



Assessment, Inventory and Ethnobotanical Survey of Medicinal Plants in Mount Malinao (Albay, Philippines)

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Abstract

Introduction: Since there is no record of floral diversity in Mt. Malinao (Albay, Philippines), this study aims to conduct an assessment, inventory and ethnobotanical study of plants in the area. **Methodology:** Plants were collected by random sampling from 3 vegetation types. Herbarium specimens were submitted to the Philippine National Herbarium and the University of Santo Tomas Herbarium for identification. The ethnomedicinal uses of plants was confirmed by interview of local residents and forest guides. **Results:** The vegetation types surveyed consist of a lower agro-ecosystem, the rocky pathway and the secondary dipterocarp montane forest. The families Melastomataceae, Apocynaceae, Rubiaceae, Moraceae, Euphorbiaceae, Acanthaceae, Fabaceae, Verbenaceae, Solanaceae and Zingiberaceae were the most represented. There were 27 endemic plants, 15 economically-important plants, 15 medicinal plants, 9 ornamental plants, 3 poisonous plants, 3 newly-introduced plants to the locality and 6 newly-introduced plant to the Philippines. The therapeutic uses of 8 plants have been authenticated by the local residents. **Conclusions:** Pharmacological screening of endemic plants and isolation of their bioactive substances are recommended in addition to conservation measures.

Keywords: *medical chemistry, inventory, ethnobotanical, Philippines*

Introduction

Mt. Malinao is a dormant volcano situated between Camarines Sur and Albay provinces, Bicol region, in the Southeastern Luzon island, Philippines, about 20 km northwest of Mayon volcano. The mountain is forested with an elevation of 1548 m and a base diameter of 22.5 km. The crater has a wall that is breached on the eastern side. A hot spring, Malinao Lake, can be found in the montane forest, where temperatures up to 108⁰C have been recorded (1). To date, no information about its flora has been accounted for. This study, therefore, seeks to make an assessment of plants in 3 vegetation types of Mt. Malinao, determine their conservation status and their ethnomedicinal uses.

Material and Method

The survey was conducted last April 2014. Specimen collection was done by random sampling in 3 vegetative types - the lower agro-ecosystem (0 – 50 m), the rocky ascending and descending pathway (51 – 300 m) and the secondary dipterocarp and fern montane forest (301 – 800 m). The specimens in the field were pressed in between newspapers and treated with denatured alcohol. In the laboratory, the specimens were soaked in 100 mL of 95% ethanol-phenol (60:40) and subsequently oven-dried (2). Properly oven-dried specimens were mounted in herbarium sheets with official label. Herbarium specimens and photographs of the plants in their natural habitats were submitted to the curators of the University of Santo Tomas Herbarium and Philippine National Herbarium for identification. The locals and forest guides of Barangay Tagoytoy in the municipality of Tabaco at the foot of Malinao identified common and vernacular names of some plants which upon consultation with the medicinal plant atlas of Quisumbing (1978) generated information as to their scientific names and families. These locals gave anecdotal information to validate the therapeutic uses of medicinal plants reported by Quisumbing (1978).



Results and Discussion

Vegetation

The agro-ecosystem at the base of Mt. Malinao has continuous rocky streams. *Musa textilis* ("abaca") plantations were found nearby. A lush secondary dipterocarp forest surrounds the mountain, with the forest being quite dense. Although there are several peaks on the caldera rim of Mt. Malinao, the usual trek only goes to the first peak, because of security reasons. However, future pathway possibilities may include a traverse section of the mountain. Ascending to Mt. Malinao, more than 4 peaks have been visualized, interspersed with cauldrons which were formed by ancient volcanic eruptions. The ascent to Mt. Malinao is rocky but is still forested mainly with bushes, small trees, coconuts and abacas. The vegetation at 385 meters elevation is characterized by a large secondary dipterocarp and fern montane forest. Lake Malinao, a hot spring, is situated nearby. All water tributaries in this mountain drain to the nearby Lake Buhi.

