



Medicinal plants used by Burundian traditional healers for the treatment of microbial diseases



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ABSTRACT

Ethnopharmacological relevance: Infectious diseases represent a serious and worldwide public health problem. They lead to high mortality, especially in non-developed countries. In Burundi, the most frequent infectious diseases are skin and respiratory (mainly in children) infections, diarrhea, added to malaria, HIV/AIDS and tuberculosis. Local population used mostly traditional herbal medicines, sometimes animal and mineral substances, to fight against these plagues.

Objectives: To survey in different markets and herbal shops in Bujumbura city, medicinal plants sold to treat microbial infections, with particular emphasis on the different practices of traditional healers (THs) regarding plant parts used, methods of preparation and administration, dosage and treatment duration. **Materials and methods:** The ethnobotanical survey was conducted by interviewing, using a pre-set questionnaire, sixty representative healers, belonging to different associations of THs approved and recognised by the Ministry of Health. Each interviewed herbalist also participated in the collection of samples and the determination of the common names of plants. The plausibility of recorded uses has been verified through an extensive literature search.

Results: Our informants enabled us to collect 155 different plant species, distributed in 51 families and 139 genera. The most represented families were Asteraceae (20 genera and 25 species), Fabaceae (14 genera and 16 species), Lamiaceae (12 genera and 15 species), Rubiaceae (9 genera and 9 species), Solanaceae (6 genera and 6 species) and Euphorbiaceae (5 genera and 6 families). These plants have been cited to treat 25 different alleged symptoms of microbial diseases through 271 multi-herbal recipes (MUHRs) and 60 mono-herbal recipes (MOHRs). *Platostoma rotundifolium* (Briq.) A. J. Paton (Lamiaceae), the most cited species, has been reported in the composition of 41 MUHRs, followed by *Virectaria major* (Schum.) Verdc (Rubiaceae, 39 recipes), *Kalanchoe crenata* (Andrews) Haw. (Crassulaceae, 37 recipes), *Stomatanthes africanus* (Oliv. & Hiern) R. M. King & H. Rob. (35 recipes), and *Helichrysum congolanum* Schltr. & O. Hoffm. (Asteraceae, 33 recipes). Regarding MOHRs, *Pentas longiflora* Oliv. (Rubiaceae) is the most important species with 19 recipes, followed by *Kalanchoe crenata* (Andrews) Haw. (Crassulaceae, 10 recipes), *Gymnosporia senegalensis* (Lam.) Loes. (Celastraceae, 9 recipes), *Tetradenia riparia* (Hochst.) Codd (Lamiaceae, 8 recipes) and *Cardiospermum halicacabum* L. (Sapindaceae, 6 recipes). Concerning the preparation and administration of recipes, our informants state to be able to adjust the doses based on the patient's age (child or adult) and/or his/her physiology (e.g. pregnancy).

Conclusion: This study indicates that medicinal plants are still widely used for the treatment of microbial diseases in Bujumbura city. However, there is much to do in this area, especially in the assessment and monitoring of the quality, effectiveness and safety of the different recipes preconised by Burundian traditional healers.

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1. Introduction

According to the World Health Organization (WHO), infectious diseases remain among the 10 main causes of the high mortality

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rates recorded in the world (WHO, 2014a); they kill almost 9 million people every year, most of them being poor people in developing countries (WHO, 2012a). They are also the cause of 70% of life losses in the WHO African Region (WHO, 2014b). The WHO reported a list of five infectious diseases (lower respiratory infections, HIV/AIDS, diarrheal diseases, malaria and tuberculosis) deemed to be responsible for almost one third of deaths in low-income countries (WHO, 2012a).

In Burundi, the most frequent infectious diseases are skin infections, diarrhea and respiratory diseases, especially among children (WHO, 2012b); malaria, HIV/AIDS and tuberculosis appear especially prevalent among adults (Niyongabo et al., 2005). As confirmed by the few ethnobotanical researches previously conducted locally (Baerts and Lehmann, 1993, 1989; Ndikubagenzi et al., 2006; Polygenis-Bigendako, 1989; Polygenis-Bigendako and Lejoly, 1989), more than 80% of the population mostly resorts to traditional herbal medicines, sometimes combined with animal and mineral substances, whether for daily cares or emergency situations. The survey of traditional practices is however still largely fragmentary compared to neighboring countries, probably a consequence of the pregnant insecurity conditions. As traditherapy is practised mostly by the elderly, there is a definite risk that this knowledge, part of the cultural heritage of the country, falls into oblivion. It is then an urgent need to continue these investigations, pushing further to chemical, pharmacological and toxicological studies to assess the correctness of these ancestral reputations.

Thus, in the present work, conducted in different markets and herbal shops in the city of Bujumbura, we will aim at investigating the medicinal plants used to treat microbial infections. We particularly insist on the different practices of traditional healers (THs), including plant parts used, herb combinations, methods of preparation and administration, dosage and treatment duration.

2. Material and methods

2.1. Study area

The study was conducted in the 13 municipalities that make up the city of Bujumbura, Capital of Burundi (Fig. 1). The City of Bujumbura is located West of the Province of Bujumbura (S –

03.37556° E – 29.49250°), and on the Northeastern shore of Lake Tanganyika, the second deepest lake in the world after Lake Baikal. The city currently covers an area of 110 km² with an average altitude of 820 m and has (in 2014) a population of about 658,859 inhabitants, about 7% of the total population of Burundi (PopulationData.net – Burundi).

The climate is tropical with a dominant all year round sunshine and an average temperature of 23 °C. As the entire country, the city has four seasons: the long and short dry seasons, as well as the long and short rainy seasons. The population of the city is multi-cultural and speaks at least one of three languages, namely Kirundi and French (official), as well as Kiswahili, depending on the municipality of residence.

2.2. Methodology

Interviewed people were traditional healers grouped in associations. Until July 2013, the city of Bujumbura comprised six associations of traditional healers recognised by the Government of Burundi, through its Ministry of Public Health, and by the Bujumbura WHO office, with an estimated total of about 100 THs.

In each of the municipalities of the city of Bujumbura, there is at least one herbal market and/or herbal shop (Fig. 1) where traditional medicines are offered to patients. In herbal markets, THs only offer plants and plants mixtures to patients with explanations on preparation/administration, duration of treatment and contraindications; patients are required to faithfully apply techniques and advices at home. By contrast, herbal shops function as clinics in which recipes are prepared and, in some cases, administered to the patient in the presence of TH. The ethnobotanical survey was conducted in the 10 herbal markets and four herbal shops that were available in Bujumbura city until 2013 (Fig. 1). Each association was contacted and proposed 10 people for individual interview (60 people in all, about 60% of recognised Bujumbura THs).

The survey was performed during the dry season, in June and July 2011, 2012 and 2013, using the same methodology. The working language was mainly Kirundi, except for a few people who spoke in French and Kiswahili, all languages mastered by the principal researcher (J. Ngezahayo). Our study followed the principles outlined in the latest version of the Declaration of Helsinki (World Medical Association, 2013). In all instances, informed

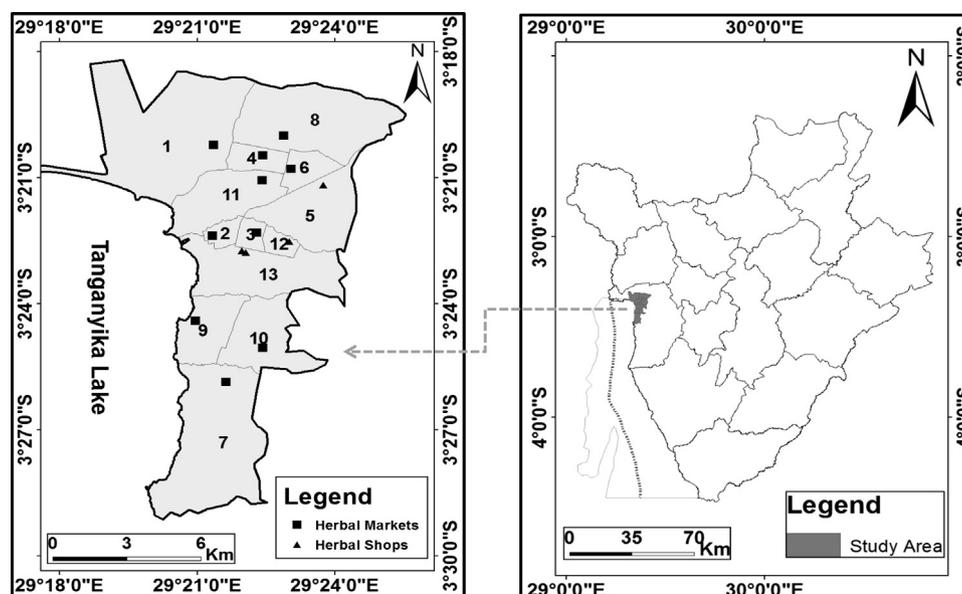


Fig. 1. Map of Burundi (right) highlighting Bujumbura city (study area) and its 13 municipalities (left): 1. Buterere, 2. Buyenzi, 3. Bwiza, 4. Cibitoke, 5. Gihosha, 6. Kamenge, 7. Kanyosha, 8. Kinama, 9. Kinindo, 10. Musaga, 11. Ngagara, 12. Nyakabiga, and 13. Rohero.

Table 1
Microbial diseases most common in Burundi and treated by traditional medicine in Bujumbura city, and the corresponding number of cited medicinal plants.

Microbial disease	Number of medicinal plants cited	Number of healers treating this disease (% , n=60)
Diarrheal disease		
• Cholera	5	5
• Diarrhea	58	65
• Dysentery	12	12
• Typhus	5	5
Skin disease		
• Foot mycosis	24	50
• Leprosy	8	5
• Measles	15	33
• Purulent rashes	54	62
• Skin mycosis	10	57
• Varicella	28	45
• Yaws	11	10
Respiratory disease		
• Cough	20	58
• Angina	3	10
• Pneumonia	15	43
• Tuberculosis	13	5
Other disease		
• Fever	19	37
• Gonorrhoea	4	5
• Meningitis	5	3
• Otitis	14	42
• Ringworm	72	77
• Sinusitis	19	33
• Syphilis	1	2
• Tetanus	1	7
• Tonsillitis	4	28
• Tooth decay	12	40

consent was obtained from the respondents to divulge information and, when consent was refused (3% of contacted informants), no question whatsoever was forced on the individual. Monetary incentives, roughly equivalent to a consultation honorary, were given to compensate for time taken. The approach of some healers was somewhat difficult, as they visibly aimed at protecting their knowledge and job. The researchers usually alleviated this feeling with a thorough explanation of the study goals but it remains difficult to determine who did or did not speak frankly.

2.3. Questionnaire and symptomatology allowing to recognise microbial diseases

In order to develop a useful questionnaire, based on meaningful and recognisable symptoms, we resorted to local practitioners as well as on data from the WHO and the “Université du Burundi” about local infectious diseases (Baerts and Lehmann, 1989, 1993; Niyongabo et al., 2005; Polygenis-Bigendako, 1989; WHO, 2012c) to prepare a list of 25 microbial diseases (Table 1). These include not only highly common microbial diseases, but also some supposedly eradicated diseases to gather knowledge on older recipes known by healers. The questionnaire was divided into four main parts, namely: (a) identification of the traditional healer including the full name (information not to be divulged), age, sex, marital status, nationality, address (information not to be divulged), spoken language, level of education, as well as his/her main business; (b) information relating to the profession of the traditional healer including the origin of his/her expertise (school, inheritance, personal experience, training) and his/her seniority in the profession; (c) information relating to treated microbial diseases, based on names in Table 1; and (d) medicinal recipes and plants used in the treatment of the above diseases and their uses;

this includes the common names of major and associated plants (if any), the ingredients (if any) to mix, the location of herb harvest, the part(s) used, the mode of preparation of the recipe, the dosage and route of administration, the duration of treatment, the contraindications (“interdicts”) and potential side effects of treatments, as well as other possible treatment practices.

Regarding the “diagnosis” by THs, we have noted that a number of patients are in fact examined and diagnosed in hospitals; the lack of money to buy modern drugs drives many to resort to THs, either with their prescription or with information about their disease. For some diseases for which signs are directly visible on the body (e.g. skin mycosis) or evident (e.g. diarrhea), THs state to have the experience to recognise them immediately and do not need a medical information.

2.4. Collection and identification of plant samples

The majority of Bujumbura city herbal markets and shops suppliers inhabit the hills overlooking the city. They collect their plants in these hills, in different forests of the country, in their gardens or around the city. All samples were collected under their common names with the participation of interviewed herbalists. In order to harvest from nearby and distant locations (in forests for example), we grouped informants according to their usual harvest sites and carried out as many trips as cited harvest sites. Herbaria were collected in duplicate at ground level and at the cited time of harvest. For each plant, we harvested leaves, bark, flowers, fruit and/or seed (if any). However, when it comes to very small plants, we have decided to harvest the entire plant especially when it is not part of threatened plants of Burundi (Sibomana et al., 2008a, 2008b) in order to preserve biodiversity. We followed a series of rules at harvest, particularly in accordance with those set out by Chan et al. (2012) and Shaw et al. (2012).

Herbaria were carefully pressed, dried and stored at the Herbarium of the Department of Biology, Faculty of Sciences at the “Université du Burundi” where they were subjected to a scientific determination by specialised botanists. The family, genus and species of each plant were determined: (i) by comparing with existing herbarium specimens; (ii) by confronting with literature data (Haston et al., 2009; Troupin, 1978–1987), and (iii) by referring to specialised databases, including the African Plant Database (Lebrun and Stork, 2012; CJB, 2012), The Plant List (2013) and IPNI (2012).

2.5. Graphical overview of data

The relationships between multi-herbal recipes (MUHRs) and plants were displayed (Fig. 2) as an interaction network using the software Cytoscape 2.7.0 (<http://cytoscape.org>), with the layout organic (Shannon et al., 2003; Mukazayire et al., 2011).

3. Results and discussion

3.1. Studied population and medical practices of traditional healers (THs)

Over the 60 THs interviewed, 55% are men and 45% women. Their average ages are 48 and 49 years respectively for men and women (Fig. 3), which is consistent with the “sex ratio” of the Burundian population in general, 96 males per 100 females (UN/DESA, 2009). As life expectancy at birth in Burundi is 52 years for men and 54 years for women (OMS, 2014), the Burundian traditional healers are mostly in the category of “elderly”. Moreover, some of our informants have stated to meet problems in finding successors; if young people do not get interested, there is a real

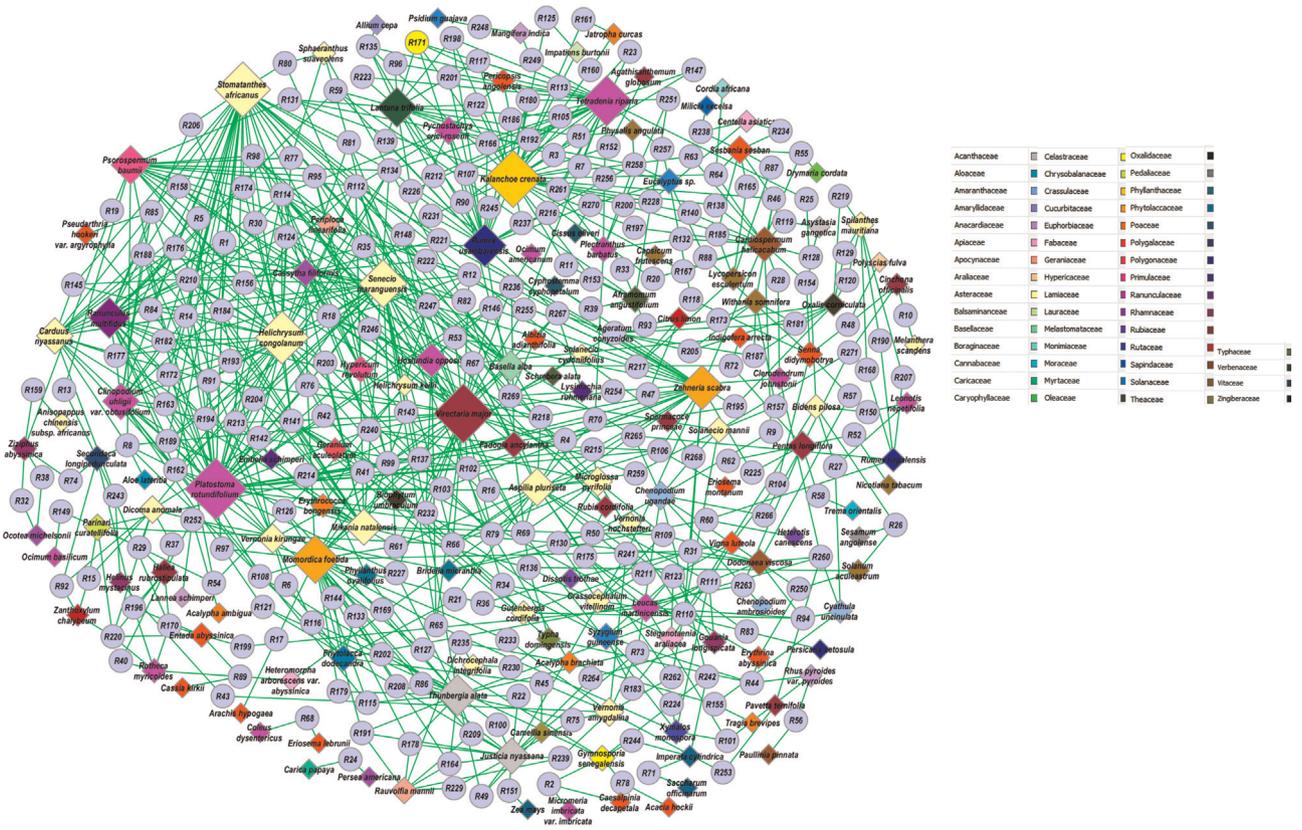


Fig. 2. Relationships between MUHRs and medicinal plants. Recipes are represented as circles, medicinal plants as diamonds; the size of the diamond is proportional to the frequency of citation of a medicinal plant. The colors of diamonds correspond to the botanical family of the plant (Shannon et al., 2003). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

