for growth of certain valuable species like vanilla or pyrethrum.

4. There is much useful information bearing on this project dispersed in various offices and libraries, as well as valuable field experience available from very well qualified Bolivian professionals and non-professionals familiar with both the Yungas and Chapare field conditions. In some instances, these untapped sources of information surpass the findings of the UNIDO team.

5. The technical and economic infrastructure necessary for developing the new cultures listed in Tables 6 and 7 does exist and should only be directed to bear on the subject of transforming the suggestions into concrete realities.

6. There is a need for systematic presentation of existing and potential plant resources in both regions.

Insofar as recommendations are concerned, the following are the most obvious as of this date:

1. Develop commercial aromatic and medicinal plant inventories for the Yungas, and Chapare.

2. Prepare outline for a cinchona industry project with the assistance of Colonel Ardiles, who is also an agronomist.

3. Start the new, suggested cultures using the existing agreement with IBTA.

4. Search for copaiba trees, Tolu balsam trees and vanilla vines in both regions, as well as Ficus glabrata and Ficus matapalo trees mainly near La Asunta and Chimoré.

5. Conduct tapping tests for latex of Ficus glabrata (bibosi) and Ficus matapalo (matapalo) at La Jota Experimental Station.

6. Explore economic feasibility of coffee decaffeination in the Yungas.

7. Contract Raúl Estrada to assist the Agrochemical Project at Cochabamba in pyrethrum growing and processing, as well as in laying out a program for solasodin production.

8. Give active support to the annatto replanting program at Caranavi.

9. Contact the marigold flowers flour produced at the Yungas and Cochabamba to find ways and means for stepping up their output.

10. Analyze Caranavi turmeric for color shade and Alleppey content.

11. Contact Rafael Guevara to replicate in the Yungas the African vetivert oil industry based on his experience.

12. Introduce the higher yielding Eucalyptus species mentioned above in the Chapare on a trial basis, as well as citronella, palmarosa and vetivert

13. Buy a prototype essential oil steam distillation/ fractionation plant for lemongrass as per G. Quaglia's suggestion. C. Franz will search for likely suppliers at a September meeting on essential oils in Southern France and at a November meeting in India.

14. Make arrangements for immediate increase of the Mentha arvensis cultivation.

15. Introduce cultivation of cubé (Lonchocarpus nicou DC., Leguminosae) at La Jota.

TABLES

AROMATIC PLANTS AND PARTS THEREOF AND THEIR DERIVATIVES FOR WHICH OFFICIAL TRADE STATISTICS ARE AVAILABLE - TABLE1

No.	SOURCE PLANT	FAMILIES	SOURCE PLANT	FAMILIES
** AROMATIC PLANTS AND PARTS				
1 AMBRETTE SEED OR MUSK	ABELMOSCHUS ABELMOSCHATUS	MALVACEAE		
2 ANISE	PIMPINELLA ANISUM L.	UMBELLIFERAE		
3 BADIAN SEED	ILLICIUM VERUM HOOK F.	ILLIACEAE		
4 BASIL	OCIMUM BASILICUM	LABIATAE		
5 CAPERS	CAPPARIS SPINOSA	CAPPARIDACEAE		
6 CARAWAY	CARUM CARVI L.	UMBELLIFERAE		
7 CARDAMOM	ELETTARIA CARDAMOMUM MATON	ZINGIBERACEAE		
8 CASSIA BUDS AND VERA	CINNAMOMUM CASSIA	LAURACEAE		
9 CINNAMON AND CHIPS AND FLOWERS	CINNAMOUM ZEYLANICUM	LAURACEAE		
10 CLOVES, WHOLE FRUITS, STEMS, CLOVES	EUGENIA CARYOPHYLLATA THUNB	MYRTACEAE		
11 CORIANDER	CORIANDER SATIVUM L.	UMBELLIFERAE		
12 CUMIN	CUMINUM CYMINUM	UMBELLIFERAE		
13 CURRY AND CURRY POWDER				
14 DILL	ANETHUM GRAVEOLENS	UMBELLIFERAE		
15 FENNEL	FOENICULUM VULGARE MILL	UMBELLIFERAE		
16 FENUGREEK SEED	TRIGONELLA FOENUM GRECUM L.	LEGUMINOSAE		
17 GINGER ROOT	ZINGIBER OFFICINALE ROSCOE	ZINGIBERACEAE		
18 HOP CONES, PELLETS AND LUPULIN	HUMULUS LUPULUS L.	MORACEAE		
19 JUNIPER SEED	JUNIPERUS COMMUNIS L.	PINACEAE		
20 LAUREL BAY LEAVES	LAURUS NOBILIS L.	LAURACEAE		
21 LICORICE ROOT	GLYCYRRHIZA GLABRA L. SEVERAL VAR.	LEGUMINOSAE		
22 MACE, BOMBAY	MYRISTICA MALABARICA	MYRISTICACEAE		
23 MACE, NSPF	MYRISTICA FRAGANS	MYRISTICACEAE		
24 MARJORAM	ORIGANUM VULGARE AND OTHER O.	LABIATAE		
25 MINT LEAVES	MENTHA ARVENSIS AND OTHER M.	LABIATAE		
26 MUSTARD SEEDS	BRASSICA NIGRA AND OTHER B.	CRUCIFERAE		
27 NUTMEG	MYRISTICA FRAGRANS	MYRISTACEAE		
28 ORIGANUM	ORIGANUM VULGARE AND OTHER O.	LABIATAE		
29 PAPRIKA	CAPSICUM ANNUUM	SOLANACEAE		
30 PARSLEY	PETROSELINUM CRISPUM	UMBRELLIFERAE		
31 PEPPER, BLACK	PIPER NIGRUM L.	PIPERACEAE		
32 PEPPER, WHITE	PIPER NIGRUM L.	PIPERACEAE		
33 PEPPER, ABAMBIR, ARCHO				
34 PEPPER, RED	CAPSICUM ANNUUM AND OTHER C.	SOLANACEAE		
35 PIMENTO, ALLSPICE	PIMENTA OFFICINALIS LIND.	MURTACEAE		
36 ROSEMARY	ROSMARINUS OFFICINALIS	LABIATAE		
37 SAFFRON	CROCUS SATIVUS L.	IRIDACEAE		
39 SANDALWOOD	SANTALUM ALBUM L.	SANTALACEAE		
40 SAVORY	SATUREJA HORTENSIS	LABIATAE		
41 TARRAGON	ARTEMISIA DRACUNCULUS L.	COMPOSITAE		
42 THYME	THYMUS VULGARIS L.	LABIATAE		
43 TONKA BEANS	COUMAROUNA ODORATA	LEGUMINOSAE		
44 TURMERIC	CURCUMA LONGA LINN.	ZINGIBERACEAE		
45 VANILLA BEANS	VANILLA PLANIFOLIA ANDR.	ORCHIDACEAE		
38 Sage	Salvia Officinalis	Labiatae		

