An ethnobotanical survey of medicinal plants used in the eastern highlands of Papua New Guinea

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Abstract

Background: The Eastern Highlands area of Papua New Guinea (PNG) has a rich tradition of medicinal plant use. However, rapid modernization is resulting in the loss of independent language traditions and consequently a loss of individuals knowledgeable in medicinal plant use. This report represents a program to document and preserve traditional knowledge concerning medicinal plant use in PNG. This report documents and compares traditional plant use in the Eastern Highlands districts of Unggai-Bena, Okapa, and Obura-Wonenara, and puts these new records in context of previously documented PNG medicinal plant use.

Methods: This manuscript is an annotated combination of Traditional Medicines survey reports generated by UPNG trainees using a survey questionnaire titled “Information sheet on traditional herbal reparations and medicinal plants of PNG”. The Traditional Medicines survey project is supported by WHO, US NIH and PNG governmental health care initiatives and funding.

Results: Overall, after “poisoning” (synonymous with “magic”) the most commonly recorded ailments addressed by medicinal plant use were pain, gynecological disease, gastrointestinal maladies, anemia or malnutrition and malaria. However, the recorded indications for plant use varied widely amongst the different survey locations. Unlike many areas of PNG, mixing of ingredients was the most common mode of preparation recorded, except for two areas where the consumption of fresh plant material was more common. Throughout the Eastern Highlands oral administration was most common, with topical application second. Overall, leaves were most commonly used in the preparations of the healers interviewed, followed by bark and stems. Several new medicinal uses of plants were also documented.

Conclusions: Collaboration between the WHO, UPNG and the PNG Department of Health initiated Traditional Medicine survey program in order to preserve traditional knowledge concerning medicinal plant use in PNG. This effort promotes integration of effective and accessible traditional practices with Western protocols. The Traditional Medicine surveys are particularly important because, in the absence of the clinical validation, the documentation of the consistent use of a given plant for specific indication by a large number of herbalists, across a wide range of ethnic traditions, maybe considered as a positive criterion for the promulgation of said use among PNG’s recently formed traditional healer associations.

Keywords: Papua New Guinea, Eastern Highlands, Medicinal Plants, Obura-Wonenara, Unggai-Bena, Okapa

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Background

Rural communities in Papua New Guinea (PNG) rely on a tradition of plant use for health needs [1]. PNG has at least 800 ethnic traditions characterized by distinct languages scattered mostly in rural hamlets across a geographically segregated mountainous country of 462,840 km$^2$ [2,3], of which the Eastern Highlands Province occupies 11,200 km$^2$. This geology has also resulted in extraordinary biological diversity estimated to be greater than 5% of the global total including an estimated 15,000 to 20,000 vascular plants, approximately 60% of which are endemic [4,5]. Human settlement has existed from at least 40,000 years BP on the north coast (Houn Peninsula) of PNG. More recently, human occupation of the Ivane Valley in the PNG Highlands has been dated to 49,000 to 44,000 years ago [6]. Of PNG's approximately 6.2 million people about 430,000 reside in the Eastern Highlands [7]. This extended habitation of diverse environs has led to a rich and varied practice of medicinal plant use [8].

Reports from Western contact as early as the 1800s detailed the use of medicinal plants by PNG people to treat various maladies [9]. This Western perception of the cultural tradition of medicinal plant use, however, has been disparaged in some literature because often the curing properties of the plants are conceived by the users as magical [10]. This was the case in PNG Highlands where, until recently, non-western concepts of illness etiology predominated. Nevertheless, as in most of PNG, it is the current practice in the Highlands to use different plants to treat various symptoms regardless of whether the cause of the symptoms is conceived of as mystical or somatic.

The fact that a sizable majority of the PNG population relies on medicinal plants and traditional practitioners for health care has been formally recognized by the national government [1]. The 2001–2010 PNG National Health Plan promoted collaboration between the World Health Organization (WHO) and the University of Papua New Guinea (UPNG) to assist in the development of traditional medicines in the country. A traditional medicines survey instrument was developed using WHO guidelines and with vetting from Western Pacific WHO regional officers. In 2001 the UPNG Traditional Medicines surveys were initiated with endorsements from the UPNG School of Medicine and Health Sciences Research and Ethics Committee and the Medical Research and Advisory Committee of the PNG Department of Health. A proprietary database for traditional medicines was also established, which is maintained at UPNG [11], and now serves as a national resource as the government seeks to move validated and safe herbal remedies into the national health care formulary [1]. It is widely recognized that the traditional use of medicinal plants constitutes an important information reservoir that is threatened by on-going development and Westernization. This cultural reservoir of knowledge has been empirically tested and adopted through millennia of trial and error, but prior to the UPNG Traditional Medicines surveys, three of which are reported here, there was no national effort to preserve such knowledge. The documentation of medicinal plants in PNG has been haphazard and the accrued knowledge has not been widely disseminated internationally. Furthermore, the corresponding pharmacological validation of PNG medicinal plant use has not been systematically studied. We estimate that historically some 800 PNG plants species have been described in the literature for treatment of various ailments, but this represents only a fraction of the total number of plants actually utilized.

We present here a survey of traditional healers and report their current uses of medicinal plants from three distinct ethnic regions of the Eastern Highlands. The objective is to document and preserve knowledge of medicinal plant use in the Eastern Highlands of PNG, to use this activity as a scientific and culturally affirmative training exercise for senior UPNG students, and to put the recorded plant use into the PNG context by comparison with archived literature concerning medicinal plant use in PNG. This activity has identified many species used medicinally in the Eastern Highlands that are also used elsewhere in PNG, and a few species for which there are rare or no literature reports of medicinal use.

Methods

The Traditional Medicine survey program at UPNG provides an effective training exercise for select senior bachelors of pharmacy students. The Traditional Medicines Database currently contains cultural plant use data from over 34 Local Level Governments (LLGs) in PNG. Students are instructed on plant identification and preservation, herbal medicine use, and how to administer the survey instrument titled “Information sheet on traditional herbal preparations and medicinal plants of Papua New Guinea”. This survey instrument questionnaire is designed to facilitate semi-structured face-to-face interviews with healers. The interaction is directed at recording new data concerning the medicinal uses of plants and the related cultural traditions, and includes field work for the collection of plant vouchers. The students are supported to travel to their home districts to conduct the surveys amid “wantok” communities. Wantok implies more than a common language in PNG, encompassing a meaning of extended kinship as well. Students meet first with elders, village heads, ward councilors, etc., in the study communities to gather names of healers before contacting them with the...
request for interviews. The principal requirement being
that the healers are recognized in the community to
have knowledge and skills of providing herbal treat-
ments, that they are active in the practice and are willing
to share their knowledge. The interviews are usually
conducted in Tok Pisin or Tok Ples (local dialects) be-
cause facility with English is not uniform amongst the
interviewees and it is important to communicate as
clearly as possible.