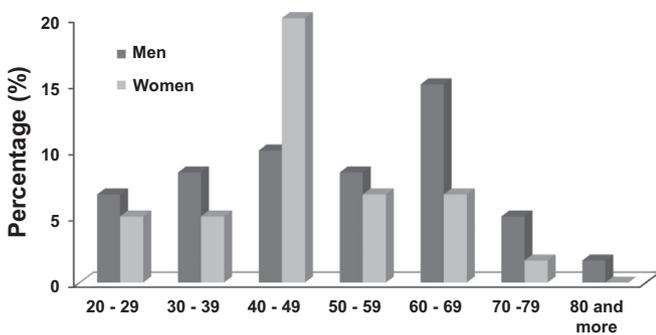


Fig. 3. Age distribution of interviewed traditional healers.

risk of loss of this irreplaceable knowledge. Over 60% of our informants are found in two municipalities, namely Kinama and Bwiza (Fig. 4). This sampling repartition roughly corresponds to the distribution of herbal markets and shops; but, in the absence of official statistics, this could not be objectified. These two municipalities are inhabited by people with low incomes, and who can meet their daily needs only by selling medicinal plants to patients from all over the town. Eighty-seven percent of respondents reported to exert TH profession as main activity; the others associate traditherapy with other activities such as agriculture, livestock farming, church activities (for priests and sisters), public services, etc. Regarding the origin of their expertise, 88% of interviewed healers gained experience from traditional knowledge (inheritance) and/or training, and 12% rely on their personal talent. Diagnosing is recognised difficult to achieve by most interviewed THs; it is then quite difficult for them to differentiate diarrhea, dysentery or cholera. In some exceptional

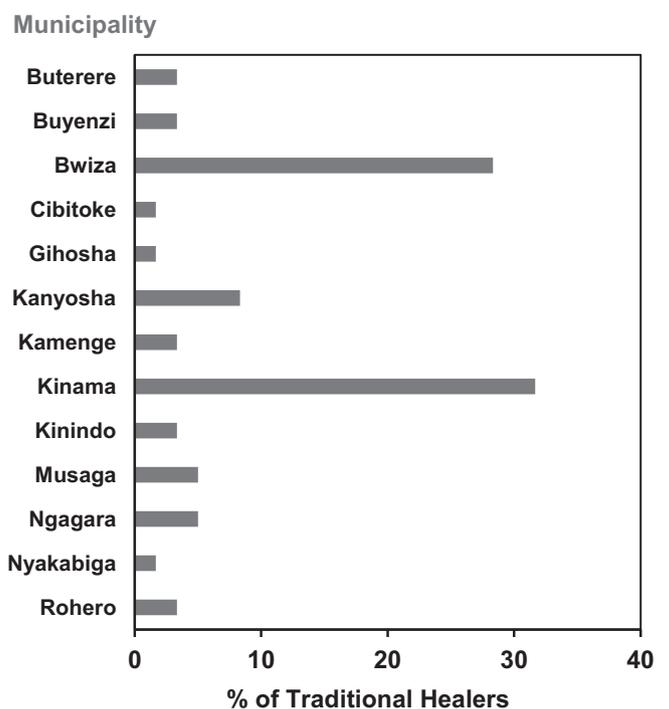


Fig. 4. Distribution of interviewed traditional healers in the 13 municipalities of Bujumbura city.

cases, they demand that patients come up with laboratory results. However, for diseases with physical signs that are immediately visible (such as skin diseases), our informants state to have

Table 2
Herbal recipes (multi- and mono-) reported by respondents.

Botanical name (vernacular name, part used ^a , voucher specimen number)	Microbial diseases treated ^b (recipes involved ^c)	Mode of preparation ^d /mode of administration/interdicts ^e /[citation frequency (% of THs)]
Acanthaceae		
<i>Asystasia gangetica</i> (Urusogo, L, JN027)	9 (R119, R128)	9 (Squeeze/instillation in the ear) [3%]
<i>Justicia nyassana</i> (Ikinga, L or AP, JN068)	6 (MOHR, R22), 13 (MOHR, R49, R75♣, R100, R121, R229, R239♣), 5 (R73, R86♣, R151♣, R164, R178♣, R191, R209, R241), 12 (R264♣)	5 (Decoction/rubbing on the body); 6 (decoction/drink/beer, sweet products and modern medicines ^e); 12 (maceration/drink); 13 (decoction/drink, and rubbing on the body/beer ^e) [32%]
<i>Justicia subsessilis</i> (Umubazibazi, L, JN007)	25 (MOHR), 5 (MOHR), 6 (MOHR)	25 (Powder/rubbing on the body) [50%]
<i>Thuinbergia alata</i> (Iganzamwonga, L or AP, JN102)	6 (R22♣), 13 (R49♣, R75, R100♣, R121♣, R169♣, R179, R202♣, R208♣), 5 (R73, R86, R115♣, R126♣, R164♣, R178, R191♣, R209♣), 19 (R108♣), 17 (R110), 2 (R227, R232)	2 (Decoction/application on the body, drink and enema); 5 (decoction/rubbing on the body); 6 (decoction/drink/sweet products and modern medicines ^e); 17 (decoction/drink/beer and modern medicines ^e); 13 (maceration/rubbing on the body/beer ^e); 19 (powder/rubbing on the body 3 time a day) [35%]
Aloaceae		
<i>Aloe lateritia</i> (Ingagari, L or R, JN079)	2 (R8, MOHR), 12 (MOHR), 11 (MOHR), 20 (MOHR)	12 (Maceration/drink); 2 (crush/application on the body); 11 (sap/application on the foot); 20 (decoction/drink/beer ^e) [7%]
Amaranthaceae		
<i>Chenopodium ambrosioides</i> (Umunceke), (L, JN016)	13 (MOHR), 25 (R263♣)	13 (Maceration/application on the body); 25 (powder/rubbing on the body) [3%]
<i>Chenopodium ugandae</i> (Umugombe, L, JN073)	1 (MOHR), 9 (R9), 16 (R50), 5 (R73), 3 (R242), 2 (R250, R265), 25 (R263, R266), 12 (R268)	3 (Maceration/drink; calcination/scarifications); 12 (maceration/drink); 1–2 (powder/application on the body); 9 (squeeze/instillation in the ear/beer and modern medicines ^e); 16 (powder/eating/beer and modern medicines ^e); 25 (powder/rubbing on the body); 5 (maceration/application on the body) [17%]
<i>Cyathula uncinulata</i> (Ikiramata, L, JN015)	3 (R27), 12 (R94, R155, R260♣)	3 (Decoction/drink); 12 (maceration/enema/beer ^e) [7%]
Amaryllidaceae		
<i>Allium cepa</i> (Igitunguru, L or T, JN077)	4 (R135, MOHR)	4 (Crush/juice drink/beer ^e) [3%]
Anacardiaceae		
<i>Lannea schimperii</i> (Umufute, STB, JN039)	12 (R252)	12 (Maceration/drink) [2%]
<i>Mangifera indica</i> (Umwembe, L, JN148)	12 (R248), 10 (R249♣)	10 (Decoction/vapor inhalation/beer ^e); 12 (maceration/enema) [3%]
<i>Rhus pyroides var. pyroides</i> (Umusagara, L, JN006)	12 (R44, R101), 6 (R56)	6 (Decoction/drink); 12 (maceration/enema/beer and modern medicines ^e) [5%]
Apiaceae		
<i>Centella asiatica</i> (Gutwikumwe, L, JN117)	8 (MOHR), 9 (R228, R234, R238)	8 (Heating in the ash/vapor inhalation); 9 (maceration/instillation in the ear, or drink/beer ^e) [7%]
<i>Heteromorpha arborescens var. abyssinica</i> (Umaturampene, L or R, JN071)	1 (R79), 6 (R89)	1 (Decoction/rubbing on the body, or drink); 6 (decoction/drink and enema) [3%]
<i>Steganotaenia araliacea</i> (Umuganasha, AP or STB, JN003)	12 (R111, R123, R136, R183♣)	12 (Decoction/drink) [7%]
Apocynaceae		
<i>Periploca linearifolia</i> (Umuguguna, L, JN062)	1 (R95), 2 (98), 5 (R99)	1, 2 and 5 (Powder/rubbing on the body/beer and modern medicines ^e) [5%]
<i>Rauvolfia mannii</i> (Ibamba, L, AP or STB, JN115)	13 (MOHR, R229♣, R239), 5 (R164, R178, R191, R209), 12 (R235)	5 (Decoction/application on the body); 12 (decoction/drink); 13 (decoction/drink and rubbing on the body) [13%]
Araliaceae		
<i>Polyscias fulva</i> (Umwungo, STB, JN036)	10 (R48)	10 (Decoction/drink/beer ^e) [2%]
Asteraceae		
<i>Ageratum conyzoides</i> (Akarura, L or AP, JN075)	18 (R173♣, R181, R187♣, R195♣, R205♣), 2 (R267, R269)	2 (Calcination/application on the body/modern medicines ^e); 18 (Maceration/application on the body) [12%]
<i>Anisopappus chinensis subsp. africanus</i> (Umukamisha, L, JN048)	8 (R159)	8 (Powder/application in nose) [3%]
<i>Aspilia plurisetata</i> (Icumya, L or AP, JN080)	11 (MOHR), 13 (R21), 5 (MOHR, R66, R82), 12 (MOHR, R70, R83♣, R111, R175, R211♣), 1 (R4, R16♣, R67, R79, R106♣), 18 (61), 2 (R69, R218), 10 (R259♣, R262)	1–2 (Decoction/drink); 5 (maceration/body washing); 12 (decoction/enema/sweet products and modern medicines ^e); 10 (maceration/drink); 18 (powder/application on the foot); 11 (powder/application on the foot); 13 (crush/application on the body) [37%]
<i>Bidens pilosa</i> (Icanda, L, AP or WP, JN049)	17 (MOHR, R110), 1 (MOHR, R25), 2 (R26), 3 (R27, R150)	3 (Decoction/drink); 1–2 (decoction/rubbing on the body or drink) [12%]
<i>Bothriocline longipes</i> (Umubebe, L, JN053)	7 (MOHR)	7 (Teeth are brushed with a single plant leaf) [2%]
<i>Carduus nyassanus</i> (Ighandambwa, L or AP, JN084)	2 (R1, R5, R35, R85, R145♣, R163, R177, R184, R189, R210, R243♣), 1 (R8, R14, R91, R162, R176, R188)	1–2 (Calcination/application on the body/modern medicines ^e) [28%]
<i>Crassocephalum vitellinum</i> (Akayungubira, L or AP, JN119)	1 (R34), 21 (R109, R130), 17 (R110), 12 (R211)	12 (Maceration/drink/beer and modern medicines ^e); 1 (calcination/application on body); 21 (decoction/enema and vapor inhalation) [8%]
<i>Dichrocephala integrifolia</i> (Agatambambuga, L, JN033)	12 (R230, R235)	12 (Decoction/drink) [3%]
<i>Dicoma anomala</i> (Umwanzuranya, L, STB, T or R, JN120)	1 (MOHR), 12 (R15♣, R29, R37♣, R92, R141, R220, R252), 2 (R35)	12 (Decoction/drink/beer, sweet products and modern medicines ^e); 1 (powder/application on the body); 2 (calcination/eating) [15%]
<i>Gutenbergia cordifolia</i> (Umweza, L,	2 (R31, R36, R41, R42), 12 (R94)	12 (Maceration/enema, or drink/beer ^e); 2 (decoction/rubbing

Table 2 (continued)

Botanical name (vernacular name, part used ^a , voucher specimen number)	Microbial diseases treated ^b (recipes involved ^c)	Mode of preparation ^d /mode of administration/interdicts ^e /[citation frequency (% of THs)]
JN029)		on the body, or enema/modern medicines ^e) [8%]
<i>Helichrysum congolanum</i> (Ngabimwe, L, AP or R, JN013)	1 (R12, R30♣, R79, R84, R112, 124, R134, R142, R162, R172♣, R174♣, R176, R182, R188, R193♣, R194, R203, R206, R2013), 2 (R41♣, R42, R77, R81, R85, R114, R145, R163, R177, R184, R189, R204, R210), 12 (R141)	12 (Powder/eating/sweet products ^e); 1–2 (calcination/rubbing on the body, and eating) [55%]
<i>Helichrysum keilii</i> (Imanayeze, L, JN094)	2 (R240, R247), 1 (R246)	1 (Decoction/enema/beer ^e); 2 (decoction/rubbing on the body, or drink and enema) [5%]
<i>Melanthera scandens</i> (Akavunjahoma, L, JN066)	10 (R110)	10 (Decoction/drink) [2%]
<i>Microglossa pyrifolia</i> (Umuhe, L or AP, JN134)	1 (R16, R215, R246♣), 5 (R66), 2 (R69, R240, R247♣), 21 (R109, R130), 17 (R110)	1 (Decoction/enema/beer ^e); 2 (decoction/rubbing on the body, or drink and enema); 5 (maceration/rubbing on the body); 17 (decoction/drink/beer and modern medicines ^e); 21 (decoction/enema) [17%]
<i>Mikania natalensis</i> (Nkuyumwonga, L or AP, JN005)	14 (MOHR), 21 (R109♣, R130♣), 1 (R112, R134, R162, R176, R188, R203), 2 (R114, R163, R177, R184, R189, R204, R210), 12 (R136), 11 (R143)	12 (Decoction/enema); 1–2 (calcination/application on the body, or eating/modern medicines ^e); 11 (powder/application on the foot); 14 (decoction/drink); 21 (decoction/enema and vapor inhalation) [30%]
<i>Senecio maranguensis</i> (Imbatura, L, AP or R, JN010)	1 (R12♣, R53, R76♣, R79♣, R80, R84♣, R139, R162, R176♣, R188, R203, R213), 2 (R18, R69♣, R80♣, R163, R177♣, R184, 189, R204, R210♣, R232♣, R265♣), 18 (R61♣), 19 (R65), 5 (R66, R82♣), 11 (R143♣)	1 (Decoction/application on the body and enema/beer ^e); 2 (calcination/application on the body, and eating/modern medicines ^e); 5 (maceration/rubbing on the body); 18 (powder/rubbing on the body, or drink) [48%]
<i>Solanecio angulatus</i> (Ikivurahinda, L, JN025)	5 (MOHR)	5 (Maceration/application on the body) [2%]
<i>Solanecio cydoniifolius</i> (Icegera, L, JN107)	2 (R269)	2 (Calcination/rubbing on the body/eating/modern medicines ^e) [2%]
<i>Solanecio mannii</i> (Umutagari, L, JN035)	11 (R157), 10 (R259, R262, R271), 12 (R268), 2 (R269)	10 (Maceration/drink); 11 (powder/rubbing on foot); 10 (decoction/drink); 12 (maceration/drink) [10%]
<i>Sphaeranthus suaveolens</i> (Ikinini, L, JN106)	2 (R77♣, R81), 1 (R80), 5 (R82)	1 (Calcination/rubbing on the head and eating/beer ^e); 2 (decoction/drink and enema); 5 (powder/rubbing on the body/beer ^e) [7%]
<i>Spilanthes mauritiana</i> (Ishwemu, L, JN104)	7 (MOHR, R120♣, R129♣, R168♣, R190♣, R207♣, R219♣)	7 (Heating in the ash/teeth brushing) [17%]
<i>Stomatanthes africanus</i> (Umweyo, L, R or WP, JN012)	2 (R1♣, R77, R81, R85, R114♣, R145, R163, R177, R184, R189, R206, R222♣, R240, R247, R269♣), 1 (R12, R14♣, R30, R80, R84, R112♣, R124♣, R134, R162, R172, R174, R176, R182, R188, R194, R206, R213, R221♣, R246), 12 (R141)	12 (Powder/eating/wwet products ^e); 1 (calcination/rubbing on the body, and eating/modern medicines ^e); 2 (decoction/rubbing on the body, or drink and enema) [59%]
<i>Vernonia amygdalina</i> (Umufumya, L, JN032)	5 (MOHR, R45, R73♣, R233, R241, R253♣), 12 (MOHR), 7 (MOHR), 13 (MOHR, R43♣, R75, R239), 10 (R262♣)	5 (Maceration/drink, and rubbing on the body/beer and sweet products ^e); 7 (crush/teeth brushing); 12 (decoction/drink/beer ^e); 2 (crush/rubbing on the body); 10 (maceration/drink); 13 (decoction/rubbing on the body) [22%]
<i>Vernonia hochstetteri</i> (Ikinyami, L or AP, JN098)	21 (R109, R130)	21 (Decoction/enema and vapor inhalation) [3%]
<i>Vernonia kirungae</i> (Uruhombu, L, STB or AP, JN043)	5 (R6♣), 2 (R85, R163, R184, R189), 3 (R116♣, R127♣), 1 (R137, R162, R188)	3 (Decoction/enema and vapor is inhalation); 1–2 (calcination/rubbing on the body, or eating/modern medicines ^e); 5 (maceration/rubbing on body) [17%]
Balsaminaceae		
<i>Impatiens burtonii</i> (Igisogoro, L or WP, JN096)	11 (MOHR, R113♣, R125♣)	1 (Decoction/rubbing on the body; or drink; 11 (powder/application on foot) [10%]
Basellaceae		
<i>Basella alba</i> L. (Umurerama, L or AP, JN081)	25 (R72), 1 (R95, R112, R124, R137, 148), 2 (R98, R114, R146, R218), 5 (R99)	1 (Calcination/ash eating); 2 (decoction/drink); 5 (powder/rubbing on the body) [18%]
Boraginaceae		
<i>Cordia africana</i> (Umuhasahasa, L, JN115)	9 (R60)	9 (Maceration/drink) [2%]
Cannabaceae		
<i>Trema orientalis</i> (Umugwampore, L or STB, JN101)	25 (R58)	25 (Powder/rubbing on the body) [2%]
Caricaceae		
<i>Carica papaya</i> (Ipapaye, R or S, JN057)	10 (MOHR), 12 (R24)	10 (Maceration/drink); 12 (maceration/drink) [3%]
Caryophyllaceae		
<i>Drymaria cordata</i> (Urura rw'inzovu, L or AP, JN121)	8 (MOHR, R55)	8 (Crush/juice instillation in the nose; and/or decoction/drink) [5%]
Celastraceae		
<i>Gymnosporia senegalensis</i> (Umusongati, L, STB or R, JN070)	3 (MOHR, R2♣, R78♣, R116, R127, R242♣, R244♣)	3 (Maceration/drink; calcination/scarifications) [25%]
Chrysobalanaceae		
<i>Parinari curatellifolia</i> (Umunazi, STB or R, JN152)	17 (MOHR, R149♣), 12 (R15, R29, R220), 15 (R54, R70♣), 5 (R66♣)	12 (Decoction/drink/sweet products ^e); 5 (powder/rubbing on the body); 15 (decoction/drink); 17 (decoction/drink/beer and modern medicines ^e) [13%]
Cleomaceae		
<i>Cleome gynandra</i> (Urusogi, L, JN024)	12 (MOHR)	12 (Decoction/drink) [2%]
Crassulaceae		