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AROMATIC PLANTS AND PARTS THEREOF AND THEIR DERIVATIVES FOR WHICH OFFICIAL TRADE STATISTICS ARE AVAILABLE - TABLE1

****

No.	SOURCE PLANT	FAMILIES	SOURCE PLANT	FAMILIES
• DERIVATIVES				
• ESSENTIAL OILS				
1 ALMOND, BITTER	ILLICIUM VERUM HOOK FIL.	ILLICEAE	PIMPINELLA ANISUM L.	UMBELLIFERAE
2 ANISE	PIMPINELLA RACEMOSA	MYRTACEAE		
3 BAY LEAF	PIMENTA RACEMOSA	MYRTACEAE		
4 BERGAMOT	CITRUS AURANTIUM L. VAR. BERGAMIA WIGHT AND ARN.	RUTACEAE		
5 CAMPHOR	CINNAMOMUM PARTHENOXYLON MEISN AND EBERM	LAURACEAE		
6 CANANGA OF YLANG-YLANG	CANANGA ODORATA, FORMA GENUINA	ANNONACEAE	CANANGA ODORATA, FORMA GENUINA	ANNONACEAE
7 CARAWAY	CARUM CARVI L.	UMBELLIFERAE		
8 CASSIA	CINNAMOMUM CASSIA	LAURACEAE		
9 CEDAR LEAF	THUJA OCCIDENTALIS L.	PINACEAE		
10 CINNAMON	CINNAMOMUM CASSIA NEES	LAURACEAE		
11 CITRONELLA	CYMBOPOGON NARDUS (L.) RENDLE	GRAMINEAE		
12 CLOVE	EUGENIA CARYOPHYLLATA THUNB.	MYRTACEAE		
13 CORIANDER	MENTHA ARVENSIS	LABIATAE		
14 EUCALYPTUS	EUCALYPTUS GLOBULUS LABILL AND OTHER E.	MYRTACEAE		
15 GERANIUM	PELARGONIUM ODORATISSIMUM AIT	GERANIACEAE		
16 GRAPEFRUIT	CITRUS PARADISI	RUTACEAE		
17 JASMIN	JASMINUM OFFICINALE	OLEACEAE		
18 LAVENDER	LAVANDULA OFFICINALIS CHAIX	LABIATAE		
19 (SPIKE) LAVENDER	LAVANDULA SPICA L.	LABIATAE		
20 LEMON	CITRUS LIMONUM (L) RISSO	RUTACEAE		
21 LEMONGRASS	CYMBOPOGON FLEXUOSUS (NEES) STAPF.	GRAMINEAE	CYMBOPOGON CITRATUS (DC.) STAPF	GRAMINEAE
22 LIME	CITRUS AURANTIFOLIA SWINGLE	RUTACEAE		
23 LIMBRADE, OR BOIS DE ROSE	AMIRA ROSAEODORA	LAURACEAE	BURSERA DELPECHIANA POISS.	BURSERACEAE
24 ORANGE FLOWER OR NEROLI	CITRUS AURANTIUM	RUTACEAE		
25 ORANGE	CITRUS AURANTIUM VAR. SYNENSIS L.	RUTACEAE		
26 ORIGANUM	ORIGANUM VULGARE L.	LABIATAE		
27 ORRIS	IRIS PALLIDA	IRIDACEAE		
28 PALMAROSA	CYMBOPOGON MARTINI, VAR MOTIA STAPF.	GRAMINEAE		
29 PATCHOULI	POGOSTEMON CABLIN (BLANCO) BENTH.	LABIATAE		
30 PEPPERMINT	MENTHA PIPERITA L.	LABIATAE		
31 PETITGRAIN	CITRUS AURANTIUM SUBSPECIES AMARA	RUTACEAE		
32 PINE NEEDLES	PINUS SYLVESTRIS L.	PINACEAE		
33 ROSE OR ATTAR OF ROSES	ROSA DAMASCENA MILL. AND VAR.	ROSACEAE	ROSA GALLICA L. AND VAR.	ROSACEAE
34 ROSEMARY	ROSMARINUS OFFICINALIS L.	LABIATAE		
35 SANDALWOOD	SANTALUM ALBUM L.	SANTALACEAE		
36 SASSAFRAS	SASSAFRAS ALBIDUM (NUTT) NEES	LAURACEAE		
37 SPEARMINT	MENTHA SPICATA L.	LABIATAE		
38 THYME	THYMUS VULGARIS L.	LABIATAE		
39 VETIVERT	VETIVERIA ZIZANIOIDES STAPF	GRAMINEAE		
• SAPS AND EXTRACTS				
1 HOPS EXTRACT	HUMULUS LUPULUS L.	MORACEAE		