Samples of the plants useful for identification (flowers,
fruits or nuts, twigs with leaves) in addition to the parts
used medicinally were harvested, dried and compressed
in newspapers. A copy of the survey questionnaire is
provided in supplementary information Additional file 1.
Newspapers were changed daily until they remained dry
after compression. Pressed plant samples, plant photo-
graphs and descriptions were assigned a voucher num-
bers and deposited at the UPNG Herbarium for
identification and reference purposes [8]. The data con-
cerning plant use are written up under supervision into
student authored reports and the plant information is
entered into the Traditional Medicines Database, which
contains the combined reports generated by a decade’s
work in this endeavor. It is the student reports that pro-
vide the base information for this current report.

Guidelines regulating accession of the database have
been developed at UPNG in order to recognize and trace
the traditional knowledge and intellectual property of
the source communities. The guidelines operate under
the current UPNG benefit sharing model, which is ap-
pllicable to many areas of natural products research and
which includes guidelines concerning intellectual prop-
erty rights and benefits sharing that has been approved
by the PNG government. The proprietary UPNG Trad-
tional Medicines Database records, in addition to plant
medicinal use, information concerning source indivi-
duals and communities in order to recognize and trace
the traditional knowledge intellectual property.

The three student reports compiled here detail medi-
cinal plant use from three separate regions and several
distinguishable language and dialect groups in the East-
ern Highlands province of PNG (Figure 1). The Eastern
Highlands areas surveyed encompass Ipma-Baruya lan-
guage groups of the Marawaka area of the Yeila Rural
Local Level Government (LLG), Obura-Wonenara elect-
orate; the Bena, Gahuku and Siane language groups of
the Ungle-Bena LLG; and the Fore/Keyagana/Kimi lan-
guage groups of the Okapa LLG [12]. Forty five practi-
tioners were interviewed for this work: three from Ande
village, 16 from Jomuru village, one from Marawaka sta-
tion, five from Wauko village, one from Boike village,
one from Gawol village, one from Kam’mwa village, and
one from Kwaksiolo village in the Marawaka/South
Obura Wonenara LLG area; two from Numurapoka

![Figure 1 Map of Eastern Highlands Province of Papua New Guinea showing Local Level Governments (LLG) where studies were carried out.](http://www.ethnobiomed.com/content/8/1/47)
village, one from Ginipauka village, one from Masiga, two from Orumba village, and two from Sekagu village from the Unggai Benna LLG area; four from the Haga villages, two from Yavanita village and two from Amusa village in the Okapa LLG of the Eastern Highlands.

Results and discussion

Dataset and diseases

A total of 60 specimens were described from the Marawaka area, 76 from the Okapa LLG; and 77 in the Unggai-Bena LLG. Two plants specimens each in the Marawaka and Okapa constituencies only served as additives or spices: *Piper gibbilimum* and a *Saccharum* sp. to mask bitter tastes of herbal preparations; *Saccharum* species are commonly used as a salty preservative. In the Kayagana language area, *Rungia klossii* and *Zingiber officinale* are the two species that are routinely added to various medicinal preparations. The addition of pork to concoctions is frequent in all areas studied, but especially in the Unggai-Bena LLG, where the practice was recorded as nearly universal. Pork is a high protein food and cultural icon in the Highlands.

The total number of diseases and symptoms listed in this report is 220, with several species recorded as having more than one use. Disease descriptions have been sorted into 14 general categories as shown in Table 1. Overall, by far the largest category of plant use (n = 45 [20.5%]) was “magic”, synonymously referred to here as “poisoned” (Table 1). In the regions surveyed, with few exceptions, “poisoned” refers to a syndrome consisting of abdominal swelling with accompanying constipation, swelling of extremities, acute and occasional body pains and aches; sometimes accompanied by anorexia/dysphagia. The underlying reason for the discomfort is thought to be sorcery or witchcraft directed at the affected individual. Overall, after “poisoning” the next most common (n = 23 [10.5%]) afflictions for which herbal treatments were recorded were pain, gynecological and gastrointestinal maladies. Treatments for pulmonary conditions and anemia or malnutrition ranked next (n = 21 [9.5%]), with malaria ranking number 8 (n = 20 [9.1%]) of the top overall categories of use. Unfortunately, these overall averages do not accurately represent the variation in the reported plant usages recorded in the different survey locations. While magic was the predominant condition treated overall, in the Marawaka area the largest category of medicinal plants use was for pulmonary diseases (17 of the overall total of 21 in that disease category). In the Bena dialect area, anemia and malnutrition had the highest number of plant uses recorded, 12 of the 37, with no species at this location recorded as being used to treat “poisoning”.

Plant parts utilized, preparation and administration

Overall, leaves were most commonly used in the preparations of the healers interviewed (Figure 2). This was followed by bark and stems as the next most likely plant parts to be used. Exceptions to this rule were the reports from Gahuku and Siane language groups where stems and flowers were reported to be used more frequently than bark. The mixture of two or more ingredients is the most common mode of preparation recorded in the Eastern Highlands, except for the Gahuku and Marawaka regions where the consumption of fresh material or fresh succus (expressed juice) was reported as more common (Figure 3). Also reported was the occasional practice of the storage and consumption of dried medicinal plants. Throughout the Eastern Highlands oral consumption of medicinal plants was the most common administration practice recorded (Figure 4). Topical application was the second most widely practiced mode of administration.

Commonly used plant species among healers that were interviewed

*Ascarina philippinensis* is a fairly widespread tree in the PNG highlands [33]. Reports of its medicinal use are uncommon, although its use in ritual food preparation (“kirai” in the Chimbu region of the highlands) for which health promotion is a component of the ceremony, has been reported [21]. A concoction incorporating leaves of *Ascarina philippinensis* is used by the Fore to treat “poison”, however in Marawaka the fresh leaves and fruit are used to treat high fevers and weight loss. In both areas the preparations are consumed with other ingredients, in the Fore area after heating.

*Bidens pilosa* is a medicinal plant used widely in PNG, often applied topically for sores and boils. The freshly squeezed succus from leaves of *Bidens pilosa* is utilized by the Keyagana group to treat sores and wounds, in the Marawaka area the succus of leaves and shoots is used for the same conditions. In both areas the application method is topical. *B. pilosa* is a common weed widely distributed from low altitudes to over 2,000 m in Papua New Guinea [16]. An additional recorded use is the use of fresh leaves, gently heated, and placed over the affected eye to treat red or sore eyes [9,16].