Table 2 (continued)

Botanical name (vernacular name, part used ^a , voucher specimen number)	Microbial diseases treated ^b (recipes involved ^c)	Mode of preparation ^d /mode of administration/interdicts ^e /[citation frequency (% of THs)]
<i>Kalanchoe crenata</i> (Ikizirankuga, L, AP, R or WP, JN132)	8 (MOHR, R23♣, R117, R166, R198, 237♣, R245♣), 11 (MOHR, R113, R125), 9 (MOHR, R20, R46, R63, R64♣, R138, R140, R167, R197, R200, R228♣), 4 (R3, R7, R11, R51♣, R105, R107, R122♣, R131♣, R135, R147♣, R152, R153, R171, R180, R186♣, R192, R131♣), 1 (R160), 5 (R161)	8 (Decoction/instillation in the nose, or drink); 1 and 5 (sap/application on body); 4 (maceration/drink/beer ^e); 11 (Heating in the ash/application on the foot); 9 (maceration/instillation in the, or drink/modern medicines ^e) [62%]
Cucurbitaceae		
<i>Momordica foetida</i> (Umwishwa, L or AP, JN135)	1 (MOHR, R76, R137), 11 (R17, R97♣), 2 (R31, R36, R41, R267, R269), 18 (R61), 19 (R65♣, R109), 5 (R86, R99, R115, R126, R126, R144♣, R164, R178, R191, R209, R233♣), 13 (R169, R179♣, R202, R208), 12 (R252)	1 (Squeezing/application on the body); 2 (decoction/rubbing on the body, or enema/modern medicines ^e); 5 (crush/rubbing on the body); 12 (maceration/drink); 18 (powder/rubbing on the body); 11 (crush/rubbing on foot); 13 (maceration/rubbing on the body); 19 (maceration/rubbing on the body, or drink) [48%]
<i>Zehneria scabra</i> (Umushishiro, L or AP, JN041)	7 (MOHR), 1 (MOHR, R4, R53, R79, R102, R106, R112, R134, R137♣, R215♣, R221, R236), 11 (MOHR), 2 (R1, R31, R114, R146, R218, R222), 15 (R47♣, R103), 8 (R55), 5 (R66, R241♣), 17 (R110), 25 (R225)	1–2 (Decoction/application on the body and enema/modern medicines ^e); 8 (crush, juice squeezing/instillation in the nose); 7 (decoction/teeth brushing); 11 (crush/rubbing on foot); 5 (maceration/rubbing on the body); 15 (maceration/application on the body); 17 (decoction/drink/beer and modern medicines ^e); 25 (powder/rubbing on the body) [47%]
Euphorbiaceae		
<i>Acalypha ambigua</i> (Umukundanya, STB, JN047)	12 (R252)	12 (Maceration/drink) [2%]
<i>Acalypha brachiata</i> (Kamimura, L, JN051)	1 (R79), 12 (R155♣, R235)	12 (Decoction/drink); 1 (decoction/drink) [5%]
<i>Erythrococca bongensis</i> (Umutinti, L, JN072)	18 (R61), 2 (R69, R240), 1 (R213)	1 (Decoction/drink); 2 (decoction/application on the body, or drink and enema); 18 (powder/rubbing on the body) [7%]
<i>Jatropha curcas</i> (Ikivurahinda, L, JN131)	1 (R160♣), 5 (R161♣)	1 (Squeezing/application on the head) [3%]
<i>Ricinus communis</i> (Ikibonobono, SJN113)	1 (MOHR)	1 (Powder/rubbing on the body) [2%]
<i>Tragia brevipes</i> (Isusa, L, JN023)	12 (R155)	12 (Decoction/drink) [2%]
Fabaceae		
<i>Acacia hockii</i> (Umugenge, L or STB, JN014)	8 (MOHR), 3 (R78)	8 (Decoction/drink); 3 (Calcination/scarifications) [3%]
<i>Acacia sieberiana</i> var. <i>woodii</i> (Umunyi-nya, STB, JN026)	7 (MOHR)	7 (Heating in the ash/teeth brushing) [5%]
<i>Albizia adianthifolia</i> (Umusebeyi, L, JN004)	2 (R267, R269)	2 (Calcination/application on the body) [3%]
<i>Alysicarpus zeyheri</i> (Uruzi, R, JN078)	24 (MOHR)	24 (Decoction/application on the body) [5%]
<i>Arachis hypogaea</i> (Ibiyoba, L, JN052)	11 (MOHR, R17♣)	11 (Maceration/application on foot) [8%]
<i>Caesalpinia decapetala</i> (Umubambangwe, R, WP, JN153)	3 (MOHR, R2)	3 (Maceration/drink; and/or calcination/scarification) [3%]
<i>Cassia kirkii</i> (Agashiha, R, JN085)	6 (R89)	6 (Decoction/drink and enema) [2%]
<i>Entada abyssinica</i> (Umusange, L or R, JN154)	6 (R170, R196), 12 (R199, R220)	6 (Decoction/enema); 12 (maceration/enema) [8%]
<i>Eriosema lebrunii</i> (Inanka, S, JN122)	11 (R68)	11 (Crushed/juice dropping on the foot) [2%]
<i>Eriosema montanum</i> (Umukonyantoke, L, JN091)	1 (R106)	12 (Maceration/enema/beer ^e); 1 (calcination/eating) [2%]
<i>Erythrina abyssinica</i> (Umurinzi, L, R or STB, JN124)	7 (MOHR), 10 (MOHR), 12 (R44), 17 (R110♣), 2 (R250)	2 (Decoction/rubbing on the body, or drink/Beer ^e); 7 (crush/rubbing on the body); 12 (maceration/enema/beer and modern medicines ^e); 10 (maceration/drink/beer ^e); 17 (decoction/drink/beer and modern medicines ^e) [5%]
<i>Indigofera arrecta</i> (Umusorora, L, JN067)	1 (R67), 25 (R72)	1 (Crush/rubbing on the body) [3%]
<i>Pericopsis angolensis</i> (Umubangwa, L, AP or R, JN061)	4 (R122, R171, R180, R186)	4 (Decoction/drink) [7%]
<i>Pseudarthria hookeri</i> var. <i>argyrophylla</i> (Ikigubugubu, L or AP, JN060)	2 (R85), 1 (R91♣)	1 (Powder/rubbing on the body); 2 (calcination/eating) [3%]
<i>Senna didymobotrya</i> (Umubagabaga, L, JN108)	10 (MOHR, R48, R57♣, R88♣, R104♣, R118♣), 9 (R154)	9 (Crush, juice squeezing/instillation in the ear); 10 (decoction/enema and vapor inhalation) [12%]
<i>Sesbania sesban</i> (Umunyegenyeye, L or R, JN037)	23 (MOHR), 7 (MOHR), 9 (R46♣, R64, R234♣, R238♣), 8 (R55 ♣), 3 (R87♣, R165♣, R185♣)	8 (Crush, juice squeezing/instillation in the nose; and/or decoction/drink); 3 (calcination/scarifications); 7 (decoction/teeth brushing); 9 (maceration/drink/beer ^e); 23 (decoction/drink/beer ^e) [17%]
<i>Vigna luteola</i> (Umuryanyoni, L or AP, JN097)	2 (R31), 10 (R104), 12 (R111, R123)	2 (Decoction/application on the body and enema/modern medicines ^e); 10 (decoction/drink); 12 (maceration/enema) [7%]
Geraniaceae		
<i>Geranium aculeolatum</i> (Incaruza, L, JN130)	1 (R102, R142), 2 (R103), 12 (R141)	12 (Powder/eating/sweet products ^e); 1–2 (powder/rubbing on the body) [7%]
Hypericaceae		
<i>Hypericum revolutum</i> (Umusesankware, L or AP, JN127)	2 (R69, R98, R114), 1 (R95, R112, R124), 5 (R99)	1 (Calcination/eating); 2 (decoction/rubbing on the body, or drink and enema); 5 (powder/rubbing on the body) [12%]
<i>Psorospermum baumii</i> (Umukubagwa, L, STB or R, JN076)	1 (MOHR, R8♣, R67, R79, R95, R112, R134, R156, R236), 2 (R5♣, R77, R98, R114, R158), 11 (R13), 20 (R19), 15 (R54♣), 5 (R82, R99), 4 (R131)	1 (Powder/rubbing on the body); 2 (decoction/rubbing on the body, or drink and enema); 5 (powder/rubbing on the body/beer ^e); 11 (powder/rubbing on foot); 4 (maceration/drink); 15 (decoction/drink); 20 (decoction/drink/sweet products and modern medicines ^e) [38%]

Table 2 (continued)

Botanical name (vernacular name, part used ^a , voucher specimen number)	Microbial diseases treated ^b (recipes involved ^c)	Mode of preparation ^d /mode of administration/interdicts ^e /[citation frequency (% of THs)]
Lamiaceae		
<i>Clerodendrum johnstonii</i> (Umunyankuru, L, JN087)	8 (R28♣), 13 (R254♣), 12 (R260)	8 (Decoction/drink); 12 (maceration/drink); 13 (crush/rubbing on the body) [5%]
<i>Clerodendrum schweinfurthii</i> (Umugutabatema, L, JN118)	12 (MOHR)	12 (Maceration/drink) [2%]
<i>Clinopodium uhligii</i> var. <i>obtusifolium</i> (Umuzirasato, L or AP, JN021)	2 (R85, R114, R163, R177, R189), 19 (R108), 1 (R112, R162, R172, R176, R182, R188, R193, R194), 5 (R115), 13 (R121), 5 (R126)	1–2 (Calcination/application on the body and/or eating/modern medicines ^e); 5 and 13 (crush/rubbing on the body); 19 (powder/rubbing on the body) [28%]
<i>Coleus dysentericus</i> (Inumpu, R, JN088)	11 (68♣)	11 (Crush/juice is dropped on the foot) [2%]
<i>Hoslundia opposita</i> (Umusita, L or AP, JN069)	1 (R4, R34♣, R53, R67♣, R112, R148, R156), 2 (R18, R114, R146, R158, R232), 15 (R54), 19 (R65)	1–2 (Decoction/body washing and enema/modern medicines ^e); 15 (decoction/drink); 19 (maceration/rubbing on the body, or drink) [23%]
<i>Leonotis nepetifolia</i> (Umotongotongo, L, JN030)	12 (MOHR), 3 (MOHR, R27♣, R150♣)	3 (Decoction/drink); 12 (maceration/drink) [7%]
<i>Leucas martinicensis</i> (Akanyamapfundo, L or AP, JN136)	12 (MOHR, R83, R94, R101♣, R111, R123, R141, R175♣, R199♣, R260)	12 (Maceration/drink/beer and sweet products ^e) [17%]
<i>Micromeria imbricata</i> var. <i>imbricate</i> (Umukoroka, L or AP, JN137)	3 (R2)	3 (Maceration/drink; or calcination/scarifications) [2%]
<i>Ocimum americanum</i> (Umwenya, L, JN038)	1 (R236)	1 (Decoction/rubbing on the body; or drink and enema) [2%]
<i>Ocimum basilicum</i> (Umusurasura, L, JN147)	17 (R149)	17 (Decoction/drink/beer and modern medicines ^e) [2%]
<i>Tetradenia riparia</i> (Umuravumba, L, ST or AP, JN100)	11 (MOHR), 14 (MOHR), 4 (MOHR, R3♣, R7♣, R51, R90♣, R96, R105, R107♣, R135, R147, R171♣, R180♣, R186, R192♣, R251, R255♣, R256, R257, R261♣), 5 (MOHR), 25 (MOHR), 8 (R23, R117♣, R147♣, R198♣, R201♣, R212, R216, R223, R226♣), 1 (R25♣, R134), 10 (R249)	8 (Maceration/drink); 1 (decoction/rubbing on the body, or drink); 4 (maceration/drink/beer ^e); 5 (crush/rubbing on the body/beer ^e); 10 (decoction/vapor inhalation and drink/beer ^e); 11 (crush/application on foot); 14 (heating in the ash/rubbing on the throat); 25 (powder/rubbing on the body) [63%]
<i>Platostoma rotundifolium</i> (Umusekerasuka, L, WP, AP or R, JN008)	2 (MOHR, R1, R5, R103♣, R146, R163♣, R184♣, R189♣, R204♣, R210, R214♣, R227♣, R232, R240♣), 5 (MOHR, R99), 1 (R4♣, R8, R12, R14, R16, R76, R91, R102♣, R106, R112, R114, R124, R134♣, R142♣, R148♣, R162♣, R172, R182, R188♣, R194, R203♣, R213♣, R215, R236♣), 11 (R97), 12 (R141), 18 (R195)	5 (Powder/rubbing on the body/bBeer ^e); 12 (powder/eating/sweet products ^e); 1–2 (calcination/rubbing on the body eating/modern medicines ^e); 11 (crush/rubbing on foot) [75%]
<i>Plectranthus barbatus</i> (Igicuncu, L, JN139)	10 (MOHR), 12 (R70), 9 (R132), 4 (R251, R256, R258, R261)	10 (Crush, juice squeezing/drink); 12 (decoction/drink/sweet products ^e); 4 (maceration/drink); 9 (crush, juice squeezing/instillation in the ear) [12%]
<i>Pycnostachys erici-rosenii</i> (Umusinduka, L, R or AP, JN059)	4 (R107, R122, R131, R258), 1 (R112, R148), 2 (R114, R146)	1–2 (Calcination/eating); 4 (decoction/drink) [13%]
<i>Rotheca myricoides</i> (Umukuzanyana, L, T or R, JN114)	12 (R40♣, R220♣), 6 (R89♣, R170♣, R196)	6 (Decoction/enema); 12 (decoction/drink) [8%]
Lauraceae		
<i>Cassipourea filiformis</i> (Imburabwamo, L, JN116)	2 (R18, R145, R222, R240, R247), 1 (R76, R221, R246)	1 (Calcination/application on the body/modern medicines ^e); 2 (decoction/application on the body, or drink and enema) [13%]
<i>Ocotea michelsonii</i> (Umuganza, STB, JN149)	7 (R32, R38)	7 (Maceration/drink and instillation in the nose) [3%]
<i>Persea americana</i> (Ivoka, F or S, JN141)	7 (MOHR), 12 (R24♣)	7 (Decoction/teeth brushing); 12 (maceration/drink) [3%]
Malvaceae		
<i>Hibiscus diversifolius</i> (Umuguso, L, JN095)	22 (MOHR)	22 (Maceration/throat washing) [3%]
Melastomataceae		
<i>Dissotis trochae</i> (Umushonge, L, JN020)	2 (R31, R36)	2 (Decoction/application on the body, or enema/modern medicines ^e) [3%]
<i>Heterotis canescens</i> (Umusoma w'abungere, L, JN040)	14 (MOHR), 17 (R60)	14 (Maceration/drink/beer ^e); 17 (decoction/drink) [3%]
Monimiaceae		
<i>Xymalos monospora</i> (Umuhotora, L or AP, JN042)	19 (R65), 2 (R69), 12 (R101, R111, R224♣)	12 (Maceration/enema/beer ^e); 2 (decoction/drink); 19 (maceration/drink) [9%]
Moraceae		
<i>Ficus ovata</i> (Igikobekobe, L, JN128)	9 (MOHR)	9 (Heating in the ash, squeezing/instillation in the ear/beer ^e) [2%]
<i>Milicia excelsa</i> (Umukamba, L, JN145)	9 (R238)	9 (Squeezing/instillation in the) [2%]
Myrtaceae		
<i>Eucalyptus</i> sp. (Umukaratusi wera, L, JN092)	10 (MOHR), 4 (MOHR, R3, R118, R257, R258, R270♣)	4 (Decoction/drink/beer ^e); 10 (Decoction/enema and vapor inhalation) [13%]
<i>Psidium guajava</i> (Ipera, L, JN046)	12 (R248♣)	12 (Maceration/enema) [2%]
<i>Syzygium guineense</i> (Umugoti, L, STB or AP, JN103)	1 (R34), 12 (R44♣, R111, R123, R141♣, R183, R224)	12 (Maceration/enema/sweet products ^e); 1 (calcination/rubbing on the body) [12%]
Oleaceae		
<i>Schreberia alata</i> (Umubanga, L, JN111)	2 (R269)	2 (Maceration/drink) [2%]
Oxalidaceae		
<i>Biophytum umbraculum</i> (Tinyabakwe, L, JN074)	1 (R34), 12 (R141)	12 (Powder/eating/sweet products ^e); 1 (Calcination/application on the body) [2%]

Table 2 (continued)