Table 1: Dominant Species Cited According to Family (N = 37 = 52.86%)

| Family (%; N = 70) | Code and Scientific Name | Habitat & Habit | Status |
|-------------------------|--|-----------------|---------|
| Melastomataceae (7.14%) | 14Z-003 <i>Melastoma malabathricum</i> L. | M (V) | Med. |
| | 14Z-007 <i>Polyscias melastoma</i> Forst. | M (S) | E |
| | 14Z-009 <i>Melastoma sp.</i> Blume | M (W) | E |
| | 14Y-001 <i>Dissotis sp.</i> Benth. | M (V) | --- |
| | 14W-015 <i>Astronomia sp.</i> | M (B) | --- |
| Apocynaceae (7.14%) | 14Z-026 <i>Thevetia peruviana</i> (Pers.) Merr. | A (T) | O, Med. |
| | 14W-013 <i>Voacanga globosa</i> (Blanco) Merr. | M (T) | E, Med. |
| | 14W-014 <i>Cerbera manghas</i> L. | M (T) | P |
| | 14Y-006 <i>Ervatamia ivaricata</i> Roem. & Schult. | P (S) | Med. |
| | 14Y-008 <i>Plumeria sp.</i> Scop. | M (T) | O |
| Rubiaceae (5.71%) | 14Z-008 <i>Wendlandia glabrata</i> DC. | M (S) | E |
| | 14Z-013 <i>Borreria hispida</i> K. Schum. | M (V) | E |
| | 14X-004 <i>Argostemma sp.</i> Wall. | M (S) | T |
| | 14Y-005 <i>Mussaenda philippinensis</i> Merr. | M (S) | E |
| Moraceae (5.71%) | 14Z-004 <i>Ficus nota</i> (Blancoi) Merr. | M (T) | E |
| | 14Z-010 <i>Ficus fistulosa</i> Reinwardt ex Blume | M (T) | E |
| | 14Z-010 <i>Ficus septica</i> Burm. F. | P (T) | Med. |
| | 14Y-015 <i>Poikilospermum suaveolens</i> Merr. | P (WV) | Med. |
| Euphorbiaceae (5.71%) | 14Z-019 <i>Endospermum peltatum</i> Merr. | P (T) | --- |
| | 14Z-020 <i>Croton tiglium</i> L. | P (WV) A(S) | P, E |
| | 14Z-033 <i>Breynia rhamnoides</i> (Retr.) Muell-Arg. | A (S) | --- |
| | 14Z-034 <i>Manihot esculenta</i> Crantz | | P, Eco. |
| Acanthaceae (4.29%) | 14Z-012 <i>Justicia sp.</i> L. | M (V) | E |
| | 14W-004 <i>Strobilanthes sp.</i> Blume | M (S) | --- |
| | 14Z-017 Unidentified sp. | P (S) | --- |
| Fabaceae (4.29%) | 14Z-011 <i>Clitoria sp.</i> L. | M (T) | E |
| | 14Z-024 <i>Crotolaria incana</i> Linn. | A (H) | E |
| | 14X-013 <i>Desmodium sp.</i> | P (H) | --- |
| Solanaceae (4.29%) | 14Z-029 <i>Capsicum frutescens</i> L. | A (S) | Eco, |
| | 14W-017 <i>Solanum torvum</i> Sw. | P (B) | Med |
| | 14X-014 <i>Solanum sp.</i> | P (B) | Eco. |
| Zingiberaceae (4.29%) | 14W-001 <i>Costus speciosus</i> C. Specht. | M (H) | Med. |
| | 14W-009 <i>Alpinia elegans</i> K. Schum. | M (H) | E |
| | 14W-009 <i>Alpinia sp.</i> | M (H) | E |

Species Richness

Table 1 lists the dominant families comprising more than 50% of the total population of plants sampled. Tables 2 and 3 summarizes families represented at lower frequencies.

A total of 34 families were represented dominated by Melastomataceae, Apocynaceae, Rubiaceae, Moraceae, Euphorbiaceae, Acanthaceae, Fabaceae, Verbenaceae, Solanaceae and Zingiberaceae. However, several common species of pantropical distribution from these families have been observed during the collection process but were excluded from the official count of 70 plants collected. This observations point out that species richness are not representative of the whole population if a more intensive collection have been undertaken, including the upper mossy area (above 800m) of Mt. Malinao. Some families were left unsurveyed, such as



Table 1 (Continued)

| Family (%) N = 70) | Code and Scientific Name | Habitat & Habit | Status |
|------------------------|--|-----------------|--------|
| Verbenaceae (4.29%) | 14Z-001 <i>Stachytarpheta jamaicensis</i> (L.) Vahl. | M (T) | Med. |
| | 14Z-030 <i>Premna nauseosa</i> Blanco | P (T) | E -- |
| | 14W-016 <i>Clerodendrum intermedium</i> B. Thomas | P (T) | |