*Crassocephalum crepidioides*, is widespread in subtropical and tropical areas around the World. Succus from fresh leaves is used in the Gahuku areas for fresh cuts and wounds, in the Keyagana group the leaves are heated and then succus is used for sores and wounds. In both cases application is topical. Leaves and petioles have been reported to be heated and crushed and applied to sores in the Mt. Hagen area of the highlands [13], and the application of crushed leaves to sores was...
| Genus and species [References] | Voucher number | Family Local name [Dialect : Village] | Disease | Plant part | Medicinal preparation | Route |
|--------------------------------|----------------|----------------------------------------|---------|------------|-----------------------|-------|
| Abrus sp. [9,11]              | WL065          | Leguminosae Amanani-Aginogo [U : A]     | GIT / Swelling [Magic] | L | Concoction | O |
| Adenostemma sp. [13,14], [15] | SK057          | Asteraceae Hovepa [B : S]               | Swollen skin & skin infection | L, F & vines | Sun drying | E |
| Ageratum conyzoides L. [8,9,11,13,14,16], [15] | SK013          | Asteraceae Govu suva [S : O] | Diarrhea | L & F | F / Succus | O |
| Alpinia sp. [8,9,11,13,14,16], [17] | WL052          | Zingiberaceae Armo-o [Ki : A]          | GIT / Swelling [Magic] | Stem | Concoction | O |
| Alpinia sp. [8,9,11,13,14,16], [17] | SK056          | Zingiberaceae Sinogepuna [B : S]       | Swollen joints | L | Chopped leaves are cooked together with pig meat | O |
| Alpinia sp. [8,9,11,13,14,16], [17] | SK030          | Zingiberaceae Gini gie [S : O]         | Flatulence | yf L | Cut into pieces & cooked with pig meat in bamboo | O |
| Alpinia sp. [8,9,11,13,14,16], [17] | RJ006          | Zingiberaceae Kokadene [J : J]         | Ovulation / Fertility | Fruit/Seeds | Fresh | O |
| Alpinia sp. [8,9,11,13,14,16], [17] | SK020          | Zingiberaceae Gavu [S : O]             | Sever fever | yf L & shoot | Cut into pieces & cooked with pig meat in bamboo | O |
| Alstonia brasili Monach. [8-11,13,16,18] | SK064          | Apocynaceae Gigipe [B : S]             | Skin infection | Sap (Milkywhite) | Fresh / Succus | E |
| Alstonia scholaris (L.) R.Br. [8-11,13,16,18] | RJ011          | Apocynaceae Yaknalae's Ita [J : M-B]   | Malaria | L, B | Fresh / dry | O |
| Alstonia sp. [8-11,13,14,16], [15,18,19] | SK046          | Apocynaceae Hhipa [B : S]              | To gain strengten during warfare | L & B | Cut into small pieces & cooked with pig meat in bamboo | O |
| Alyxia sp. [14], [18]          | RJ034a         | Apocynaceae Kevitingoje [I : J]        | Dyspnea | soft L | Fresh | O |
| Aristochia indica L. [20]      | RJ001          | Meliaceae Yak/I itchale [I : J]        | Malaria, Abortion, uterine inflammation | L, B | Fresh, Decoction | O |
| Ascarina philippinensis C.B.Rob. [21], [14] | RJ036          | Chloranthaceae Nebotniari [I : J]      | High fever | L, fruit | Fresh | O |
| Ascarina philippinensis C.B.Rob. [21], [14] | WL021          | Chloranthaceae Pawasa [F : Y]          | GIT / Swelling [Magic] | L | Concoction | O |
| Aspium sp.                      | WL034          | Unidentified Waise [F : Y / E]         | Diarrhea / abdominal pain / Cachexia | L | Concoction | O |
| Bacopa sp.                      | SK033          | Scrophulariaceae Momoto [G : U]        | For gaining weight | L, F & Stem | Cut into pieces & cooked with pig meat in bamboo | O |
| Barringtonia sp. [8,9,13,15-17] | SK054          | Barringtoniaceae Lahapa [B : S]        | Stomach ache | L & sap | Sap & chopped leaves are mixed together and cooked with pig meat in bamboo | O |
| Begonia rex Putz.               | RJ012          | Begoniaceae Woyatchale [I : J]         | Sores / Boils (esp. on neck) | L, Stem | Fresh or dried | O |
| Begonia sp. [9,10,21], [13,14], [15,20,22-24] | WL031          | Begoniaceae Awaya [F : Y]              | Excessive menstrual bleeding | L | Concoction | O |
| Begonia sp. [9,10,21], [13,14], [15,22-24] | RJ002          | Begoniaceae Saiguwong'giye [I : J]     | Strong cough / general good health | L / or A | Fresh | O |
| Bidens pilosa L. [9,11,13,15,16,19,24] | WL045          | Astenaceae Kamena [K : E]              | Sores & Wounds | L | Heated / Succus | E |
Table 1 Medicinally Utilized Plants in the Eastern Highlands of Papua New Guinea (Continued)