Botanical name (vernacular name, part used ^a , voucher specimen number)	Microbial diseases treated ^b (recipes involved ^c)	Mode of preparation ^d /mode of administration/interdicts ^e /[citation frequency (% of THs)]
<i>Oxalis corniculata</i> (Akunyu ka nyamanza, L or AP, JN138)	7 (R120, R129), 18 (173, 181)	7 (Heating in the ash/teeth brushing); 18 (maceration/application on the body) [13%]
Pedaliaceae		
<i>Sesamum angolense</i> (Umurendarenda, AP, JN002)	2 (R26♣)	2 (Decoction/drink) [2%]
Phyllanthaceae		
<i>Bridelia micrantha</i> (Umugimbu, R or STB, JN082)	16 (R50), 17 (R60♣), 12 (R252)	12 (Maceration/drink); 16 (Powder/eating/beer and modern medicines ^e); 17 (decoction/drink) [5%]
<i>Phyllanthus ovalifolius</i> (Umubwigwa, L or STB, JN142)	3 (R116, R127) 12 (R141)	3 (Decoction/enema and vapor inhalation/sweet products ^e); 12 (Maceration/drink) [5%]
Phytolaccaceae		
<i>Phytolacca dodecandra</i> (Umwokora, L, JN140)	2 (MOHR, R8♣), 5 (MOHR, R6, R45♣, R133♣, R144), 13 (R21♣), 25 (R263)	2 (Squeezing/application on body); 5 (crush/rubbing on the body/beer and sweet products ^e); 13 (crush/rubbing on the body); 25 (powder/rubbing on the body) [17%]
Piperaceae		
<i>Piper capense</i> (Inkonjoro, L, JN064)	9 (MOHR)	9 (Crush, juice squeezing/Instillation in the ear) [2%]
Poaceae		
<i>Imperata cylindrica</i> (Umusovu, L, R or FL, JN129)	4 (R71), 3 (R242, R244)	3 (Decoction/drink; calcination/scarifications); 4 (calcination/scarifications) [5%]
<i>Saccharum officinarum</i> (Umusigati, FL, JN045)	4 (R71)	4 (Calcination/scarification) [2%]
<i>Zea mays</i> (Ikigori, S, JN034)	5 (R151)	5 (Crush/eating/beer ^e) [2%]
Polygalaceae		
<i>Securidaca longipedunculata</i> (Umunya-gasozi, L or R, JN109)	1 (R8), 11 (R13♣), 8 (R74), 12 (R92♣), 6 (R170, R196♣)	6 (Decoction/enema); 8 (decoction/vapor inhalation); 12 (decoction/drink); 1 (calcination/application on the body/beer ^e); 11 (powder/rubbing on foot; or maceration/drink) [10%]
Polygonaceae		
<i>Persicaria setosula</i> (Ikizigangore, L, JN063)	12 (R83)	12 (Decoction/enema) [2%]
<i>Rumex nepalensis</i> (Isesabirego, L or R, JN011)	16 (MOHR), 17 (R60), 7 (R168, R190, R207), 2 (R265)	7 (Heating in the ash/teeth brushing); 1 (crush/rubbing on the body); 16 (decoction/drink/beer ^e); 17 (decoction/drink) [10%]
<i>Rumex usambarensis</i> (Umufumbegeti, L or AP, JN110)	2 (R35♣, R267, R269), 4 (R59, R90, R107, R135, R139, R171, R180, R186, R192, R212♣, R216♣, R226, R231, R258, R270), 8(R166, R192, R201, R237, R245)	8 (Maceration/drink); 2 (calcination/eating); 4 (maceration/drink/beer ^e) [38%]
Primulaceae		
<i>Embelia schimperi</i> (Umukarakara, L, JN123)	12 (R141), 1 (142)	12 (Powder/eating/sweet products ^e); 1 (powder/rubbing on the body) [3%]
<i>Lysimachia ruhmeriana</i> (Umuyobora, L, JN151)	2 (R267, R269)	2 (Calcination/application on the body, or eating/modern medicines) [3%]
Ranunculaceae		
<i>Ranunculus multifidus</i> (Ruheha, L or AP, JN143)	4 (R59), 1 (R84, R112, R124, R162, R172, R174, R176, R182, R188, R193, R194, R206), 2 (R85, R114, R163, 177, R189, 2018♣), 19 (R108), 12 (R141)	12 (Powder/eating/sweet products ^e); 1–2 (calcination/rubbing on the body, or eating/modern medicines ^e); 4 (decoction/drink); 19 (powder/rubbing on the body) [35%]
Rhamnaceae		
<i>Gouania longispicata</i> Engl. (Ikibimbafuro, L or AP, JN018)	12 (R111♣, R123♣, R175, R264)	12 (Maceration/enema) [7%]
<i>Helinus mystacinus</i> (Umubimbafuro, L, JN126)	13 (R43), 2 (R243)	2 (Calcination/eating/beer ^e); 13 (Crush/rubbing on the body) [3%]
<i>Ziziphus abyssinica</i> (Umukugutu, STB, JN019)	8 (MOHR, R74♣, R159♣), 20 (R19), 7 (R32♣, R38)	8 (Powder/application in nose); 7 (maceration/drink); 20 (decoction/drink/sweet products and modern medicines ^e) [10%]
Rubiaceae		
<i>Agathisanthemum globosum</i> (Akazi-banda, L or T, JN054)	12 (MOHR), 4 (R152♣)	12 (Decoction/drink); 4 (decoction/drink/beer ^e) [3%]
<i>Cinchona officinalis</i> (Kenkina, L or STB, JN056)	10 (MOHR, R10♣, R48♣, R271)	10 (Decoction/drink/beer and modern medicines ^e) [12%]
<i>Fadogia ancylantha</i> (Umuvuzampundu, L, JN125)	1 (R67, R106, R236, R246), 12 (R136), 2 (R240, R247)	1 (Decoction/enema/beer ^e); 2 (powder, decoction/rubbing on the body, or drink and enema) [12%]
<i>Hallea rubrostipulata</i> (Umugomera, L or STB, JN093)	12 (R29, R37, R40, R220, R252), 6 (R70, R196)	6 (Decoction/enema); 12 (decoction/drink/beer, sweet products and modern medicines ^e) [12%]
<i>Pavetta ternifolia</i> (Umunyamabuye, L, JN001)	5 (MOHR, R253), 12 (R260)	12 (Maceration/drink); 5 (decoction/drink) [5%]
<i>Pentas longiflora</i> (Isagara, L or R, JN144)	25 (MOHR, R52♣, R58♣, R62♣, R72♣, R225♣, R263, R266♣), 10 (R271)	10 (Decoction/drink); 25 (powder/rubbing on the body) [48%]
<i>Rubia cordifolia</i> (Umukararambwa, L, AP or STB, JN112)	2 (MOHR, R114), 16 (R50♣), 1 (R112)	2 (Calcination/eating); 16 (powder/drink/beer and modern medicines ^e) [8%]
<i>Spermacoce princeae</i> (Umunyovunyovu, L or R, JN044)	1 (R12), 12 (R268♣)	12 (Maceration/drink); 1 (decoction/enema, or drink/sweet products) [3%]
<i>Virectaria major</i> (Umukizikizi, L, AP, R or WP, JN009)	20 (MOHR), 13 (MOHR), 2 (R1, R18, R69, R78–79, R81, R91, R98♣, R103, R114, R146, R158♣, R214, R218, R227, R232, R240), 1 (MOHR, R4, R8, R12, R53♣, R67, R79, R95♣, R102, R112, R124, R137, R148, R156♣, R213, R236), 18	1–2 (Decoction/application on the body and enema/modern medicines ^e); 12 (Powder/eating/sweet products ^e); 4 (maceration/drink); 5 (maceration/application on the body); 13 (maceration/application on the body/beer ^e); 18 (powder/rubbing on the body); 19 (maceration/application on the body on the

Table 2 (continued)

Botanical name (vernacular name, part used ^a , voucher specimen number)	Microbial diseases treated ^b (recipes involved ^c)	Mode of preparation ^d /mode of administration/interdicts ^e /[citation frequency (% of THs)]
	(R61), 19 (R65), 5 (R66, R99♣), 12 (R141), 13 (R254), 4 (R255), 10 (R259)	body, or drink); 20 (decoction/vapor inhalation/beer ^e) [72%]
Rutaceae		
<i>Citrus limon</i> (Indimu, L, F or FP, JN017)	15 (R47), 4 (R93♣), 22 (R217♣)	4 (Crush/juice drink/beer ^e); 15 (crush/rubbing on the body); 22 (maceration/washing throat) [5%]
<i>Zanthoxylum chalybeum</i> (Igugu, L or R, JN022)	12 (R15, R92, R220)	12 (Decoction/drink/sweet products and modern medicines ^e) [5%]
Sapindaceae		
<i>Cardiospermum halicacabum</i> (Im-bogobogo, L, JN028)	9 (MOHR, R9♣, R20♣, R28, R46, R63♣, R64, R119♣, 128♣, R132♣, R138♣, R140♣, R154♣, R167♣, R197♣, R200♣); 8 (R28)	8 (Decoction/drink); 9 (maceration/instillation in the ear and/or drink) [35%]
<i>Dodonaea viscosa</i> (Umusasa, L or AP, JN090)	12 (MOHR, R94♣, R111, R260), 2 (R31♣), 10 (R57), 21 (R109, R130)	2 (Decoction/application on the body, or enema/modern medicines ^e); 10 (decoction/drink); 12 (maceration/enema, or drink/beer ^e); 21 (decoction/enema and vapor inhalation) [15%]
<i>Paullinia pinnata</i> (Umusarasara, L or R, JN150)	12 (MOHR), 6 (R56♣)	6 (Decoction/drink); 12 (decoction/drink/sweet products ^e) [3%]
Solanaceae		
<i>Capsicum frutescens</i> (Agapiripiri, S, JN083)	4 (R33)	4 (Powder mixed with a tea decoction/drink/beer ^e) [2%]
<i>Lycopersicon esculentum</i> (Inyanya, L or R, JN146)	3 (R87, R165, 185), 22 (R217)	3 (Calcination/scarifications); 22 (maceration/washing throat) [7%]
<i>Nicotiana tabacum</i> (Itabi, L, JN065)	25 (R52)	25 (Powder/rubbing on the body) [2%]
<i>Physalis angulata</i> (Intumbaswa, L, JN031)	4 (R51, R258)	4 (Maceration/drink) [3%]
<i>Solanum aculeastrum</i> Dunal (Umunembera, L or S, JN105)	2 (R26, R250♣), 12 (R136♣)	12 (Decoction/enema); 2 (decoction/rubbing on the body, or drink/beer ^e) [5%]
<i>Withania somnifera</i> (Umusendabazimu, L or AP, JN058)	9 (R46), 11 (R157), 18 (173, R181♣, R187, R205)	9 (Maceration/instillation in the ear); 11 (powder/rubbing on the body on foot); 18 (maceration/application on the body) [10%]
Theaceae		
<i>Camellia sinensis</i> (Icayi, L, JN055)	5 (R45), 13 (R49)	5 (Decoction/enema/modern medicines ^e); 13 (maceration/massage of the body and enema) [3%]
Typhaceae		
<i>Typha domingensis</i> (Umuberebere, L or R, JN099)	12 (R44, R136, R141, R230♣)	12 (Decoction/enema/beer and sweet products ^e) [7%]
Verbenaceae		
<i>Lantana trifolia</i> (Umuhengerihengeri, L, R or AP, JN133)	4 (R3, R51, R59♣, R90, R96♣, R105 ♣, R107, R122, R131, R135♣, R139 ♣, R171, R192, R212, R223♣, R226), 8 (R117, R166, R198, R201)	4 and 8 (Maceration/drink/beer ^e) [33%]
Vitaceae		
<i>Cissus oliveri</i> (Umugobore, L, JN086)	4 (R270)	4 (Maceration/drink) [2%]
<i>Cyphostemma cyphopetalum</i> (Agasharika, L, JN089)	4 (R39)	4 (Decoction/drink/beer ^e) [2%]
Zingiberaceae		
<i>Aframomum angustifolium</i> (Urutake, S, T or R, JN050)	4 (MOHR, R11♣, R33♣, R39♣, R59, R93, R153, R251♣)	4 (Maceration/drink/beer ^e) [27%]

^a Parts of the plant used: L, Leaves; ST, Stem; R, Roots; WP, Whole plant; AP, Aerial parts; STB, Stem bark; S, Seeds; T, Tuber; FP, fruit peel; FL, flowers; and F, fruit.

^b Microbial diseases treated: 1, Ringworm; 2, Purulent rashes; 3, Pneumonia; 4, Cough; 5, Varicella; 6, Dysentery; 7, Tooth decay; 8, Sinusitis; 9, Otitis; 10, Fever; 11, Foot mycosis; 12, Diarrhea; 13, Measles; 14, Tonsillitis; 15, Typhus; 16, Cholera; 17, Tuberculosis; 18, Yaws; 19, Leprosy; 20, Gonorrhoea; 21, Meningitis; 22, Angina; 23, Syphilis; 24, Tetanus; and 25, Skin mycosis.

^c Recipes presented were multi-herbal recipes (MUHRs) except where the acronym MOHR (mono-herbal recipe) is mentioned. R followed by a number (e.g. R78) corresponds to a multi-herbal recipe; the complete composition of each recipe can be deduced from Fig. 2 (Cytoscape file: relationships between MUHRs and medicinal plants, supplementary data). The sign ♣ indicates that the plant is cited as a major ingredient in the recipe involved, and can be used as MOHR whenever THs cannot obtain the other plants of the recipe. Unless otherwise stated, recipes are composed of approximately equal amounts of each plant.

^d All decoctions and macerations operations are carried out with water as solvent and followed by filtrations before use; most recipes are used as beverages.

^e Interdict cited by THs.

acquired the knowledge to diagnose.

Some healers mix herbal recipes with different ingredients, depending on use, such as cow butter (skin diseases) and honey (diarrhea and cough). To avoid possible side effects, interdicts were made to patients to “make the medicine more effective”; these basically prohibit alcohol, sugary products, and modern medicines. Each type of interdict depends on the type of disease and remedy involved (Table 2). The treatment periods range between 1 and 2 weeks on average, according to the disease (Table 2); and all our informers said that they did not practice magic ceremonies during the treatment.

3.2. Plants identified and corresponding microbial diseases

The present survey identified 155 species of plants used in traditional medicine as antimicrobials by the inhabitants of the city of Bujumbura (Fig. 2, Table 2). These species are grouped into 139 genera and 51 families; the most represented are Asteraceae (20 genera and 25 species), Fabaceae (14 genera and 16 species), Lamiaceae (12 genera and 15 species), Rubiaceae (9 genera and 9 species), Solanaceae (6 genera and 6 species) and Euphorbiaceae (5 genera and 6 families). The majority of these medicinal plants were cited by informers for the treatment of skin diseases (96 species) and diarrheal diseases (66 species) (Table 1). This could be explained by the fact that these diseases (especially cholera and

dysentery), endemic in developing countries in general (WHO, 2012a), are long-known to be highly prevalent in Burundi (Dockx, 1969; Engels et al. 1995; Birmingham et al., 1997; WHO, 2012b), especially among children; this is consistent with the results of surveys about anti-diarrheal plants conducted in Western Burundi by Polygenis-Bigendako and Lejoly (1989). Relatively few plants are used in the treatment of microbial diseases by Burundian traditional medicine.

Indeed, the present ethnobotanical survey revealed 155 different species (in 51 families) for an estimated total of 2752 species (in 179 families) identified in the region; this represents about 6%

of species (Table 3). The estimate number of 2752 species was found by compiling data from Troupin (1978–1987), but probably corresponds to an underestimation.

The most cited plants include (Table 2): (i) for the treatment of skin diseases, *Platostoma rotundifolium* (citation frequency, 75%), *Virectaria major* (72%), *Helichrysum congolanum* (55%), *Stomatanthes africanus* (59%), *Senecio maranguensis* (48%), *Pentas longiflora* (48%), and *Psorospermum baumii* (38%) and (ii) for the treatment of diarrheal diseases, *Justicia subsessilis* (50%), *Aspilia pluriseta* (37%), *Leucas martinicensis* (17%), *Hallea rubrostipulata* (5%) *Pavetta ternifolia* (5%), *Rumex nepalensis* and *Rhus pyroides* var. *Pyroides* (5%).

Table 3

Estimation of the proportion of plants used by THs compared to the number of plant that can be found in the study area.