Code for habitat: M - montane forest; P - rocky pathway; A – agro-ecosystem; Code for habit: T – tree; B - bush; S - shrub; H - herbaceous; W - weed; WV - weedy vine. Code for status: E - endemic, Med. - medicinal; Eco. - economically-important; I - invasive; P - poisonous; T – threatened

Table 2: Collections of Two Species Per Family (N = 16 = 22.9%)

| Family (%) N = 70) | Code and Scientific Name | Habitat & Habit | Status |
|---------------------------|---|--------------------------------------|---------------------------|
| Asteraceae (2.86%) | 14Z-031 <i>Chromolaena odorata</i> King | A (S) P | Med., O |
| | 14X-011 <i>Mikania micrantha</i> Kunth | (W) | I |
| Sapindaceae (2.86%) | 14Z-016 <i>Nephelium</i> sp. L. | 14X-007 <i>Guioa</i> sp. Cav. | P (T) M (T) E, T |
| | | | |
| Compositae (2.86%) | 14Z-006 <i>Pseudoelephantopus spicatus</i> Rohr. | M (H) | Med. |
| | 14Z-027 <i>Vernonia cinerea</i> (L.) Less. | A (S) | Med. |
| Urticaceae (2.86%) | 14Z-002 <i>Leucocyke capiellata</i> (Poir.) Wedd. | M (T) | E |
| | 14W-007 <i>Villebrunea rubescens</i> Blume | M (T) | |
| Rutaceae (2.86%) | 14X-001 <i>Micomelum</i> sp. Blume | M (T) M (T) | E --- |
| | 14W-010 <i>Melicope</i> sp. Pelea A. Gray | | |
| Vitaceae (2.86%) | 14X-005 <i>Leea</i> sp. | (S) | E |
| | 14W-008 <i>Leea manillensis</i> Walp. | M (S) | Med. |
| Lamiaceae (2.86%) | 14X-008 <i>Clerodendrum</i> sp. L. | 14W-012 <i>Gmelina arborea</i> Roxb. | M (S) E M (T) Eco, Med |
| | | | |
| Convolvulaceae (2.86%) | 14Z-014 <i>Ipomoea plebeia</i> R. Br. | M (WV) | E I, E, Med. |
| | 14Z-022 <i>Merremia peltata</i> Merr. | P (WV) | |

Code for habitat: M - montane forest; P - rocky pathway; A – agro-ecosystem. Code for habit: T - tree; B - bush; H - herbaceous; S - shrub; W - weed; WV - weedy vine. Code for status: E - endemic, Med. - medicinal; Eco. - economically-important; I - invasive; P – poisonous.

Arecaceae, Anacardiaceae and Myrtaceae. From the 70 specimen collection, 1 plant (*Selaginella plana*) is a pteridophyte while the rest are angiosperms. *Dendrobium* sp., a parasitic plant, was found preying on the bark of *Mangifera indica*. Three invasive plants, *Mikania micrantha*, *Ludwigia hyssopifolia* and *Merremia peltata* (4) are problematic weeds to agriculturists which affect plant ecosystem structures when their population increases. Three plants, *Freycinetia* sp., *Argostemma* sp. and *Guioa* sp. are either endangered or threatened.

Most of the 70 plants sampled are shrubs (N = 26, 37.1%), followed by trees (N = 19; 27.1%) and herbs (N = 11; 15.7%) and the rest are vines, woody vines, weeds and bushes. Figure 1 shows the distribution (i.e., habitats) of the 70 plant samples collected.

Collection of specimens were mostly allocated for rare plants growing in the montane forest (~ 60%) and the rocky pathway (~ 24%). Common plants were collected in the agro-ecosystem. However, it will be interesting to determine species richness if collection is further intensified to cover the unsurveyed upper mossy area.

Figure 2 shows the statistics of 19 trees collected according to vegetation type.

The data in Figure 2 do not reflect the several leguminous trees, palms, and abaca and dipterocarp trees that can be found in any of the 3 vegetative types. However, it would appear that if these trees were included, similar distribution pattern as in Figure 2 will still be accounted for.

Figure 3 shows tree statistics in terms of height and diameter.

Poisonous Plants

The endemic *Croton tiglium* “Tuble” is used locally as a fish poison. The other 2 common poisonous plants are the ornamental *Thevetia peruviana*, the seeds of which contains the cardiotoxic glycoside thevetin (5), and the cassave plant *Manihot esculenta*, the tubers of which contains cyanophore glycosides. The leaves of *Cerbera manghas* contains another cardiotoxic glycoside called cerberin (6).

