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Medicinal Plants from Madagascar: Production and Export (**)

Because of its particular geographical position, Madagascar is one of the few countries where a variety of medicinal plants are found growing wild in different areas of the country. According to P. Boiteau, it is estimated that about 12,000 species of Phanerogames exist in Madagascar, among which nearly 80% are endemic. For a long time, the originality of this flora has attracted the attention of botanists, ethnobotanists and phytochemists. Thus, the export on a small scale of medicinal plants for various scientific studies has already existed from this far-off period. Later on, in the 20th century, the birth and the development of European pharmaceutical industries has brought a renewal of interest in medicinal plants.

Phytochemical researches carried out in several laboratories led to the identification of molecules which have been used either as active principles of medicines, or as raw materials for hemisynthesis of other active principles. In spite of great progress of organic synthesis, the extractive method still remains the most economical way for obtaining these molecules. The Malagasy flora offers a large variety of species which can be used as an important source of raw materials; that was how, 30 years ago, another type of medicinal plant export, on a large scale this time, was started for industrial extraction of these molecules.

It follows that the interest in medicinal plants which was first limited to their empiric uses, took on another appearance.

Besides the traditional pharmacopoeia aspect of medicinal plants, their economic aspect has been developed little by little. They were of interest not only to the scientific researchers, but also to a hierarchy of people ranging from the country people who collect or grow the plants to the exporters.

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In my paper, which will refer to the production and export of medicinal plants, I take up three points:

1) What are the medicinal plants which have been exported?
2) How has the production been viewed?
3) What is their economic impact?

I - Export of medicinal plants:

According to their use, it is convenient to distinguish 3 types of export:

A) export of medicinal plants for scientific studies,
B) export of medicinal plants for personal use,
C) export of medicinal plants for commercial purposes.

A) *Export of medicinal plants for scientific studies:*

The exporters are most of the time national researchers who have been working in collaboration with foreign Institutes. Table I below gives us the list of the first medicinal plants exported for phytochemical studies.

Table I — *List of the first medicinal plants exported for scientific study abroad.*

— Tanghinia madagascariensis
— Tanghinia venenifera
— Menabea venenata
— Erythrophleum komanga
— Cryptostegia madagascariensis.

It is worth noting that the attention of researchers was particularly attracted to toxic plants. For example, numerous authors have studied Tanghinia madagascariensis as a result of its historical use in Madagascar as a poison in a juridical ordeal. For according to ancient beliefs in Madagascar, the magic spirit attributed to that plant allowed all legal mysteries to be uncovered. The alleged "divine judgment" through the absorption of that plant was meant to find out and punish those guilty of theft, vandalism or political subversion.

Later on, a great number of medicinal plants were and are still the subject of export for scientific studies. It is difficult to know with precision the qualitative as well as quantitative importance of medicinal plants exported with this end in view.

B) *Export of medicinal plants for personal use*

Here, the exporters are tourists and Malagasy students who carry on their

studies abroad. Tourists generally take herbs. As for Malagasy students, two main reasons lead them to take medicinal plants with them:

1 - At first, Malagasy people have a particular vision of diseases and therefore they have a certain conception of medicine. The belief in the therapeutic virtues of medicinal plants remains deeply rooted in the Malagasy customs in spite of the progress made by modern medicine.

2 - Then, the reflex to bring something from the motherland with oneself, at all cost, can be accounted for in the very nature of the Malagasy's soul and civilisation. The spreading of Catharanthus roseus all over the neighbouring Islands of Madagascar constitutes one evidence as well as the remarkable similarity between Malagasy medicinal plants and those from Reunion. The Reunion Isle has been partly populated by slaves from Madagascar.

From 1979 up to now, the following species, in frequency order (Table II) have been the subject of regular export according to the data collected by the National Center of Pharmaceutical Researches.

Most of these plants are to be sold in the market. The total quantity exported amounts to 300 kg per year.

