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Journal of Ethnopharmacology 70 (2000) 281–300

Journal of ETHNO-PHARMACOLOGY

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Traditional herbal drugs of southern Uganda, I

F.A. Hamill [a], S. Apio [b], N.K. Mubiru [b], M. Mosango [c], R. Bukenya-Ziraba [c], O.W. Maganyi [c], D.D. Soejarto [a,*]

[a] *Program for Collaborative Research in the Pharmaceutical Sciences, Department of Medicinal Chemistry and Pharmacognosy, College of Pharmacy, M/C 877, University of Illinois at Chicago, 833 S. Wood St., Chicago, IL 60612, USA*

[b] *Natural Chemotherapeutics Research Laboratory, Ministry of Health, Kampala, Uganda*

[c] *Department of Botany, Makerere University, Kampala, Uganda*

Received 1 June 1999; received in revised form 10 January 2000; accepted 14 January 2000

Abstract

One-hundred four plant species used medicinally by herbalists from three southern Ugandan tribes were collected and identified. The collection includes a large portion of the materia medica of the Abayanda of the southwest region, as well as species used by herbalists of the Baganda and Bakiga Tribes. Literature searches were performed in preparation for further collections, and for collaborative laboratory validation of in vitro antimicrobial activity. Literature data provide support for ethnomedical claims for a number of species used in Uganda for disease treatment. © 2000 Elsevier Science Ireland Ltd. All rights reserved.

Keywords: Traditional herbal drugs; Uganda

1. Introduction

Uganda is an East African equatorial nation bordered by Lake Victoria, Tanzania and Rwanda to the south, Democratic Republic of Congo to the west, and Sudan and Kenya to the north and east (Fig. 1). A great portion of the land cover (83 990 km^2: 34.8%) is classified as small-scale farmland. Non-degraded forest accounts for 6500 km^2 (2.7%). The majority of the rest of the land cover is grassland (21.1%), scrub woodland (16.5%), water (15.3%), and bush (5.9%) (Anonymous, 1996a).

Health care for the nation is far from adequate. Malaria is the leading cause of mortality, followed closely by AIDS-related diseases such as diarrhea and respiratory infections (Bukenya-Ziraba et al., 1996). Basic pharmaceuticals are not reliably available in rural areas, but when available are often prohibitively expensive, resulting in continued dependence on the largely herbal pharmacopoeias and the traditional herbalists for day-to-day health care (Anokbonggo, 1992; Bukenya-Ziraba et al., 1996; Wallman, 1996). Overall, the segment of the population in Uganda that depends upon traditional healers for first-line health care has been reported at close to 80%. Most villages ($\pm$300–900 persons per village)

* Corresponding author.

0378-8741/00/$ - see front matter
PII: S0378-8741(00)00180-X

have at least two recognized traditional herbalists and several traditional midwives, whereas the ratio of physician to population is 1:20 000 (Anokbonggo, 1992).

Cooperative efforts between modern and traditional health care workers have been encouraged to aid in addressing Uganda's poor health status (Anokbonggo et al., 1990; Anokbonggo, 1992; Bukenya-Ziraba et al., 1996). In 1987, the Uganda Health Policy Review Commission put forth a recommendation for open referral between medical practitioners and traditional healers. The Ugandan Ministry of Health's Natural Chemotherapeutics Research Laboratory (NCRL) has been active in the promotion of various public health education initiatives which seek to educate both traditional and conventional health care professionals in Uganda. Through a research agreement between the NCRL and the University of Illinois at Chicago, field studies on medicinal plants of southern Uganda were undertaken. Herbalists and individuals from the southern tribal groups, namely, the Baganda, Bakiga and Abayanda (Batwa) were interviewed to gain a general understanding of the regional traditional herbal medical practices, as a basis for designing a more extended future study.

2. Background and study site

Buganda, the Kingdom of the Baganda, is the largest of several traditional kingdoms within the Republic of Uganda. Luganda is spoken by the Baganda, and is the principal language in the south-central region that includes the capital city of Kampala (Ssemakula, 1998). Members of the Bakiga, a primarily southwestern tribe, are found in the regions near the Bwindi Impenetrable National Park (BINP). This large but more rural population speaks Rukiga, which is related to Luganda, both of which are Bantu languages (Ssekamwa, 1984).

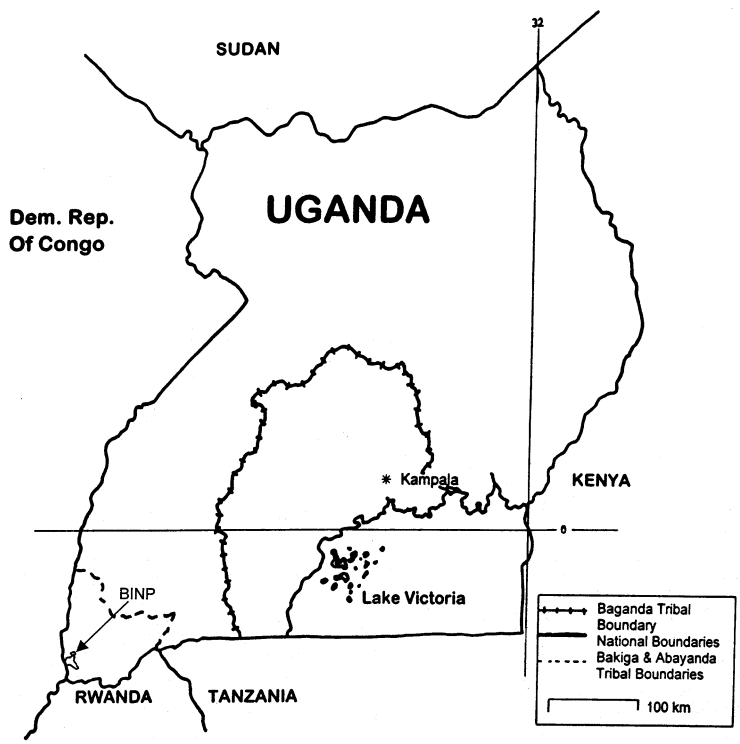

Fig. 1. Sketch map of study regions in Uganda

The third tribal group, the Abayanda of southwestern Uganda, is the smallest of the three tribes studied; it numbers fewer than 2000 individuals concentrated in three Districts, Rukungiri, Kisoro, and Kabale, making up less than 0.2% of the population in the study region. This population has diminished considerably from the 1980 census (3378) and the 1969 census (3076) (Kabananukye and Wily, 1996). At least 50% of the total population live in single, squatter households on private farms owned by members of a majority tribe, and are generally widely separated from the next Abayanda household. These people are historically and integrally associated with the forests, including Bwindi, Mgahinga and Echuya. Indeed, their culture is reportedly structured "in a profound way upon the forest…" (Kabananukye and Wily, 1996). Members of this tribe are considered to be representative of the eastern-most group of the Pygmoid Africans, and are referred to by the surrounding populations as the Batwa, Twa, or Pygmy (Cavalli-Sforza, 1922; Kabananukye and Wily, 1996). These latter names, however, (Batwa, Twa, Pygmy) are considered pejorative by the Abayanda, and should not be used. The name Abayanda (singular: Umuyanda or Omuyanda) is preferred by the Abayanda people themselves.

