



# Amazonian Women's Medicine: Treatments for Mycoses

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## Abstract

Botanical treatments for dermal mycoses and vaginal yeast infections used among villagers of the Yarapa River region, Loreto, Peru were tested for bioactivity in this study. Treatments of dermal mycoses included preparations of *Ysimia angusta* (Clusiaceae), *Senna reticulata* (Fabaceae), *Senna macrophylla* (Fabaceae), *Genipa americana* (Rubiaceae), *Croton lechleri* (Euphorbiaceae), *Chenopodium ambrosioides* (Chenopodiaceae), and *Cecropia membranacea* (Cecropiaceae) and the beetle larvae that consume it. Remedies for vaginal yeast infections, used separately and in mixtures by midwives are *Spondias mombin* (Anacardiaceae), *Maytenus macrocarpa* (Celastraceae), *Campsiandra spruceana* (Fabaceae), *Psidium guajava* (Myrtaceae), *Coussapoa nitida* (Cecropiaceae), *Brosimum acutifolium* (Moraceae), *Brosimum rubescens* (Moraceae), *Swarzizia polyphylla* (Fabaceae), *Anacardium giganteum* (Anacardiaceae), *Maquira coreocea* (Moraceae), *Croton lechleri*, *Copaifera paupera* (Fabaceae), and an unidentified white fungus. Disk diffusion assays were conducted against two yeasts, two dermatophytes, two gram-positive bacteria, and three gram-negative bacteria. In addition, a crystal violet bioassay was conducted on skin and colon cancer cell lines to assess the cytotoxicity associated with the use of these anti-fungal plants. Most of the extracts showed bioactivity against several of the test organisms; all but two were active against *Candida albicans*, the fungus responsible for yeast infections. *Copaifera paupera* and *Croton lechleri* were the only two extracts found to be significantly cytotoxic.

## Introduction



The study site: the Yarapa river lodge and surrounding Varzea forest at the beginning of the rainy season.



Cornell field station location, Peru.

Medicinal plants are of major importance in communities that have an abundance of plants, but a shortage of health care. The use of medicinal plants by indigenous tribes or peoples is ubiquitous, and the knowledge of medicinal properties in plants is often passed down through the generations, a process by which preparations of active plants are ever refined.

The Yarapa River is a small tributary to the Amazon in the state of Loreto, Peru. For five weeks in the summer of 2001, the people of two villages on the River (Jaldar and Jerusalem) worked with us to compile information about the plants they use to treat mycoses.

The main informants for this study were a forest guide (Estéban Mosquera) and botanist (Juan Ruiz), three midwives from the villages on site (Felicitia, Leocha, and Jorge), and two merchants in the medicinal plants marketplace in Iquitos.

Yeast infections, caused by the fungus *Candida albicans* (Ascomycota), are a common affliction around the world. Women who are pregnant are at increased risk for vaginal yeast infections because glycogen content on the vulva is abnormal during pregnancy? Candidiasis can take other severe pathological forms; it can cause thrush in babies and in immunocompromised patients, chronic bronchitis, endocarditis, and meningitis. Infections are tenacious and treatments are few.

Dermal mycoses, such as ringworm and athlete's foot, are caused by dermatophytes in the genera *Epidermophyton*, *Microsporum*, and *Trichophyton*. Dermatophytosis is more common in warm, humid climates,<sup>3,4</sup> so it tends to occur frequently in the tropical rainforest. Often, humans are infected with zoophilic dermatophytosis through contact with animals.<sup>1</sup> Readily available botanical treatments can greatly alleviate the spread of repeated fungal infection.

## Materials and Methods

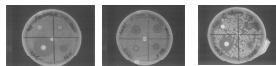
Plants were identified and collected at the Yarapa field site except plants that were unavailable in the Varzea forest, which were purchased in the medicinal plants market in Iquitos. These included *Brosimum rubescens*, *Anacardium giganteum*, *Swarzizia polyphylla*, *Chenopodium ambrosioides*, saps of *Croton lechleri* and *Copaifera paupera*, and a mix sold by a merchant specifically for yeast infections (Norma's mix). Two plant mixes for treating yeast infections that were made by local midwives were also tested.

Plants were ground and extracted in 70% ethanol at a standard concentration of 25mg/mL. Extracts were tested whole, the goal being to study each plant as it is used in folk medicine. All 25 plants were tested against the following microorganisms using a disk diffusion assay on appropriate media:

- two yeasts (*Candida albicans* and *Saccharomyces cerevisiae*)
- two dermatophytes (*Trichophyton mentagrophytes* and *Epidermophyton floccosum*)
- two gram-positive bacteria (*Bacillus cereus* and *Staphylococcus aureus*)
- three gram-negative bacteria (*Escherichia coli*, *Pseudomonas aeruginosa*, and *Helicobacter pylori*).

Cytotoxicity associated with the use of these anti-fungal plants (some of which are are ingested, and others which are applied topically) was tested using a crystal violet assay on two human cancer cell lines:

- colon cancer HT29
- skin cell carcinoma A431



Disk diffusion assays

## Results

### Anti-fungal activity

Plants used against yeast infections were very active against *Candida albicans*, the fungus responsible for yeast infections. They were also active against *S. cerevisiae*, another yeast in the Ascomycota phylum.

Plants used against ringworm were shown to be slightly less active against dermatophytes in the disk diffusion assay, although they were active against yeasts, indicating anti-fungal activity.