AROMATIC PLANTS AND PARTS THEREOF AND THEIR DERIVATIVES FOR WHICH OFFICIAL TRADE STATISTICS ARE AVAILABLE - TABLE1

SOURCE PLANT	FAMILIES	SOURCE PLANT	FAMILIES
PICE OLLORESIUS			
PAPRIKA	CAPSICUM ANNUUM	SOLANACEAE	
PEPPER, BLACK	PIPER NIGRUM L.	PIPERACEAE	

****

MEDICINAL PLANTS AND PARTS THEREOF AND THEIR DERIVATIVES FOR WHICH OFFICIAL TRADE STATISTICS ARE AVAILABLE - TABLE2

****

No.	SOURCE PLANT	FAMILIES	SOURCE PLANT	FAMILIES
** MEDICINAL PLANTS AND PARTS				
*				
1 ARISTOLOCHIA ROOT	ARISTOLOCHIA BRACTEA RETZ. AND OTHER A.	ARISTOLOCHIACEAE		
2 BEAR BERRY LEAVES	VACCINIUM ERYTROCARPON MICHX.	ERICACEAE		
3 BELLADONNA	ATROPA BELLADONNA	SOLANACEAE		
4 BLETILLA ROOT	BLETIA HYACINTHINA R. BR.	ORCHIDACEAE		
5 CALUMBA ROOT	JATROHRIZA PALMATA (DC) MIERS	MENISPERMACEAE		
6 CASCARA SAGRADA	RHAMNUS PURSHIANA DC	RHAMNACEAE		
7 CINCHONA BARK	CINCHONA CALISAYA WEDD. AND OTHER C.	RUBIACEAE		
8 COLCHICUM SEEDS	COLCHICUM AUTUMNALE L.	ILIACEAE		
9 COLOCYNTH PULP	CITRULLUS COLOCYNTHIS SCHRAD	CURCUBITACEAE		
10 CONDURANGO BARK	MARSDENIA CONDURANGO REICHENB F.	ASCLEPIDEACEAE		
11 CUBEBS	PIPER CUBEBA L.F.	PIPERACEAE		
12 DIGITALIS	DIGITALIS PURPUREAV	SCROPHULARIACEAE		
13 EPHEDRA	EPHEDRA MAJOR HOST AND OTHER E.	EPHEDRACEAE		
14 GENTIAN ROOT	GENTIANA LUTEA L.	GENTIANACEAE		
15 GINSENG, RED AND WHITE	PANAX GINSENG C.A.MEY.	ARIALACEAE		
16 INDIAN SERPENTINE ROOT	RAUWOLFIA SERPENTINA BENTH EX KURZ.	APOCYNACEAE		
17 IPECAC ROOT	CEPHAELIS IPECACUANHA A. RICH.	RUBIACEAE		
18 JABORANDI LEAVES	PILOCARPUS JABORANDI HOLMES	RUTACEAE		
19 JALAP ROOT	EXOGONIUM PURGA LINDL.	CONVULVACEAE	IPONOE ORIZABENSIS LEDENDIS.	CONVULVACEAE
20 JOBS TEARS	COIX LACRIMA-JOBI	GRAMINEAE		
21 NARD (SPIKENARD)	NARDOSTACHYS JATAMANSI DC.	VALLERIANACEAE		
22 NUX VOMICA	STRYCHNOS NUX-VOMICA L.	LOGANIACEA		
23 PATCHOULI LEAVES	POGOSTEMON CABLIN (BLANCO) BENTH	LABIATAE		
24 POLYGALA ROOT (SENEGA ROOT)	POLYGALA SENEGA L.	POLYGGALACEAE		
25 PSYLLIUM SEED AND HUSK	PLANTAGO OVATA FORSK	PLANTAGINACEAE		
26 RHUBARB	RHEUM OFFICINALE BAILL	POLYGONACEAE		
27 SENNA LEAVES	CASSIA SENNA L.	LEGUMINOSAE		
28 SOPHORA FLOWER	SOPHORA JAPONICA L.	LEGUMINOSAE		
29 SQUILL	URGINEA MARITIMA (L) BAKER	LILIACEAE		
30 STRAMONIUM	DATURA STRAMONIUM L.	SOLANACEAE		
31 STROPHANTUS SEEDS	STROPHANTUS KOMBE OLIV.	APOCYNACEAE		
** DERIVATIVES				
* OTHER DERIVATIVES				
1 ALOES (CAPE ALOE) (CURACAO ALOE)	ALOE FEROX MILL. AND OTHER A.	LILIACEAE	ALOE BARBADENSIS MILL. AND OTHER A.	LILIACEAE
2 CAMPHOR	CINNAMOMUM CAMPHORA NEES AND EBERM.	LAURACEAE		
3 CROTONOIL	CROTON TIGLIUM L.	EUPHORBIACEAE		
4 DIGITALIS GLYCOSIDES	DIGITALIS PURPUREA L.	SCROPHULARIACEAE		
5 FICIN	FICUS GLABRATA H.B. AND K.	MORACEAE		
6 GINSENG EXTRACT	PANAX GINSENG C.A. MEY.	ARALIACEAE		
7 GLYCYRRHIZIN AND GLYCYRRHIZINATES	GLYCYRRHIZA GLABRA L.	LEGUMINOSEAE		
8 PAPAIN	CARICA PAPAYA L.	CARICACEAE		
9 RUTIN	EUCALYPTUS MACRORRHYNCHA F.V.M.	MYRTACEAE	SOPHORA JAPONICA L.	LEGUMINOSEAE
10 SANTONIN	ARTEMISIA MARITIMA L. SENS. LAT.	COMPOSITAE		
11. Tolu Balsam	Myroxylon Balsamum Harms	Leguminosae		

