

Antimicrobial Screening of Maranao Medicinal Plants

Carmelita G. Hansel and Verna B. Lagare

The search for novel bioactive compounds, including antimicrobial ones, continues. This is largely so because some pathogens have developed resistance to certain currently used drugs and some diseases have yet to be treated chemotherapeutically. The search for these producers of possibly novel bioactive compounds have targeted microorganisms (Garcia-Hansel et al., 2000), animals such as marine sponges (Aloot et al., 2001), and plants, ranging from the simple algae (Garcia, 1978) to the higher flowering plants (Masilungan et al., 1955).

Ethno-botanical listings of plants used for medicinal purposes are valuable as a guide for identifying plants that might contain antimicrobial compounds. There is a high level of positive correlation between the traditional medical use of the plant and the current therapeutic use of the chemical extracted from the plant (Farnsworth, 1988). One ethno-botanical report is a listing of 157 medicinal plants used by the Maranaos (Flores et al., 1981). This publication is out of print; consequently, an umbrella project was proposed aimed at preparing and publishing a revised and expanded edition of this report. To be included in this expanded report would be a notation on the antimicrobial activity of these Maranao medicinal plants.

Thus, among other objectives in this umbrella proposal, the objectives of this particular project were incorporated. These are: to establish a garden (CNSM Botanical Garden) where available Maranao medicinal plants can be propagated, and to test crude extracts of selected plants for antimicrobial activity against representative test organisms. The garden is intended to be not only a showcase of these

Maranao medicinal plants (including endemic and indigenous plants and of plant specimens for class use), but to have available fresh material for antimicrobial and other kinds of tests (e.g., cytotoxic, mutagenic, antimitotic) that may be done in the future.

Review of Literature

Plants have always been a source of products which are of economic importance to man – food, fiber, wood, oils, resins, rubber, drugs, and so forth (Edlin, 1969). Plants produce the active ingredients in a wide variety of medicines like laxatives, diuretics, heart medicine, ulcer treatments, analgesics, hormones, and anesthetics. It is said that one of every four prescription drugs contain ingredients originally derived from plants (Berg, 1997).

There has been a continuing tradition of usage of plants for medicinal purposes, such as in the long history of Chinese herbal medicine. Folk medicine has also been practiced by various tribal groups in the Philippines, by those in the Cordillera region (Co, 1989), by the Maranaos (Flores et al. (1981), by various other tribes, as cited by Madulid and Gaerlan (1994), and by the general populace (Concha, 1982; de Guzman-Ladion, 1985; de Padua et al., 1978; de Padua and Pancho, 1989). These reports detail the different illnesses and the preparations of the plants for the treatment of these illnesses. Quisumbing, in 1951, prepared a comprehensive work on Philippine medicinal plants, their chemical components and the illnesses for which they are used, citing the works by earlier authors both in and outside the Philippines.

The growing trend to return to herbal medicine has necessitated the need for standardizing the preparation of these plants (Chomchalow and Henle, 1993; PCHRD, 1991) and for testing their efficacy.

Methodology

Garden of Maranao Medicinal Plants

An area, approximately 710 m² (~17 x 42 m), between the Bio-Chem Building and the Science Lecture Hall was identified as the

area for the CNSM Botanical Garden. The area was fenced-in with interlink wire on a hollow block foundation, with gates located on the north and south sides of the garden. Part of the area was covered with a double layer of fish net to provide shade for shade-loving plants. Medicinal plants, a number of which are wild plants, were collected from around the campus. Several species were found being cultivated in the yard of a Maranao local resident at 5th St. of the MSU Campus. These plants were transplanted and grown in the garden.

Experimental Plants

Ten medicinal plants used by the Maranaos were selected from the publication of Flores et al. (1981) for antimicrobial testing. These plants were selected on the basis of whether the illness they were purported to treat would entail the necessity for antimicrobial action. These plants are: arbaka (*Hyptis capitata* Jacq.), ganalem (*Clerodendrum quadriloculare* [Blanco] Merr.), kabiro-biro (*Stachytarpheta jamaicensis* [Linn.] Vahl), kasapisapi (*Ageratum conyzoides* Linn.), kasep a nipay (*Drymaria cordata* [Linn.] Willd.), kasep a tau (*Oxalis corniculata* Miq.), mangoaw (*Erigeron sumatrensis* Retz.), sapar (*Sida acuta* Burm. f.), talompa a koda (*Elephantopus spicatus* Aubl.), and tamda (*Elephantopus mollis* HBK.). Table 1 lists the plants with the corresponding illness for which they are used by the Maranaos. Four of the plants are shown in Figures 1 through 4.

Preparation of Plant Extracts

Either the entire plant, as in the case of the *kasep a nipay* and *kasep a tau*, or the leaves (for the rest) were used. The plant materials were air dried for a week, then cut into pieces and kept at room temperature in sealed, separate and labeled plastic bags until ready for the extraction process.

Seventy per cent ethyl alcohol was used as solvent for the extraction. A pre-weighed quantity of dried plant material was soaked in a specific volume of 70% ethyl alcohol for 48-72 hours and shaken mechanically from time to time. The extract was decanted and filtered through Whatman filter paper no. 1. The filtrate was allowed to evaporate for one week in order to make the extract more concentrated.