| Plant Name | Family | Uses & Preparations |
|------------|--------|---------------------|
| Bidens pilosa L. | Asteraceae | Toiporeyie [I : J] Cuts/Wounds/Scratches (Hemostatis) L & shoot Succus (crushed) | E |
| Blumea sp. [9,10,13,14,21] | Asteraceae | Aleu [F : Y] Weight decrease due to abdominal problems /nausea | L | Concoction | O |
| Boerlagiodendron eminens (W. Bull) Merr.*** | Araliaceae | Sofa [B : S] Control sexual desire of men | L | Leaves cut into pieces and cooked with pig meat in bamboo | O |
| Bubbia sp. | Winteraceae | Pangwe [I : J] Aches and pains, cough, arthritis, dyspnea | L, B | Decoction | O |
| Calycacanthus magnusianus K. Schum | Acanthaceae | Ikovote/Wusale [I : W / AD] Sores (all types) | L | Fresh (Macerated) | E |
| Castanopsis acuminatissima (Blume) Rehder [10,21], [14] | Fagaceae | Nege [S : G] Otitis media | B | F./Succus (Scraped and juice extracted) | E |
| Casuarina oligodon L.A.S. Johnson | Winteraceae | Alaeva / Karavefa [K / K : A] GIT / Swelling (Magic) | B | Concoction | O |
| Chionanthus ramiflorus Roxb. | Oleaceae | Hagavi [B : S] Malnutrition/ Growth retardation | L & B | Scraped bark & chopped leaves are cooked in bamboo with pig meat | O |
| Chrysanthemum sp. | Asteraceae | Seveya [S : O] Boil | F | F./Succus | E |
| Cinnamomum sp. [9,10,21], [13,14], [15,20,22-24] | Lauraceae | Yaravu [F : U] Weakness / nausea / vomiting | B | Concoction | O |
| Cladonia scabriuscula (Delise) Leight | Cladoniaceae | Yahoma [B : S] Poison within body system | L & B | Scraped B is added to chopped L & pig meat and cooked in bamboo | O |
| Coleus blumei Benth. [9,11] | Lamiaceae | Mufler [B : S] Induce labour in childbirth | L | Cut into pieces and cooked with other leaves & pig meat in bamboo | O |
| Coleus scutellarioides (L.) Benth. [9,21], [13,15] | Lamiaceae | Wuririta [I : J] Strong productive cough f soft L | Heated and Fresh | O |
| Commelina sp. [8,9,11,14], [15] | Commelinaceae | Hitirifa [K : E] Headache [Analgesic] | A | Fresh | O |
| Commersonia bartramiana (L.) Merr. [8,21] | Sterculiaceae | Kalafia [K : E] Emetic | B | Concoction | O |
| Coprosma sp. [14] | Rubiaceae | Loanoya [K : A] GIT / Swelling (Magic) | L | Concoction | O |
| Cordyline fruticosa (Linnæus) A. Chevalier [8,13,14,16], [15] | Agavaceae | Gini fono [S : O] Anemia & Dizziness yL | Cut into pieces & cooked with pig meat in bamboo | O |
| Cordyline terminalis (L) Kunth [9-11] | Agavaceae | Alebiyei [L : KA] Magical soft un-sprouted shoot / L | Concoction | O |
| Cosmos sp. | Asteraceae | Seho gihii [G : N] Toothache | F | Decoction (O (Rinse)) | O |
| Crassocephalum crepidioides (Benth.) S. Moore [9,21], [14,15] | Asteraceae | Matchope [I : J] Wounds and cuts (hemostasis) | L | Succus (crushed) | E |
| Crassocephalum crepidioides (Benth.) S. Moore [9,21], [14,15] | Asteraceae | Okor gi (G : N) Fresh cuts yL, F & Stern | F./Succus (All are squeezed together) | E |
| Plant Name | Family | Primary Use | Primary Part(s) | Preparation | Medicinal Use |
|------------|--------|-------------|-----------------|-------------|---------------|
| *Crasscephalum crepidioides* (Benth.) S. Moore | Asteraceae | Ino-Kamena-e [K : E] | Sores & Wounds | L | Heated / Succus | E |
| *Crotalaria retusa* L. | Leguminosae | Orupa flava [G : G] | Chicken-pox | F | Fresh / Succus | E |
| *Curculigo orchioides* Gaertn. | Hypoxidaceae | Orupa napa [G : N] | Growth retarded children | Tubers | Maceration, then liquid is used to cook greens & meat in bamboo | O |
| *Cyrtandra* sp. | Gesneriaceae | Minise [B : S] | Malnutrition | L & Stem | Cut into pieces and cooked with pig meat in bamboo | O |
| *Cyrtandra* sp. | Gesneriaceae | Asaswa [F : Y] | Weight decrease due to abdominal problems / nausea | L | Concoction | O |
| *Cyrtandra* sp. | Gesneriaceae | Kodatchale [I : J] | Emetic and strong cough (expectorant) | L | Fresh | O |
| *Decaspermum bracteatum* (Roxb.) A.J.Scott | Myrtaceae | Sosome [B : S] | Back & joint pain, headache & toothache | L & B | Cut into pieces and cooked with pig meat in bamboo | O |
| *Dendrobium* sp. | Orchidaceae | Fonomuna [S : O] | Severe headache & dizziness | L & stem | Cut into pieces & cooked with pig meat | O |
| *Dendrobium* sp. | Orchidaceae | Kinua [K : E] | Backache [Analgesic] | A | Fresh | O |
| *Dendrocnide interupta* (L.) Chew | Urticaceae | Fai [K : U] | Muscle / joint pains / headache | L | Fresh | E |
| *Dendrocnide* sp. | Urticaceae | Iwole [I : J] | Productive cough soft | L | Concoction | O |
| *Desmodium* sp. | Leguminosae | Suwaroka ginona [S : O] | Malnutrition | L, F & Stem | Cooked with meat in bamboo | O |
| *Dianella ensifolia* (L.) DC. | Liliaceae | Mamuha [B : S] | Irritating cough & throat mucus | L & Tuberis | Infusion | O |
| *Diospyros* sp. | Ebenaceae | Kigi Yosita-e [F : Y] | Shortness of breath w/ abdominal discomfort & bodyswelling | B | Concoction | O |
| *Diospyros* sp. | Ebenaceae | HamaitoYosita [K : E] | Significant weight loss | L & B | Concoction | O |
| *Dodonaea viscosa* Jacq. | Sapindaceae | Karu [K : E] | Bone Fractures / Painful joints | L | Heated | E |
| *Drymnia cordata* (L.) DC. | Caryophyllaceae | Motdeikedike [I : J] | Tooth ache | A | Decoction | O |
| *Elaeagnus* sp. | Elaeagnaceae | Tunaka Yosita-e [U : Y] | GIT / Swelling (Magic) | L | Dried | O |
| *Elaeocarpus* sp. | Elaeocarpaceae | Ukari [K : A] | GIT / Swelling (Magic) | B | Concoction | O |
| *Eleutheranthera* sp. | Asteraceae | Lemu [K : A] | Pains [general analgesic] | R | Concoction | O |
| *Emilia prenanthoides* DC. | Asteraceae | Gambiri govu [S : O] | Rumbling stomach | L | Cut into pieces & cooked with pig meat in bamboo | O |
| *Eperon suratensis* Retz. | Asteraceae | Kisekise / Okiopa [K : U] | GIT / Swelling (Magic) | B | Concoction | O |
| *Euphorbia hirta* L. | Euphorbiaceae | Saha ghihi [G : U] | Dysentery | L, F & Stem | Fresh / Succus | O |
| Plant Name | Family | Medicinal Use | Mode of Administration | Associated Symptoms |
|------------|--------|---------------|------------------------|---------------------|
| Eurya sp. | Theaceae | Headache, fatigue, GI discomfort, muscle aches and arthralgia | Concoction | O |
| Ficus benjamina | Moraceae | Joint & back pain | L & B | O |
| Ficus copiosa | Moraceae | Chest Pains, labored breathing | L & B | O |
| Ficus pumila | Moraceae | Malaise, fever, shaking, vomiting [sometimes] | L | O |
| Ficus pungens | Moraceae | Shivering hands & feet | L & Fruit | O |
| Gardenia sp. | Rubiaceae | Faintness / Epilepsy | L | O |
| Glochidion sp. | Euphorbiaceae | Frequent dizziness | yf L | O |
| Gordonia papuana | Proteaceae | GIT / Swelling [Magic] | L | O |
| Graptophyllum pictum | Acanthaceae | Excessive menstrual bleeding | L | O |
| Grevillea papuana | Proteaceae | Poulitice | L | O |
| Hemigraphis sp. | Acanthaceae | GIT / Swelling [Magic] | L | O |
| Hemigraphis sp. | Acanthaceae | Magical | L | O |
| Hyptis sp. | Labiatae | Spear wounds | L | O |
| Kibara katikii | Monimiaceae | Epilepsy | L | O |
| Plant Name                        | Family     | Common Name     | Uses                                                                 | Extracted Format | Notes                                      | Reference |
|----------------------------------|------------|-----------------|----------------------------------------------------------------------|------------------|--------------------------------------------|-----------|
| Laportea decumana (Roxb.) Wedd. | Urticaceae | Nabotne         | Liver pain, joint pain, magical                                       | L & Fresh        |                                            |           |
| Laportea decumana (Roxb.) Wedd. | Urticaceae | Nabotne         | Liver pain, joint pain, magical                                       | L                |                                            |           |
| Laportea sp.                     | Urticaceae | Keletchale      | Liver pain (Epicatric pain)                                          | f soft L         |                                            |           |
| Leucozyte capitellata (Poir.)    | Urticaceae | Hagaza          | Skin itchiness, L & stem                                             | Fresh / Succus   |                                            | O & E     |
| Litsea exsudens Kosterm.         | Urticaceae | Sagifa          | Cleanses body system                                                 | L & B            |                                            |           |
| Ludwigia hyssopifolia (G. Don)   | Urticaceae | Lawolawosa      | Blood in urine, yellow tongue, headache with high fever, aching     | A                |                                            |           |
| Ludwigia octovalvis (Jacq.) Raven| Urticaceae | Goluwayo        | Ulcer sores, Fruit & seeds                                           | Fresh / Succus   |                                            | E         |
| Maclura sp.                      | Moraceae   | Iveriate        | Malaria                                                               | soft L           |                                            | O         |
| Mединilla sp.                   | Melastomataceae | Lunu aria      | Anemia                                                                | L                |                                            | O         |
| Melastoma malabathricum L.       | Melastomataceae | Tawakaya      | GIT / Swelling (Magic)                                               | L & B            |                                            | O         |
| Melastoma sp.                    | Melastomataceae | Kora Yosa / Au | Heart Problems                                                        | L                |                                            | O         |
| Mucuna stanleyi C.T.White        | Leguminosae | Kang’ole      | Contraception                                                        | soft L           |                                            | O         |
| Munaya paniculata (L.) Jack      | Rutaceae   | Onupa yaha      | Mentally disturbed                                                   | L                |                                            | O         |
| Munaya sp.                       | Rutaceae   | Nuva yaha       | Nasal congestion                                                     | L                |                                            |           |
| Musa sp.                         | Musaceae   | Abu            | GIT / Swelling (Magic)                                               | Stem             |                                            | O         |
| Myrmecodia sp.                  | Rubiaceae   | Klekina         | Magical                                                              | soft L           |                                            | O         |
| Ophiorrhiza nervosa Ridl.        | Rubiaceae   | Atu            | Poison within body system                                           | L                | Cooked with pig meat in bamboo             | O         |
| Ophiorrhiza sp.                  | Rubiaceae   | Temu / Afela Hefi | Epigastric pain, nausea, vomiting, abdominal swelling [Stomach cancer] | L & soft stem    |                                            | O         |
| Orania sp.                       | Arecaceae   | Vayave          | Difficult breathing, cough and wheezing                              | B                |                                            | O         |
| Oxalis comiculata L.             | Oxalidaceae | Sokolo         | Dysmenorrhoea                                                        | L, F & Stem      |                                            | O         |
| Oxalis comiculata L.             | Oxalidaceae | Gehani gihi    | Labour pain                                                           | L, F & Stem      |                                            | O         |
| Pandanus sp.                     | Pandanaceae | Awangwe        | Asthma                                                               | soft L           |                                            | O         |
Table 1 Medicinally Utilized Plants in the Eastern Highlands of Papua New Guinea (Continued)