MEDICINAL PLANTS AND PARTS THEREOF AND THEIR DERIVATIVES FOR WHICH OFFICIAL TRADE STATISTICS ARE AVAILABLE - TABLE2

No.	Source Plant	Families	Source Plant	Families
Alkaloids and their parts				
1. Brucine	Striychnos Nox-Vomica L.	Lobanizaceae		
2. Caffeine	Coffea Arabica L.	Rubiaceae		
3. Cinchonine	Cinchona Micrantha R and P	Rubiaceae		
4. Emetine	Cephaelis Ipecacuanha R and CH	Rubiaceae		
5. Ephedrine	Ephedra Equisetina Bungi and other E.	Epheraceae		
6. Laevo-Alkaloids of Bella donna leaves	Atropa Belladora L.	Solanaceae		
7. Nicotine	Nicotiana Taracum	Solanaeceae		
8. Quinidine	Cinchona Calisaya Wedd. and other C.	Rubiaceae		
9. Quinine	Cinchona Calisaya Wedd. and other C.	Rubiaceae		
10. Strychnine	Strychnos Nox-Vomica L.	Loganiaceae		
11. Theobromine	Theobroma Cacao L.	Sterculiaceae		

Table 3

PLANTS USED IN THE FORMULATION OF MEDICINES IN BOLIVIA

No.	PLANTS AND PARTS	SCIENTIFIC NAMES	FAMILIES
**			
1	ANISE	PIMPINELLA ANISUM L.	UMBELLIFERAE
2	ARTICHOKE	CYNARA SCOLYMUS L.	COMPOSITAE
3	BLACK BERRY BARK	RUBUS VILLOSUS	ROSACEAE
4	BLACK ELDER	SAMBUCUS NIGRA L.	PLANTAGINACEAE
5	BOLDO LEAVES	PEUMUS BOLDUS MOLINA	MONIMIACEAE
7	DANDELION	TARAXACUM OFFICINALE WEBER	COMPOSITAE
8	DEVIL'S CLAW	HARPAGOPHYTUM PROCUMBERS D.C.	
9	GERMAN CAMOMILE	MATRICARIA CHAMOMILLA L.	COMPOSITAE
10	HAWTHORN	CRATAEGUS OXYACANTHA L.	ROSACEAE
11	HIGH MALLOW	MALVA SYLVESTRIS	MALVACEAE
12	HOLY THISTLE	SILYBUM MARIANUM (L.) GAERTN	
13	IMMORTELLE FLOWERS	HELICHRYSUM ORIENTALE	COMPOSITAE
14	JAPANESE PAGODA TREE	SOPHORA JAPONICA L.	LEGUMINOSAE
15	KKA-KEA	CULCITIUM CANESCENS HUMB. AND BONPL.	COMPOSITAE
16	LANCE-LEAF PLANTAIN	PLANTAGO LANCEOLATA L.	PLANTAGINACEAE
17	LEMON VERBENA	LIPPIA CITRIODORA	VERBENACEAE
18	LICORICE	GLYCYRRHIZA GLABRA L.	LEGUMINOSAE
19	LILY OF THE VALLEY	CONVALLARIA MAJALIS L.	LILIACEAE
20	LINDEN LEAVES	TILIA PLATYPHYLLOS SCOPOLI	TILIACEAE
21	MEADOW SAFFRON	COLCHICUM AUTUMNALE L.	LILIACEAE
22	NUX-VOMICA	STRYCHNOS NUX-VOMICA L.	STRYCHNACEAE
23	OLEANDER	NERIUM OLEANDER L.	APOCYNACEAE
24	PASSION FLOWER	PASSIFLORA INCARNATA L.	PASSIFLORACEAE
25	PEPPERMINT	MENTHA PIPERITA L.	LABIATAE
26	POWDERED JALAP ROOT	EXOGONIUM PURGA LINDL.	CONVULVACEAE
27	ROSE HIPS	ROSA CANINA L.	ROSACEAE
28	SAGE	SALVIA OFFICINALIS	LABIATAE
29	SENNA	CINNAMOMUM CASSIA NEES	LAURACEAE
30	SENNA FRUITS, LEAVES, PODS	CASSIA ACUTIFOLIA DEL.	CAESALPINIACEAE
30	SENNA FRUITS, LEAVES, PODS	CASSIA ANGUSTIFOLIA VAHL	CAESALPINIACEAE
31	SHAVE GRASS	EQUISETUM ARVENSE L.	EQUISETACEAE
32	SOUR CHERRY	PRUNUS CERASUS	
33	SPRING ADONIS	ADONIS VERNALIS L.	
34	SUNDEW	DROSERA ROTUNDIFOLIA L.	DROSERACEAE
35	TOLU BALSAM	MYROXYLON BALSAMUM HARMS	LEGUMINOSAE
36	TURMERIC, ROOT	CURCUMA LONGA LINN.	ZINGIBERACEAE
37	VALERIAN	VALERIANA OFFICINALIS L.	VALERIANACEAE
38	WHITE WILLOW	SALIX ALBA	SALICACEAE
39	WITCH HAZEL	HAMAMELIS VIGINIANA L.	HAMAMELIDACEAE
40	YARROW	ACHILLEA MILLEFOLIUM L.	COMPOSITAE
**	ESSENCES		
1	NIAOULI OIL	MELALEUCA QUINQUENERVIA S.T. BLAKE	MYRTACEAE
**	EXTRACTS		
1	ALTHEA	ALTHEA OFFICINALIS L.	MALVACEAE
2	CINCHONA, YELLOW, BARK	CINCHONA LEDGERIANA MOENS TRIMEN.	RUBIACEAE
3	CONDURANGO	MARSDENIA CONDURANGO REICHENB.	ASCLEPIADACEAE
4	HAW, BLACK, BARK	VIBURNUM PRUNIFOLIUM L.	CAPRIFOLIACEAE