Families of plants most represented in the region ^a		Families of medicinal plants most used by THs in the present study	
Number of species by family	Families ^b	Number of species cited	Families ^b
Over 50	Acanthaceae (69), Asteraceae (227), Cyperaceae (110), Euphorbiaceae/Phyllanthaceae (74), Fabaceae/Papilionaceae (209), Lamiaceae (80), Myrtaceae (83), Orchidaceae (166), Poaceae (237), Rubiaceae (120)	84	Acanthaceae (4), Asteraceae (25), Euphorbiaceae (6), Fabaceae (17), Lamiaceae (15), Myrtaceae (3), Phyllanthaceae (2), Poaceae (3), Rubiaceae (9)
20–50	Amaranthaceae (35), Apiaceae/Umbelliferae (25), Asclepiadaceae (41), Brassicaceae (20), Caesalpiniaceae (30), Commelinaceae (39), Convolvulaceae (33), Cucurbitaceae (27), Liliaceae (31), Malvaceae (39), Melastomataceae (21), Mimosaceae (25), Moraceae (33), Proteaceae (46), Scrophulariaceae (40), Solanaceae (34), Urticaceae (22), Verbenaceae (30)	20	Amaranthaceae (3), Apiaceae (3), Cucurbitaceae (2), Malvaceae (1), Melastomataceae (2), Moraceae (2), Solanaceae (6), Verbenaceae (1)
11–19	Anacardiaceae (14), Apocynaceae (17), Araceae (15), Balsaminaceae (17), Begoniaceae (12), Boraginaceae (19), Capparaceae/Cleomaceae (14), Caryophyllaceae (15), Clusiaceae (11), Crassulaceae (12), Flacourtiaceae (11), Gentianaceae (11), Loganiaceae (11), Loranthaceae (14), Lythraceae (11), Menispermaceae (11), Oleaceae (13), Polygalaceae (15), Polygonaceae (15), Ranunculaceae (11), Rosaceae (17), Rutaceae (17), Sapindaceae (14), Sterculiaceae (12), Tiliaceae (15), Vitaceae (18)	23	Anacardiaceae (3), Apocynaceae (2), Balsaminaceae (1), Boraginaceae (1), Caryophyllaceae (1), Capparaceae (1), Crassulaceae (1), Oleaceae (1), Polygalaceae (1), Polygonaceae (3), Ranunculaceae (1), Rutaceae (2), Sapindaceae (3), Vitaceae (2)
7–10	Bignoniaceae (8), Campanulaceae (8), Celastraceae (10), Chenopodiaceae (7), Cupressaceae (9), Dioscoreaceae (7), Ericaceae (7), Geraniaceae (8), Iridaceae (8), Lauraceae (8), Lemnaceae (8), Lobeliaceae (10), Marantaceae (8), Meliaceae (10), Musaceae (10), Myrsinaceae (8), Nyctaginaceae (8), Onagraceae (9), Oxalidaceae (8), Portulacaceae (9), Rhamnaceae (9), Sapotaceae (7), Thymelaeaceae (7)	11	Celastraceae (1), Geraniaceae (2), Lauraceae (3), Oxalidaceae (2), Rhamnaceae (3)
5–6	Agavaceae (6), Amaryllidaceae (5), Annonaceae (5), Araliaceae (6), Bromeliaceae (6), Combretaceae (6), Hippocrateaceae (5), Juncaceae (6), Ochnaceae (6), Passifloraceae (5), Piperaceae (6)	3	Amaryllidaceae (1), Araliaceae (1), Piperaceae (1)
4	Alismataceae, Casuarinaceae, Hydrocharitaceae, Molluginaceae, Pittosporaceae, Potamogetonaceae, Primulaceae, Rhizophoraceae, Theaceae, Ulmaceae, Violaceae, Zingiberaceae	4	Primulaceae (2), Theaceae (1), Zingiberaceae (1)
3	Aizoaceae, Amygdalaceae, Aponogetonaceae, Araucariaceae, Aristolochiaceae, Cactaceae, Chrysobalanaceae, Dipsacaceae, Ebenaceae, Gesneriaceae, Hypoxidaceae, Myricaceae, Nymphaeaceae, Pinaceae, Plumbaginaceae, Trapaceae, Turneraceae, Typhaceae	2	Chrysobalanaceae (1), Typhaceae (1)
2	Arecaceae, Bombacaceae, Burseraceae, Callitrichaceae, Caprifoliaceae, Caricaceae, Connaraceae, Cuscutaceae, Cycadaceae, Droseraceae, Fumariaceae, Haloragaceae, Malpighiaceae, Najadaceae, Olacaceae, Papaveraceae, Pedaliaceae, Plantaginaceae, Podocarpaceae, Pontederiaceae, Santalaceae, Simaroubaceae, Xyridaceae	2	Caricaceae (1), Pedaliaceae (1)
1	Alangiaceae, Aquifoliaceae, Balanitaceae, Balanophoraceae, Basellaceae, Burmanniaceae, Cabombaceae, Cannabaceae, Canellaceae, Cannaceae, Ceratophyllaceae, Cornaceae, Dichapetalaceae, Eriocaulaceae, Escalloniaceae, Hamamelidaceae, Hydrangeaceae, Hydnoraceae, Icacinateae, Linaceae, Malaceae, Melianthaceae, Monimiaceae, Oliniaceae, Opiliaceae, Orobanchaceae, Phytolaccaceae, Podostemaceae, Punicaceae, Resedaceae, Salicaceae, Salvadoraceae, Smilacaceae, Sphenocleaceae, Taccaceae, Tropealaceae, Zygophyllaceae	3	Basellaceae (1), Cannabaceae (1), Monimiaceae (1)
–	–		Aloaceae/Xanthorrhoeaceae (1) ^c , Hypericaceae (2) ^c
Total: 2752	179	155	51

^a Data compiled from Troupin (1978–1987).

^b Number in brackets corresponds to the number of species in the family.

^c Species probably introduced after Troupin's work.

Some of these plants (*Virectaria major*, *S. maranguensis*, *P. longiflora* and *P. baumii*, *A. plurisetia*, *J. subsessilis*, *P. ternifolia*, *R. nepalensis* and *R. pyroides* var. *pyroides*) were also mentioned for similar usages in other countries (Maikerere-Faniyo et al., 1989; Rwangabo, 1993), which strengthens our data. In addition, some phytochemical and pharmacological studies performed on some of these species (*V. major*, *S. maranguensis*, *P. longiflora*, *P. baumii*, *A. plurisetia*, *J. subsessilis*, *P. ternifolia* and *R. nepalensis*) could justify their antimicrobial uses in Burundian traditional medicine (Sindambiwe et al., 1999; Nieuwinger, 2000; Cos et al., 2002; Tsaffack et al., 2009). The most cited plant (*P. rotundifolium*) is quite rare in the region and was difficult to harvest in the wild; this is probably why some THs prefer to cultivate it in their gardens. This species, which we recorded as widely used in traditional Burundian medicine, may thus be endangered and conservation measures should be considered.

3.3. Preparations, dosages and routes of administration of medicines

Burundian THs use medicinal plants in diverse forms: solutions (decoction and maceration) to take in the form of drinks or enema, powders (orally or used as ointments, especially for skin diseases), ashes (especially orally or in scarification) and steam (for breathing). The most common modes of preparation of recipes consist in aqueous decoctions and macerations, while drinking and rubbing on the body were the most practiced modes of administration. Our informers state to be able to adjust the doses based on the patient's age (child or adult) and/or his/her physiological state (e.g. pregnancy) using handfuls, pinches, teaspoons, tablespoons, cups, bottles, etc. When analysing the results of this ethnobotanical survey, we tried to estimate the amounts of solutions (volumes) and solids (powder mass or parts of plants), with reference to Chifundera (2001) approximations.

3.4. Recipes applied to the treatment of microbial diseases

According to the Burundian adage “*Imiti ikora ikoranye*” (“*Drugs are more active in combination*”), most of the Burundian medicinal plants are used as a mixture of two or more plants. Thus, during our ethnobotanical survey, we identified 271 different multi-herbal recipes (MUHRs) and 60 mono-herbal recipes (MOHRs) (Table 2, Fig. 2). This phenomenon of polymedication, typical of traditional medicine, was also recorded in the work of Mukazayire et al. (2011) who identified in Rwanda 68 MUHRs and 65 MOHRs used in the treatment of liver diseases. In addition, it is known that plants are capable of producing a large number of antimicrobial molecules but with often low activity (Lewis and Ausubel, 2006) and combining plants in recipes may synergistically increase their antimicrobial activities to clinically significant activities.

Similarly, several authors have mentioned this possibility of direct or indirect antimicrobial synergy among different plants extracts (Al-Bayati, 2008; Capasso and Sorrentino, 2005; Cassella et al., 2002; Efferth and Koch, 2011; Mau et al., 2001; Wagner, 2005, 2011), extracts from different parts of the same plant (Van Vuuren and Viljoen, 2011), different compounds isolated from a plant or from different plants (Hsieh et al., 2001; Mabona et al., 2013; Naidoo et al., 2013; Nazera et al., 2005; Van Vuuren and Viljoen, 2011), plant extracts or compounds and clinically-used antibiotics (Okusa et al., 2007; Rakholiya and Chanda, 2012). Such synergies at tissular levels however require the simultaneous perfusion of tissues by concerned metabolites at the correct concentrations and ratios, which may be difficult to achieve in practice. Nevertheless, some authors have shown that herbal preparations (most often used in traditional medicine) may clearly have a clinical beneficial effect compared to single components (Butterweck et al., 1998; Gagnier et al., 2004; Jäger et al., 2009; Wagner et al., 2004).

As noted above, experienced healers have reported that they are able to estimate the proportions of each plant in the recipe. This is important for herbal medicines as synergy also depends on the proportions (ratios) among extracts or combined products (Hsieh et al., 2001; Wagner and Ulrich-Merzenich, 2009). Along the survey, the main plant (that is to say the plant without which the recipe is incomplete, corresponding to the “emperor” of Chinese herbal formulations) of each MUHR was reported by informants (noted in Table 2 by the sign ♣). The other plants in the composition of a recipe are designated as “secondary” because they can be replaced, depending on the diagnostic, patient or TH. Ninety-three percent of surveyed plants are used in the composition of MUHRs and 8% are exclusively used as MOHRs. *Platostoma rotundifolium* (Briq.) A. J. Paton (Lamiaceae), the most highly cited species, is involved in the composition of 41 different MUHRs, followed by *Virectaria major* (Schum.) Verdc (Rubiaceae, 39 recipes), *Kalanchoe crenata* (Andrews) Haw. (Crassulaceae, 37 recipes), *Stomatanthes africanus* (Oliv. & Hiern) R. M. King & H. Rob. (35 recipes), and *Helichrysum congolanum* Schltr. & O. Hoffm. (Asteraceae, 33 recipes). Concerning MOHRs, the most important herb is *Pentas longiflora* Oliv. (Rubiaceae) with 19 recipes, followed by *Kalanchoe crenata* (Andrews) Haw. (Crassulaceae, 10 recipes), *Gymnosporia senegalensis* (Lam.) Loes. (Celastraceae, 9 recipes), *Tetradenia riparia* (Hochst.) Codd (Lamiaceae, 8 recipes) and *Cardiospermum halicacabum* L. (Sapindaceae, 6 recipes). Some MUHRs were reported by THs as being composed of several plants, up to 7 (R124, Fig. 2). Similar investigations reported synergies of up to 9 plants (Wagner, 2005, 2011).

4. Conclusion

Only very few studies have been published on the use of medicinal plants in Burundian traditional medicine and, to our knowledge, no work has been reported on the medicinal plants, sold in the herbal markets and herbal shops of the city of Bujumbura for antimicrobial properties. This survey of 60 THs has enabled to identify 155 medicinal plants used in the treatment of microbial diseases in Bujumbura. These plants, distributed in 51 families, are used to cure 25 different types of diseases through 271 MUHRs and 60 MOHRs. Among the plants most cited by our informants, some are particularly attractive as they have not been investigated so far, i.e. *Platostoma rotundifolium* (Briq.) A. J. Paton, *Helichrysum congolanum* Schltr. & O. Hoffm., *Senecio maranguensis* O. Hoffm and *Justicia subsessilis* Oliv. Identifying the active compounds and/or investigating synergistic aspects may contribute to the discovery of new antimicrobial strategies, in the hope to overcome resistances, a major worldwide public health problem. As various plants mentioned in this work are also used in traditional medicine in other countries (especially in Africa) for the treatment of similar diseases, this leads us to assert that the information collected from Bujumbura THs complements and reinforces the knowledge of antimicrobial plants applications.

Finally, this study, in line with WHO data, indicates a marked commitment of Burundians towards traditional medicine and pharmacopoeia; according to THs and to our own observations (informal discussions), all levels of society would recourse to THs. A political commitment to promoting traditional medicine is a reality in Burundi (creation of a National Department of Traditional Medicine in the Ministry of Public Health since 2002, celebration of an African Traditional Medicine Day the 31st of August of each year since 2003, etc.); there remains however quite a lot to do in this area, especially in the assessment and monitoring of the quality, effectiveness and safety of the different recipes delivered by THs.

Auteurs contributions

Jérémie Ngezahayo prepared the study, obtained and analysed survey data, collected and identified herby and wrote the paper.

François Havyarimana and Léonard Hari participated to botanical identification

Caroline Stévigny revised the paper

Pierre Duez supervised the study, analysed survey and botanical data and wrote the paper.

Conflict of interests

We report no declaration of interests.

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Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.jep.2015.07.028>.

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Supplementary table: Modes of preparation and administration of herbal recipes reported by respondents

Botanical name (vernacular name, part used ^a , voucher specimen number)	Mode of preparation ^d /Mode of administration/Interdicts ^e / [Citation frequency (% of THs)]
Acanthaceae	
<i>Asystasia gangetica</i> (L.) T. Anderson (Urusogo, L, JN027)	9 (A handful of fresh leaves are packed in banana leaves, heated and the juice is squeezed out from the leaves /A drop is instilled in the ear twice a day) [3%]
<i>Justicia nyassana</i> Lindau (Ikinga, L or AP, JN068)	5 (A handful of leaves are decocted in a bottle of water and rubbed on the body twice a day); 6 (150 g of fresh leaves are pounded and decocted in water (2 glasses)/ A cup (mixed with honey) is drunk twice a day/Beer, sweet products and modern medicines ^e); 12 (A handful of leaves are macerated in a bottle of water/Half a glass is drunk twice a day for 7 days); 13 (A handful of leaves are decocted in water (1 L)/Half a cup is drunk once a day, and decoction is rubbed on the body twice a day until recovery/Beer ^e) [32%]
<i>Justicia subsessilis</i> Oliv. (Umubazibazi, L, JN007)	25 (A handful of dried leaves are pounded, powdered and mixed with cow butter/The mixture is rubbed on the body twice a day for a week) [50%]
<i>Thunbergia alata</i> Bojer ex Sims (Iganzamwonga, L or AP, JN102)	2 (2 handfuls of fresh leaves are pounded, decocted in 1 L of water and mixed with cow butter/The mixture is applied on the body, half a cup is drunk twice a day and enema once a day); 5 (A handful of leaves decocted in water (1 L)/The decoction is rubbed on the body twice or twice a day); 6 (A handful of fresh leaves are pounded and decocted in water (3 glasses)/A cup is drunk twice a day/Sweet products and modern medicines ^e); 17 (A handful of leaves are decocted in water (1 L)/A cup (mixed with honey) is drunk twice a day for 7 days/Beer and modern medicines ^e); 13 (A handful of leaves are macerated in water (a bottle) /The macerate is rubbed on the body twice a day for 3 days/Beer ^e); 19 (300 g of dried plant material are pounded, powdered and mixed with cow butter/The mixture is rubbed on the body 3 time a day) [35%]
Aloaceae	
<i>Aloe lateritia</i> Engl. (Ingagari, L or R, JN079)	12 (A handful of leaves are macerated in water (1 L)/Half a glass twice is drunk a day); 2 (2 handfuls of fresh leaves are crushed/ The juice squeezed out from the crushed leaves is applied on the body); 11 (A fresh leaf is cut and the sap is dropped on the foot); 20 (About 150 g of roots are decocted in a bottle of water/A cup is drunk a day for a week /Beer ^e) [7%]
Amaranthaceae	
<i>Chenopodium ambrosioides</i> L. (Umunceke, L, JN016)	13 (3 handfuls of leaves are macerated in water (2 L)/The macerate is applied on the body once a day for 2 days); 25 (A handful of dried leaves are pounded, powdered and mixed with cow butter/The mixture is rubbed on the body twice a day for a week) [3%]
<i>Chenopodium ugandae</i> (Aellen) Aellen (Umugombe, L, JN073)	3 (A handful of leaves are macerated in water (1 L)/2 glasses are drunk a day until recovery; 2 handfuls of dried leaves are calcined/Scarifications are practiced once a day); 12 (A handful of leaves are macerated in water (a bottle)/A glass is drunk twice a day for 3 days); 1-2 (A handful of dried leaves are pounded and mixed with cow butter/The mixture is applied on the body and two pinches are eaten once a day until recovery) ; 9 (A handful of fresh leaves are pounded and the juice is squeezed out from the leaves/ 3 drops are instilled in the ear twice a day until recovery/Beer and modern medicines ^e); 16 (100 g of dried leaves are pounded and powdered/A spoonful powder is eaten 3 times a day/Beer and modern medicines ^e); 25 (About 500 g of dried leaves are pounded, powdered and mixed with cow butter/The mixture is rubbed on the body twice a day for a week); 5 (2 handfuls of leaves are macerated in water (2 bottles) and applied on the body twice a day) [17%]
<i>Cyathula uncinulata</i> (Schrad.) Schinz (Ikiramata, L, JN015)	3 (A handful of leaves are decocted in water (1 L)/A glass is drunk a day); 12 (A handful of leaves are macerated in water (1 L)/The macerate is used as enema once daily (child) in the evening, or a glass (mixed with honey) is drunk a day (adult) for recovery/Beer ^e) [7 %]
Amaryllidaceae	
<i>Allium cepa</i> L. (Igitunguru, L or T, JN077)	4 (Juice is squeezed out from a handful of crushed tubers and mixed with 2 spoons of sugar and lemon juice/Half a spoon (child) or a spoon (adult) is drunk twice a day/Beer ^e) [3%]
Anacardiaceae	
<i>Lannea schimperi</i> (Hochst. ex A. Rich.) Engl. (Umufute, STB, JN039)	12 (A handful of stem barks are macerated in water (1 L)/A glass is drunk twice a day for 3 days) [2%]
<i>Mangifera indica</i> L. (Umwembe, L, JN148)	10 (A handful of leaves are decocted and water (2 glasses)/Vapor is inhaled and a cup of decoction is drunk twice a day/Beer ^e); 12 (A handful of leaves are macerated in water (500 mL) and used as enema once a day for 3 days) [3%]
<i>Rhus pyroides</i> Burch. var. <i>pyroides</i> (Umusagara, L, JN006)	6 (A handful of fresh roots are pounded and decocted in water (1 L)/A cup is drunk a day); 12 (A handful of leaves are macerated in water (3 glasses)/The macerate is used as enema (child) once daily in the evening/Beer and modern medicines ^e) [5%]
Apiaceae	
<i>Centella asiatica</i> (L.) Urb. (Gutwikumwe, L, JN117)	8 (A handful of leaves are packed in banana leaves and heated in the ash/ Vapor is inhaled until recovery); 9 (A handful of fresh leaves are pounded, and/or macerated in water (a bottle)/3 drops of the pounded leaves are instilled in the ear twice a day, or a cup of decoction is drunk a day/Beer ^e) [7%]
<i>Heteromorpha arborescens</i> var. <i>abyssinica</i> (Hochst. ex A. Rich.) H. Wolff (Umuturampene, L or R, JN071)	1 (2 handfuls of dried leaves are pounded and/or decocted in a bottle of water/The pounded leaves are mixed with cow butter and rubbed on the body, or a bottle of the decoction is drunk twice (morning and evening) a day); 6 (A handful of fresh roots are pounded and decocted in water (1 L)/A cup is drunk a day and used as enema once in two days) [3%]
<i>Steganotaenia araliacea</i> Hochst. (Umugnasha, AP or STB, JN003)	12 (A handful of aerial parts are decocted in water (1 L)/Half a glass is drunk twice a day for 2 weeks) [7%]