The Abayanda consider the lands surrounding the Bwindi, Mgahinga and Echuya Forests as ancestral domain, and refer to parts of these areas as *aha nahacu* (our territory). The majority of these people are land-less and are prevented from entering or living within the Parks by law, except by acquisition of an entry permit and payment of a prescribed fee (Anonymous, 1996b; Kabananukye and Wily, 1996). Most of them live in close proximity to the three forests of the study area, BINP, Echuya Forest, and Mgahinga National Park, and are involved in *kuhakwa* (clientage: the practice of performing a variety of labors for the right to stay on the property of the landlord) (Kabananukye and Wily, 1996). At the time of this study, only three Abayanda individuals in the region had stable, gainful employment. The recent delocalization and slow acculturation of the Abayanda probably contributes to steady loss of culture-specific knowledge and practice, including the uses of plants as medicine.

Field work was carried out in Kampala, Kabale and Rukungiri Districts. The District of Kampala, where the capital city of Uganda is located, lies near the northern shores of Lake Victoria, with an altitudinal range of 1189–1402 m above sea level. The district is highly populous (close to one million people), and is heavily farmed by local peoples. Dense deciduous tropical rain forest can be found in patches at the fringes of the district (Rwabwoogo, 1998). The Districts of Kabale and Rukungiri have comparable climates, though the altitudal range of the region of BINP is large. The BINP itself, located in Rukungiri and Kisoro Districts, covers an area of 331 km^2 and is situated in the extreme southwest of Uganda. It has been considered to be a remnant of Pleistocene refugium, with a large altitudal range (Kalina and Butynski, 1996).

3. Methodology

3.1. Selection of interviewees

Data on the medicinal uses of plants were gathered in 1996–1997 by targeting single individuals whose skills in medical herbalism was recognized by the members of his or her own tribe. Field interviews in Kampala District were conducted in English with Ms Olivia Maganyi of the Department of Botany, Makerere University, and with Ms Molly Kajumba of Kampala. Interviews in and around Bwindi Impenetrable National Park (BINP), which included territory within both Kabale District and Rukungiri District, were conducted in English with Mr Ngabirano Savio Greens, a Mukiga school teacher and amateur herbalist from Ruhija and, later, with Mr William Akuru, a Mukiga cook from Ruhija village. Collections made in and around BINP under the guidance of the Omuyanda Mr Calebo Naambeneza were assisted by Ms Clemency M. Akankuasa and Mr Januarius, who served as translators for Mr Naambeneza. Mr Januarius and Ms Akankuasa also made frequent ethnomedical contributions during field interviews with Mr Naam-

beneza which led to collections based on their knowledge.

In addition to interviews with pre-selected interviewees, data were also collected during impromptu sessions with various individuals as the opportunity arose.

Mr Naambeneza and his father, Mr Jakobo Bandusya, are well known to botanists and researchers in the area of the southwest. Mr Bandusya is often named by researchers as an example of the Abayanda's sophisticated knowledge of the forest, and has worked extensively with researchers, such as Cunningham, in the documentation of economically useful species in Bwindi (Cunningham, 1996). Unfortunately, Mr Bandusya was ill and confined to his bed during the period of this field work. Mr Naambeneza retains his father's knowledge, and was willing to participate in this project. Mr Naambeneza has an understanding that his father's expertise is in danger of being lost, therefore, he was eager to offer his knowledge for this study. Ms Maganyi was also referred to the project as highly knowledgeable and well connected. She was interviewed extensively over a period of months, and was selected based on her high level of botanical knowledge and for her high level of knowledge of the medicinal plants of the region, much of which was passed to her from family members.

3.2. Method of interview

Data gathering was performed as a continuous informal question-and-answer interview (semi-structured format; Alexiades, 1996) during hikes in the forests. A previous review of the regional epidemiology was made, which allowed the interviewer to hazard a guess at conditions being described, thereby providing an informed basis for further, more elucidative questions. For example, an apparently elaborate medicinal plant remedy prescribed in a particular way for individuals suffering from *empanami*, described as 'stomach worms which cause skin problems', may not immediately be recognizable and may seem magical or nonsensical to Western-trained personnel. In this case, however, further questioning revealed that a regional parasitic malady (hookworm: *Necator americanus* and *Ankylostoma duodenale*) was probably being described. Humans contract hookworms by contact with larvae-infested soils. The larvae penetrate unbroken skin giving rise to a pruritic rash, thus, the common name 'ground itch'; hence, 'stomach (intestinal) worms which cause skin problems'. Confusing etiologies are common, e.g. ascariasis (*Ascaris lumbricoides*, aka roundworm), which is noted in the literature as epidemic in the region, and may give rise to dermatitis of a different sort during the migratory phase of the disease.

The semi-structured interview format was chosen because it allows the freedom to pursue many lines of questioning. Basic information was always queried in order to complete a desired profile for each medicinal plant species that included the following data:

- Common/local plant name(s).
- Disease state(s) treated by this plant species [note: complete questioning and recording of descriptions of the disease(s) and the local name(s) of the disease(s) are most helpful in ascertaining disease etiology)].
- Methods and considerations of harvest of the plant, preparation of the medicine, plant parts used, combinations with other species, etc.
- Details of the administration of the treatment, including the approximate amounts and number of doses per day or week, etc.
- Prohibitions involved in using the plant for treatment of disease, e.g. not for use in pregnant women or children under a certain age, or in doses higher than x, or for longer than n days, etc.
- The estimation of the herbalist regarding the origins and history of the use of this plant, and how she/he came to learn of this use.

All interviews were video recorded or audio recorded with participant permission. Prior to participation, each interviewee was appraised of the project structure, participants, goals, and potential for further research, publication and dissemination of data collected. Interviews with these and other herbalists in Uganda are continuing, with the results to be reported in future papers.