Test Microorganisms

Four representative test microorganisms were used in testing the antimicrobial activity of the plant extracts. These were: *Staphylococcus aureus*, a gram-positive bacterium; *Escherichia coli*, a gram-negative bacterium; *Candida albicans*, a yeast; and *Aspergillus niger*, a mold. These cultures were originally obtained from the UP NSRI Culture Collection of Microorganisms, Diliman, Quezon City, and were maintained in nutrient agar (for the bacteria) and Sabouraud's dextrose agar (for the fungi) slants. Eighteen- to 24-hour old nutrient broth and Sabouraud's dextrose broth cultures, for the bacteria and fungi, respectively, which were grown in a 37°C incubator, were used in the antimicrobial test.

Antimicrobial Test

The antimicrobial test used the filter paper disc diffusion method (Anderson, 1974). Materials were sterilized in a pressure cooker-type sterilizer (at 121°C or 15 psi for 15 minutes) and all procedures were done using aseptic techniques.

Preparation of agar plates: Nutrient agar (Becton-Dickinson BBL) was used for the bacterial test organisms and potato dextrose agar for the yeast and mold test organisms. The media were sterilized, allowed to cool to around 50°C, and then, at about 20 ml, poured into each pre-sterilized petri dish.

Cotton swabbing technique for seeding the agar plates: A sterile cotton swab was dipped into the 18-24 hour broth culture of the test organism and was carefully streaked over the surface of the sterile agar plate. The plate was then turned at right angles and the swab was streaked again over the entire surface to ensure a uniform film of the test microbe.

Filter paper disc test: Circular discs of 6-mm diameter were prepared by cutting a sheet of Whatman filter paper no. 3 with a paper puncher, and then sterilizing the discs. With a pair of sterile forceps (dipped into ethyl alcohol and flamed), a disc was picked up and soaked in the plant extract and then, excess liquid was drained by letting the edge of the disc touch the side/brim of the container. The impregnated

disc was placed into one sector of the plate. Three sectors were made in one plate, with each disc impregnated with differing extracts. A disc dipped in ethyl alcohol served as the control. Three discs for each extract placed in different plates served as the replicates.

The plates were incubated at 37°C for 48 hours. They were then examined for the appearance of a clear zone around the disc, i.e., inhibition of growth of the test organism. This would indicate the presence of antimicrobial compound(s) in the extract. The plant extract that exhibited the zone of inhibition, the width of the zone, as well as the test organism it inhibited, were all recorded.

Findings

Garden of Maranao Medicinal Plants

The garden (CNSM Botanical Garden) was inaugurated during the celebration of the CNSM Science Week in February 2002 (Figure 5). At that time, a total of 58 plants had been planted and were growing in the garden. These consisted of 34 Maranao medicinal plants, 12 endemic/indigenous plants, and 12 class specimens. Table 2 gives a detailed list of these plants.

Antimicrobial Activity of the Extracts

Ten Maranao medicinal plants were selected for the testing of their antimicrobial activity. These plants were selected since their use by the Maranaos implied that they should exhibit some kind of antibacterial action. Ethanolic extracts were prepared and tested using the filter paper disc diffusion technique. Presence of a clear zone around the disc, meaning the inhibition of growth of the test organism, indicated that the plant had antimicrobial activity. Four of the test plates are shown in Figures 6 through 9. The results are summarized in Table 3. All plants showed antimicrobial activity against either one or more of the test microbes. Two of the plants (*mangoaw* and *talompa a koda*) had distinct broad-spectrum antimicrobial action in inhibiting three of the four test microbes, that is, the gram-positive and gram-negative bacteria (*S. aureus* and *E. coli*, respectively) and the yeast (*C. albicans*). None of the plants inhibited the mold, *A. niger*. These results are a tentative confirmation of the use for which these plants

are used by the Maranaos. These findings may thus open a door for the continued testing of these plants' therapeutic and pharmacological potential.

Only ten Maranao medicinal plants, presented here as possible representatives of the others, have been be the subject of this study due to fund limitations.

Carmelita G. Hansel and **Verna B. Lagare** are both professors in the faculty of the College of Natural Sciences and Mathematics, MSU, Marawi City.

BIBLIOGRAPHY

- Aloot, Haide May G., Jose M. Oclarit and Carmelita Garcia-Hansel. 2001. "Isolation of microbes from a marine sponge, *Thorecta* sp., and testing for their Antimicrobial activity." Paper presented during the 6th Annual Regional Convention of the Philippine Society for Microbiology, Inc. (PSM) Mindanao Chapter on November 16-17, 2001 at Xavier University, Cagayan de Oro City.
- Anderson, Dean. 1974. *Laboratory Instructions in Microbiology*. C.V. Mosby Co., Saint Louis, Missouri.
- Berg, Linda R. 1997. *Introductory Botany*. Saunders College Publishing, Pennsylvania.
- Chomchalow, Narong and Henle, Hans V. eds. 1993. *Medicinal and Aromatic Plants in Asia: Breeding and Improvement*. RAPA Publication: 1993/19. Science Publishers, Inc., Lebanon, New Hampshire.
- Co, Leonardo L. 1989. *Common Medicinal Plants of the Cordillera Region (Northern Luzon, Philippines)*. Revised & expanded ed. A trainor's manual for community based health programs. Community Health Education, Services and Training in the Cordillera Region (CHESTCORE), Baguio City.
- Concha, Jesusa A. 1982. *Philippine National Formulary*. 2nd ed. National Science and Technology Authority, Bicutan, Taguig, Metro Manila.
- De Guzman-Ladion, Herminia. 1985. *Healing Wonders of Herbs: Guide to the Effective Use of Medicinal Plants*. Philippine Publishing House, Manila.
- De Padua, Ludivina S., Gregorio C. Lugod and Juan V. Pancho. 1978. *Handbook on Philippine Medicinal Plants*. Vol. 2. Documentation and Information Section, Office of the Director of Research, University of the Philippines at Los Baños.
- De Padua, Ludivina S. and Pancho, Juan V. 1989. *Handbook on Philippine Medicinal Plants*. Vol. 4. Documentation and Information Section, Office of the Director of Research, University of the Philippines at Los Baños.
- Edlin, H.L. 1969. *Plants and Man: the Story of Our Basic Food*. The Natural History Press, Garden City, New York.
- Farnsworth, Norman R. 1986. "Screening Plants for New Medicines." In: Wilson, E.O. ed. *Biodiversity*. National Academy Press, Washington,