| Plant Name                                | Genus     | Family      | Tribe | Plant Part Used | Application Method | Dosage | Comments |
|-------------------------------------------|-----------|-------------|-------|-----------------|-------------------|--------|----------|
| Phyllanthus niruri L. [9,11,13,16]        | SK070     | Euphorbiaceae | Gaha  | L & F           | Fresh / Succus    | E      |          |
| Piper aduncum L. [29]                     | WL043     | Piperaceae   | Kamani | L               | Heated            | E      |          |
| Piper betle L. [9,10,16]                  | SK061     | Piperaceae   | Yagerere | L & F           | Chopped and cooked together with pig meat | O      |          |
| Piper gimbilimbum C.D.C. [14], [31,12]   | RU038     | Piperaceae   | Kutmunne | L               | Wrapper           | O      |          |
| Piper sp. [8-10,21], [13,14,16], [17,18,22] | RU039    | Piperaceae   | Mudutganane | L               | Magical           | soft L |          |
| Piper sp. [8-10,21], [13,14,16], [17,18,22] | RU026    | Piperaceae   | Gegieja   | L               | Magical           | soft L |          |
| Pipturus argenteus (G.Forst.) Wedd. [9,10,13,16,18,26] | SK067 | Urticaceae   | Ase yaha | L               | Succus            | E      |          |
| Pittosporum sinuatum BL. [14]            | WL058     | Pittosporaceae | Ilawau-u | L               | Concoction        | O      |          |
| Pittosporum sp. [9,21], [13,14,16]       | RU027     | Pittosporaceae | Wununghie | A               | Decoction         | O      |          |
| Planchonella sp. [14]                     | RU024     | Sapotaceae   | Ikklake   | L               | Decoction (bark) / fresh | O      |          |
| Plantago major L. [21]                    | SK044     | Plantaginaceae | Getuya   | Whole           | Chopped leaves are cooked together with pig meat | O      |          |
| Plantago major L. [21]                    | SK034     | Plantaginaceae | Masiga gihi | L & stem       | F / Succus        | E      |          |
| Plectranthus scutellarioides R. Br. [3,13,14,16,18] | SK040 | Lamiaceae   | Salita   | Dyentery        | Cut into pieces & cooked with pig meat in bamboo | O      |          |
| Podocarpus neriifolius Don. [9,27]       | WL054     | Podocarpaceae | Laso    | L               | Concoction        | O      |          |
| Poikilospermum sp. [8,14]                 | SK058     | Urticaceae   | Sikrutafa | L & vine       | Chopped leaves & scraped vines are cooked together with pig meat | O      |          |
| Polygala paniculata L. [21], [13], [14]  | SK016     | Polygalaceae  | Nuva gihi | L & F          | Cooked with meat in bamboo | O      |          |
| Polygonum strigosum R. Br. [14]          | RU022     | Polygonaceae | Tungole   | L               | Fresh             | O      |          |
| Polyscias filicifolia (C.Moore ex E.Fourn.) L.H.Bailey | RU005 | Araliaceae   | Iriduki/’Imethchale | L               | Fresh             | O      |          |
| Psidium guajava L. [8,9,13,16]           | SK002     | Myrtaceae    | Gusigusi  | L               | Fresh / Succus    | O      | (Chewed) |
| Pterocarpus sp.                           | SK003     | Leguminosae  | Gulumehe  | L & F & Stem    | F / Succus (All at once) | O  |          |
| Psychotria sp. [9,11,21], [13,14]        | WL033     | Rubiaceae    | Katoya    | L               | Concoction        | O      |          |
| Rubus malaccanus L. [9,14,16,21]         | WL023     | Rosaceae     | Uruturu   | L               | Concoction        | O      |          |
| Rungia klossi S.Moore [11,21], [14,30]   | WL004     | Acanthaceae  | Hefi      | none            | Herb              | O      |         |
| Saccharum sp. [9,11,21], [13,14,16], [17,23,26] | RU051 | Poaceae      | Sale / Saimije | L               | Crystalized       | Additive (taste / texture) | O      |          |
| Plant Name | Family        | Common Name | Uses |
|------------|---------------|-------------|------|
| Sacciolepis sp. [10,13,14,21] | Poaceae | Hufa-aigoyae [K: AN] | Small sores & minor cuts |
| Salacia sp. [14]* | Celastraceae | Agenala [K: Y] | GIT / Swelling [Magic] |
| Sambucus javanica Reinw. ex Blume | Caprifoliaceae | Golani yaha [G: N] | Chicken-pox |
| Sanchezia nobilis var. glaucophylla | Acanthaceae | Girukaru [G: U] | Broken bones & joint dislocations |
| Saurauia andreana (F.Muell.) Diels [8,14]* | Actinidiaceae | Ayano [Ki: K] | GIT / Swelling [Magic] |
| Saurauia sp. [8,21]*, [14]* | Actinidiaceae | Goiva [S: O] | Ulcers |
| Saurauia sp. [8,21]*, [14]* | Actinidiaceae | Kiahuyave [B: S] | Dysmenorrhoea |
| Saurauia sp. [8,21]*, [14]* | Actinidiaceae | Karakieta [F: Y] | Pains, Fevers & GI Symptoms |
| Sauraia sp. [8,21]*, [14]* | Actinidiaceae | Koilel [I: W/AD] | Liver pain / epigastric pain |
| Saurauia sp. [8,21]*, [14]* | Actinidiaceae | Kogana [K: U] | GIT / Swelling [Magic] |
| Selaginella emmeliana Van Geert | Selaginellaceae | Kakasi [Ki / K: A] | Swollen Hands and Feet |
| Sida acuta Burm. F. [9,13,16] | Malvaceae | Nivinilahi [G: O] | Dysmenorrhoea, Diarrhea |
| Siganbeckia orientalis L. [14]* | Asteraceae | Mezama [B: S] | Diarrhea |
| Smilax rotundifolia L. [8,9,16] | Smilacaceae | Kogana [K: Y] | Pains and Fevers [Analgesic] |
| Smilax sp. [8,9,14,16]* | Smilacaceae | Ala-Kogana [K: U] | GIT / Swelling [Magic] |
| Smilax sp. [8,9,14,16]* | Smilacaceae | Gatapa nara [S: O] | Epilepsy |
| Steganthera sp. [14]* | Monimiaceae | Kwagisal'lik [I: AD] | Strong cough with burning/nausea |