****

PLANTS USED IN THE FORMULATION OF MEDICINES IN BOLIVIA

****

No.	PLANTS AND PARTS	SCIENTIFIC NAMES	FAMILIES
5	IPECAC	CEPHAELIS IPECACUANHA A. RICH.	RUBIACEAE
6	PISCIDIA	PSIDIUM GUAJAVA L.	MYRTACEAE
7	RHUBARB FLOWER	RHEUM PALMATUM L.	POLYGONACEAE
8	SENNA	CASSIA ACUTIFOLIA DELILE	CESAL PINIACEAE
9	SUNDEW	DROSERA ROTUNDIFOLIA L.	DROSERACEAE
10	THYME	THYMUS VULGARIS	
**	CONSTITUENTS OF ESSENTIAL OILS		
1	CAMPHOR	CINNAMOMUM CAMPHORA NEES EBERM	LAURACEAE
2	CINEOLE	EUCALYPTUS GLOBULUS LABILL.	MYRTACEAE
3	GUAIACOL	GUAJACUM OFFICINALE L.	ZYGOPHYLLACEAE
4	MENTHOL	MENTHA ARVENSIS L.	LAMIATAE

AROMATIC PLANTS AND PARTS THEREOF AND THEIR DERIVATIVES FOR WHICH OFFICIAL TRADE STATISTICS ARE AVAILABLE - TABLE 4

No.	SOURCE PLANTS	FAMILIES	IMPORTS 1987, US$ MILLIONS		
			USA	EEC	JAPAN
** AROMATIC PLANTS AND PARTS					
*					
1 BADIAN SEED	ILLICIUM VERUM HOOK F.	ILLIACEAE	2.2	1.3	N.A.
2 CARDAMOM	ELETTARIA CARDAMOMUM MATON	ZINGIBERACEAE	0.8	1.9	N.A.
3 CASSIA BUDS AND VERA	CINNAMOMUM CASSIA	LAURACEAE	25.3	N.A.	N.A.
4 CINNAMON AND CHIPS AND FLOWERS	CINNAMOMUM ZEYLANICUM	LAURACEAE	2.3	6.3	5.3
5 CLOVES, WHOLE FRUITS, STEMS, CLOVES	EUGENIA CARYOPHYLLATA THUNB.	MYRTACEAE	3.4	8.4	1.0
6 GINGER ROOT	ZINGIBER OFFICINALE ROSCOE	ZINGIBERACEAE	4.0	8.0	39.2
7 MACE, BOMBAY	MYRISTICA MALABARICA	MYRISTICACEAE	1.1	N.A.	N.A.
8 MACE, ESPP	MYRISTICA FRAGRANS	MYRISTICACEAE	3.1	11.7	N.A.
9 MARIGOLD FLOWERS	TAGETES ERECTA	COMPOSITAE			
10 NUTMEG	MYRISTICA FRAGRANS	MYRISTICACEAE	12.9	29.3	2.7
11 PAPRIKA	CAPSICUM ANNUUM	SOLANACEAE	9.9	N.A.	N.A.
12 PEPPER, BLACK	PIPER NIGRUM L.	PIPERACEAE	147.9	N.A.	N.A.
13 PEPPER, RED	CAPSICUM ANNUUM AND OTHER C.	SOLANACEAE	9.3	N.A.	N.A.
14 PEPPER, WHITE	PIPER NIGRUM L.	PIPERACEAE	26.5	N.A.	N.A.
15 PEPPERMINT LEAVES	MENTHA ARVENSIS	LABIATAE			
16 PIMENTO, ALLSPICE	PIMENTA OFFICINALIS LIND.	MYRTACEAE	1.7	N.A.	0.2
17 TURMERIC	CURCUMA LONGA LINN.	ZINGIBERACEAE	1.8	3.1	3.1
18 VANILLA	VANILLA PLANIFOLIA ANDR.	ORCHIDACEAE	77.5	29.2	2.9
** DERIVATIVES					
* ESSENTIAL OILS					
1 ANISE	ILLICIUM VERUM HOOK FIL.	ILLICEAE	0.5	N.A.	N.A.
2 ANISE	PIMPINELLA ANISUM L.	UMBELLIFERAE	0.5	N.A.	N.A.
3 BAY LEAF	PIMENTA RACEMOSA	MYRTACEAE	N.A.	N.A.	N.A.
5 BERGAMOT	CITRUS AURANTIUM L. VAR. BERGAMIA WIGHT AND ARN.	RUTACEAE	3.1	5.0	0.9
6 CANANGA	CANANGA ODORATA, FORMA MACROPHYLA	ANNONACEAE	2.1	N.A.	0.6
7 CASSIA	CINNAMOMUM CASSIA	LAURACEAE	6.8	N.A.	1.3
8 CINNAMON	CINNAMOMUM ZEYLANICUM	LAURACEAE	0.3	N.A.	N.A.
9 CITRONELLA	CYMBOPOGON BARDUS (L.) RENDLE	GRAMINEAE	4.5	5.3	N.A.
10 CLOVE	EUGENIA CARYOPHYLLATA THUNB.	MYRTACEAE	2.4	N.A.	0.7
11 CORIANDER	MENTHA ARVENSIS	LABIATAE	1.4	N.A.	N.A.
12 EUCALYPTUS	EUCALYPTUS GLOBULUS LABILL. AND OTHER E.	MYRTACEAE	1.6	7.7	0.4
13 GRAPEFRUIT	CITRUS PARADISI	RUTACEAE	0.7	N.A.	N.A.
14 JASMIN	JASMINUM OFFICINALE	OLEACEAE	N.A.	4.5	1.1
15 LEMON	CITRUS LIMONUM (L.) RISSO	RUTACEAE	8.4	18.6	6.2
16 LEMONGRASS	CYMBOPOGON CITRATUS (DC.) STAPF.	GRAMINEAE	0.6	N.A.	0.2
17 LEMONGRASS	CYMBOPOGON FLEXUOSUS (NEES) STAPF.	GRAMINEAE	0.6	N.A.	0.2
18 LIME	CITRUS AURANTIFOLIA SWINGLE	RUTACEAE	8.9	N.A.	N.A.
19 NUTMEG	MIRISTICA FRAGRANS	MYRISTICACEAE	3.2	N.A.	N.A.
20 ORANGE	CITRUS AURANTIUM VAR. SYNENSIS L.	RUTACEAE	4.5	12.9	8.5
21 ORANGE FLOWER OR NEROLI	CITRUS AURANTIUM	RUTACEAE	0.7	N.A.	N.A.
22. Palmarosa	CYMBOPOGON MARTINI, VAR. MOTIA STAPF.	GRAMINEAE	0.5	N.A.	N.A.