Figure 4 shows the statistics of the 70 plants sampled according to endemicity, medicinal or economic purposes, ornamentality and conservation



obvious that there are overlaps in data, as certain endemic plants are also either medicinal,

Table 3: One Species Per Family Collection (N = 17 = 24.3%)

| Family (%; N = 70) | Scientific Name (Code) | Habitat | Status |
|-------------------------|---|---------|-----------|
| Piperaceae (1.47%) | 14X-002 <i>Piper</i> sp. | M (H) | --- |
| Caprifoliaceae (1.47%) | 14X-006 <i>Lonicera</i> sp. L. | M (V) | E |
| Rosaceae (1.47%) | 14X-009 <i>Rubus</i> sp. L. | M (S) | H, E, Eco |
| Clethraceae (1.47%) | 14W-005 <i>Clethra canescens</i> Sleumer | M (S) | E, Rare |
| Pandanaceae (1.47%) | 14W-006 <i>Freycinetia</i> sp. Gaudich. | M (S) | End. |
| Iridaceae (1.47%) | 14W-011 <i>Neomarica longifolia</i> Sprague | M (H) | O |
| Thymelaceae (1.47%) | 14Y-003 <i>Wikstroemia nutans</i> Bentham. | M (S) | Eco. |
| Dioscoreaceae (1.47%) | 14Y-007 <i>Tacca palmata</i> Blume. | M (H) | O |
| Musaceae (1.47%) | 14Y-011 <i>Heliconia psittacorum</i> L. | P (H) | O |
| Selaginellaceae (1.47%) | 14Z-005 <i>Selaginella plana</i> Hieron. | M (S) | O |
| Strelitziaceae (1.47%) | 14Z-018 <i>Strelitzia reginae</i> Aiton | P (S) | O |
| Marantaceae (1.47%) | 14Z-021 <i>Dendrobium</i> sp. Sw. | P (S) | E, O |
| Dilleniaceae (1.47%) | 14Z-025 <i>Dillenia</i> sp. L. | A (T) | E |
| Sterculiaceae (1.47%) | 14Z-032 <i>Theobroma cacao</i> L. | A (T) | Eco. |
| Boraginaceae (1.47%) | 14Z-034 <i>Carmona retusa</i> Vahl. | A (S) | Eco, Med |
| Theaceae (1.47%) | 14X-012 <i>Pyrenaria</i> sp. H. Keng | P (S) | --- |
| Onagraceae (1.47%) | 14X-015 <i>Ludwigia hyssopifolia</i> Exell. | P (H) | I |

Code for habitat: M - montane forest; P - rocky pathway; A – agro-ecosystem; Code for habits: T - tree; B - bush; H - Herbaceous; S - shrub; W - weed; WV - weedy vine. Code for status: E- endemic, Med. - medicinal; Eco. - economically important; O - ornamental; End. - endangered

Figure 1: Distribution of the Plant Samples According to Habitat (N = 70)

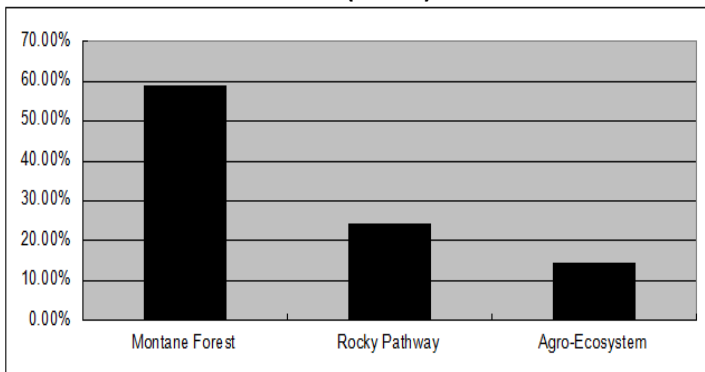
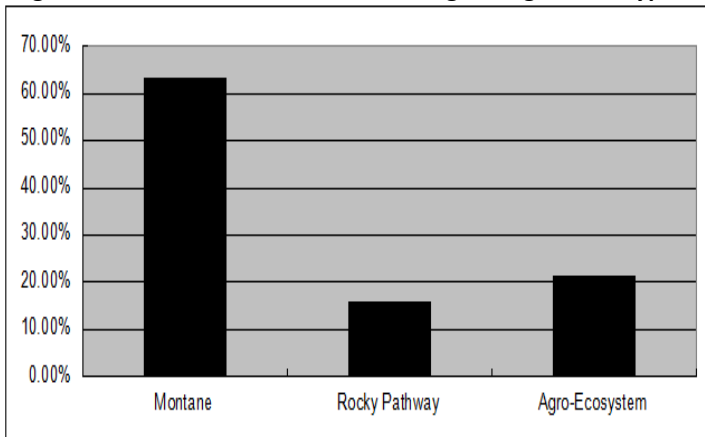
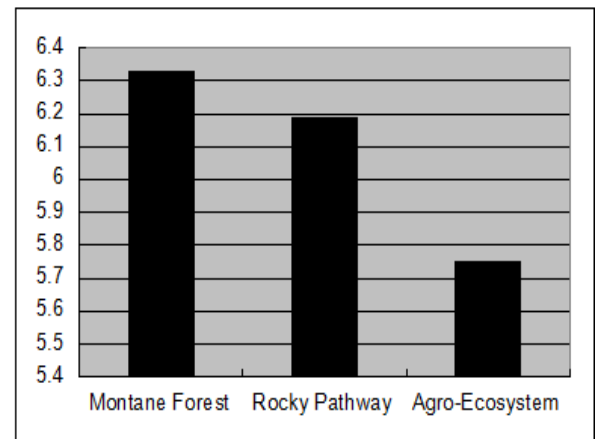