*Note: Table continues on the next page.*
Table 1 Medicinally Utilized Plants in the Eastern Highlands of Papua New Guinea (Continued)

| Common Name | Genus | Family | Scientific Name | Conditions | Parts Used | Preparation | Comments |
|-------------|-------|--------|-----------------|------------|------------|-------------|----------|
| Symplocos sp. [14,21], [13,14,16] | Symplocos sp. | Symplocaceae | Vefa [K : E] | Emetic | B | Concoction | O |
| Symplocos sp. [14,21], [13,14,16] | Symplocos sp. | Symplocaceae | Nimihavaya [K : A] | Epigastric pain | L | Concoction | O |
| Symplocos sp. [14,21] | Symplocos sp. | Symplocaceae | Guruke [I : W] | Cough | L | Fresh | O |
| Syzygium longipes | Syzygium longipes | Myrtaceae | Maze [B : S] | Malnutrition | L & B | Cut into pieces and cooked with pig meat in bamboo | O |
| Syzygium sp. [8-11,21], [13,14,16] | Syzygium sp. | Myrtaceae | Nuva yaha [G : G] | Mild-severe chest pain | L & Fruit | Dry / fresh chopped leaves are cooked with meat in bamboo | O |
| Syzygium sp. [8-11,21], [13,14,16] | Syzygium sp. | Myrtaceae | Yasawa [F : Y] | GIT / Swelling [Magic] | B | Concoction | O |
| Syzygium sp. [8-11,21], [13,14,16] | Syzygium sp. | Myrtaceae | Na-a [K : A] | Swallowing of poison | L & B | Cut into pieces and cooked with pig meat in bamboo | O |
| Tagetes sp. [11] | Tagetes | Asteraceae | Ukuromini [G : N] | Toothache | F & Stem near F | F (All are squeezed and applied directly) | O |
| Tasmannia piperita (Hook. f.) Miers. | Tasmannia piperita | Winteraceae | Iriduikichale [I : J] | Malaria and strong cough | L | Fresh or dry | O |
| Tecoma sp. [21], [15] | Tecoma | Bignoniaceae | Na-a [K : A] | Vaginal discharge / bleeding | R | Concoction | O |
| Timonius belensis Merr. & L.M. Perry [14] | Timonius belensis | Rubiaceae | Kipe [B : S] | Joint & back pain | L & B | Scraped B is added to chopped L & pig meat and cooked in bamboo | O |
| Timonius sp. [9,13,14,16] | Timonius sp. | Rubiaceae | Ubago [K : E] | GIT / Swelling [Magic] | L | Concoction | O |
| Trichospermum sp. | Trichospermum | Tiliaceae | Aviya [K : A] | Headache, fatigue, GI discomfort, muscle aches and arthralgia | L | Concoction | O |
| Tridax procumbens L. | Tridax procumbens | Asteraceae | Lilita [G : U] | Mild-severe headache | L | Cooked with meat in bamboo | O |
| Tristiropsis sp. | Tristiropsis | Sapindaceae | Longola [I : J] | Malaria, cough w/ chest pain / Magical | soft L | Fresh | O |
| Uncaria sp. [8,21], [14] | Uncaria sp. | Rubiaceae | Glagigo [B : S] | Internal sores & candida infections | L & Stem | Candida: stem smashed to release succus which is gargled; sores: stem and leaves are cooked and eaten | O (Rinse) / O |
| Unidentified SK011 | Araliaceae | Gororotave nara [S : O] | Toothache | L & stem | F / Succus (Cut & squeezed in hand) | E |
| Unidentified SK065 | Not given | Nagepa [B : S] | Headache | L, F & Stem | All parts are cooked together with pig meat | O |
| Unidentified RJ003 | Unidentified | Imetchale [I : J] | Malaria | L | Fresh | O |
| Unidentified RJ016 | Icacinaceae | Kavikaule [I : J] | Strong cough | L | Fresh or dry | O |
| Unidentified RJ025 | Scrophulariaceae | Imetchale [I : J] | Malaria and Asthma | A | Fresh or dry | O |
| Unidentified RJ026 | Solanaceae | Kwagi/Kuwogie [I : J] | Persistent cough | L | Fresh | O |
**Table 1 Medicinally Utilized Plants in the Eastern Highlands of Papua New Guinea (Continued)**