3.3. Plant collection and identification

All interview data were documented by voucher herbarium specimens. Interviews and collections in and around Kampala District were made during the months of November and December, 1996, and again in March, 1997. In January and February, 1997, day trips by foot and vehicle were made with interviewees and a translator to various locations in BINP as well as in outlying villages. Day trips with Mr Naambeneza, Mr Januarius and Ms Akankuasa included collections from Kabale and Rukungiri Districts; collecting excursions with Mr N.S. Greens or Mr William Akuro were confined to Kabale District. Voucher herbarium specimens were collected in sets of five for deposits at the Department of Botany of Makerere University in Kampala, the Institute for Tropical Forest Conservation in Ruhija, the Natural Chemotherapeutics Research Laboratory in Kampala, Field Museum of Natural History in Chicago (USA) and the Missouri Botanical Gardens in St Louis (USA). Each specimen was labeled with a numbered tag and placed between newsprint in plant presses. Field and preliminary identifications were performed at Makerere University, while final identifications were conducted at the Field Museum and at the Missouri Botanical Gardens.

3.4. Data analysis and compilation

Video and written data collected during interviews were reviewed upon return to Chicago. Names of species were entered into an in-house database of medicinal plants of East Africa and cross-referenced with existing literature to determine similar uses in other regions of East Africa. Literature search of the NAPRALERT database at the University of Illinois at Chicago (Loub et al., 1985) was conducted on ethnomedical, chemical, toxicity and biological study data.

4. Results

The results of our field study are presented in Table 1. Forty-eight plants were mentioned as used commonly by the Abayanda, 61 as used commonly by the Bakiga, and 28 as used commonly by the Baganda, for a total of 103 taxa, of which 101 were identified to species and are listed in Table 1. Many of the species 'overlap', i.e. are used by several or all three tribes.

The family Asteraceae is the most richly represented in the overall collection (20 species), followed by Euphorbiaceae (9) and Fabaceae (7) (Table 1). The Asteraceae is particularly richly represented in the Abayanda collection, accounting for 11 of 48 species reported. No other family is represented by more than three species in the Abayanda collection. For the entire collection of 101 identified species, 53 (52.4%) referenced as medicinally valuable are herbaceous annuals and perennials, 33 (32.7%) are trees, and 15 (14.9%) are shrubs or vines. Specimens were collected from a range of habitats, including disturbed areas such as paths, roadsides and cultivated areas, as well as from the forest itself. A theory has been proposed by Moerman (1979) to explain the seeming imbalance in the taxonomic distribution and habit of medicinally-used species per family available to local communities, which states that such discontinuity is the result of a selective, rather than a random or symbol-driven, process of species usage.

The Omuyanda herbalist Mr Calebo Naambeneza was able to distinguish by discrete terminology the symptoms of various illnesses within his capability to treat. In addition, species within the Abayanda materia medica (as related by Mr Naambeneza) usually possess a common name that has no relation to the effects which it is purported to express when taken as medicine. For example, *Momordica foetida* Schumach. (Cucurbitaceae), collected near Kitahurira village in Mpungu, BINP, is known by the name *omwihura*, and is reputed to be a cure for *ekigweire* (children's stomach-aches *not* caused by intestinal 'worms'). By contrast, *enjoka* is the proper term for G.I. disturbances caused by intestinal 'worms', a complaint for which one might chew the leaves of *rukokota* (*Piper guineensis* Schumach. et Thonn., Piperaceae) as needed. However, *enjoka* was not to be confused with *empanami*, an illness described as 'intestinal worms causing skin prob-

Table 1
List of collected species, with some selected uses given in interviews[a]

Family/species (voucher no.)	District	Drug compounding	Use category (disease treated)	Tribe(s)
Acanthaceae [5]				
Dicliptera laxata C.B. Clark	Kabale	D2/LF/200 ml/po/qd/@	Dysentery	Bakiga, Abayanda
(Hamill 1090)				
Dicliptera leonotis C.B. Clark	Rukungiri	D2/LF200 ml/po/qd/@	Diarrhea	Bakiga, Abayanda
(Hamill 1055)				
Justicia exigua S. Moore	Kampala	I2/LF/200 ml/po/tid/@ {with LF of *Senecio disfolius*}	Abortive, {anthelmintic}	Baganda
(Hamill 1012)				
Mackaya bella Harv.	Rukungiri	*I3/FL/200 ml/po/once only	Antiabortive	Abayanda
(Hamill 1100)				
Thunbergia alata Boj.	Kabale	I2/LF+ST/200 ml/po/qid/@	Fever/malaria	Bakiga
(Hamill 1075)				
Anacardiaceae [1]				
Mangifera indica L.	Kampala	D2/LF+BK/200 ml/po/@	Antitussive	Baganda
(Hamill 1007)				
Aristolochiaceae [1]				
Aristolochia elegans Mast.	Kampala	D2/SD/1tsp/po/tid for 3 days	Malaria	Baganda
(Hamill 1001)				
Asteraceae [20]				
Adenostemma caffra DC.	Kabale	EMB/LF	Sore throat	Bakiga
(Hamill 1046)				
Ageratum conyzoides L.	Kampala	D2/LF+RT/200 ml/po/qid/@	Antitussive {antifungal}	Baganda {Bakiga}
(Hamill 1003)				
Anisopappus africanus (Hook. f.) Oliv. et Hiern	Kabale	Vapor of crushed leaves/@	Headache	Bakiga
(Hamill 1049)				
Bidens pilosa L.	Kabale	EMB/LF/@	Wounds	Bakiga, Baganda, Abayanda
(Hamill 1011)				
Bothriocline ugandensis (S. Moore) M.G. Gilbert	Kabale	*I2/LF/200 ml/po/per hour/@	Stomachache	Bakiga, Abayanda
(Hamill 1052)				
Carduus kikuyorum R.E. Freis	Kabale	EMB/LF+ST/@	Wounds	Bakiga
(Hamill 1057)				
Crassocephalum biafrae (Oliv. et Hiern) S. Moore	Kabale	*I1/LF+FL/200 ml/po/tid/@	Malaria	Bakiga, Abayanda
(Hamill 1058)				
Crassocephalum montuosum (S. Moore) Milne-Redh.	Kabale	EMB/LF/@ {I1/LF/rub heated leaves on body}	Wounds {fever}	Abayanda
(Hamill 1082)				
Crassocephalum sacrobasis (DC.) S. Moore	Rukungiri	*I2/LF/200 ml/po/bid/@	Dysmennorhea	Baganda
(Hamill 1023)		{EMB/LF}	{wounds}	{Bakiga}
Crassocephalum vitellinum (Benth.) S. Moore	Kabale	EMB/LF	Wounds	Abayanda
(Hamill 1073)				
Dichrocephala integrifolia (L.f.) Kuntze	Rukungiri	EMB/FR or SD/apply to throat	Sore throat	Baganda
(Hamill 1024)		EMB/FR or SD/apply to lesion	Ringworm	Bakiga