D.C.

- Flores, Corazon G., Carmelita O. Garcia and Fatima M. Natangcop. 1981. *Maranao Medicinal Plants*. URC (University Research Center) Press, Mindanao State University, Marawi City.
- Garcia, Carmelita O. 1978. "Preliminary Report on the Screening of Marine Algae for Antibacterial Properties." *Philippine Biota* 13 (2): 63-68. (Reprinted in *Mindanao Journal* 5 (3): 41-45, Jan.-March 1979)
- Garcia-Hansel, Carmelita O., Rhea Amor C. Lumactud and Jose M. Oclarit. 2000. "Preliminary Extraction of Bioactive Compounds from Three *Bacillus* Isolates." Paper presented during the 5th Annual Regional Convention of the PSM Mindanao Chapter on November 17-18, 2000 at MSU-IIT, Iligan City.
- Madulid, Domingo A. 1995. *A Pictorial Cyclopedic of Philippine Ornamental Plants*. Bookmark, Makati, Metro Manila.
- Madulid, Domingo A. and Gaerlan, Ferdinand J.M. 1994. *A Bibliography on Philippine Ethnobotany, Ethnopharmacology, and Related Subjects*. National Museum, Manila.
- Masilungan, V.A., J. Maranon, V.V. Valencia, N.C. Diokno and P. de Leon. 1955. "Screening of Philippine Higher Plants for Antibacterial Substances." *Philipp. J. Sci.* 84 (3): 275-301.
- Merrill, Elmer. 1912. *A Flora of Manila*. Bureau of Printing, Manila. (1982 reprint. Bookmark, Manila.)
- Muhari, Hajara, Carmelita O. Garcia-Hansel and Verna B. Lagare. 1998. "Bacterial Isolates Exhibiting Antifungal Property." Paper presented during the 3rd Annual Regional Convention of the PSM Mindanao Chapter on November 13-14, 1998 at Xavier University, Cagayan de Oro City.
- PCHRD. 1991. "Selection and Scientific Validation of Medicinal Plants for Primary Health Care." Technical Report Series No. 12. Philippine Council for Health Research and Development, Department of Science and Technology.
- Quisumbing, Eduardo. 1978. *Medicinal plants of the Philippines*. Katha Publishing Co., Inc. (JMC Press, Inc., Quezon City). (Original publication is 1951.)

Table 1. List of plants and the corresponding illnesses for which they are used by the Maranaos. (Adapted from Flores et al., 1981)

Maranao name/ Scientific name	Illness
Arbaka <i>Hyptis capitata</i> Jacq.	Dry cough in adults; toothache Gas pain of baby; convulsion of children
Ganalem <i>Clerodendrum quadriloculare</i> [Blanco] Merr.	Boil; tuberculosis On-and-off fever
Kabiro-biro <i>Stachytarpheta jamaicensis</i> [Linn.] Vahl	Wound; boil Abdominal pain
Kasapisapi <i>Ageratum conyzoides</i> Linn.	Wound; fever Abdominal pain; enlarged stomach
Kasep a nipay <i>Drymaria cordata</i> [Linn.] Willd.	Wound; cough and fever Allergy; abdominal pain
Kasep a taw <i>Oxalis corniculata</i> Miq.	Cough; fever Infection of lips and tongue
Mangoaw <i>Erigeron sumatrensis</i> Retz.	Skin disease; influenza Headache
Sapar <i>Sida acuta</i> Burm. f.	Boil; advanced tuberculosis Strengthening mother's abdomen after delivery
Talompa a koda <i>Elephantopus spicatus</i> Aubl.	Diarrhea; tuberculosis Abdominal pain and ulcer
Tamda* <i>Elephantopus mollis</i> HBK.	Stool with blood

* - Information from H. Mohamad, 2000, pers. comm.

Table 2. List of plants cultivated in the CNSM Botanical Garden at its inauguration-opening on February 2002 during the CNSM Science Week celebration (Maranao medicinal plants; Endemic and indigenous plants; Class specimens)