TABLE 1: Anti-fungal bioactivity of treatments for yeast infections

Species	plant part used	Anti-fungal Bioactivity			
		<i>C. albicans</i>	<i>S. cerevisiae</i>	<i>E. floccosum</i>	<i>T. mentagrophytes</i>
1 <i>Anacardium giganteum</i>	bark	+	++	-	-
2 <i>Brosimum acutifolium</i>	bark	+++	+	+	-
3 <i>Brosimum rubescens</i>	wood	+++	+	+	-
4 <i>Campsiandra spruceana</i>	bark	+++	++	-	-
5 <i>Copaifera paupera</i>	resin	+++	++++	+	+
6 <i>Coussapoa nitida</i>	bark	++	-	-	-
7 <i>Croton lechleri</i>	resin	+++	+++	-	+
8 Felicitia's mix (2,4,12,14,17)	barks	+++	+	-	-
9 Jorge's mix (1,3,6,12,16,17)	various	++	++	++	+
10 Jorge's mix (made by Jorge)	various	++	+	+	-
11 <i>Maquira coreocea</i>	resin	-	-	+	-
12 <i>Maytenus macrocarpa</i>	bark	++	++	-	-
13 Norma's mix (6,17, other)	various	+	+	-	+
14 <i>Psidium guajava</i>	bark	++	+	+	-
15 <i>Psidium guajava</i>	leaves	++	++	-	+
16 <i>Swarzizia polyphylla</i>	wood	+++	+++	-	-
17 <i>Spondias mombin</i>	bark	+	++	+	+
18 unidentified white fungus	whole	+	-	-	-

TABLE 2: Anti-fungal bioactivity of treatments for dermal mycoses

Species	plant part used	Anti-fungal Bioactivity			
		<i>C. albicans</i>	<i>S. cerevisiae</i>	<i>E. floccosum</i>	<i>T. mentagrophytes</i>
1 <i>Cecropia membranacea</i>	leaves	++	-	+	-
2 <i>Chenopodium ambrosioides</i>	leaves	-	-	-	-
3 <i>Croton lechleri</i>	resin	+++	+++	-	+
4 <i>Genipa americana</i>	fruit	++	-	+	-
5 <i>Senna macrophylla</i>	fruit	-	-	-	-
6 <i>Senna reticulata</i>	bark	+++	++	-	-
7 unidentified beetle larvae	whole	-	-	-	-
8 <i>Vismia angusta</i>	resin	+++	+	-	-

-no activity, + 1.0-2.0mm inhibition, ++ 2.1-4.0mm inhibition, +++ 4.1-10.0mm, ++++ >10.0mm inhibition

### Anti-bacterial activity

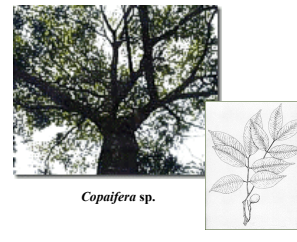
There was comparatively little anti-bacterial activity. *Copaifera paupera* was the only extract active against all bacteria. *Campsiandra spruceana* and *Vismia angusta* were active against *S. aureus* and *P. aeruginosa*. Five other plants were also active against *P. aeruginosa*. Plants active against the ulcer-causing bacteria *H. pylori* were *A. giganteum*, *B. acutifolium*, *C. spruceana*, *C. paupera*, *C. lechleri*, Felicitia's mix, Jorge's mix, *M. macrocarpa*, *P. guajava* leaves, and *S. polyphylla*.

### Cytotoxicity

The plants were generally non-toxic to cancer cell lines. The point of recovery of the cancer cells was the 2<sup>nd</sup> or 3<sup>rd</sup> dilution (0.83uL or 7.5uL extract, 10mg/mL) for all but two treatments. *Croton lechleri* (Sangre de Grado) was toxic at the 6<sup>th</sup> dilution (5.6<sup>th</sup> uL), and *Copaifera paupera* (Copaiba) at the 16<sup>th</sup> (2.2<sup>nd</sup> uL).



*Croton lechleri*



*Copaifera sp.*



A midwife's tools of the trade: Machete and rubber boots.



Learning about medicinal plants in the marketplace. Extract pictured: *Maquira coreocea*.

Searching for rainforest cures.

## Discussion

•Correlation between gathered ethnobotanical information and laboratory testing is high: all but one of the treatments for yeast infections were active against the yeast *Candida albicans*.

•The plants used against dermal mycoses were not as active against dermatophytes. This could be due to the testing procedure, since the disk diffusion assay technique was not optimized for mycelial fungi. A susceptibility test was also conducted on the dermatophytes with poor results. Other techniques for conducting bioassays on dermatophytes should be explored.

•Most plants were not anti-bacterial. People may have selected plants that in addition to inhibiting fungal growth, do not kill the beneficial, normally-occurring bacteria that protect against yeast infections.

•The two cytotoxic plants, *Croton lechleri* and *Copaifera paupera*, were the only two for which extraordinary caution was urged; they are known to be powerful plants, and two drops, heavily diluted in water, are effective as medicine.

•Results indicate that ethnomedical studies are a very efficient way of researching medicinal plants; random screening for anti-yeast plants would not yield as high a percentage of active plants.

Medicinal plant extracts at the market. Experimental extraction (in 70% ethanol) mimicked traditional extraction (in aguardiente, or sugar cane rum).



## References

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Peru field station map drawn by Peter Fraissinet.

*Croton lechleri* photographs accessed 6/4/02 at <http://www.rain-forest.com/Plant-Images/>

*Copaifera sp.* photograph accessed 6/4/02 at [http://www.amazing.com.br/produto/oléo\\_copaiba.htm](http://www.amazing.com.br/produto/oléo_copaiba.htm)

*Copaifera sp.* illustration accessed 6/4/02 at <http://www.tropislab.com/copaiba.html>

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