TABLE II — *List of medicinal plants exported for personal use.*

1. MYSTROXYLON aethiopicum	13. LYGODIUM lanceolatum
2. CENTELLA asiatica	14. CLIDEMIA hirta
3. APHLOIA theaeformis	15. L. PHYLLOXYLON phyllanthoides
4. HELICHRYSUM gymnocephalum	16. CEDRELOPSIS grevei
5. MOLLUGO nudicaulis	17. HELICHRYSUM faradifani
6. HYLOCEREUS lemairi	18. EUCALYPTUS citriodora
7. HARUNGA madagascariensis	19. LYCOPODIUM cernuum
8. CYMBOPOGON citratus	20. CYATHULA uncinulata
9. CUSSONIA bojeri	21. FICUS pyrifolia
10. ZEA mays	22. AVICENNA marina
11. TODDALIA asiatica	23. PSIADIA salviaefolia
12. PENTOPETIA androsaemifolia	

B) *Export of medicinal plants for commercial purpose*

This is the most important type of export because it plays a significant role in the economy of our country. Here, the exporters are private commercial companies which provide Occidental pharmaceutical firms with raw materials. At the moment, there are six medicinal plant export companies.

We have collected all the medicinal plants exported since 1970 and we can classify them into three categories (Table III).

TABLE III — *List of medicinal plants exported since 1970 for industrial use.*

Category A: *medicinal plants which have been the subject of regular export:*
- Catharanthus roseus
- Centella asiatica
- Pygeum africanum
- Rauvolfia confertiflora
- Drosera madagascariensis
- Voacanga thouarsii

Category B: *new species and crude extracts of medicinal plants exported recently:*
- Areca madagascariensis (23.5 tons)
- Adansonia sp (1.0 ton)
- Medemia nobilis (3.2 tons)
- Ravenea rivularis (0.3 ton)
- Nummelarioides cotyle (1.0 ton)

— *essential oils from:*
- Helychrisum gymnocephalum
- Raventsara madagascariensis
- Melaleuca viridiflora
- Eucalyptus globulus
- Cymbopogon citratus
- Eucalyptus citriodora

Category C: *medicinal plants the export of which has been stopped for a few years:*
- Harunga madagascariensis
- Catharanthus lanceus.

We are going to focus our attention on the first category of medicinal plants:

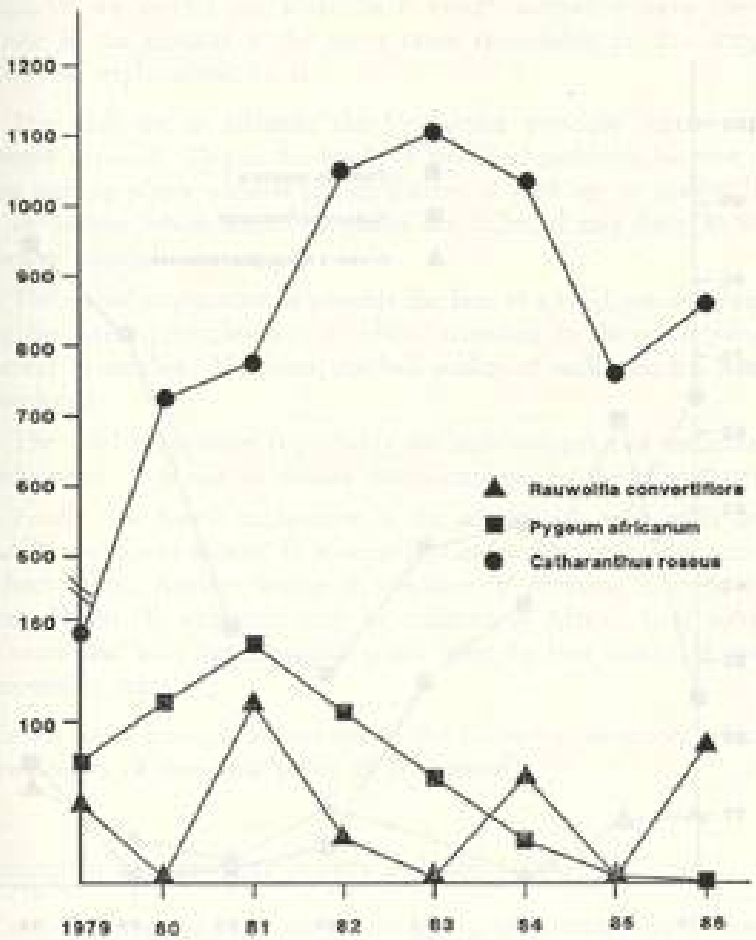
1 - First of all, as far as the six export companies are concerned (Table IV), we notice that the PRONATEX exports the greatest part of medicinal plants; yet there is a sort of competition and no company has the monopoly in the export of a plant.