| Plant | Use for                                      | Uses of Plant | Plant Part | Uses of Plant | Condition and Symptoms |
|-------|----------------------------------------------|---------------|------------|---------------|------------------------|
| Unidentified RJ028 Unidentified Kimamite (small) | Malaria / mental enhancement | L, Stem | Leaf Fresh / Stem charred and inhaled | O |
| Unidentified RJ031 Unidentified Ka’tungjie | Strong cough with rhinorrhea (decongestant) | L | Fresh | O |
| Unidentified RJ034b Unidentified Ammate | Dyspnea | soft L | Fresh | O |
| Unidentified RJ035 Unidentified Kimamite (big) | Headache / Malaise | L | Fresh | O |
| Unidentified RJ040 Euphorbiaceae Klalebongbonge | Magical | soft shoot / L | Concoction | O |
| Unidentified WL008 Leguminosae Orovia | Abdominal discomfort / bodyaches [also magical: make people like bearer] | F | Fresh | O |
| Unidentified WL012 Unidentified Kuougo | GIT / Swelling [Magic] | Stem [dried] | Concoction | O |
| Unidentified WL016 Euphorbiaceae Kamira | Excessive menstrual bleeding | L | Concoction | O |
| Unidentified WL026 Unidentified Tevesa | GIT / Swelling [Magic] | A | Concoction | O |
| Unidentified WL027 Myrtaceae Kuta | GIT / Swelling [Magic] [also magical as protection for bearer] | B | Concoction | O |
| Unidentified WL028 Unknown Nonhe | GIT / Swelling [Magic] | L & B | Concoction | O |
| Unidentified WL041 Unidentified Eso-Aginogi | Weight Loss with severe bodyaches and GI complications | A | Concoction | O |
| Unidentified WL050 Unidentified Veya | Swollen Hands and Feet | A | Concoction | O / E |
| Unidentified WL055 Lamiales Natano | GIT / Swelling [Magic] | B | Concoction | O |
| Unidentified WL057 Sapindaceae M-e | Pains [BodyAches] | B | Concoction | O |
| Unidentified WL060 Theaceae Alau / Kalau | GIT / Swelling [Magic] | B | Concoction | O |
| Unidentified WL061 Unidentified Kaviaya / Kamagafa | GIT / Swelling [Magic] | B | Concoction | O |
| Unidentified WL068 Melastomataceae Masirita | GIT / Swelling [Magic] | L | Concoction | O |
| Unidentified WL076 Unidentified Hapalaga Hitirifae | Diarrhea | F / Fruit | Fresh | O |
| Unidentified RJ050 Unidentified Tungoje | Cough | L | Fresh | O |
| Unea strigosa (Ach.) Eaton WL063 Parmeliaceae Oleazu | Headache | A | Concoction | O |
| Vaccinium sp. [13], [14]*, [21]*, [15]* RJ019 Ericaceae Yopengchale | Strong cough, asthma/dyspnea, fertility, stop menstruation | L | Fresh | O |
Crassocephalum crepidioides is widespread in subtropical and tropical areas around the world. Antimalarial and antimicrobial dihydroisocoumarin compounds have been isolated from an endophytic Geotrichum sp. fungus of this plant [34], although there is no evidence that the coumarin compounds contribute to the putative medicinal properties of this plant.

Gahaku-speaking people cook chopped leaves and fruit of Ficus pungens and use them to treat “shivering hands and feet”, while in Marawaka liquid extract from fresh leaves is used to treat thrush (oral candidiasis). In both cases the traditional medicines are consumed orally.

Ficus pungens is common throughout the lowlands of Papua New Guinea [33] and there are many reports of its medicinal use in PNG [9,10,13,14,16]. Its use for coughs has been repeatedly reported; e.g., in Holdsworth [9] coughs are treated in the Sepik by swallowing sap obtained from the root. Also, the leaves of Ficus pungens are crushed together with the leaves of a species of Mallotus, and mixed with water and consumed to relieve a bad cough in Buka, Bougainville [9]. A solution made from crushed and squeezed bark is taken orally for a week for treatment of asthma [16]. Other reported uses include: in the previous Northern District of PNG, leaves were heated over a fire and applied topically to alleviate body pains [13,35]. Also, the Traditional Medicine Database records the use of fresh leaves in the treatment of inguinal hernia (swelling of testicles) by brushing the leaves upwards against the testicles [16]. The application of leaves to sores was also reported by Telban [10].

Both Oxalis corniculata and Plantago major are used in Bena and Gahaku speaking communities. In Bena areas Oxalis corniculata is cooked with pig meat and eaten to treat painful menses, while in Gahaku areas its fresh fruit and flowers, as well as freshly squeezed succus, are recorded as consumed orally to relieve labor pains. Oxalis corniculata is found everywhere in Papua New Guinea, but most commonly in the Highlands [33]. Traditional uses include pulping of the whole plant to extract sap that is drunk to treat syphilis and prostate cancer [16]. To treat burns, the whole plant is crushed, chewed and spat onto the burn [9].

According to Zubair [36], “Plantago major (common plantain) has been used in folk medicine all over the world, mainly for the healing of wounds.” We have found reports of its medicinal use in PNG are uncommon, however. Plantago major is cooked whole in Bena areas and consumed orally as treatment for diarrhea,
while in Gahaku areas leaves and succus from stems are reported to be applied topically to treat deep wounds. *Zingiber officinale* is found in many preparations in Kaygana speaking areas where the rhizome is used as an additive to improve taste and texture of medicinal preparations; however in Marawaka it is used in a concoction to treat sore throat and for magical purposes. *Zingiber* is grown as a culinary and ornamental plant [16]. It is widely used for a plethora of indications too numerous to list here e.g., [8-10,16,21,22,26,30].

**Lesser known medicinal plant species of PNG**

It is frequently the case in reports such as this that it is not always possible to find references for medicinal use in PNG for all the species listed. Plants identified to the species level reported here, but not found listed as medicinal in the PNG literature we reviewed, include: *Begonia rex*, which is consumed orally for boils and sores, including tropical ulcers, in the Ipma-Baruya language area. There are several *Begonia* species reported as used medicinally in PNG [9,10,13,14,20,22-24], but not *B. rex*. So far as we can tell the species *Begonia rex* has only been reported from West Papua to this point [33]. Likewise, there are records of *Calycacanthus magnusianus* in PNG [33], but not of its medicinal use. This is also the case for other plants listed in this report: *Ascarina philippinensis; Chionanthus ramiflorus; Gordonia papuana; Kibara katiki; Litsea exudens; Ludwigia hys- sopifolia; Ludwigia octovalvis; Melastoma malabathricum; Ophiorrhiza nervosa; Pittosporum sinuatum; Selaginella emmeliana*; a spike moss; *Sigesbeckia orientalis; Timonius belensis and Usnea strigosa*; (* Known to exist in PNG, personal communication, Prof. Robert Jorim et al. Journal of Ethnobiology and Ethnomedicine 2012, 8:47 http://www.ethnobiomed.com/content/8/1/47

![Figure 3 Methods of preparation of medicinal plants prevalent in the Eastern Highlands region of PNG. (The use of a plant as a wrapper/container to prepare medicines may not imply medicinal action by itself.)](image)

![Figure 4 Route of consumption of medicinal plants and preparations by frequency of use or mode. Note: For reasons of clarity the language groups have been folded into LLGs (Unggai-Bena LLG for Bena, Gahaku and Siane languages; Okapa LLG for Fore, Kimi and Keyagana languages and Obura-Wonenara LLG for Ipma-Baruya language).](image)
Johns, Botanical Research Institute of Texas, New Guinea Research Program).