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AROMATIC PLANTS AND PARTS THEREOF AND THEIR DERIVATIVES FOR WHICH OFFICIAL TRADE STATISTICS ARE AVAILABLE - TABLE 4

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No.	SOURCE PLANTS	FAMILIES	IMPORTS 1987, US$ MILLIONS		
			USA	EEC	JAPAN
25 VETIVERT	VETIVERIA ZIZANIOIDES STAPF.	GRAMINEAE	3.6	4.6	0.6
26 YLANG-YLANG	CANANGA ODORATA, FORMA GENUINA	ANNONACEAE	2.1	5.0	N.A.
• SAPS AND EXTRACTS					
1 QUASSIA AMARA EXTRACT	QUASSIA AMARA ?	SIMARUBACEAE	N.A.	0.2	N.A.
• SPICE OLLORESINS					
1 PAPRIKA	CAPSICUM ANNUUM	SOLANACEAE	11.3	N.A.	N.A.
2 PEPPER, BLACK	PIPER NIGRUM L.	PIPERACEAE	6.9	N.A.	N.A.

MEDICINAL PLANTS AND PARTS THEREOF AND THEIR DERIVATIVES FOR WHICH OFFICIAL TRADE STATISTICS ARE AVAILABLE - TABLE 5

No.	SOURCE PLANTS	FAMILIES	IMPORTS 1987, US$ MILLIONS		
			USA	EEC	JAPAN
**	MEDICINAL PLANTS AND PARTS				
1	CINCHONA BARK	CINCHONA CALISAYA WEDD. AND OTHER C.	N.A.	16.5	N.A.
2	COLOCYNTH PULP	CITRULLUS COLOCYNTHIS SCHRAD.	N.A.	N.A.	N.A.
3	CONDURANGO BARK	MARSDENIA CONDURANGO REICHENB. F.	N.A.	N.A.	N.A.
4	CUBEBS	PIPER CUBEBA L.F.	N.A.	N.A.	N.A.
5	EPHEDRA	EPHEDRA NAMIS HOST AND OTHER E.	N.A.	N.A.	0.3
6	GINSENG, RED AND WHITE	PANAX GINSENG C.A.MEY.	4.2	N.A.	34.9
7	INDIAN SERPENTINE ROOT	RAUWOLFIA SERPENTINA BENTH EX KURZ.	N.A.	N.A.	N.A.
8	IPECAC ROOT	CEPHAELIS IPECACUANHA A. RICH.	N.A.	N.A.	N.A.
9	JABORANDI LEAVES	PILOCARPUS JABORANDI HOLMES	N.A.	N.A.	N.A.
10	JALAP ROOT	EXOGONIUM PURGA LINDL.	0.9	N.A.	N.A.
11	JALAP ROOT	IPOMOEA ORIZABENSIS LEDANOIS	0.9	N.A.	N.A.
12	NUX VOMICA	STRYCHNOS NUX-VOMICA L.	N.A.	N.A.	N.A.
13	PATCHOULI LEAVES	POGOSTEMON CABLIN (BLANCO) BENTH	N.A.	N.A.	N.A.
14	POLYGALA ROOT (SENEGA ROOT)	POLYGALA SENEGA L.	N.A.	N.A.	N.A.
15	PSYLLIUM SEED AND HUSK	PLANTAGO OVATA FORSK.	19.6	N.A.	N.A.
16	PYRETHRUM FLOWERS	CHRYSANTHEMUM CINERARIAEFOLIUM	3.0	0.3	
17	SENNA LEAVES	CASSIA SENNA L.	N.A.	N.A.	N.A.
18	SOPHORA FLOWER	SOPHORA FLAVESCENS AITON	N.A.	N.A.	0.3
19	STROPHANTUS SEEDS	STROPHANTUS KOMBE OLIV.	N.A.	N.A.	N.A.
	DERIVATIVES				
	ALKALOIDS AND THEIR SALTS				
1	BRUCINE	STRYCHNOS NUX-VOMICA L.	N.A.	N.A.	N.A.
2	CAFFEINE	COFFEA ARABICA L.	N.A.	17.0	4.7
3	CINCHONINE	CINCHONA HICKANTHA H AND P.	N.A.	N.A.	N.A.
4	EMETINE	CEPHAELIS IPECACUANHA R. AND CH.	N.A.	N.A.	N.A.
5	EPHEDRINE	EPHEDRA EQUISETINA BUNGE AND OTHER E.	N.A.	5.7	N.A.
6	QUINIDINE	CINCHONA CALISAYA WEDD. AND OTHER C.	N.A.	6.A.	N.A.
7	QUININE	CINCHONA CALISAYA WEDD. AND OTHER C.	N.A.	10.5	N.A.