Table 1 (*Continued*)

Family/species (voucher no.)	District	Drug compounding	Use category (disease treated)	Tribe(s)
Erigeron floribunda HBK (Hamill 1062)	Kabale	MAS/FL+young LF/@	Antitussive	Bakiga
Erlangea cordifolia S. Moore (Hamill 1059)	Kabale	MAS/LF/swallow juice/@	Stomachache {worms}	Bakiga {Abayanda}
Galinsoga parviflora Cav. (Hamill 1006)	Kampala	EMB/LF	Bleeding	Baganda
Tagetes minuta L. (Hamill 1035)	Kabale	Smell & chew leaves/@	Headache	Bakiga
Vernonia amygdalina Del. (Hamill 1104)	Rukungiri	*I1/LF/150 ml/po/bid/@	Malaria, worms	Abayanda, Bakiga, Baganda
Vernonia auriculifera Hiern (Hamill 1019)	Kampala	D2/RT/200 ml/po/bid/@ *I2/LF/200 ml/po/tid/@	Malaria Worms	Baganda Abayanda
Vernonia brachycalyx O. Hoffm. (Hamill 1025)	Kabale	I2/LF/200 ml/po/tid/@	Fever	Bakiga, Baganda
Vernonia lasiopus O. Hoffm. (Hamill 1036)	Kabale	*I2/LF/200 ml/po/every hour/@ *I2/LF/200 ml/po/tid/@ *I1/ /200 ml/po/	Stomachache Worms Malaria	Bakiga Abayanda Baganda
Vernonia tufnellae S. Moore (Hamill 1080)	Kabale	EMB/Roasted leaves/placed into cuts made in skin at site of pain	'Pain in side' (right hypochondriac)	Abayanda
Balsaminaceae [1]				
Impatiens stuhlmannii Warb. (Hamill 1050)	Kabale	EMB/LF+ST	Skin rash	Bakiga
Basellaceae [1]				
Basella alba L. (Hamill 1038)	Kabale	EMB/WP	Snake bite	Bakiga
Bignoniaceae [1]				
Markhamia lutea (Benth.) K. Schum. (Hamill 1009)	Kampala	D2/RT/200 ml/po/qid+/@ EXP/FL/warmed in banana leaf, juice squeezed into ear	Malaria/fever Earache	Baganda Baganda
Campanulaceae [1]				
Lobelia stuhlmannii Stuhl. (Hamill 1056)	Kabale	EXP/WP/juice applied to wart daily	Warts	Bakiga
Caryophyllaceae [1]				
Drymaria cordata (L.) Willd. ex Roem. et Schult. (Hamill 1077)	Kabale	I2/LF+ST/200 ml/po/qid+/@	Adverse reaction to red meat	Baganda, Bakiga
Commelinaceae [2]				
Commelina africana L. (Hamill 1010)	Kampala	ST/inserted into vaginal canal EXP/WP/io	Abortifacient Conjunctivitis	Baganda Bakiga
Commelina petersii Hassk. (Hamill 1071)	Kabale	ST/inserted into ear canal	Earache	Abayanda
Crassulaceae [1]				
Kalanchoe densiflora Rolfe (Hamill 1070)	Kabale	EXP/LF/warmed over fire then squeeze juice into ear EXP/LF/warmed over fire then squeeze juice over cut	Earache Heal umbilical cord	Abayanda Abayanda
Cucurbitaceae [1]				
Momordica foetida Schumach. (Hamill 1099)	Rukungiri	*I2/LF/200 ml/po/once/children	Stomach ache	Abayanda

Table 1 (*Continued*)

Family/species (voucher no.)	District	Drug compounding	Use category (disease treated)	Tribe(s)
Dennstaedtiaceae [1]				
Pteridium aquilinum (L.) Kuhn (Hamill 1092)	Kabale	*I1/ground RT/100 ml/po/tid/ for 2 days or as needed	Diarrhea	Abayanda
Euphorbiaceae [9]				
Acalypha manniana Müell.-Arg. (Hamill 1110)	Kabale	D2/ST/200 ml/po/tid/@	Diarrhea	Abayanda
Alchornea hirtella Benth. (Hamill 1047)	Kabale	I2/Reproductive structures/po/200 ml/tid/@	Worms	Bakiga
Cluytia abyssinica Jaub. et Spach (Hamill 1069)	Kabale	EXP/LF + FL/mix in water/po/not more than 100 ml	Headache	Bakiga
Croton macrostachys Hochst. ex A. Rich.	Kabale	D2/BK/boil down to 1/2 original strength/100 ml/po/once	Worms/stomach ache	Abayanda
(Hamill 1045)		D2/BK/	Rheumatism	Bakiga
Euphorbia hirta L. (Hamill 1005)	Kampala	I2/WP	Antiamoebic/stomach ache	Bakiga
Euphorbia tirucalli L. (Hamill 1065)	Kabale	EXP/WP/juice applied daily	Warts	Bakiga
Flueggea virosa (Roxb. ex Willd.) Baill.	Kampala	EMB/LF	Wounds	Baganda
(Hamill 1021)			Diarrhea	Baganda
Macaranga kilimandscharica Pax (Hamill 1037)	Kabale	P2 + salt/LF + BK/@	Antitussive	Bakiga
Phyllanthus volkensii Engl. (Hamill 1106)	Kabale	*I2/LF of one plant/200 ml/po/as needed	Headache	Abayanda
Fabaceae [7]				
Acacia sp. (Hamill 1105)	Kabale	D2/BK/200 ml/po/tid/@	Constipation	Abayanda
Albizia gummifera (G. Gmelin) C.A. Smith (Hamill 1109)	Kabale	I2/LF + BK/200 ml/po/hourly/@	Labor induction	Bakiga, Abayanda
Erythrina abyssinica Lar. (Hamill 1027)	Kabale	I2/inner BK/200 ml/po/tid/@	Candidiasis	Bakiga, Baganda
Indigofera arrecta Hochst. ex A. Rich.	Kabale	D2/LF/with # 1023/200 ml/po/bid	Dysmennorhea	Baganda, Bakiga
(Hamill 1032)		I2/LF/200 ml/po/hourly/@	Headache	Bakiga
Senna septemtrionalis (Viv.) I. et B. (Hamill 1026)	Kabale	EMB/LF + FL	Wounds, snake bite	Bakiga
Sesbania sesban Fawc. et Rendle	Kabale	MAS/LF + FL/@	Stomach ache	Bakiga
(Hamill 1029)		MAS/LF + FL	Labor induction	Bakiga
Tephrosia interrupta Engl. (Hamill 1107)	Kabale	I2/LF/200 ml/po/tid	Antidiarrheal	Abayanda
Lamiaceae [4]				
Leonotis nepetifolia (L.) R. Br. (Hamill 1044)	Kabale	MAS/LF + FL/one at a time/@	Stomach ache	Bakiga
Leucas martinicensis R. Br.	Kabale	MAS/LF/@	Antidiarrheal	Bakiga, Abayanda