TABLE IV — *Medicinal plant export companies.*

Designation	Plants exported from 1979 to 1986
PRONATEX	roseus, D. madagascariensis, R. confertiflora, V. thouarsii, P. africanum
SOAMADINA	C. roseus, D. madagascariensis, C. asiatica, P. africanum
COREMA	C. roseus, D. madagascariensis
CORIMEX	C. roseus, C. asiatica
SOPRACAM	C. roseus, C. asiatica
SEVPROMA	D. madagascariensis

2 - Then, graph I shows us the quantity exported per year, from 1979 to 1986 for C. roseus, P. africanum and R. confertiflora:

— Periwinkle *C. roseus* is exported far more than any other medicinal plant. This plant, which was considered as an anti-diabetic in traditional medicine, has gained considerable importance in modern medicine. Leaves of the plant contain two alkaloids: V L B and Leurocristine, which are used for treatment of a variety of cancers, especially leukemia in children. Roots of the plant contain an alkaloid called ajmalicine (raubasine), which is very popular in modern medicine as an anti-fibrillant agent. Previously, the plant was mainly collected from wild sources. Since a couple of years, it has been widely cultivated in the southern region of Madagascar. The quantity exported, that had increased considerably until 1983, has now decreased.



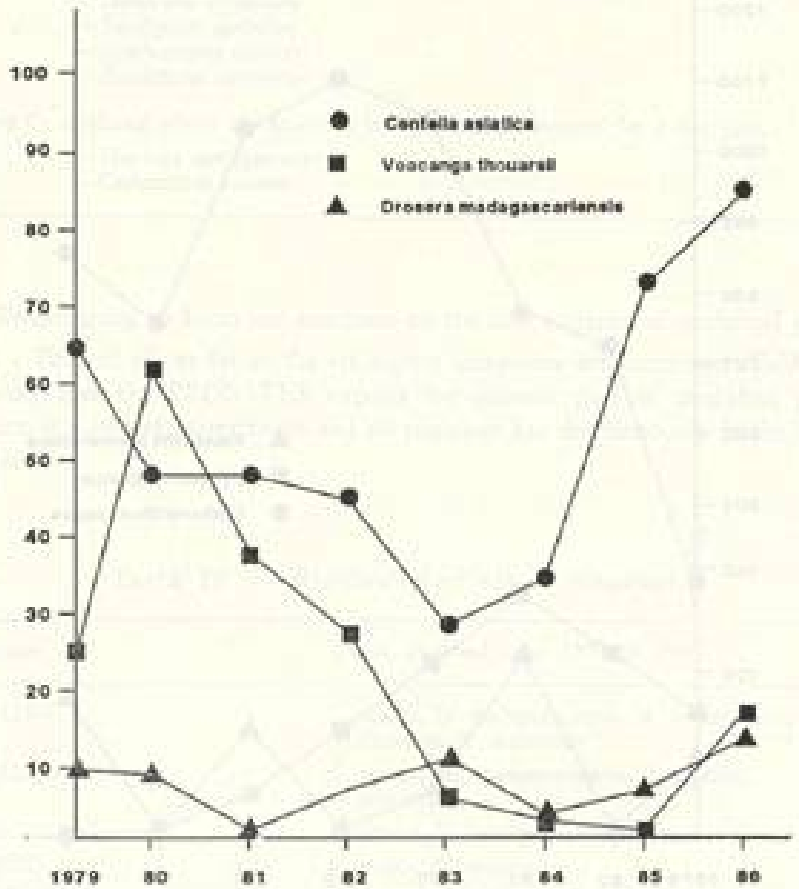
Graph I - The annual quantity exported from 1979 to 1986 for C. roseus, P. africanum and R. confertiflora.

— Stem barks of *P. africanum* contain a lipid sterol complex that is used to treat prostatic adenomia. The demand for P. africanum which is being collected in wild sources has gone down progressively, and since 1985 the quantity exported has gone down to zero.

— The roots of the plant *R. confertiflora* contain reserpine and related alkaloids, which are used in hypertension as well as in the treatment of mental disorders as a tranquillizer. The demand for R. confertiflora has been very irregular and sometimes it goes down to zero.