Figure 2: Distribution of Trees According to Vegetation Type

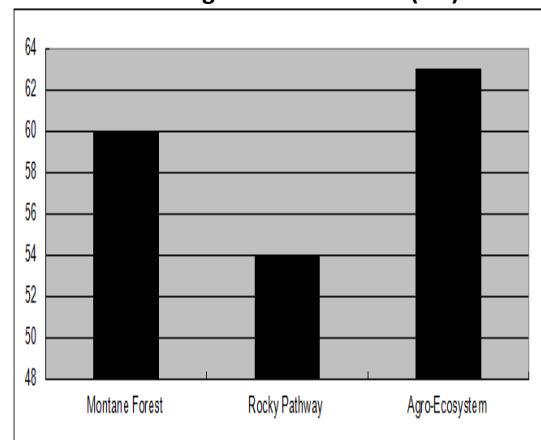


status, based on the data provided in Tables 1 to 3. It is

Figure 3: Tree Height and Diameter Statistics Mean Tree Height (Meters)



Mean Breast Height Tree Diameter (cm)

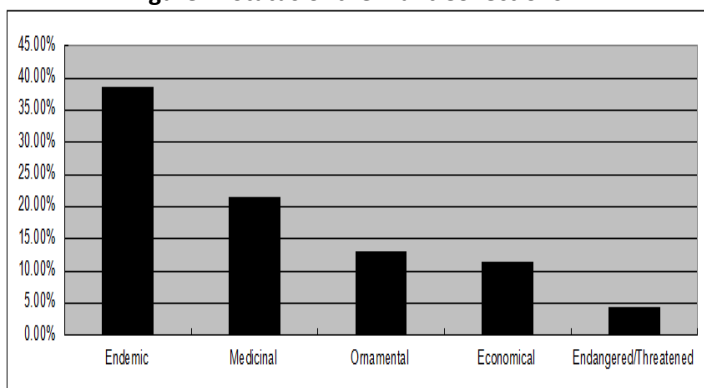


ornamental or economical. It is, therefore, imperative that the full potentials of each plant with



overlapping status are carried out.

Figure 4: Status of the Plant Collections



Economically-Important Plants

The fiber of *Leucocyke capitellata* is used in the rope-making industry, while *Wikstroemia nutans* is used in paper and currency-making. The bark of *Gmelina arborea* is used in furniture construction while its seed oil is a bio-fuel. Economical plants used as food include *Rubus* sp., *Manihot esculenta*, *Theobroma cacao*, *Solanum torvum*, *Capsicum frutescens* and *Carmona retusa*.

Table 4: Newly-Introduced Plants

| Status | Scientific Name | Former Location |
|-------------------------------------|--|--|
| Newly-introduced to the Locality | <i>Borreria hispida</i> K. Schum. | Batangas, Laguna, Mindoro, Panay and Basilan |
| | <i>Merremia peltata</i> Merr. | Bataan and Rizal Mindanao |
| | <i>Pyrenaria</i> sp. | |
| Newly-introduced to the Philippines | <i>Chromolaena odorata</i> King (Chandrasekaran, 2010) | USA, Latin America and India |
| | <i>Wikstroemia nutan</i> Bentham. | China & Hong Kong S. America & Africa |
| | <i>Neomarica longifolia</i> Sprague | Taiwan |
| | <i>Pyrenaria</i> sp. | Central & S. America |
| | <i>Solanum torvum</i> Sw. | |

Newly-Introduced Plants

Table 4 summarizes plant collections that are either newly-introduced to the locality of Albay or newly-introduced to the Philippines.