<i>Catalogue of Plants</i>		
Plant No.	Common name	Scientific name; Uses
1	Arbaka (Maranao)	<i>Hyptis capitata</i> Jacq.; Maranao medicinal plant
2	Barongis or Bawing a bigas (Mar)	<i>Pandanus amaryllidifolius</i> Roxb. Maranao medicinal plant; Indigenous
3	Baw-a-kasina (Mar.)	<i>Artemisia vulgaris</i> L.; Maranao medicinal plant
4	Bawing (Mar.)	<i>Cymbopogon citratus</i> (D.C.) Stapf.; Mar. med. plt.
5	Caricature plant (Eng)	<i>Graptophyllum pictum</i> (L.) Griff. Class specimen – The necessity of chlorophyll for Photosynthesis
6	Centipede plant (Eng)	<i>Homalocladium platycladium</i> (F.J. Muell.) L.H. Bailey; Syn. <i>Muehlenbeckia platyclada</i> (FJMuell) Meissn.; Class specimen – Specialized stem
7	Denggaw (Mar.)	<i>Bryophyllum pinnatum</i> (Lamk.) Kurz Syn. <i>Kalanchoe pinnata</i> (Lamk.) Pers. Maranao medicinal plant
8	Dilang-baka (Tag) or Opuntia (Eng.)	<i>Nopalea cochenillifera</i> (L.) Salm-Dyck Class specimen – Specialized stem
9	Durian	<i>Durio zibethinus</i> Murr.; Maranao med. plant; Class specimen – scale hair
10	Five-fingers (Eng)	<i>Schefflera odorata</i> (Blco.) Merr.; Endemic
11	Ganalem (Mar.)	<i>Clerodendrum quadriloculare</i> (Blco.)

		Merr.; Maranao medicinal plant; Endemic
12	Gas balanday or	<i>Asclepias curassavica</i> L.; Maranao med. plant Senda (Mar.)
13	Genda (Mar.)	<i>Allium porrum</i> L.; Maranao medicinal plant
14	Kabiro-biro (Mar.)	<i>Stachytarpheta jamaicensis</i> (L.) Vahl.: Mar. med.plt
15	Kadelem (Mar.)	<i>Pogostemon cablin</i> (Blco.) Benth.; Mar. med. plt.
16	Kalawag (Mar.)	<i>Curcuma longa</i> L.; Maranao med. plant
17	Kapal (Mar.)	<i>Plectranthus amboinicus</i> (Lour.) Spr.; Mar. med. plt
18	Karomenga (Mar.)	<i>Acorus calamus</i> L.; Maranao med. plant
19	Kasapisapi or Mengiyak (Mar.)	<i>Ageratum conyzoides</i> L.; Maranao med. plant
20	Kasep-a-nipay (Mar.)	<i>Drymaria cordata</i> ; Maranao med. plant
21	Kasep-a-taw (Mar.)	<i>Oxalis corniculata</i> L.; Maranao med. plant
22	Katabas sa palaw(Mar)	<i>Emilia sonchifolia</i> (L.) DC. Maranao medicinal plant
23	Large-fishtail palm	<i>Caryota rumphiana</i> Mart. var. <i>philippinensis</i> Becc.; Edible shoot bud; Variety is endemic
24	Lasona a mariga (Mar)	<i>Eleutherine palmifolia</i> (L.) Merr. Maranao medicinal plant
25	Lubi-lubi (Bikol)	<i>Ficus pseudopalma</i> Blco.; Edible young shoot Endemic

- | | | |
|----|----------------------------------|---|
| 26 | Lychee (Eng) | <i>Litchi chinensis</i> Sorr. subsp. <i>chinensis</i>
Class specimen – Edible aril |
| 27 | Mangilas (Mar.) | <i>Ludwigia</i> sp.; Maranao med. plant |
| 28 | Mangoaw or
Tayatarapan (Mar.) | <i>Erigeron sumatrensis</i> ; Maranao med.
plant |
| 29 | Mantawasi (Mar.) | <i>Costus speciosus</i> (Koenig) Smith; Mar.
med. plt. |
| 30 | Mombas (Mar.) | <i>Mentha arvensis</i> L.; Maranao med. plant |
| 31 | Native aroids | <i>Alocasia atropurpurea</i> Engl.; Indigenous |
| 32 | | <i>Alocasia micholitziana</i> Hort. Sander
Endemic beautiful ornamental plant |
| 33 | | <i>Alocasia sandariana</i> Bull.
Endemic attractive aroid |
| 34 | | <i>Alocasia zebrina</i> C.Koch. & Hort. Veitch
Endemic ornamental
<i>Alocasia</i> sp.; Endemic ornamental |
| 35 | Native fern allies | <i>Psilotum nudum</i>
Class specimen – Most primitive
tracheophyte |
| 36 | | <i>Lycopodium clavatum</i> L. |
| 37 | | <i>Selaginella</i> sp. |
| 38 | Native ferns | Several species; Endemic/Indigenous |
| 39 | | <i>Cyathea</i> sp. (tree fern)
Class specimens – Various positions of
sori |
| 40 | Neem tree (Eng) | <i>Azidarachta indica</i> A. Juss.
Class specimen – Insecticidal |
| 41 | Pair a mariga (Mar.) | <i>Coleus blumei</i> Benth.; Maranao med.
plant |
| 42 | Paliyas (Mar.) | <i>Justicia gendarussa</i> Burm. f.; Maranao
med. plt. Indigenous plant |
| 43 | Pili (Bikol; Tag.) | <i>Canarium luzonicum</i> A. Gray; Edible nut
Endemic |