Table 1 (*Continued*)

Family/species (voucher no.)	District	Drug compounding	Use category (disease treated)	Tribe(s)
(Hamill 1054)				
Pycnostachys erici-rosenii R.E. Fries	Kabale	MAS/LF/once only	Stomach ache	Abayanda
(Hamill 1085)		MAS/LF/once only	Worms	Abayanda
Tetradenia riparia (Hochst.) Codd.	Kabale	D2/LF/200 ml/once only	Worms	Abayanda, Bakiga
(Hamill 1086)				
Lauraceae [1]				
Ocotea kenyensis (Chiov.) Robyns et Wilczek	Rukungiri	D2/BK/100 ml po/bid/@	Antitussive	Abayanda
(Hamill 1102)		MAS/BK/@	Antidiarrheal	Abayanda
Melastomataceae [2]				
Dissotis irvingiana Hook.	Kabale	I1/LF + ST/apply topically warm	Ringworm	Bakiga
(Hamill 1053)				
Tristemma mauritanium J.F. Gmel.	Rukungiri	*I2/LF/mix w/soil/rub on neck	Sore throat	Abayanda
(Hamill 1096)				
Melianthaceae [1]				
Bersama abyssinica Fresen.	Kabale	I3/FL + LF/200 ml/po/once only	Stomach ache	Bakiga
(Hamill 1063)				
Moraceae [3]				
Ficus asperifolia Miq.	Kampala	D2/LF/200 ml/po	'Kidney trouble'	Bakiga
(Hamill 1022)				
Ficus ottoniifolia (Miq.) Miq.	Kabale	No details given	Laxative, galactogogue	Bakiga
(Hamill 1108)				
Ficus ovata Vahl	Kabale	I2/LF + ST/po	Galactogoge	Bakiga
(Hamill 1028)				
Myricaceae [1]				
Myrica salicifolia Hochst. ex A. Rich.	Kampala	PD/RT/w/water/200 ml/po/tid	Fever/malaria	Baganda
(Hamill 1013)		I2/RT/200 ml/po/once only/	Stomach ache	Bakiga
Myrsinaceae [2]				
Maesa lanceolata Forsk.	Kabale	I2/LF + BK/200 ml/po/bid	Stomach ache	Bakiga
(Hamill 1033)				
Myrsine melanophloeos (L.) R. Br.	Kabale	Crush leaves into gin or beer and take by the cup	Stomach ache	Bakiga
(Hamill 1067)				
Myrtaceae [2]				
Eucalyptus sp.	Kampala	P2/BK + salt/@	Antitussive	Baganda
(Hamill 1008)				
Syzygium guineense (Willd.) DC	Kampala	MAS/LF/@	Stomachache	Bakiga, Baganda
(Hamill 1015)				
Oliniaceae [1]				
Olinia macrophylla Gilg	Kabale	I1/LF/200 ml/po/	Fever/malaria, stomach ache	Bakiga/Baganda
(Hamill 1066)				
Oxalidaceae [1]				
Oxalis corniculata L.	Kampala	EMB/WP	Wounds	
(Hamill 1002)				
Phytolaccaceae [1]				
Phytolacca dodecandra L'Hérit.	Kabale	EMB/LF	Rash, fungus	Baganda, Bakiga
(Hamill 1016)		I2/FL/200 ml/once	Tapeworm	Baganda
		D1/RT/bathe in water	Antileprotic	Baganda

Table 1 (*Continued*)

Family/species (voucher no.)	District	Drug compounding	Use category (disease treated)	Tribe(s)
Piperaceae [2]				
Piper guineensis Schum. et Thonn.	Rukungiri	MAS/RT/as needed	Worms	Abayanda (Hamill 1098)
Piper umbellatum L.	Rukungiri	Ash from burned stems rubbed into cuts made at site of pain	'Pain in side' (right hypochondriac)	Abayanda
(Hamill 1097)				
Plantaginaceae [1]				
Plantago palmata Hook. f.	Kabale	Tie belt of roots around waist	Antidiarrheal	Abayanda
(Hamill 1087)				
Poaceae [3]				
Cymbopogon nardus (L.) Rendle	Kabale	No details given	Abortifacient	Bakiga
(Hamill 1040)				
Pennisetum purpureum Schumach.	Kabale	MAS/ST/@	Induce labor	Bakiga
(Hamill 1030)				
Setaria poiretiana (Schultes) Kunth	Kabale	Smoke/WP/in cigarettes	Asthma relief	Bakiga
(Hamill 1041)				
Podocarpaceae [1]				
Podocarpus milanjianus Rendle	Kabale	D2/LF/200 ml/po	Worms	Bakiga
(Hamill 1031)				
Primulaceae [1]				
Lysimachia ruhmeriana Vatke	Rukungiri	EXP/RT/po/@	Stomach ache	Bakiga, Abayanda
(Hamill 1101)		EXP/FR/apply topically	Warts	Abayanda
Proteaceae [1]				
Faurea saligna Harvey	Kabale	I1/LF + ST/200 ml/po/qid/@	Diarrhea	Bakiga
(Hamill 1043)				
Rhamnaceae [2]				
Gouania longispicata Engl.	Kabale	I2/WP ground/200 ml/po/once only	Stomach ache	Abayanda
(Hamill 1083)				
Maesopsis eminii Engl.	Rukungiri	D2/inner BK/200 ml/po once only	Stomach ache	Abayanda
(Hamill 1095)		D2/inner BK/200 ml/po/once only	Worms	Abayanda
Rosaceae [4]				
Eriobotrya japonica (Thunb.) Lindley	Kampala	I2 or D2/LF/200 ml/po/qid/@	Anemia	Bakiga, Baganda
(Hamill 1017)				
Hagenia abyssinica (Bruce) J.F. Gmel.	Kabale	*I2/BK/200 ml/po/	Stomach ache	Bakiga, Baganda, Abayanda
(Hamill 1014)				
Prunus africana (Hook. f.) Kalkman	Kabale	D2/BK/200 ml/po/bid/only for adults	Anthelmintic	Abayanda
(Hamill 1094)				
Rubus apetalous Poir.	Kabale	MAS/young LF/@	Diarrhea, stomach ache	Bakiga, Abayanda
(Hamill 1042)				
Rubiaceae [4]				
Rytigynia beniensis (De Wild.) Rosyn.	Kampala	MAS/LF/@	Worms	Bakiga
(Hamill 1048)				
Rytigynia kigeziensis Verdc.	Kabale	D1/inner BK/mix with millet flour when making millet bread/po/@	Worms	Abayanda
(Hamill 1089)				
Spermacoce princea (K. Schum.) Verdc.	Kabale	ST/inserted into ear canal	Earache	Abayanda