Graph II shows us the annual quantity exported from 1979 to 1986 for C. asiatica, D. madagascariensis and V. thouarsii.

— *C. asiatica* contains two triterpene glycosides called asiaticoside and madecassoside, which are used in modern medicine as a healing substance. The plant is to be found growing wild in the eastern region of Madagascar. The



Graph II - Graph showing the annual quantity exported from 1979 to 1986 for C. asiatica, V. thouarsii and D. madagascariensis.

quantity exported decreased regularly until 1981, but since 1985 the demand for *C. asiatica* has gone up. Madagascar is the main supplier of this plant.

— The seeds of *V. thouarsii* contain an alkaloid named tabersonine, which is used as a raw material for hemisynthesis of vincamine. The demand for V. thouarsii, which is collected in wild sources, has decreased remarkably year after year.

— Finally, crude quinones of *D. madagascariensis* are used as an antispasmodic and constitute one of the ingredients for mixtures against cough. The demand for *D. madagascariensis* which is collected in natura has been the subject of fluctuations.

It ensues from these two graphs that one of the main features of the export of medicinal plants in Madagascar is the irregularity of the quantities exported. Does it result from the insufficiency of the quantity available, for the collection cannot afford to cover the demand, or from the decrease of the users' demand? Some inquiries we carried out with the 6 export companies have shown that the decrease in the demand is the major cause responsible for this irregularity. These are some explanations for it:

1 - The first one is certainly the low active principle content compared to the norms required. This is the result of irrational gathering because countrymen often pick up plants without any distinction of their age or quality. Besides, the part of regions where medicinal plants are collected may have an influence on the active principle content.

2 - The second explanation is possibly the lack of a valid guarantee certificate indicating the active principle content, which, according to the users, varies from one shipment to another. Moreover, the bad quality of packaging has been sometimes mentioned.

3 - The third explanation is probably the high unit price of medicinal plants from Madagascar. It is due to diverse duties imposed by the official service.

4 - Finally, the fourth explanation is the competition with other countries. India and Kenya export as well *C. roseus*; *R. Confertiflora* competes with *R. serpentina* from India. Another species of voacanga, *V. africana*, is to be found in Cameroon. Finally, *P. africanum* may be collected in Africa. It is quite logical that the users deal with the companies which offer the best quality of production at a competitive price.

This last point leads us to proceed to the following paragraph, which refers to the production of medicinal plants in Madagascar.

II - Production of medicinal plants in Madagascar

As stated during the comment on the two graphs, except for *C. roseus*, the other plants exported are collected in wild sources. Madagascar's map (Fig. 1) shows us the main regions for gathering or cultivating these plants:

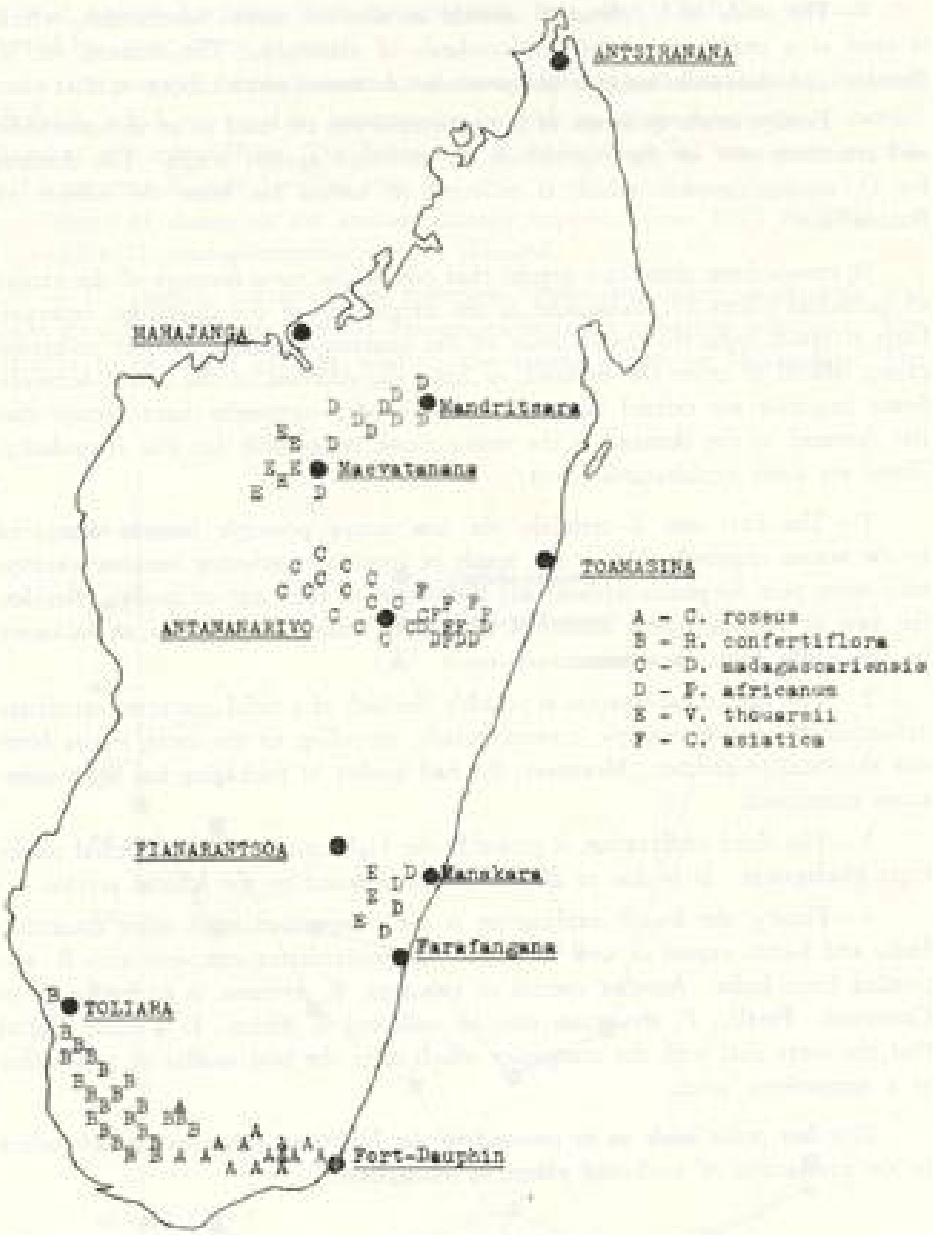


Figure 1 - Madagascar's map showing the main regions for collecting or cultivating medicinal plants.

— C. roseus is cultivated in the southern region of Madagascar but it can be collected as well in wild sources in the same region. A few tests of cultivation carried out in other regions gave a negative result.

— R. confertiflora is collected as well in this part of the country.

— P. africanum is collected in the western part of Madagascar, especially in Mandritsara and Port Bergé.

— V. thouarsii is collected in the western region of Madagascar between Garafantsy and Maevatanana, but it can be found in the eastern region, between Manakara and Farafangana.

— Finally, C. asiatica and D. madagascariensis are collected in the eastern forest. An attempt has been made to cultivate C. asiatica but it did not give any interesting results.