44		Pobreng kahoy (Bis.) <i>Euphorbia tirucalli</i> L. or Stick plant (Eng) Class specimen – Specialized stem
45	Ponkan	<i>Citrus</i> sp.; Class specimen – Fruit hesperidium
46	Queen-of-the-night cactus	<i>Epiphyllum oxypetalum</i> (DC) Haw. Class specimen – Specialized stem
47	Rambutan (Tag.)	<i>Nephelium lappaceum</i> (L.) Mant. Class specimen – Edible aril Indigenous, but some var. hybrid/ imported
48	Ribas (Mar.)	<i>Medinilla</i> sp.; Maranao medicinal plant Endemic ornamental plant
49	Sabi or Gintang (Mar.)	<i>Chenopodium ambrosioides</i> L.; Mar. med. plt.
50	Sapar (Mar.)	<i>Sida acuta</i> Burm. f.; Maranao med. plant
51	Sarindeketa (Mar.)	<i>Bidens pilosa</i> L.; Maranao med. plant
52	Talawatawa (Mar.)	<i>Euphorbia hirta</i> L.; Maranao med. plant
53	Talid (Mar.)	<i>Scleria</i> sp.; Maranao med. plant
54	Talompa-a-koda (Mar.) or Palo-a-koda	<i>Elephantopus spicatus</i> ; Maranao med. plant Syn. <i>Pseudelephantopus spicatus</i>
55	Tamda (Mar.)	<i>Elephantopus mollis</i> ; Maranao med. plt.
56	Tebo (Mar.)	<i>Saccharum officinarum</i> L.; Maranao med. plt.
57	Tikala (Bis.)	<i>Etilingeria elatior</i> ; Indigenous ornamental
58	Tsaang-gubat (Tag.)	<i>Carmona retusa</i> (Vahl) Masam. Syn. <i>Ehretia microphylla</i> Lam. Philippine medicinal plant; endemic

Table 3. Antimicrobial activity of ten Maranao medicinal plants.

Plant Name	S. aureus	E. coli	C. albicans	A. niger
Arbaka (<i>Hyptis capitata</i>)	-	+	-	-
Ganalem (<i>Clerodendrum quadriloculare</i>)	-	++	-	-
Kabiro-biro (<i>Stachytarpheta jamaicensis</i>)	+	+	-	-
Kasapisapi (<i>Ageratum conyzoides</i>)	+	+	-	-
Tamda (<i>Elephantopus mollis</i>)	-	+	-	-
Kasep a nipay (<i>Drymaria cordata</i>)	+++	+	++	-
Kasep a taw (<i>Oxalis corniculata</i>)	++	-	-	-
Mangoaw (<i>Erigeron sumatrensis</i>)	+++	+++	++	-
Sapar (<i>Sida acuta</i>)	++	++	+	-
Talompa a koda (<i>Elephantopus spicatus</i>)	+++	+++	++	-

Legend:

+++ = strong inhibitory activity

++ = distinct inhibitory activity

+ = slight inhibitory activity

- = no inhibitory activity



Figure 1. Kasep a taw (*Oxalis corniculata* Miq.)



Figure 2. Kasep a nipay (*Drymaria cordata* [Linn.] Willd.)



Figure 3. Ganalem (*Clerodendrum quadriloculare* [Blco.] Merr.)



Figure 4. Mangoaw (*Erigeron sumatrensis* Retz.)