Table 1 (*Continued*)

Family/species (voucher no.)	District	Drug compounding	Use category (disease treated)	Tribe(s)
(Hamill 1081)				
Virectaria major Verdc.	Kabale	I1/LF/200 ml/po/once only	Back ache	Bakiga
(Hamill 1076)				
Rutaceae [1]				
Zanthoxylum gilletii (De Wild.) Waterman	Kabale	MAS/BK/@	Worms, sore throat, cough	Abayanda
(Hamill 1131)				
Solanaceae [3]				
Datura stramonium L.	Kabale	No details given	Sore throat, stomach ache	Bakiga
(Hamill 1061)				
Physalis peruviana L.	Kabale	EXP/WP/	Rash/ringworm	Bakiga
(Hamill 1060)				
Solanum aculeatissimum Jacq.	Kabale	EXP/FR/IO	Trachoma	Bakiga, Baganda, Abayanda
(Hamill 1072)				
Sterculiaceae [1]				
Dombeya goetzennii K. Schumach.	Kabale	D2/FL + BK/200 ml/po/@	Indigestion	Bakiga, Abayanda
(Hamill 1039)				
Thymelaeaceae [1]				
Peddiea africana Harv.	Kabale	Bark necklace tied around neck	Heartburn	Abayanda
(Hamill 1091)				
Tiliaceae [1]				
Triumfetta cordifolia A. Rich.	Kabale	PD/RT/mixed into food/tid	Diarrhea	Abayanda
(Hamill 1093)				
Umbelliferae [2]				
Centella asiatica (L.) Urban	Kampala	EMB/WP	Joint pain	Baganda
(Hamill 1004)				
Agrocharis incognita (Norman) Heyw. et Jury	Kabale	I1/LF/200 ml/one or two cups	Indigestion, worms	Bakiga, Abayanda
(Hamill 1074)				
Urticaceae [2]				
Urtica massaica Mildbr.	Kabale	EMB/LF/as needed	Boils, sores	Bakiga
(Hamill 1034)				
Urtica ovalifolia (Schumach.) Chew	Rukungiri	D1/LF/wash with the decoction	Ground itch (ascariasis)	Abayanda
(Hamill 1103)				
Vitaceae [1]				
Cyphostemma adenocaule (A. Rich.) Descoings ex Willd. et Drum.	Kampala	I1/LF or RT/200 ml/po/qd/@	Yellow fever	Baganda
(Hamill 1020)		EMB/LF/heated and applied	Boils	Baganda
		D2/RT/200 ml/po/bid/@	Tapeworm	Baganda
		EMB/LF/heated and applied	Septic wounds	Baganda

[a] LF, leaf; RT, root; ST, stem; FL, flower; BK, bark; SB, stem bark; WP, whole plant; D1 signifies a 'strong decoction', corresponding to a handful of indicated material per 200 ml water; D2 signifies a 'mild decoction', corresponding to about half the amount in D1 per 200 ml water; D3 signifies a 'weak decoction', corresponding to about a heaped tablespoon per 200 ml water; I1–I3 signify similar measurements, as 'strong infusion' and so on; *I1–*I3 signify 'warm infusions' or 'cold infusions' as indicated; PD, plant part is pounded fresh, as with a mortar and pestle; EXP, plant part is expressed to yield juice, usually mixed with an equal portion of water; MAS, plant part is chewed; EMB, plant part is crushed and packed into or onto the surface of the skin, over a wound, for example; P1 signifies powdering of dried plant material; P2 signifies powdering of material and mixing with a small portion of salt, to effect a mixture which is licked occasionally to effect relief; po, by mouth; Top, topical; IO, directly onto eye; qd, once per day; bid, twice per day; tid, thrice per day; qid, four times per day; @: 'as needed to effect result'.

lems' and for which *omumbya*, *Urtica ovalifolia* (Schumach.) Chew (Urticaceae) would do as treatment. Through the tireless efforts of the translators, Mr Naambeneza was able and careful to distinguish between at least three forms of diarrheal disease, including what he considers 'regular diarrhea', different from that caused by intestinal worms, and, further, different from diarrhea containing blood. Whether a verifiable bio chemical presence and activity corresponding to clinical manifestations can or cannot be demonstrated based on analysis of the practice of medical herbalism in Uganda is a question which remains to be answered.

Of the 101 identified species, 72 (71.3%) were referenced in the NAPRALERT database. Of these 72, 43 species have been published as used for similar purposes in some part of the world. Twenty-six species showed bioactivity of a type which might have been predicted by the ethnomedical use; e.g. *Bidens pilosa* L. (Asteraceae), the exudate of which is placed on wounds to aid and speed healing, has been shown to have antibacterial activity (Boily and Van Puyvelde, 1986; Sarg et al., 1991; Desta, 1993; Vlietinck et al., 1995). Of the 101 species, approximately two-thirds are already on record in the world literature, while one quarter are reported to have bioactivity of a type seemingly related to the ethnomedical use (Table 2). Twenty-nine species are not found referenced in the NAPRALERT database.

5. Discussion and conclusions

East Africans depend heavily upon herbal remedies and the individuals knowledgeable in their use (Fabry et al., 1998). Such remedies are sourced from the rich flora of the region, where in Uganda alone, about 5000 species of higher plants are found (Davis et al., 1986). Regardless of the continuing loss of diversity in plant and animal life in Uganda, patches of forest still remain which warrant continued protection and study (Kingdon, 1990).