8	STRYCHNINE	STRYCHNOS NUX-VOMICA L.	N.A.	A.A.	A.A.
9	THEOBROMINE	THEOBROMA CACAO L.	N.A.	5.7	N.A.
	OTHER DERIVATIVES				
1	FICIN	FICUS GLABRATA H.B. AND K.	N.A.	1.A.	N.A.
2	GINSENG EXTRACT	PANAX GINSENG C.A. MEY.	4.4	N.A.	N.A.
3	PAPAIN	CARICA PAPAYA L.	0.2	N.A.	0.4
4	RUTIN	SOPHORA FLAVESCENS AITON	N.A.	33.0	0.9
5	TOLU BALSAM	MYROXYLON BALSAMUM HARMS.	N.A.	N.A.	N.A.
6	PYRETHRUM EXTRACT	CHRYSANTHEMUM CINERARIFOLIUM	9.4	3.7	0.3

T A B L E 6

COMPREHENSIVE LIST OF CANDIDATE PLANTS FOR FINAL SELECTION FOR PROJECT IMPLEMENTATION AT UNIDO HEADQUARTERS

AROMATIC PLANTS

1.	Anise	Pimpinella anisum L.	Umbelliferae
2.	Badian	Illicium verum Hook F.	Illiaceae
3.	Black & white peper	Piper nigrum L.	Zingiberacea
5.	Cinnamon	Cinnamomum zeylanicum	Lauraceae
6.	Cinnamon cassia	Cinnamomum cassia	Lauraceae
7.	Citronella	Cymbopogon nardus (L) Rendle	Gramineae
8.	Cloves	Eugenia caryophyllata Thunb	Myrtacea
9.	Eucalyptus	Eucalyptus globulus Labill.	Myrtaceae
10.	Fennel	Foeniculum vulgare Mill.	Umbelliferae
11.	Grapefruit	Citrus paradisi	Rutaceae
12.	Lemon	Citrus limonum (L)Risso	Rutaceae
13.	Lemongrass	Cymbopogon citratus (DC)Stapf.	Gramineae
14.	Lime	Citrus aurantifolia Swingle	Rutaceae
15.	Cornmint	Mentha arvensis	Labiatae
16.	Nutmeg & mace	Myristica fragrans	Myristaceae
17.	Orange	Citrus aurantium var.sinensis L.	Rutaceae
18.	Palmarosa	Cymbopogon martini var.motia Stapf.	Gramineae
19.	Paprika	Capsicum annuum	Solanaceae
20.	Turmeric	Curcuma longa Linn.	Zingiberaceae
21.	Vanilla	Vanilla planifolia Andr.	Orchidaceae
22.	Vetivert	Vetiveria zizanioides Stapf.	Gramineae

MEDICINAL PLANTS

1. American Wormseed	Chenopodium ambrosioides L.	Chenopoidiaceae
2. Coffee (for caffeine)	Coffea arabica L. & other	Rubiaceae
3. Cinchona	Cinchona calisaya Wedd. & other C.	Rubiaceae
4. Cocillana	Guarea rusbyi (Britt.)Rusby	Meliaceae
5. Condurango	Marsdenia condurango Reichemb. f.	Asclepedaceae
6. Copaiba	Copaifera coriacea Mart.	Leguminosae
7. Ephedra (for Ephedrine)	Ephedra major Host & other E.	Ephedraceae
8. Ficus spp (for ficin)	Ficus glabrata HBK & other F.	Moraceae
9. Ginseng	Panax ginseng C.A. Mey	Arialaceae
10. Ipecac	Cephaelis ipecacuanha A. Rich.	Rubiaceae
11. Psyllium	Plantago ovata Forsk.	Plantaginaceae
12. Senna	Cassia senna L.	Leguminosae
13. Solanum eleagnifolium	Solanum eleagnifolium Gay	Solanaceae
14. Solanum marginatum	Solanum marginatum	Solanaceae
15. Tolu Balsam Tree	Toluifera balsamum L.	Leguminosae