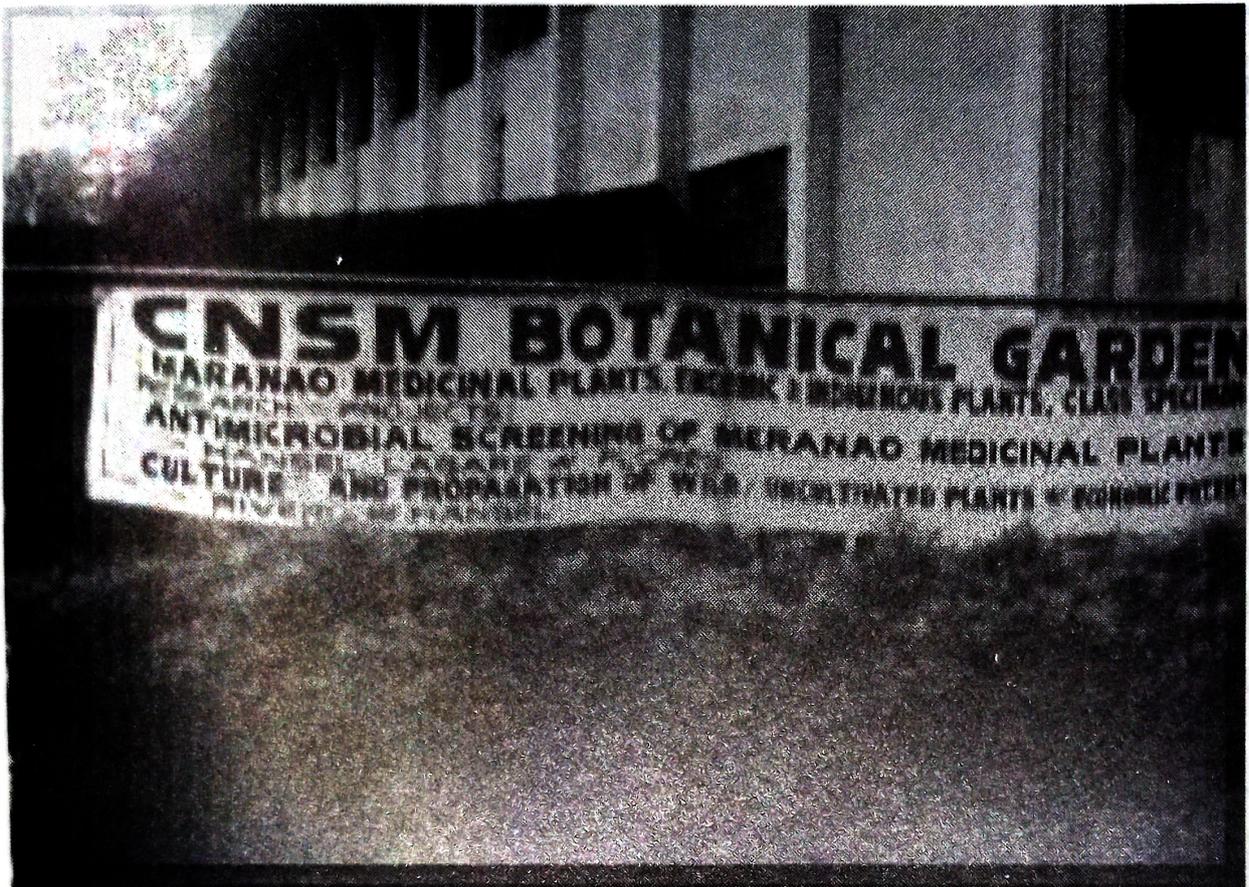


Figure 5. The CNSM Botanical Garden at its inauguration-opening on February 2002 during the CNSM Science Week celebration.

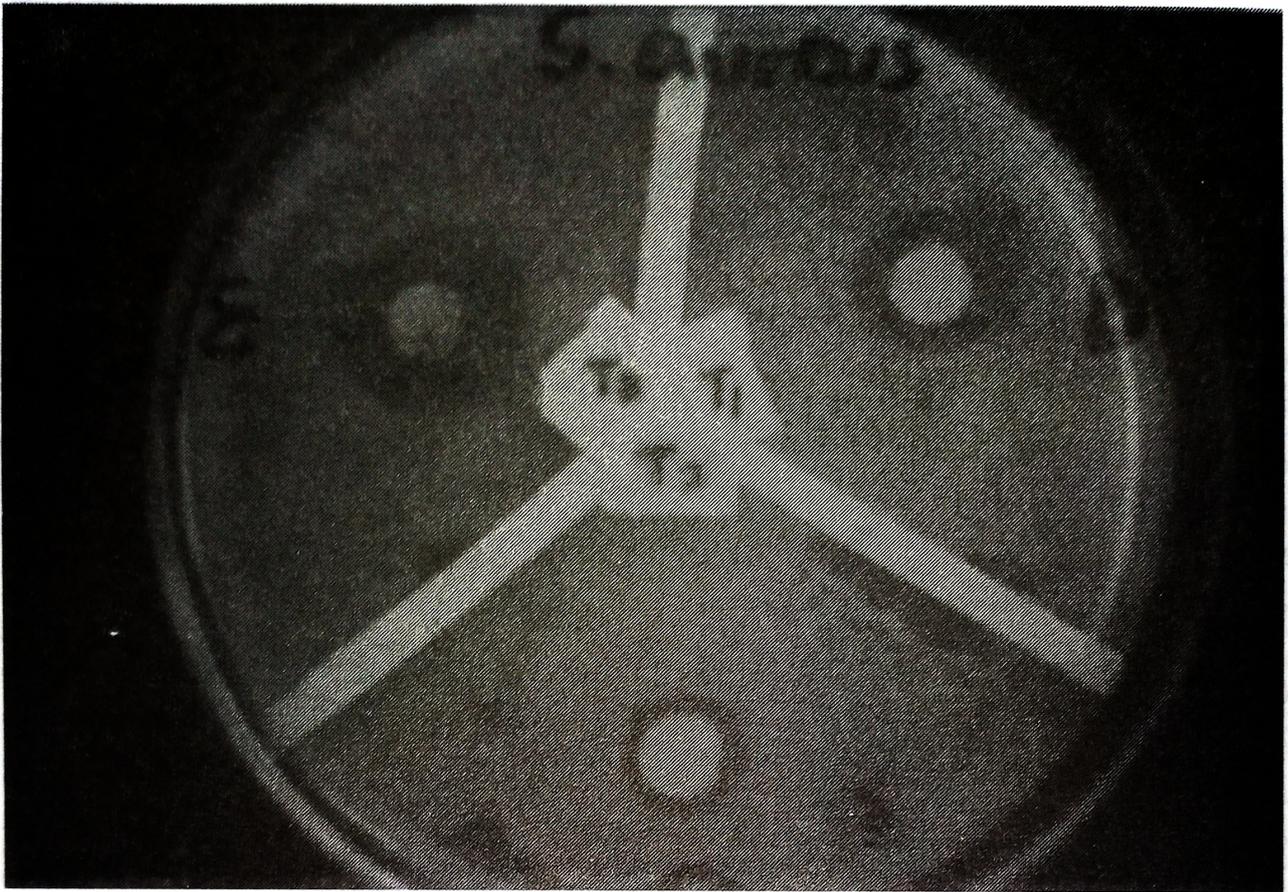


Figure 6. Antimicrobial activity of mangoaw (T3), kasep a nipay (T1) and kasep a tauw (T2) towards *Staphylococcus aureus*