The reported prevalence of diarrheal disease for the region appears to be reflected by the high percentage of antidiarrheal remedies noted by all interviewees, particularly Mr Naambeneza (28 of 55 total remedies, or 50.9%). Though data have not been found to give an estimation of the prevalence of bacterial gastro-enteritis for the southwest region, intestinal parasite load is known to be notably high (Ashford et al., 1990). Because prevalence of ascariasis (89% in the study region) is used by epidemiologists as an index of feco-oral transmission in a community, bacterial diarrheal pathogens, such as *E. coli*, can be assumed to be an important part of the epidemiology of the region (Snyder and Merson, 1982; Basch, 1990; Lucas and Gilles, 1990). A Ministry of Health multi-sector review conducted in 1996 supports this assumption (Bukenya-Ziraba et al., 1996).

The demonstration of bioactivity by an extract of a plant which corresponds to its traditional application (Table 2) is considered supportive of the traditional medicinal use of the plant (Robineau and Soejarto, 1996). The presence in a traditional antidiarrheal of an antibacterial compound effective in vivo against infection with *Salmonella* (Boily and Van Puyvelde, 1986; Meckes et al., 1997; Gubarev et al., 1998) is one example. Another example is that of *Albizia gummifera* (Gmel.) C.A. Smith (Fabaceae), a commonly used abortifacient/labor inducer, which has been shown to induce uterine muscle contractions in vitro, and to induce partial to complete abortion in rats, rabbits, and guinea-pigs when administered by all routes tested (Lipton, 1959; Anonymous, 1964). The determination of the presence of a specific chemical with a known bioactivity related to the ethnomedical use would similarly be considered supportive of the traditional medicinal use of the plant. Using these methods of analysis, the literature supports the traditional use(s) of nine species (19.1%) used by Abayanda, 14 species (35.9%) used by Bakiga, and nine species (34.6%) used by Baganda.

Of the 72 species which have been found in the literature, 10 are referenced as having a toxic effect (Table 3). As noted previously by Richter and Carlson (1998), all study results, including the possibility of toxic or otherwise adverse effects, and the details of the suspected toxicity, must be

Table 2
Selected results of biological evaluations of extracts from plants collected based on published literature

Species	Selected ethnomedical use(s) from present study	Assay(s)	Results	Active compound(s) if known	References
Ageratum conyzoides (Asteraceae)	Wounds, abdominal pain, conjunctivitis, skin rash	Antibacterial, antifungal, analgesic, nematicide, antiinflammatory	Active		Durodola, 1977; Van Puyvelde et al., 1980; Akah, 1988; Mishra et al., 1993; Singh et al., 1994; Caceres et al., 1995; Vlietinck et al., 1995; Magalhaes et al., 1997
Albizia gummifera (Fabaceae)	Abortifacient, labor induction	Uterine tissue contraction	Active (activity has been patented)	Saponins	Lipton, 1959; Anonymous, 1964
Aristolochia elegans (Aristolochiaceae)	Abortion	Abortifacient (*Aristolochia* spp.)	Active		Kamboj, 1988
Bidens pilosa (Asteraceae)	Wound healing	Antimicrobial	Active		Halberstein and Saunders, 1978; Van Puyvelde et al., 1980; Desta, 1993
Centella asiatica (Apiaceae)	Pain, inflammation, headache, wounds	Analgesic, antistress, antimicrobial wound healing	Active	Triterpenoids	Dhar et al., 1968; Ramaswamy et al., 1970; Ray and Majumdar, 1974; Chaudhuri et al., 1978; Poizot and Dumez, 1978; Morisset et al., 1988; Sakina and Dandiya, 1990; Montecchio et al., 1991; Sarma et al., 1996
Crassocephalum vitellinum (Asteraceae)	Skin infection and irritation	Antifungal	Active		Vlietinck et al., 1995
Croton macrostachys (Euphorbiaceae)	Gastrointestinal complaints	Antimicrobial	Active		Taniguchi et al., 1978; Desta, 1993; Taniguchi and Kubo, 1993
Datura stramonium (Solanaceae)	Sore throat, gastrointestinal complaints	Antimicrobial	Active		Hocking, 1977; Almagboul et al., 1984; Desta, 1993
Eriobotrya japonica (Rosaceae)	AIDS	Antiviral	Active		Singh, 1971; Minshi, 1989
Erythrina abyssinica (Fabaceae)	Candidiasis, diarrhea	Antifungal, antibacterial, antidiarrheal (mice)	Active	pterocarpans, flavanones, chalcone	Taniguchi et al., 1978; Van Puyvelde et al., 1980; Kamat et al., 1981; Taniguchi and Kubo, 1993

Table 2 (*Continued*)

Species	Selected ethnomedical use(s) from present study	Assay(s)	Results	Active compound(s) if known	References
Euphorbia hirta (Euphorbiaceae)	Diarrhea, dysentery	Antiamebic, antidiarrheal	Active	quercitrin (flavonoid)	Dhar et al., 1968; Ndir and Pousset, 1981; Ajao et al., 1985; Duez et al., 1991; Hussain and Deeni, 1991; Bashir et al., 1992; Galvez et al., 1992; Vlietinck et al., 1995
Euphorbia tirucalli (Euphorbiaceae)	Warts, skin eruptions, sores	Antiviral, antimicrobial	Active		Dhar et al., 1968; Taniguchi et al., 1978; Van den Berghe et al., 1978
Flueggea virosa (Euphorbiaceae)	Wounds, diarrhea	Antimicrobial	Active		Collier and Pijl, 1949
Hagenia abyssinica (Rosaceae)	Gastrointestinal complaints, malaria	Antispasmodic (ileum), antimalarial antimicrobial	Active		Arragie et al., 1983; Kasa, 1991; Taniguchi and Kubo, 1993
Impatiens stuhlmannii (Balsaminaceae)	Skin rash, scabies	Acaricidal	Active		Van Puyvelde et al., 1985
Leonotis nepetifolia (Lamiaceae)	Gastrointestinal complaints, diarrhea	Antispasmodic (ileum), antimicrobial	Active		Bhakuni et al., 1970; Van Puyvelde et al., 1980; Boily and Van Puyvelde, 1986; Calixto et al., 1991; Gopal et al., 1995
Maesa lanceolata (Myrsinaceae)	Gastrointestinal complaints	Antimicrobial	Active	maesanin	Taniguchi et al., 1978; Kubo et al., 1987
Momordica foetida (Cucurbitaceae)	Gastrointestinal complaints, ear infection	Antimicrobial	Active		Boily and Van Puyvelde, 1986
Phytolacca dodecandra (Phytolaccaceae)	Ringworm, gastrointestinal complaints	Antimicrobial	Active		Taniguchi et al., 1978; Van Puyvelde et al., 1980; Desta, 1993
Plantago palmata (Plantaginaceae)	Diarrhea, skin irritation	Antifungal	Active		Van Puyvelde et al., 1980; Vlietinck et al., 1995
Rubus apetalous (Rosaceae)	Gastrointestinal complaints	Antimicrobial	Active		Van Puyvelde et al., 1980; Maikere-Faniyo et al., 1985; Desta, 1993; Vlietinck et al., 1995
Sesbania sesban (Fabaceae)	Anthelmintic, gastrointestinal complaints	Nematode lethality assay	Active		Pakrashi et al., 1975; Van Puyvelde et al., 1980; Kamboj, 1988; Ibrahim, 1992