Botanical name (vernacular name, part used ^a , voucher specimen number)	Mode of preparation ^d /Mode of administration/Interdicts ^e / [Citation frequency (% of THs)]
Apocynaceae	
<i>Periploca linearifolia</i> Quart. -Dill. & A. Rich. ex A. Rich. (Umuguguna, L, JN062)	1, 2 & 5 (A handful of dried leaves are pounded, powdered and mixed with cow butter/The mixture is rubbed on the body once two days until recovery/Beer and modern medicines ^e) [5%]
<i>Rauvolfia mannii</i> Stapf (Ibamba, L, AP or STB, JN115)	5 (A handful of leaves are decocted in a bottle of water and applied on the body twice a day); 12 (A handful of plant material are decocted in water (2 glasses) and mixed with honey/A spoon (child) is drunk 3 times a day, or a glass (adult) a day); 13 (A handful of leaves are decocted in a bottle of water/Half a cup is drunk once a day, and the decoction is rubbed on the body twice a day for 5 days) [13%]
Araliaceae	
<i>Polyscias fulva</i> (Hiern) Harms (Umwungo, STB, JN036)	10 (150 g of stem barks are decocted in a bottle of water/A small cup is drunk 3 times a day/ Beer ^e) [2%]
Asteraceae	
<i>Ageratum conyzoides</i> L. (Akarura, L or AP, JN075)	2 (Two handfuls of dried plant material are calcined and mixed with cow butter/The ash is applied on the body ; and/or two pinches are eaten once a day until recovery / Modern medicines ^e); 18 (Two handfuls of fresh leaves are macerated in water (1,5 L)/The decoction is applied on the body once a day) [12%]
<i>Anisopappus chinensis</i> subsp. <i>africanus</i> (Hook. f.) S. Ortiz & Paiva (Umukamisha, L, JN048)	8 (A handful of dried stem bark are powdered/Two pinches powder are applied in nose twice a day using a finger) [3%]
<i>Aspilia plurisetata</i> Schweinf. (Icumya, L or AP, JN080)	1-2 (2 handfuls of leaves are pounded, and/or decocted in water (1 L) /The pounded leaves are mixed with cow butter and applied on the body, or half a cup of the decoction is drunk twice a day and used as enema once a day); 5 (A handful of fresh leaves are pounded, macerated in a bottle of water and mixed with cow butter/The body is washed with the macerate once a day); 12 (A handful of fresh leaves are decocted in ½ L of water/Enema once daily in the morning for 3 days/Sweet products and modern medicines ^e); 10 (3 handfuls of fresh leaves are crushed, macerated with 1L of water/A cup (adult) or half a cup (child) is drunk twice a day for 5 days); 18 (3 handfuls of dried leaves are powdered and mixed with cow butter/The mixture is applied on the foot once a day); 11 (3 handfuls of dried leaves are powdered and mixed with cow butter/The mixture is applied on the foot once a day); 13 (3 handfuls of fresh leaves are pounded/Application on the body once or twice a day) [37%]
<i>Bidens pilosa</i> L. (Icanda, L, AP or WP, JN049)	3 (A handful plant material is decocted in 500 mL of water/A glass is drunk once a day); 1-2 (About 260 g of fresh leaves are pounded and/or decocted in a bottle of water/The pounded leaves are rubbed on the body twice a day and/or a cup of the decoction is drunk twice a day till recovery)[12%]
<i>Bothriocline longipes</i> (Oliv. & Hiern) N.E.Br. (Umubebe, L, JN053)	7 (Teeth are brushed with a single plant leaf once a day) [2 %]
<i>Carduus nyassanus</i> (S. Moore) R.E. Fr. (Igihandambwa, L or AP, JN084)	1-2 (500 g of dried leaves are calcined / The ash (mixed with cow butter) is applied on the body and/or two pinches are eaten once a day until recovery/Modern medicines ^e) [28%]
<i>Crassocephalum vitellinum</i> (Bentham) S. Moore (Akayungubira, L or AP, JN119)	12 (A handful of leaves are macerated in water (500 mL) and mixed with honey/A spoon is drunk 3 times a day for 2 days/Beer and modern medicines ^e); 1 (2 handfuls of dried leaves are calcined and mixed with cow butter/The ash is applied on body once a day); 21 (A handful of dried leaves are pounded and decocted in water (a bottle)/The decoction is used as enema and vapor is inhaled)[8%]
<i>Dichrocephala integrifolia</i> (L.f.) O. Ktze (Agatambambuga, L, JN033)	12 (A handful of leaves are decocted in water (3 glasses) and mixed with honey/A spoon is drunk 3 times a day (child), or one glass once a day (adult)) [3%]
<i>Dicoma anomala</i> Sond. (Umwanzuranya, L, STB, T or R, JN120)	12 (A handful of leaves are decocted in water (1 L)/Half a glass is drunk 3 times a day/Beer, sweet products and modern medicines); 1 (About 300 g of dried leaves are pounded and mixed with cow butter/The mixture is applied on the body once a day until recovery); 2 (2 handfuls of dried leaves are pounded and calcined/A spoonful powder is eaten 3 times a day) [15%]
<i>Gutenbergia cordifolia</i> Benth. ex Oliv. (Umweza, L, JN029)	12 (A handful of leaves are macerated in 720 mL of water/Enema is practiced once daily in the evening (child), or a glass (mixed with honey) is drunk a day until recovery (adult)/ Beer ^e); 2 (2 handfuls of fresh leaves are crushed, and/or decocted in water (1 L)/The crushed leaves are mixed with cow butter and rubbed on the body, or decoction is used as enema once a day/modern medicines ^e) [8%]
<i>Helichrysum congolanum</i> Schltr. & O. Hoffm. (Ngabimwe, L, AP or R, JN013)	12 (A handful of dried leaves are powdered/A spoonful powder is eaten a day/Sweet products ^e); 1-2 (2 handfuls of dried aerial parts are calcined/The ash is mixed with cow butter and rubbed on the body once two days until recovery, and two pinches powder are eaten once a day) [55%]
<i>Helichrysum keilii</i> Moeser (Imanayeze, L, JN094)	1 (A handful of leaves are decocted in a bottle of water/Enema is practiced once a day for 3 days/Beer ^e); 2 (2 handfuls of dried leaves are pounded, and/or decocted in water (1,5 L)/The pounded leaves are mixed with cow butter and rubbed on the body, or a cup of decoction is drunk twice a day and used as enema once a day) [5%]
<i>Melanthera scandens</i> (Schumach. & Thonn.) Roberty (Akavunjahoma, L, JN066)	10 (A handful of leaves are decocted in water (a bottle)/A cup (adult) or half a cup (child) is drunk twice a day for 2 days) [2%]
<i>Microglossa pyrifolia</i> (Lam.) Kuntze (Umuhe, L or AP, JN134)	1 (2 handfuls of leaves are decocted in water (a bottle)/The decoction is used as enema once a day for 3 days/Beer ^e); 2 (A handful of dried leaves are pounded, and/or decocted in water (a bottle)/The pounded leaves are mixed with cow butter and rubbed on the body, or a cup of decoction is drunk twice a day and enema once a day); 5 (2 handfuls of fresh leaves are pounded, macerated in water (1,5 L) and mixed with cow butter/The mixture is rubbed on the body once a day); 17 (A handful of

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	leaves are decocted in water (a bottle)/A cup (mixed with honey) is drunk twice a day for 7 days/ Beer and modern medicines ^e ; 21 (A handful of dried leaves are pounded and decocted in water (1 L)/Enema is practiced and vapor is inhaled once a day) [17%]
<i>Mikania natalensis</i> DC. (Nkuyumwonga, L or AP, JN005)	12 (A handful of leaves are decocted in water (1 L)/Enema is practiced twice a week in the evening); 1-2 (A handful of dried leaves are calcined and mixed with cow butter/The mixture is applied on the body, or two pinches are eaten once a day until recovery/Modern medicines ^e); 11 (A handful of dried leaves are powdered and mixed with cow butter/The mixture is applied on the foot twice a day until recovery); 14 (A handful of leaves are pounded and decocted in water (1 L)/A cup is drunk twice a day only); 21 (A handful of dried leaves are pounded and decocted in water (1 L)/Enema is practiced and vapor is inhaled once a day) [30%]
<i>Senecio maranguensis</i> O. Hoffm. (Imbatura, L, AP or R, JN010)	1 (2 handfuls of dried aerial parts are decocted in water (a bottle) and mixed with cow butter/The mixture is applied on the body and uses as enema once a day/Beer ^e); 2 (About 270-300 g of dried leaves are calcined and mixed with cow butter/The ash is applied on the body, and 2 pinches are eaten once a day until recovery/Modern medicines ^e); 5 (300 g of fresh leaves are pounded, macerated and mixed with cow butter/The mixture is rubbed on the body once a day); 18 (A handful of dried leaves are powdered and mixed with cow butter/The mixture is rubbed on the body once a day); 11 (2 handfuls of dried leaves are powdered, mixed with cow butter and rubbed on foot twice a day until recovery); 19 (A handful of fresh leaves are pounded, and/or macerated in water (1 L)/The pounded leaves are mixed with cow butter and rubbed on the body, or a cap of macerate is drunk once a day) [48%]
<i>Solanecio angulatus</i> (Vahl) C. Jeffrey (Ikivurahinda, L, JN025)	5 (A handful of leaves are macerated in water (a bottle) and applied on the body twice a day) [2%]
<i>Solanecio cydoniifolius</i> (O. Hoffm.) C. Jeffrey (Icegera, L, JN107)	2 (300 g of dried leaves are calcined and mixed with cow butter/The ash is rubbed on the body and two pinches are eaten once a day until recovery/modern medicines ^e) [2%]
<i>Solanecio mannii</i> (Hook. f.) C. Jeffrey (Umutagari, L, JN035)	10 (A handful of leaves are macerated in water (1 L)/A cup (adult) or half a cup (child) is drunk twice a day for 5 days); 11 (1/2 kg of dried leaves are powdered and mixed with cow butter/The mixture is rubbed on foot once a day); 10 (A handful of leaves are decocted in a bottle of water/A cup (adult) or half a cup (child) is drunk twice a day for 2 days); 12 (A handful of leaves are macerated in water (3 glasses) /A glass is drunk twice a day for 3 days) [10%]
<i>Sphaeranthus suaveolens</i> (Forssk.) DC. (Ikinini, L, JN106)	1 (250 g of dried leaves are calcined and mixed with cow butter/The ash is rubbed on the head and 2 pinches are eaten once a day/Beer ^e); 2 (2 handfuls of dried leaves are pounded and decocted with a bottle of water/A cup is drunk twice a day and enema once a day); 5 (A handful of dried leaves are pounded, powdered and mixed with palm oil/The mixture is rubbed on the body twice a day/Beer ^e) [7%]
<i>Spilanthes mauritiana</i> (A. Rich. ex Pers.) DC. (Ishwemu, L, JN104)	7 (A handful of leaves are packed in banana leaves and heated in the ash /Teeth are brushed twice a day for 3 days) [17%]
<i>Stomatanthus africanus</i> (Oliv. & Hiern) R. M. King & H. Rob. (Umweyo, L, R or WP, JN012)	12 (A handful of dried leaves are powdered/A spoonful powder is eaten a day/Sweet products); 1 (350 g of dried aerial parts are calcined/The ash is mixed with cow butter and rubbed on the body once 2 days until recovery, and 2 pinches of ash are eaten once a day/Modern medicines ^e); 2 (3 handfuls of dried leaves are pounded, and/or decocted in 2 L of water /The pounded leaves are mixed with cow butter and rubbed on the body, or a cup of decoction is drunk twice a day and used as enema once a day) [59%]
<i>Vernonia amygdalina</i> Delile (Umufumya, L, JN032)	5 (A handful of leaves are macerated in 2 glasses of water/Half a cup is drunk a day, and the macerate is rubbed on the body once a day)/Beer and sweet products ^e); 7 (100 g of fresh roots barks are pounded and used to brush the teeth once in 2 days); 12 (Decoction /A glass is drunk daily for 3 days/Beer ^e); 2 (2 handfuls of fresh leaves are pounded and rubbed on the body once a day); 10 (A handful of leaves are macerated in water (a bottle)/A cup (adult) or half a cup (child) is drunk twice a day for 5 days); 13 (A handful of leaves are decocted in water (1 L) and rubbed on the body twice a day for 3 days) [22%]
<i>Vernonia hochstetteri</i> Sch. Bip. (Ikinyami, L or AP, JN098)	21 (A handful of dried leaves are pounded and decocted in water (1 L)/Enema is practiced and vapor is inhaled) [3%]
<i>Vernonia kirungae</i> R. E. Fr. (Uruhombu, L, STB or AP, JN043)	3 (A handful of leaves are decocted in water (1 L)/Enema is practiced and vapor is inhaled once a day); 1-2 (2 handfuls of dried leaves are calcined/The ash is mixed with cow butter and rubbed on the body, or two pinches are eaten once a day until recovery/Modern medicines ^e); 5 (Fresh plant material (about 300 g) are pounded, macerated and mixed with cow butter/The mixture is rubbed on body once a day) [17%]
Balsaminaceae	
<i>Impatiens burtonii</i> Hook. f. (Igisogoro, L or WP, JN096)	1 (2 handfuls of fresh leaves are pounded, and/or decocted in water (bottle)/The pounded leaves are mixed with cow butter and rubbed on the body; or the decoction is drunk twice (morning and evening) a day); 11 (About 50 g of dried plant material are powdered and mixed with cow butter/ The mixture is applied on foot once a day) [10%]
Basellaceae	
<i>Basella alba</i> L. (Umurerama, L or AP, JN081)	1 (350 g of dried leaves are pounded, calcined and salted/Half a spoon is eaten twice a day); 2 (2 handfuls of dried leaves are pounded and decocted in water (a bottle)/ The decoction (mixed with cow butter) is applied on the body, and a cup is drunk twice a day and enema twice a day); 5 (A handful of dried leaves are pounded, powdered and mixed with cow butter /The mixture is rubbed on the body once 2 days until recovery) [18%]
Boraginaceae	