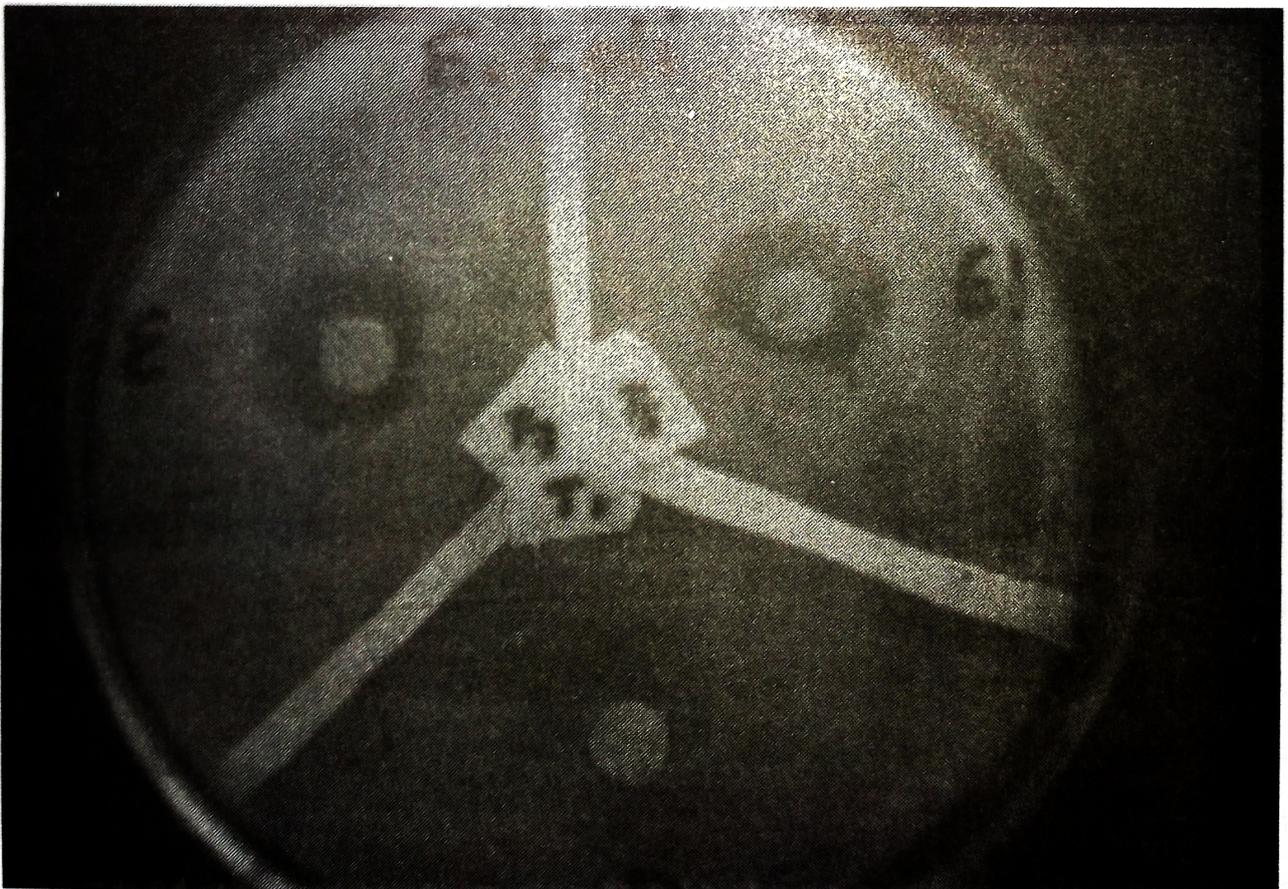


Figure 7. Plate showing inhibitory activity of mangoaw (T3) and talompa a koda (T5) and non-inhibition of kasep a nipay (T1) towards *Escherichia coli*