III - Economic aspect of medicinal plants in Madagascar

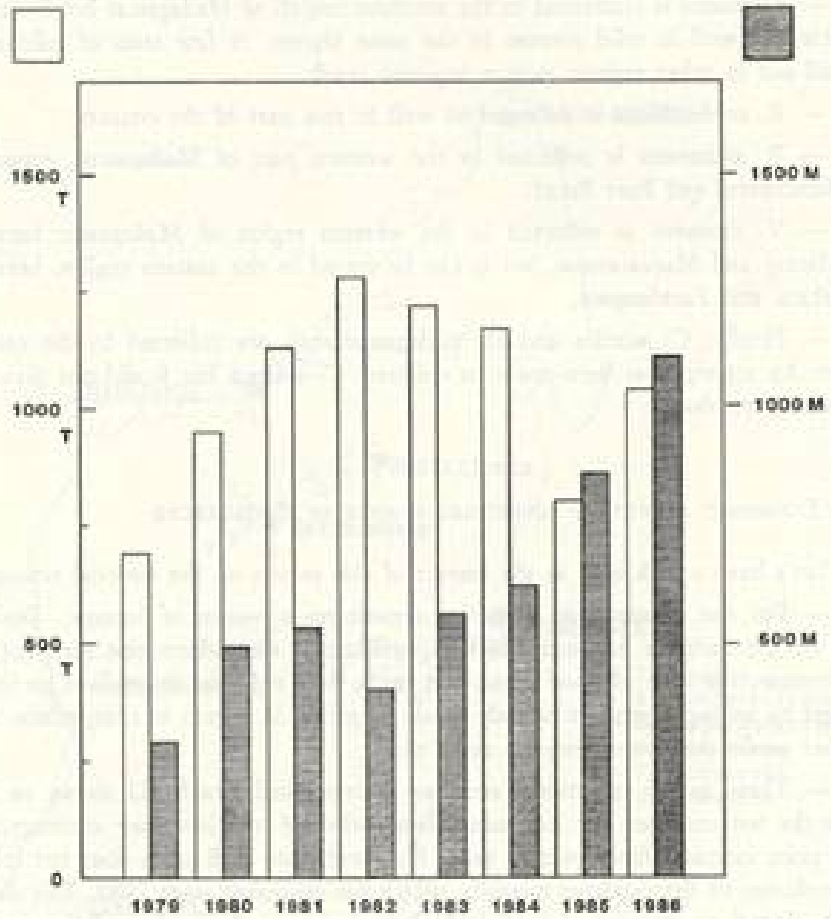
Let's have a look now at the impact of this export on the national economy:

— For the countrymen, gathering constitutes a source of income. Besides, here we are facing a problem which is well-known somewhere else too: for the countryman, the man of good sense that he is, sees only the immediate profit he can get by selling a product he only needs to gather in natura in comparison with another profit that would require extra work.

— Then, as far as national economy is concerned, graph III shows us that if we do not consider the increasing devaluation of the Malagasy currency, the FOB price increases from year to year. However, this FOB price does not follow the evolution of the exported quantity, which has decreased since 1983. This shows clearly that the unit price of medicinal plants has been the subject of fluctuations from year to year, according to the supply and demand (Table V).

Table V — *Unit price (FMG) of medicinal plants exported from* 1979 *to* 1986.

	1979	1980	1981	1982	1983	1984	1985	1986
C. roseus	314.7	423.6	388.5	249.5	416.9	504.6	840.5	846.7
C. asiatica	938.5	1310.0	1050.0	414.8	1260.0	1441.8	3808.2	3000.0
P. africanum	550.4	584.6	606.7	711.5	624.4	600.0	—	—
R. confertiflora	383.5	—	575.4	550.0	—	440.0	—	1380.0
V. thouarsii	750.0	750.0	771.6	373.4	862.0	721.0	3500.0	1013.8
D. madagascariensis	601.0	682.9	747.0	1241.1	1741.1	1607.3	2963.6	2063.6



Graph III - The total quantity exported (Tonnes) and the evolution of the FOB price (Millions FMG) of medicinal plants from 1979 to 1986.

Finally, as it appears that exports of medicinal plants represent hundreds of millions, it seems interesting to compare these FOB prices to those of a few agricultural products such as vanilla, cloves and tobacco (Table VI).

Table VI indicates clearly that there is no possible comparison between the medicinal plants and vanilla or cloves; nevertheless, they bring in more money than tobacco and many other agricultural products.

Conclusion

I would like to conclude my report with some remarks about the future of medicinal plants in Madagascar:

TABLE VI — *The FOB price (Million FMG of medicinal plants compared to those of a few agricultural products).*

	Vanilla	Cloves	Medicinal plants	Tobacco
1979	3,114	15,007	298	166
1980	5,944	6,583	489	366
1981	7,491	17,721	542	248
1982	16,672	25,331	398	0
1983	27,211	6,963	568	0
1984	30,400	20,485	625	0
1985	28,805	24,483	861	1,261
1986	33,183	24,191	1,126	0

— the export of medicinal plants contributes to bringing in foreign currency for Madagascar, which would find more profit if these plants were cultivated in a rational way. The different areas of the country offer a wide range of climate, soil, altitude, so that probably, nearly all the medicinal plants used in modern medicine can be cultivated in the appropriate regions of the country,

— the standard quality should be established in order to avoid the sending of second-rate products,

— cooperation with European laboratories and pharmaceutical firms should be developed for a better evaluation of the results.

When will Madagascar produce crude extracts? This brings up a number of problems that would be tedious to enumerate here.