Ethnobotanical Study

The therapeutic uses of 8 plants as described by Quisumbing (3) were confirmed by locals of Barangay Tagoytoy, Malinao and the forest guides. Table 5 gives the anecdotal information of these plants.

Medicinal Plants

Table 6 lists the medicinally-important plants based on their therapeutic uses, using animal models, and their bioactive

constituents.

Table 5: Summary of Anecdotal Information of Medicinal Plants

| Scientific Name | Plant Part Used | Preparation | Therapeutic Use |
|--|-----------------|-------------|-------------------|
| <i>Stachytarpheta jamaicensis</i> (L.) Vahl. | Root | Decoction | Abortifacient |
| <i>Pseudoelephantopus spicatus</i> Rohr. | Leaves | Poultice | Eczema |
| <i>Poikilospermum suaveolens</i> Merr. | Root | Decoction | Fever |
| <i>Merremia peltata</i> Merr. | Leaves | Poultice | Wounds and ulcers |
| <i>Breynia rhamnoides</i> (Retr.) Muell-Arg. | Bark | Infusion | Hemorrhage |
| <i>Vernonia cinerea</i> (L.) Less. | Seed | Decoction | Vermifuge |
| <i>Capsicum frutescens</i> L. | Berries | Poultice | Arthritis |
| <i>Carmona retusa</i> Vahl. | Bark | Infusion | Diarrhea |

Conclusion

The following conclusions are drawn based on the results of the study:

1. There are 70 species collected with the following statistics: 27 endemic, 15 economically important, 15 medicinally important, 3 poisonous, 3 invasive, 1 parasitic, 3 newly introduced to the locality; and 5 newly introduced to the Philippines.

3. The purported therapeutic uses of 8 medicinal plants as reported by Quisumbing(1978) have been confirmed by the locals and forest guides in Tagoytoy, Tabaco, Albay.

From these conclusions, the following recommendations are proposed:

1. To make an assessment and inventory of angiosperms in the upper mossy forest of Mt. Malinao, to include pteridophytes, angiosperms and gymnosperms.

2. To perform *in vivo* pharmacological screening in experimental animals and *in vitro* bioassay-guided isolation of pharmacologically-active constituents of the endemic plants identified.

3. The local government units of the bordering towns of Malinao and the provincial government of Albay must undertake conservation measures for the preservation and protection of endemic plants in Mt. Malinao.

**Table 6: List of Medicinal Plants Sampled**

| Scientific Name | Plant Part (Preparation) | Active Constituents | Therapeutic Uses |
|--|--|---|------------------------------------|
| <i>Melastoma malabathricum</i> L. | Water & alcoholic leaf extracts | Phenolics - flavonoids & tannins | Hepatitis Cancer Analgesic |
| <i>Voacanga globosa</i> (Blanco) Merr. | Ethanol leaf extract | Alkaloids - globospiraminedeoxyv obtusine | Antimicrobial Tuberculosis |
| <i>Ficus septica</i> Burm. F. | Hexane insoluble leaf extract; methanol leaf extract | Alkaloids - Ficuseptine and antofine | Antimicrobial Breast cancer |
| <i>Solanum torvum</i> Sw. | Fruits | Steroidal saponins | Cytotoxic Inflammation |
| <i>Pseudoelephantopus spicatus</i> Rohr. | Aqueous extract of aerial parts | --- | Hepatitis Inflammation |
| <i>Vernonia cinerea</i> (L.) Less. | Various extracts of leaves & flowers & roots | Sesquiterpene Sterols | Inflammation Analgesic Antipyretic |
| <i>Leea manillensis</i> Walp. | Whole plant | Phenolics | Hypertension |
| <i>Gmelina arborea</i> Roxb. | Aqueous bark & fruit extract | Iridoids | Diabetes Diuretic |
| <i>Costus speciosus</i> C. Specht. | Extracts of rhizomes & aerial parts | Eremanthin Diosgenin Benzoquinone | Diabetes Dyslipidemia Antioxidant |

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AUTHORS' CONTRIBUTIONS

Authors contributed equally to all aspects of the study.

PEER REVIEW

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CONFLICTS OF INTEREST

The authors declare that they have no competing interests.