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<i>Cordia africana</i> Lam. (Umuhasahasa, L, JN115)	9 (A handful of leaves are pounded, and/or macerated in a bottle of water/ Few drops are instilled in the ear, or a cup of decoction is drunk a day) [2 %]
Cannabaceae	
<i>Trema orientalis</i> (L.) Blume (Umugwampore, L or STB, JN101)	25 (500 g of dried leaves are pounded, powdered and mixed with cow butter/The mixture is rubbed on the body twice a day for a week) [2%]
Caricaceae	
<i>Carica papaya</i> L. (Ipapaye, R or S, JN057)	10 (50 g of roots are pounded and macerated with 1L of water/A cup is drunk each day); 12 (50 g of roots are macerated in water (1 L)/A glass is drunk twice a day) [3%]
Caryophyllaceae	
<i>Drymaria cordata</i> (L.) Willd. ex Roem. & Schult. (Urura rw'inzovu, L or AP, JN121)	8 (A handful of fresh leaves are crushed/Instillation of 2-3 drops (of juice squeezed out from crushed leaves) in the nose 3 times a day; and/or a handful of fresh leaves are decocted in 200 mL of water /1-2 spoons are drunk twice a day [5%]
Celastraceae	
<i>Gymnosporia senegalensis</i> (Lam.) Loes. (Umusongati, L, STB or R, JN070)	3 (About 300 g of roots are maceration in water (2 L)/A glass is drunk once a day for recovery; A handful of dried leaves are calcined/Scarifications are practiced once a day) [25%]
Chrysobalanaceae	
<i>Parinari curatellifolia</i> Planch. ex Benth. (Umunazi, STB or R, JN152)	12 (130-150 g of roots are decocted in a bottle of water/Half a glass is drunk 3 times a day for 3 days /Sweet products ^e); 5 (350 g of dried stem balks are pounded, powdered mixed with cow butter/The mixture is rubbed on the body once a day); 15 (300 g of roots are pounded and decocted in 1,5 L of water/Half a cup is drunk twice (morning and evening) a day); 17 (150 g of roots are decocted in water (1 L)/A cup (mixed with honey) is drunk twice a day for 7 days/Beer and modern medicines ^e) [13%]
Cleomaceae	
<i>Cleome gynandra</i> L. (Urusogi, L, JN024)	12 (A handful of leaves are decocted in water (a bottle)/Half a glass is drunk twice a day for two weeks) [2%]
Crassulaceae	
<i>Kalanchoe crenata</i> (Andrews) Haw. (Ikizirankuga, L, AP, R or WP, JN132)	8 (A handful of leaves are crushed, and/or decocted with 500 mL of water/2-3 drops of the juice squeezed out from crushed leaves are instilled in the nose 3 times a day for a week, or 1-2 spoons of decoction are drunk twice a day); 1 & 5 (A leaf of the plant is cut and the sap is dropped on body); 4 (A handful of leaves are macerated in water (1 L)/A glass (mixed with honey) is drunk twice a day/ Beer ^e); 11 (About ½ kg of fresh leaves are packed in banana leaves and heated in the ash/The juice is squeezed out from leaves and dropped on the foot once a day); 9 (A handful of leaves are pounded, and/or macerated in water (2 glasses)/A drop of juice squeezed out from leaves is instilled in the ear twice a day, or a cup of macerate is drunk a day until recovery/Modern medicines ^e) [62%]
Cucurbitaceae	
<i>Momordica foetida</i> Schumach. (Umwishwa, L or AP, JN135)	1 (150 g of fresh leaves are pounded and the juice squeezed out from leaves is dropped on the body); 2 (A handful of fresh leaves are crushed and decocted in water (720 ml)/The crushed leaves are mixed with cow butter and rubbed on the body, or the decoction is used as enema once a day/modern medicines ^e); 5 (500 g of fresh leaves are pounded and rubbed on the body once or twice a day); 12 (A handful of leaves are macerated in water (1 L)/A glass is drunk twice a day for 3 days); 18 (About 300-350 g of dried leaves are powdered and mixed with cow butter/The mixture is rubbed on the body once a day); 11 (½ kg of fresh leaves are pounded and rubbed on foot twice a day until recovery); 13 (A handful of leaves are macerated in a bottle of water/The macerate is rubbed on the body twice a day for 3 days); 19 (A handful of fresh leaves are pounded, and/or macerated in water (1 L)/The pounded leaves are mixed with cow butter and rubbed on the body once a day, or a glass of macerate is drunk once a day) [48%]
<i>Zehneria scabra</i> (L.f.) Sond. (Umushishiro, L or AP, JN041)	1-2 (2 handfuls of dried aerial parts are decocted in water (720 mL) and mixed with cow butter/The decoction is applied on the body and used as enema once a day/Modern medicines ^e); 8 (A handful of fresh leaves are crushed/2-3 drops (of juice squeezed out from crushed leaves) are instilled in the nose 3 times a day for a week; and/or a handful of fresh leaves are decocted in 200 ml of water/1-2 spoons are drunk twice a day); 7 (A handful of leaves are decocted in warm water (1 L) and used to brush the teeth twice a day); 11 (500 g of fresh leaves are crushed and rubbed on foot twice a day until recovery); 5 (300 g of fresh leaves are pounded, macerated in water (1 L) and mixed with cow butter/The mixture is rubbed on the body once a day); 15 (A handful of leaves are macerated in water (a bottle) and applied on the body twice a day); 17 (A handful of leaves are decocted in water (1 L)/A cup (mixed with honey) is drunk twice a day for 7 days/Beer and modern medicines ^e); 25 (About 300-350 g of dried leaves are pounded, powdered and mixed with cow butter/The mixture is rubbed on the body twice a day for a week) [47%]
Euphorbiaceae	
<i>Acalypha ambigua</i> Pax (Umukundanya, STB, JN047)	12 (A handful of stem balk are macerated with 1 L of water/A glass is drunk twice a day for 3 days) [2%]
<i>Acalypha brachiata</i> C. Krauss (Kamimura, L, JN051)	12 (A handful of fresh leaves are decocted in a glass of water/Drunk as a teaspoon (mixed with honey) 3 times (child) or as a glass (adult) per day; 1 (A handful of dried leaves are pounded and/or decocted with water (a bottle)/The powder (mixed with cow butter) is applied on the body and/or one bottle of the decoction is drunk twice (morning and evening) a day) [5%]
<i>Erythrococca bongensis</i> Pax (Umutinti, L, JN072)	1 (2 handfuls of leaves are decocted in water (1,5 bottle)/2 soup spoons (child) or half a cup (adult) are drunk twice a day for 4 days; 2 (About 200-250 g of dried leaves are pounded, and/or decocted

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	in a bottle of water/The pounded leaves are mixed with cow butter and applied on the body, or a cup of the decoction is drunk twice a day and used as enema once a day; 18 (½ kg of dried leaves are powdered and mixed with cow butter/The mixture is rubbed on the body once a day) [7%]
<i>Jatropha curcas</i> L. (Ikivurahinda, L, JN131)	1 (2 handfuls of fresh leaves are crushed and the juice squeezed out from leaves is mixed with cow butter and applied on the head) [3%]
<i>Ricinus communis</i> L. (Ikibonobono, S, JN113)	1 (500 g of seeds are powdered/The powder is rubbed on the body twice a day for 3 days) [2%]
<i>Tragia brevipes</i> Pax (Isusa, L, JN023)	12 (A handful of leaves are decocted in water (1 L) and mixed with honey/Half a glass is drunk twice a day) [2%]
Fabaceae	
<i>Acacia hockii</i> De Wild (Umugenge, L or STB, JN014)	8 (Dried stem bark (500 g) are pounded and powdered/Two pinches powder are applied in noses once a day for a week using a finger; and/or the powder is decocted with 1L of water/Two glasses are drunk twice a day); 3 (About 300 g of plant material are calcined/ Scarifications are practiced once a day and two pinches powder are eaten) [3%]
<i>Acacia sieberiana</i> var. <i>woodii</i> (Burt Davy) Keay & Brenan (Umunyinya, STB, JN026)	7 (A handful of young stem bark are packed in banana leaves and heated in the ash /Teeth are brushed with the plant material once a day) [5%]
<i>Albizia adianthifolia</i> (Schumach.) W. Wight (Umusebeyi, L, JN004)	2 (2 handfuls of dried leaves are calcined and mixed with cow butter/The ash is applied on the body) [3%]
<i>Alysicarpus zeyheri</i> Harv. (Uruzi, R, JN078)	24 (About 300 g of roots are pounded and decocted in 1 L of water/The decoction is applied on the body twice a day) [5%]
<i>Arachis hypogaea</i> L. (Ibiyoba, L, JN052)	11 (50 g of fresh leaves are macerated in water (about 250 ml)/The macerate is applied on foot once a day) [8 %]
<i>Caesalpinia decapetala</i> (Roth) Alston (Umubambangwe, R, WP, JN153)	3 (A handful of dried leaves are macerated in water (a bottle)/A glass is drunk once a day until recovery; and/or a handful of dried leaves are calcined/Scarification once a day) [3%]
<i>Cassia kirkii</i> Oliv. (Agashiha, R, JN085)	6 (A handful of fresh roots are pounded, decocted in water (1 L) and filtered/A cup is drunk a day and used as enema once a day) [2%]
<i>Entada abyssinica</i> Steud. ex A. Rich. (Umusange, L or R, JN154)	6 (About 200 g of fresh roots are pounded, decocted in water (720 mL) and filtered/The decoction is used as enema once a day); 12 (A handful of leaves are macerated in water (1 L) and used as enema once daily in the evening) [8%]
<i>Eriosema lebrunii</i> Staner & De Craene (Inanka, S, JN122)	11 (A handful of fresh leaves are crushed/Squeeze the juice out of fresh leaves and drop it on the foot twice (morning & evening) a day) [2%]
<i>Eriosema montanum</i> Baker f. (Umukonyantoke, L, JN091)	12 (A handful of leaves are macerated in water (1 L)/The macerate is used as enema once daily in the evening (child), or a glass (mixed with honey) is drunk a day (adult) until recovery/Beer ^e); 1 (About 280-300 g of dried leaves are calcined/ Two pinches powder are eaten twice a day until recovery) [2%]
<i>Erythrina abyssinica</i> Lam. ex DC. (Umurinzi, L, R or STB, JN124)	2 (2 handfuls of fresh leaves are pounded, or decocted in a bottle of water/The pounded leaves are rubbed on the body, or half a cup is drunk daily until recovery/Beer ^e); 7 (10 g of stem barks are pounded and rubbed on the teeth once in 2 days); 12 (A handful of leaves are macerated in water (1 L)/The enema is practiced once daily in the evening (child)/Beer and modern medicines ^e); 10 (100 g of roots are pounded and macerated in ½ L of water / 500 mL are drunk a day for 5 days/Beer ^e); 17 (A handful of leaves are decocted in water (a bottle)/A cup (mixed with honey) is drunk twice a day for 7 days/Beer and modern medicines ^e) [5%]
<i>Indigofera arrecta</i> Hochst.ex A. Rich. (Umusorora, L, JN067)	1 (2 handfuls of dried leaves are pounded and mixed with cow butter/The mixture is rubbed on the body once a day) [3%]
<i>Pericopsis angolensis</i> (Baker) Meeuwen (Umubangwa, L, AP or R, JN061)	4 (A handful of leaves are decocted in water (3 glasses)/A small glass is drunk twice a day) [7%]
<i>Pseudarthria hookeri</i> var. <i>argyrophylla</i> Verdc. (Ikigubugubu, L or AP, JN060)	1 (170 g of dried leaves are pounded, powdered and mixed with cow butter/The powder is rubbed on the body once a day until recovery); 2 (A handful of dried leaves are calcined/One pinch of ash is eaten once a day) [3%]
<i>Senna didymobotrya</i> (Fresen.) H.S. Irwin & Barneby (Umubagabaga, L, JN108)	9 (A handful of fresh leaves are pounded/3 drops of juice squeezed out from the leaves are instilled in the ear twice a day for 2 days); 10 (A handful of leaves are decocted in water (1 L)/Enema is practiced and vapor is inhaled twice a day) [12%]
<i>Sesbania sesban</i> (L.) Merr. (Umunyegyeyegye, L or R, JN037)	8 (Juice is squeezed out from a handful of crushed fresh leaves/2-3 drops are instilled in the nose 3 times a day for a week; and/or a handful of fresh leaves are decocted in 200 ml of water /1-2 spoons are drunk twice a day); 3 (100 g of dried leaves are calcined/Scarifications are practiced once a day); 7 (Root powder (3 pinches) is decocted in a glass of water/The decoction is used to brush the teeth once a day); 9 (A handful of leaves are pounded, and/or macerated in water (1 L)/3 drops of juice squeezed out from the leaves is instilled in the ear twice a day, or a cup of macerate is drunk a day/Beer ^e) ; 23 (A handful of leaves are decocted in water (1 L)/A glass is drunk twice a day for 6 days/Beer ^e) [17%]
<i>Vigna luteola</i> (Jacq.) Benth. (Umuryanyoni, L or AP, JN097)	2 (Fresh leaves (about 300 g) are crushed, decocted and mixed with cow butter/The mixture is applied on the body and used as enema once a day/Modern medicines ^e); 10 (A handful of leaves are pounded and decocted in a water (3 glasses)/A glass is drunk 3 times a day for 3 days); 12 (A handful of leaves are macerated in a bottle of water/The macerate is used as an enema once daily in the evening for 3 days) [7%]
Geraniaceae	

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<i>Geranium aculeolatum</i> Oliv. (Incaruza, L, JN130)	12 (A handful of dried leaves are powdered/A spoonful powder is eaten a day/Sweet products ^e); 1-2 (3 handfuls of dried leaves are powdered and mixed with cow butter /The mixture is rubbed on the body once a day) [7%]
Hypericaceae	
<i>Hypericum revolutum</i> Vahl (Umusesankware, L or AP, JN127)	1 (2 handfuls of dried aerial parts are calcined/2 pinches of ash are eaten twice a day for recovery); 2 (2 handfuls of dried leaves are pounded, and/or decocted in a bottle of water/The pounded leaves are mixed with cow butter and rubbed on the body, or a cup of decoction is drunk twice a day and enema twice a day); 5 (About 350 g of dried leaves are pounded, powdered and mixed with cow butter/The mixture is rubbed on the body once 2 days for recovery) [12%]
<i>Psorospermum baumii</i> Engl. (Umukubagwa, L, STB or R, JN076)	1 (A handful of dried leaves powdered and mixed with cow butter/The powder is rubbed on the body twice a day); 2 (2 handful of dried leaves are pounded and/or decocted in water (a bottle)/The pounded leaves are mixed with cow butter and rubbed on the body, or a cup of decoction is drunk twice a day and used as enema twice a day); 5 (500 g of dried leaves are pounded, powdered and mixed with cow butter/ The mixture is rubbed on the body twice a day/Beer ^e); 11 (300 g of dried leaves are powdered and mixed with cow butter/The mixture is rubbed on foot once a day); 4 (A handful of fresh leaved are macerated in 1 L of water/A glass is drunk twice (morning & evening) a day until recovery); 15 (150-200 g of stem balks are pounded and decocted in a 2 bottles of water/ Half a cup is drunk twice (morning and evening) a day); 20 (130-150 g of roots are pounded and decocted in 1,5 L of water/A small glass is drunk twice (morning & evening) a day/Sweet products and modern medicines ^e) [38%]
Lamiaceae	
<i>Clerodendrum johnstonii</i> Oliv. (Umunyankuru, L, JN087)	8 (500 g of leaves are decocted in 1 L of water /A glass is drunk twice a day);12 (A handful of leaves are macerated in ½ L of water/A glass is drunk a day for 3 days); 13 (About 200 g of fresh leaves are pounded and rubbed on the body once or twice a day) [5%]
<i>Clerodendrum schweinfurthii</i> Gürke (Umugutabatema, L, JN118)	12 (A handful of leaves are macerated in water (a bottle)/A glass is drunk a day for 3 days) [2 %]
<i>Clinopodium uhligii</i> var. <i>obtusifolium</i> (Avetta) Ryding (Umuzirasato, L or AP, JN021)	1-2 (250-300 g of dried leaves are calcined and mixed with cow butter/The ash is applied on the body and/or two pinches are eaten once a day until recovery/Modern medicines ^e); 5 & 13 (300 g of fresh leaves are pounded and rubbed on the body twice a day); 19 (2 handfuls of dried leaves are pounded, powdered, mixed with cow butter and rubbed on the body 3 time a day) [28 %]
<i>Coleus dysentericus</i> Baker (Inumpu, R, JN088)	11 (A handful of fresh leaves are crushed/Squeeze the juice of fresh leaves and drop it on the foot twice (morning & evening) a day) [2%]
<i>Hoslundia opposita</i> Vahl (Umusita, L or AP, JN069)	1-2 (2 handfuls of dried aerial parts are decocted with water (1,5 L)/The body is washed with the decoction (mixed with cow butter), and enema twice a week /Modern medicines ^e); 15 (A handful of leaves are pounded and decocted in water (1 L)/Half a cup is drunk twice (morning and evening) a day); 19 (2 handfuls of fresh leaves are pounded, and/or macerated in 2 bottles of water/The pounded leaves are mixed with cow butter and rubbed on the body, or decoction is drunk once a day) [23%]
<i>Leonotis nepetifolia</i> (L.) R.Br. (Umutongotongo, L, JN030)	3 (A handful of leaves are decocted in water (1 L)/2 glasses are drunk a day); 12 (A handful of leaves are macerated in water (1 L)/A glass twice is drunk a day) [7%]
<i>Leucas martinicensis</i> (Jacq.) R.Br. (Akanyamapundo, L or AP, JN136)	12 (A handful of aerial parts are macerated in water (1 L)/A glass is drunk twice a day for 2 days/Beer and sweet products ^e) [17%]
<i>Micromeria imbricata</i> (Forssk.) C. Chr. var. <i>imbricate</i> (Umukoroka, L or AP, JN137)	3 (A handful of leaves are macerated in water (1 L)/A glass is drunk once a day until recovery; or 200 g of dried plant material are calcined/Scarifications are practiced once a day) [2%]
<i>Ocimum americanum</i> L. (Umwenya, L, JN038)	1 (3 handfuls of dried leaves are pounded, and/or decocted in water (2 L)/The powder is mixed with cow butter and rubbed on the body once a day; or 1,5 cups of decoction is drunk twice a day and used as enema once a day) [2%]
<i>Ocimum basilicum</i> L. (Umusurasura, L, JN147)	17 (A handful of leaves are decocted in water (1 L)/A cup (mixed with honey) is drunk twice a day for 7 days/Beer and modern medicines ^e) [2%]
<i>Tetradenia riparia</i> (Hochst.) Codd (Umuravumba, L, ST or AP, JN100)	8 (Half a handful of leaves are macerated in water (a glass)/A glass is drunk a day); 1 (1/2 kg of fresh leaves are pounded and/or decocted in 2 L of water/The pounded leaves are rubbed on the body twice a day, or a cup of decoction is drunk twice a day for recovery); 4 (A handful of leaves are macerated in water (a bottle)/A glass is drunk twice a day for 3 days/Beer ^e); 5 (A handful of fresh leaves are pounded and rubbed on the body once a day/Beer ^e); 10 (A handful of leaves is decocted /Vapor is inhaled and a cup of decoction is drunk twice a day/Beer ^e); 11 (A handful of fresh stem balks are pounded and mixed with cow butter/The mixture is applied on foot twice a day until recovery); 14 (2 handfuls of leaves are packed in banana leaves and heated in the ash/The leaves are rubbed on the throat every 2 days days); 25 (500 g of dried aerial parts are pounded, powdered and mixed with cow butter/The mixture is rubbed on the body once a day until recovery) [63%]
<i>Platostoma rotundifolium</i> (Briq.) A.J. Paton (Umusekerasuka, L, WP, AP or R, JN008)	5 (500 g of dried leaves are pounded, powdered and mixed with cow butter/The mixture is rubbed on the body twice a day for 3days/Beer ^e); 12 (150 g of dried leaves are powdered/A spoonful powder is eaten a day/Sweet products ^e); 1-2 (A handful of dried aerial parts are calcined/The ash is rubbed on the body once two days until recovery and two pinches powder are eaten once a day/ Modern medicines ^e); 11 (500 g of fresh leaves are pounded and rubbed on foot twice a day until recovery) [75%]
<i>Plectranthus barbatus</i> Andrews (Igicuncu, L, JN139)	10 (50 g of leaves are crushed, and juice is squeezed out from the leaves/A drop of the juice previously diluted with a cup of water is drunk once a day); 12 (A handful of leaves are decocted in