Table 2 (*Continued*)

Species	Selected ethnomedical use(s) from present study	Assay(s)	Results	Active compound(s) if known	References
Syzygium guineense (Myrtaceae)	Ringworm, gastrointestinal complaints, wounds	Antimicrobial	Active		Hussain and Deeni, 1991; Ndounga et al., 1994
Tagetes minuta (Asteraceae)	Headache, wounds	Benzodiazepine binding inhibition	Active		Taniguchi et al., 1978; Singh et al., 1994; Garcia et al., 1995; Martijena et al., 1998
Urtica massaica (Urticaceae)	Wounds, skin eruptions	Antibacterial, antifungal, antiviral	Active		Van Puyvelde et al., 1980; Vlietinck et al., 1995
Vernonia amygdalina (Asteraceae)	Malaria, gastrointestinal complaints	Antimalarial, antispasmodic (ileum), antibacterial	Active		El-Said et al., 1971; Ogunlana and Ramstad, 1975; Taniguchi et al., 1978; Laekeman et al., 1983; Rotimi et al., 1988; Hussain and Deeni, 1991; Desta, 1993

Table 3
Selected results of toxicity evaluations of extracts of plants collected based on literature data

Species	Toxicity type (if known)	Toxic compound (if known)	Organism	LD_{50} (if known)	Reference
Aristolochia elegans (Aristolochiaceae)	Nephrotoxicity, carcinogenesis, abortive	Aristolochic acid	Rat, human	–	Kamboj, 1988; Vanhaelen et al., 1994; Bruneton, 1995
Maesa lanceolata (Myrsinaceae)	Abortive, death	–	Rat, calf	50–200 mg/kg	Mugera, 1970; Gundidza, 1987
Datura stramonium (Solanaceae)	Anticholinergic effects	Alkaloids	Human	Fatal dose: seeds from <1 fruit	McNally, 1915; Oderda, 1975; Barnett et al., 1977; Meislin, 1977; Aliotta, 1987; Gururaj and Khare, 1987; Fernando and Fernando, 1990
Phytolacca dodecandra (Phytolaccaceae)	GI disorders, possibly hepatotoxicity	Saponosides	Human	–	Aliotta, 1987
Hagenia abyssinica (Rosaceae)	Retinotoxicity	–	Chicken	1.8 g/kg, 0.25 g/eye	Low et al., 1985; Suffness et al., 1988
Euphorbia tirucalli (Euphorbiaceae)	Death	–	Mice	1 g/kg	Nakanishi et al., 1965
Pennisetum purpureum (Poaceae)	Death	–	Cow	–	Dhawan et al., 1976; Guzman et al., 1978
			Mouse	0.75 g/kg	
Vernonia amygdalina (Asteraceae)	–	Steroidal saponins	Mice, rabbit	1.12 g/kg	Ohigashi et al., 1991; Akah and Okafor, 1992; Igile et al., 1995
Pteridium aquilinum (Dennstaedtiaceae)	–	Thiaminase	–	–	Brown, 1943; Aliotta, 1987
Ageratum conyzoides (Asteraceae)	–	–	Sheep	–	Purohit, 1962

included in any report made to the collaborating institutions, so that use of such species may be discouraged. Of the species with predictable bioactivity, reportedly non-toxic, several might be shown to be genuinely useful, in easily-prepared crude forms, to rural populations for the treatment of common symptoms of disease, such as superficial bacterial and fungal infections and diarrhea.

The estimated value of a locally-used crude drug or medicinal plant should not be measured solely by the potential to bring a pure compound to market in the west, but also by its history of having alleviated human suffering through the ages. The collaborative research project between the University of Illinois at Chicago and Uganda Ministry of Health is expected to contribute to an improved understanding of how crude drugs might more safely and effectively be utilized by rural populations in developing nations. Data generated during this project will be provided to the association THETA (Traditional and Modern Health Practitioners Together Against AIDS and Related Diseases, Uganda), and to the Makerere University Medical School and Department of Pharmacology and Therapeutics, as requested. Of special importance is the dissemination of knowledge of toxic plants found in Uganda, which are sometimes included as ingredients of traditional remedies. Faculty and graduate students of the University of Illinois at Chicago, the Makerere University Department of Botany, and staff of the Natural Chemotherapeutics Research Laboratory of Kampala, will continue to collaborate on the documentation and laboratory validation of the medicinal flora of Uganda.

Acknowledgements

This project was conducted under the following permits: Uganda National Council for Science and Technology: Reference No. MV433; University of Illinois at Chicago Institutional Review Board Approval: Ref H-97-411 and Research protocol # 99–411; Uganda Ministry of Health/ N.C.R.L. — U.I.C. Memorandum of Agreement. The authors wish to thank all the herbalists named in the paper, and others not cited, who have collaborated in the study for their time and their willingness to share their knowledge of medicinal plants, and Dr Roy Gereau, Missouri Botanical Gardens, MO, for his assistance in the taxonomic identification of plants collected for the present study. The authors wish to thank Drs John and Therese Hart (Wildlife Conservation Society, NY), Dr Michael Huffman (Primate Research Institute, Kyoto University, Japan), and Dr Robert Bailey (UIC Public Health) for useful discussions. The first year of fieldwork was funded in part by a grant from the MacArthur Foundation awarded to Dr Julian Kerbis of the Field Museum of Natural History, Chicago, and supplemented by the University of Illinois at Chicago Senior University Scholar Fund of Dr Doel Soejarto.

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