OTHER RELATED PLANTS

1. Annatto	Bixa orellana L.	Bixaceae
2. Cube	Lonchocarpus nicou DC	Leguminosae
3. Marigold	Tagetes erecta	Compositae
4. Pyrethrum	Chrysanthemum cinerariafolium	Compositae

TABLE 7

CANDIDATE PLANTS FOR FINAL SELECTION FOR PROJECT IMPLEMENTATION AT UNIDO HEADQUARTERS

AROMATIC PLANTS & PARTS & DERIVATIVES

AT LOS YUNGAS

1. Badian & oil (1)
2. Cardamom & oil (1)
3. Cinnamom bark
4. Cassia cinnamon bark (1)
5. Grapefruit oil
6. Lemon oil
7. Lime oil
8. Nutmeg & mace & oils (1)
9. Orange oil
10. Paprika
11. Vetivert oil (1)

IN CHAPARE

1. Anise seeds & oil & anethole (1) (2)
2. Black & white pepper
3. Cardamom seed & oil
4. Cinnamom cassia bark (1)
5. Cinnamom bark (1)
6. Citronella oil & citronellol (1)
7. Cloves & clove oil & eugenol (1)
8. Eucalyptus oil & cineol
9. Fennel oil & anethole (1) (2)
10. Lemongrass oil & citral
11. Mentha arvensis & menthol
12. Palmarosa oil (1)
13. Paprika
14. Turmeric and curcumin
15. Vanilla
16. Vetivert oil & vetiverol (1)

MEDICINAL PLANTS & DERIVATIVES

1. Cinchona bark, alkaloids & salts
2. Coffee for decaf & caffein
3. Cocillana bark
4. Condurango bark (1)
5. Copaiba balsam
6. Ipecac (1)
7. Ginseng (1)
8. Fig trees for ficin
9. Solanum marginatum (1)
10. Tolu balsam

1. American wormseed oil
2. Cocillana bark
3. Condurango bark (1)
4. Copaiba balsam
5. Fig trees for ficin
6. Ephedra & ephedrine (1)
7. Senna leaves (1)
8. Psyllium (1)
9. Solanum eleagnifolium & other (1)
10. Cube root & rotenone resin

OTHER RELATED PLANTS

1. Annatto seed, powder & extract
2. Marigold flowers & powder

1. Annatto seed, powder & extract
2. Cube root & rotenone resin
3. Marigold flowers & extract
4. Pyrethrum flowers & extract (2)

(1) Suggested new cultures.
(2) Not strictly in Chapare but in the Cochabamba valley or highlands.

P. CASTRO, UNIDO CONSULTANT ON BEHALF OF AGROYUNGAS,

LA PAZ, BOLIVIA

Meetings requested with Purchasing Managers/Vicepresidents of indicated companies for discussions on prices, specifications, lot sizes, requirements, U.S. customs and USDA regulations for imports and possibilities of medium terms contract purchases for indicated products; two meetings to be held per day during week August 7 - 11.

Essential Oils

- Berje Chemical Products, Inc., 5 Lawrence St. Broomfield, NJ 07003 (201) 748-8980	Eucalyptus oil;eucalyptol; Lemongrass oil; cornmint oil; menthol; anise oil; citronella oil; vetivert oil; cinnamon bark oil; cinnamon leaf oil; orange oil.
- J. Manheimer Inc. 47-22 Pearson Place Long Island City, NY 11101 (718) 392-7800	Eucalyptus oil; eucalyptol; menthol; cardamom oil; anise oil; citronella oil; palmarosa oil; vetivert oil; cinnamon leaf oil; orange oil; grapefruit oil; (vanilla beans).

Spices & Food Colors

- E.L. Scott & Co. Inc. One World Trade Center Suite 2347 New York, NY 10048 (212) 432-0100	Spices - Black pepper; cinnamon; cassia; cloves; nutmeg and mace; paprika; turmeric; vanilla; (orange oil; grapefruit oil).
- William Bernstein Co., Inc. 15 Park Row New York, N.Y. 10038 (212) 233-5922	Cassia, Cloves, nutmeg, orange peel.

Medicinal Plants & Derivatives

-	Meer Corp.	Cocillana Bark & Extracts; copaiba balsam; ipecac root & extract; psyllium seed & husks; senna leaves and pods; tolu balsam; cinchona bark & extracts; passion flower herbs; (Eucalyptus oil); marigold flowers; annatto seed; annatto extract; cardamom oil; spices (pepper, cardamom, paprika, turmeric; vanilla); cinnamon leaf oil; orange peel.
-	Biddle Sawyer Corp. 2 Penn Plaza New York, NY 10121 (212) 736-1580	Ficin, (citral; menthol)
-	H. Reisman Corp. 377 Crane St. Orange, NJ 07051 (201) 677-7200	Caffeine; Ephedrine & Salts; Psyllium Husks; Diosgenin
-	Prentiss Drug & Chemical Co., Inc. C. B. 2000 Park, NY 11001 (516) 326-1919	Cube extracts; Cube powder; Rotenone extracts; Floral Rotenone resins; pyrethrum extract; concentrates & formulations

Phytopharmaceuticals

-	Merck & Co., Inc. Rahway, NJ 070065-0900 (201) 574-4000	Solasodin and other phytochemicals