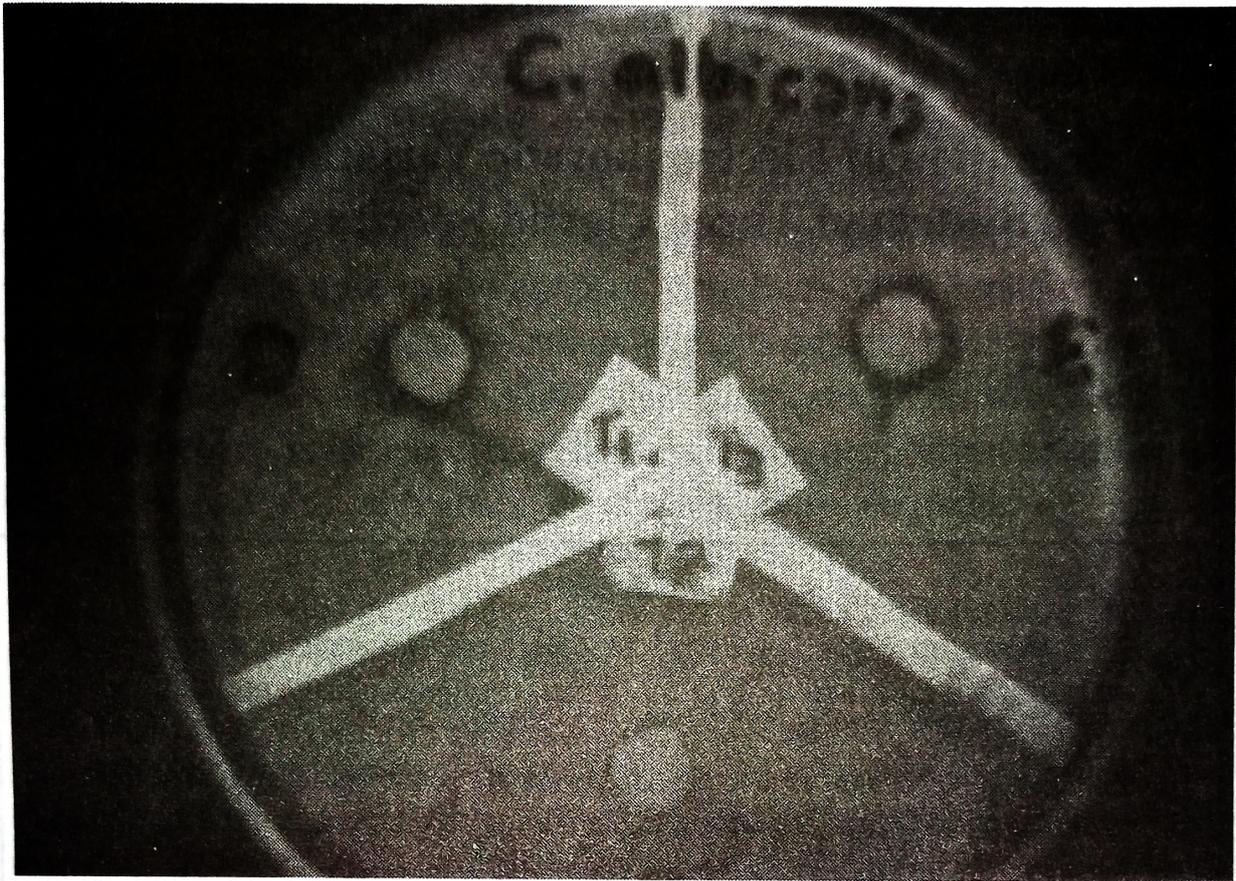


Figure 8. Plate showing inhibition of kasep a nipay (T1) and mangoaw (T3) and non-inhibition of kasep a tau (T2) towards *Candida albicans*

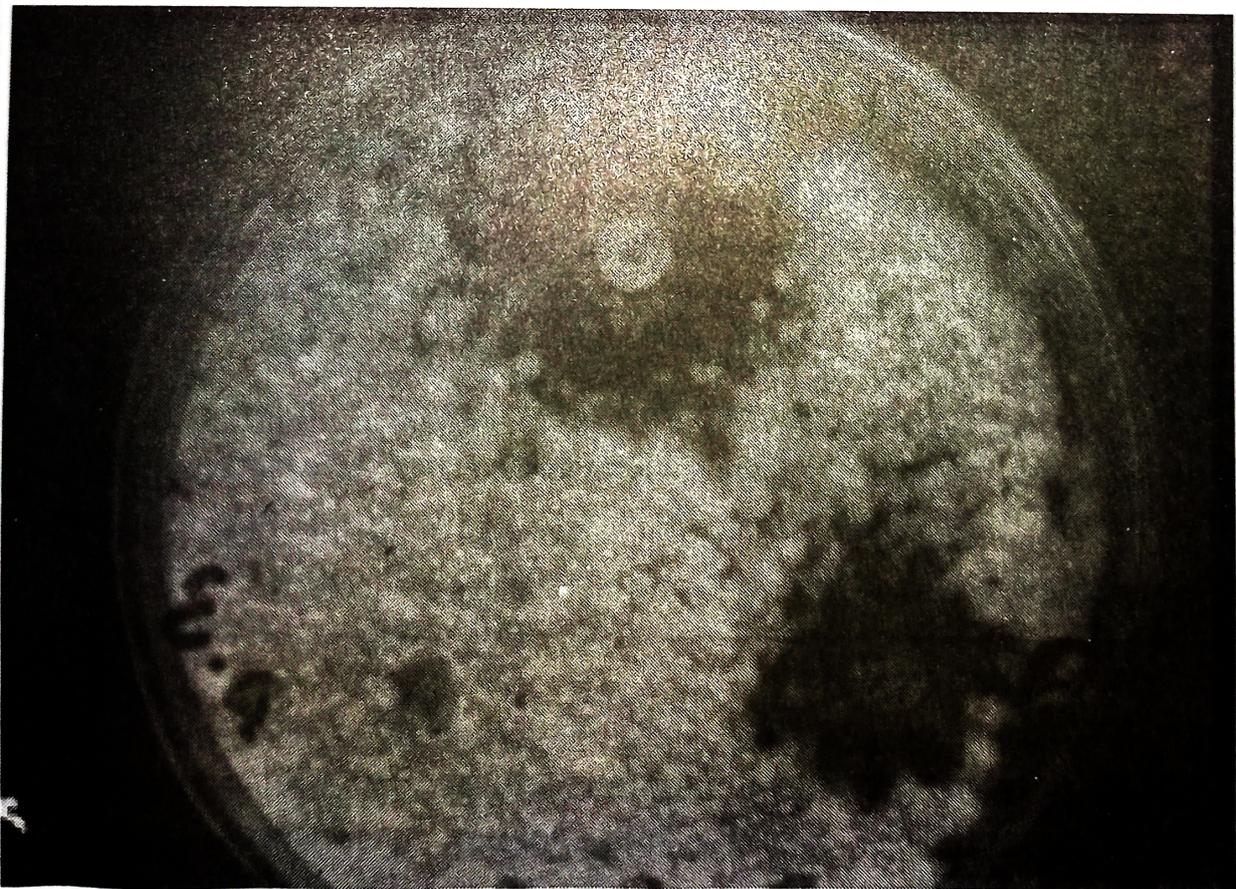


Figure 9. Plate showing non-inhibition of extracts of kasep a nipay (D) and mangoaw (T3) towards *Aspergillus niger*. E.a refers to ethyl alcohol, the control.