Leaves of *Boerlagiodendron eminens*, also known as *Osmoxylon eminens*, were recorded in Sekagu village, Bena speaking area, to be cut and eaten to suppress sexual desire in men. This plant is not listed in the PNG Plants database [33] and maybe a unique record. Blackwood [22] reported leaves from a *Boerlagiodendron* sp. to be eaten by the Kukukuku people of the Highlands. Other lesser known medicinal plants in this report that are not represented in PNG Plants database [33] include *Dendrocnie interrupta* (*Fleurya interrupta*); *Polycias filicifolia*; *Sambucus javanica*; and *Sanchezia nobilis* var. glaucophylla. We assume that *Sanchezia* is likely recently introduced as an ornamental species.

Conclusions
As described by Feil [37], “Highlanders may inhabit similar altitudes but within this range there are distinct sub regions…” The Eastern Highlands are relatively drier and historically became heavily populated later than the wetter western regions. The contemporary cultural and botanical diversity of the Eastern Highlands, the continued reliance on medicinal plants in rural communities there, and the innovation and experimentation of the practitioners, combine to yield a rich and dynamic area for study. While many traditional practitioners continue to treat symptoms attributed to “witchcraft”, modern perceptions of disease etiology are penetrating even remote villages, resulting in mixed rationales for giving treatments that reflect these changes in understanding.

Several of the species reported here are used in the Eastern Highlands but not frequently reported in the literature for medicinal use elsewhere in PNG. These include both plants that are known to be widely distributed in PNG (e.g., *Ascarina philippinensis* and *Calycacanthus magnusianus*) and also those that are not known to be widely distributed in PNG (e.g., *Boerlagiodendron eminens* and *Aristolochia indica*). The medicinal use of those plants that are localized geographically might reflect potent activity accessible only to those fortunate enough to live there, while the unique use of widely distributed plants might reflect either the local discovery of a useful property, or experimentation of local healers in plant use – practices perhaps not yet spread to or reproduced elsewhere in PNG. In any case, efforts to validate the utility of PNG medicinal plants cannot completely skirt these issues. Subjecting traditional plant preparations to laboratory testing can demonstrate specific bioactivities that may help validate the traditional use, but unfortunately, it is beyond the capacity of the PNG Department of Health or the University to test for all the bioactivities represented in the wide range of plant uses recorded by the surveys. In these circumstances, the consistent use of a particular plant for specific indication by a large number of healers, across a wide range of ethnic traditions, is notable and may support the notion of a particular herbal remedy’s efficacy.

The effort to document and validate medicinal plant use in PNG is part of a larger strategy that is under way to meet the health care needs of citizens of PNG. As described by Warururai et al. [8], the Traditional Medicines survey project complements other programs supported by the PNG Ministry of Health to promote the use of efficacious herbal remedies in underserved communities. Traditional healer associations have already been established in several provinces and basic manuals on diagnosis and plant use have been drafted. The aim is to promote integrated medical treatment options in an approach to health care that combines effective and accessible traditional practices with Western protocols (when available). The medicinal plant surveys reported here are the product of collaboration amongst the faculty at UPNG and the University of Utah, with support provided by the Fogarty International Center of the NIH, USA [38], and the PNG Ministry of Health. The Traditional Medicines survey project utilizes a university training tutorial as one component of a larger strategy aimed at providing improved health care options to a burgeoning population.

Additional file

**Additional file 1:** Information sheet on traditional herbal preparations and medicinal plants of Papua New Guinea.

Competing interests
The authors declare that they have no competing interests.

Authors’ contributions
PR and TM with colleagues established the Traditional Medicines survey program at UPNG and oversaw training and support of students and the maintenance of the Traditional Medicines Database. RJ, SK and WL, senior year Bachelor of Pharmacy students travelled to their respective Eastern Highlands communities and conducted the interviews with locally acknowledged healers and performed the corresponding plant collections and documentation. PP and OG oversee the UPNG herbarium and identified collected plants. MK and LB integrated the data from the three surveys, drafted the manuscript and performed the literature analysis. All authors read and approved the final manuscript.

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The student reports accessed for the information in this manuscript are titled: “Documentation and Evaluation of Traditional Medicine Practices in Marawaka area of Eastern Highlands Province”, 2005, by Ronald Y. Jorim; “Documentation and Evaluation of Traditional Medicine Practices in the Keyagana, Fore and Kini Constituencies of Okapa, Eastern Highlands Province”, 2006, by Wauwa Legu, and “Traditional Medicine Practices in the Ungga-Bena LLG Eastern Highlands Province”, 2010, by Seva Korape. We gratefully acknowledge contributions and sharing of the Siane speaking people of Ginipaupa and Orumba villages, the Gahuku speaking people of Orumba, Numurapoka, Ginipaupa, Masiga and Numurapoka villages, the Bena speaking people of Sekagu village; the Ipm-Baruya language people of Jomuru, Mala, Bobo, Wauko, Ande, Gawol, Kwaksio and Kam’wa villages.
and Marakawa station, the Keyaga speaking people of the Egera-Haga, Yawanita Haya, Aniruvi (Haga), Amusa, Aniruvi (Egera-Haga) and Niruvi (Egera-Haga) villages, the Fore speaking people of the Yawanita Haya, Kamyovind-Tunuku, and Egera-Haga villages and the Kimi speaking people of the Amusa and Kimi villages. Without their invaluable input this publication would not be possible. We wish to thank Professor Robert Johns, Head New Guinea Program, Botanical Research Institute of Texas, for input on plant identification while visiting the UPNG herbarium, and Robin L. Hyde, Visiting Fellow, Department of Anthropology and Resource Management, ANU College of Asia & the Pacific; for providing personal notes, many useful references on medicinal and other plant use in PNG, and helpful suggestions concerning the presentation of these studies. We also acknowledge UPNG and FRI Herbarium staff for assistance in identification of medicinal plant vouchers. This work was funded by US NIH support through the Fogarty International Center, ICGF SU01T006671. Dr. Rai, Dr. Matainaho and students were also supported by the National Department of Health, Papua New Guinea and the University of Papua New Guinea.

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