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	water (2 glasses)/Half a glass (mixed with honey) is drunk a day for 3 days/ Sweet products ^e ; 4 (2 handfuls of leaves are macerated in 1,5 L of water/ 500 mL of macerate are drunk twice (morning and evening) a day); 9 (100 g of fresh leaves are pounded/A drop of the juice squeezed out from the leaves is instilled in the ear twice a day until recovery) [12%]
<i>Pycnostachys erici-rosenii</i> R.E.Fr. (Umusinduka, L, R or AP, JN059)	1-2 (500 g of dried leaves are pounded, calcined and salted/Half a spoon is eaten twice a day); 4 (A handful of leaves are decocted in water (3 glasses)/A small glass is drunk twice a day) [13%]
<i>Rotheca myricoides</i> (Hochst.) Steane & Mabb. (Umukuzanyana, L, T or R, JN114)	6 (200 g of fresh roots are pounded, decocted in a bottle of water, filtered and used as enema once a day); 12 (A handful of leaves are decocted (500 ml)/2 mouthfuls are drunk a day) [8%]
Lauraceae	
<i>Cassytha filiformis</i> L. (Imburabwamo, L, JN116)	1 (About 2 handfuls of dried leaves are calcined and mixed with cow butter/The mixture is applied on the body and/or two pinches are eaten once a day until recovery/Modern medicines); 2 (300 g of dried leaves are pounded and/or decocted in water (1 L)/ The pounded leaves (mixed with cow butter) are applied on the body, or a cup of decoction is drunk twice a day and used as enema once a day) [13%]
<i>Ocotea michelsonii</i> Robyns & R.Wilczek (Umuganza, STB, JN149)	7 (2-3 pinches of dried stem barks powder are macerated in a glass of water/1,5 spoons are drunk and few drops are instilled in the nose) [3%]
<i>Persea americana</i> Mill. (Ivoka, F or S, JN141)	7 (3 pinches seeds powder are decocted in water (a glass) and used to brush the teeth once a day); 12 (A handful of leaves are macerated in water (1L)/A glass is drunk twice a day) [3%]
Malvaceae	
<i>Hibiscus diversifolius</i> Jacq. (Umuguso, L, JN095)	22 (A handful of fresh plant material are pounded and macerated in water (500 ml)/The throat is washed with the macerate once a day) [3%]
Melastomataceae	
<i>Dissotis trothae</i> Gilg (Umushonge, L, JN020)	2 (2 handfuls of fresh leaves are crushed, and/or decocted in 1 L of water/The crushed leaves mixed with cow butter and applied on the body, or the decoction is used as enema once a day/modern medicines ^e) [3%]
<i>Heterotis canescens</i> (E.Mey. ex Graham) Jacq.-Fél. (Umusoma w'abungere, L, JN040)	14 (A handful of leaves are macerated in a bottle of water/A glass is drunk a day until recovery/Beer ^e); 17 (A handful of leaves are decocted in 1 L of water and mixed with honey/ Half a cup is drunk once a day) [3%]
Monimiaceae	
<i>Xymalos monospora</i> (Harv.) Baill. (Umuhotora, L or AP, JN042)	12 (A handful of leaves are macerated/Enema is practiced once daily for 3 days/Beer ^e); 2 (2 handfuls of dried leaves are pounded and/or decocted in water (a bottle)/The pounded leaves are mixed with cow butter and rubbed on the body, or half a cup of decoction is drunk twice a day and used as enema once a day); 19 (A handful of fresh leaves are pounded, and/or macerated in water (1 L)/The pounded leaves are mixed with cow butter and rubbed on the body, or a cup of decoction is drunk once a day) [9%]
Moraceae	
<i>Ficus ovata</i> Vahl (Igikobekobe, L, JN128)	9 (A handful of fresh leaves are packed in banana leaves and heated/A drop of the juice squeezed out from the leaves is instilled in the ear twice a day/Beer ^e) [2%]
<i>Milicia excelsa</i> (Welw.) C. C. Berg (Umukamba, L, JN145)	9 (About 200 g of fresh leaves are pounded/3 drops of the juice squeezed out from the leaves are instilled in the ear twice a day for 2 days) [2%]
Myrtaceae	
<i>Eucalyptus</i> sp. (Umukaratusi wera, L, JN092)	4 (150 g of fresh leaves are decocted with a bottle of water/A cup (adult) or half a cup (child) is drunk twice a day for 2 days/Beer ^e); 10 (A handful of leaves are decocted in water (a bottle)/Enema is practiced once a day and vapor is inhaled twice a day) [13%]
<i>Psidium guajava</i> L. (Ipera, L, JN046)	12 (A handful of leaves are macerated in 1 L of water/The macerate is used as enema once a day for 3 days) [2%]
<i>Syzygium guineense</i> (Willd.) DC. (Umugoti, L, STB or AP, JN103)	12 (A handful of leaves are macerated in water (a bottle)/Enema is practiced once daily for 3 days/Sweet products); 1 (2 handfuls of dried leaves are calcined, mixed with cow butter and rubbed on the body once a day) [12%]
Oleaceae	
<i>Schrebera alata</i> (Hochst.) Welw. (Umubanga, L, JN111)	2 (2 handfuls of fresh leaves are macerated/A cup is drunk twice a day for recovery) [2%]
Oxalidaceae	
<i>Biophytum umbraculum</i> Welw. (Tinyabakwe, L, JN074)	12 (1/2 kg of dried leaves are powdered/A spoonful powder is eaten a day/Sweet products ^e); 1 (2 handfuls of dried leaves are calcined and mixed with cow butter/The ash is applied on the body once a day) [2%]
<i>Oxalis corniculata</i> L. (Akunyu ka nyamanza, L or AP, JN138)	7 (500 g of leaves are packed in banana leaves and heat in the ash/The leaves are used to brush the teeth twice a day for 3 days); 18 (A handful of leaves are macerated in water (1 L) and applied on the body once a day) [13%]
Pedaliaceae	
<i>Sesamum angolense</i> Welw. (Umurendarenda, AP, JN002)	2 (2 handfuls of fresh leaves are pounded and decocted in 2 L of water/ 500 mL are drunk twice a day for recovery) [2%]
Phyllanthaceae	
<i>Bridelia micrantha</i> (Hochst.) Baill. (Umugimbu, R or STB, JN082)	12 (A handful of roots are macerated in water (1 L)/A glass is drunk twice a day for 3 days); 16 (300 g of dried stem barks are pounded, powdered and mixed with honey/A spoonful is eaten 3 times a day/Beer and modern medicines ^e); 17 (About 150 g of roots are decocted in water (500 mL) and mixed with honey/Half a cup is drunk once a day) [5%]

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<i>Phyllanthus ovalifolius</i> Forssk. (Umubwigwa, L or STB, JN142)	3 (A handful of leaves are decocted in water (2 glasses)/Enema is practiced and vapor is inhaled once a day/Sweet products ^e); 12 (A handful of leaves are macerated in water (3 glasses)/A glass is drunk twice a day) [5%]
Phytolaccaceae	
<i>Phytolacca dodecandra</i> L'Hér. (Umwokora, L, JN140)	2 (130-150 g of fresh leaves are crushed and the juice squeezed out from them is applied on body once a day); 5 (250-300 g of fresh leaves are pounded and mixed with cow butter/The mixture is rubbed on the body once a day/Beer and sweet products ^e); 13 (A handful of fresh leaves are pounded and rubbed the body once or twice a day); 25 (300 g of dried leaves are pounded, powdered and mixed with cow butter/The mixture is rubbed on the body twice a day for a week) [17%]
Piperaceae	
<i>Piper capense</i> L.f. (Inkonjoro, L, JN064)	9 (A handful of fresh leaves are pounded/3 drops of juice squeezed out from the leaves are instilled in the ear twice a day for 2 days) [2%]
Poaceae	
<i>Imperata cylindrica</i> (L.) Raeusch. (Umusovu, L, R or FL, JN129)	3 (A handful of leaves are decocted in water (500 mL)/2 glasses are drunk a day until recovery; About 200 g of dried roots are calcined/Scarifications are practiced once a day); 4 (150-200 g of dried flowers are calcined/Scarification are practiced once a day) [5%]
<i>Saccharum officinarum</i> L. (Umusigati, FL, JN045)	4 (20 g of dried flowers are calcined/Scarification are practiced once a day) [2%]
<i>Zea mays</i> L. (Ikigori, S, JN034)	5 (150 g of dried seeds are pounded/A spoonful is eaten once a day/Beer ^e) [2%]
Polygalaceae	
<i>Securidaca longipedunculata</i> Fresen. (Umunyagasozzi, L or R, JN109)	6 (150 of fresh roots are pounded, decocted in water (500 mL), filtered and used as enema once a day); 8 (A handful of plant material are decocted in a pot of water and vapor is inhaled one a day); 12 (A handful of leaves are decocted in a bottle of water/The bottle is drunk twice a day in 6 days); 1 (2 handfuls of dried leaves are pounded, calcined and mixed with cow butter/The mixture is applied on the body (after a shower) once a day until recovery/Beer ^e); 11 (A handful of dried leaves are powdered and mixed with cow butter /The mixture is rubbed on foot once a day; or 2 handfuls of fresh leaves are macerated in water (a bottle)/A glass is drunk twice (morning & evening) a day until recovery) [10%]
Polygonaceae	
<i>Persicaria setosula</i> (A.Rich.) K.L.Wilson (Ikizigangore, L, JN063)	12 (A handful of leaves are decocted in a bottle of water and used as enema once daily in the morning for 3 days) [2%]
<i>Rumex nepalensis</i> Spreng. (Isesabirego, L or R, JN011)	7 (200 g of leaves are packed in banana leaves and heated in the ash/The leaves are used to brush the teeth twice a day for 3 days); 1 (300 g of fresh leaves are crushed and rubbed on the body after a shower twice a day for 3 days); 16 (A handful of fresh roots are pounded, decocted in water (2 glasses) and mixed with salt/A cup is drunk a day for 2 days/Beer ^e); 17 (A handful of leaves are decocted in water (a bottle)/Half a cup (mixed with honey) is drunk once a day) [10%]
<i>Rumex usambarensis</i> (Dammer) Dammer (Umufumbegeti, L or AP, JN110)	8 (A handful of leaves are macerated in 3 L of water/A glass is drunk a day); 2 (2 handfuls of dried leaves are pounded and calcined/A spoonful powder is eaten 3 times a day); 4 (A handful of leaves are macerated in water (1 L)/A glass is drunk twice a day for 2 days/Beer ^e) [38%]
Primulaceae	
<i>Embelia schimperii</i> Vatke (Umukarakara, L, JN123)	12 (About 130-150 g of dried leaves are powdered/A spoonful powder is eaten a day/Sweet products); 1 (2 handfuls of dried leaves are powdered and mixed with cow butter/The mixture is rubbed on the body once a day) [3%]
<i>Lysimachia ruhmeriana</i> Vatke (Umuyobora, L, JN151)	2 (A handful of dried leaves are calcined and mixed with cow butter/The mixture is applied on the body, or two pinches are eaten once a day until recovery/Modern medicines) [3%]
Ranunculaceae	
<i>Ranunculus multifidus</i> Forssk. (Ruheha, L or AP, JN143)	12 (About 150 g of dried leaves are powdered/A spoonful powder is eaten a day/Sweet products ^e); 1-2 (2 handfuls of dried leaves are calcined/The ash is mixed with cow butter and rubbed on the body, or two pinches of ash are eaten once a day until recovery/Modern medicines ^e); 4 (A handful of leaves are decocted in water (1 L) /A small glass is drunk twice a day); 19 (500 g of dried plant material are pounded, powdered and mixed with cow butter/The mixture is rubbed on the body 3 times a day) [35%]
Rhamnaceae	
<i>Gouania longispicata</i> Engl. (Ikibimbafuro, L or AP, JN018)	12 (A handful of leaves are macerated in water (1 L)/The macerate is used as enema once daily for 3 days [7%]
<i>Helinus mystacinus</i> (Aiton) E. Mey. ex Steud. (Umubimbafuro, L, JN126)	2 (About 350 g of dried leaves are calcined/A spoonful powder is eaten 3 times a day for 4 days/Beer ^e); 13 (500 g of fresh leaves are pounded and rubbed on the body twice a day for 3 days) [3%]
<i>Ziziphus abyssinica</i> Hochst. (Umukugutu, STB, JN019)	8 (A handful of dried stem barks are powdered/2 pinches powder are applied in nose 3 times a day using a finger); 7 (Dried stem bark powder (3 pinches) are macerated in a glass of water/1,5 spoons is drunk and few drops are instilled in the nose); 20 (150 g of stem bark are pounded and decocted in water (3 glasses)/A small glass is drunk twice (morning & evening) a day/Sweet products and modern medicines ^e) [10%]
Rubiaceae	
<i>Agathisanthemum globosum</i> (Hochst. ex A. Rich.) Bremek. (Akazibanda, L or T, JN054)	12 (A handful of leaves are decocted with 500 ml of water /A small cup is drunk twice a day); 4 (A handful of leaves are macerated with 500 ml of water /The decoction(mixed with honey) is drunk twice (morning and evening) a day / Beer ^e) [3%]

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<i>Cinchona officinalis</i> L. (Kenkina, L or STB, JN056)	10 (200 g of roots are pounded and decocted in water (1 L)/A cup is drunk twice a day/Beer and modern medicines ^e) [12%]
<i>Fadogia ancyllanthe</i> Schweinf. (Umuvuzampundu, L, JN125)	1 (2 handfuls of leaves are decocted in water (1 L)/The decoction is used as enema once a day for 3 days/Beer ^e); 2 (Dried leaves (200 g) are pounded, and/or decocted in a bottle of water/The pounded leaves re mixed with cow butter and rubbed on the body, or a cup is of decoction is drunk twice a day and used as enema once a day) [12%]
<i>Hallea rubrostipulata</i> (K. Schum.) Leroy (Umugomera, L or STB, JN093)	6 (350 g of fresh stem barks are pounded and decocted in water (1 L)/Enema is practiced once a day); 12 (A handful of leaves are decocted in water (a bottle)/Half a glass is drunk 3 times a day/Beer, sweet products and modern medicines ^e) [12%]
<i>Pavetta ternifolia</i> (Oliv.) Hiern (Umunyamabuye, L, JN001)	12 (A handful of leaves are macerated in water (3 glasses)/A glass is drunk a day for 3 days); 5 (A handful of leaves are decocted in water (1 L)/Half a cup is drunk a day) [5%]
<i>Pentas longiflora</i> Oliv. (Isagara, L or R, JN144)	10 (A handful of leaves are decocted in water (1,5 L)/A cup (adult) or half a cup (child) is drunk twice a day for 2 days); 25 (500 g of dried leaves are pounded, powdered and mixed with cow butter/The mixture is rubbed on the body once a day for 5 days) [48%]
<i>Rubia cordifolia</i> L. (Umukarambwa, L, AP or STB, JN112)	1-2 (500 g of dried leaves are calcined/A pinch is eaten 3 times a day); 16 (A handful of dried plant material are pounded, powdered and mixed with honey/A spoon is drunk 3 times a day/Beer and modern medicines ^e) [8%]
<i>Spermacoce princeae</i> (K. Schum.) Verdc. (Umunyovunyovu, L or R, JN044)	12 (Maceration/A glass is drunk twice a day for 3 days); 1 (2 handfuls of dried leaves are decocted in 1 L of water or calcined/The decoction is used as enema once a day, or 2 glasses are drunk twice (morning and evening) a day (adult), or the ash (mixed with cow butter) is rubbed on the body (child)/Sweet products) [3%]
<i>Virectaria major</i> (Schum.) Verdc. (Umukizikizi, L, AP, R or WP, JN009)	1-2 (Dried aerial parts (250 g) are decocted in water (a bottle) and mixed with cow butter/ The decoction is applied on the body and used as enema once a day/Modern medicines ^e); 12 (A handful of dried leaves are powdered/A spoonful powder is eaten a day/Sweet products ^e); 4 (Maceration/ Half a glass is drunk twice a day for 3 days); 5 (500 g of fresh leaves are pounded, macerated and mixed with cow butter/The mixture is rubbed on the body once a day); 13 (A handful of leaves are macerated in 1,5 L of water and applied on the body twice a day for 3 days/Beer ^e); 18 (300 g of dried leaves are powdered and mixed with cow butter/ The mixture is rubbed on the body once a day); 19 (A handful of fresh leaves are pounded, and/or macerated in 1 L of water/The grounded leaves are mixed with cow butter and rubbed on the body once a day, or a cup of macerate is drunk once a day); 20 (A handful of leaves are decocted in water (1 L)/Vapor is inhaled twice a day until recovery/Beer ^e) [72%]
Rutaceae	
<i>Citrus limon</i> (L.) Burm.f. (Indimu, L, F or FP, JN017)	4 (Fruits are crushed/A spoon of juice squeezed out from fruits is drunk twice a day for recovery/ Beer ^e); 15 (Fruit barks are pounded and rubbed on the body twice a day); 22 (A handful of fresh leaves are macerated in water (500 ml)/The throat is washed with the macerate once a day) [5%]
<i>Zanthoxylum chalybeum</i> Engl. (Igugu, L or R, JN022)	12 (A handful of leaves are decocted in water (3 glasses)/A glass is drunk 3 times a day for 3 days/Sweet products and modern medicines ^e) [5%]
Sapindaceae	
<i>Cardiospermum halicacabum</i> L. (Imbogobogo, L, JN028)	8 (500 g of leaves are decocted in 1 L of water/A glass is drunk twice a day); 9 (Leaves are pounded and/or macerated/instillation of one drop in the ear and/or oral drink of a cup a day) [35%]
<i>Dodonaea viscosa</i> (L.) Jacq. (Umusasa, L or AP, JN090)	2 (350 g of fresh leaves are crushed, and/or decocted in water (a bottle)/The crushed leaves are mixed with cow butter and applied on the body, or the decoction is used as enema once a day/modern medicines ^e); 10 (A handful of leaves are pounded and decocted in water (500 mL)/A spoon is drunk twice a day); 12 (A handful of leaves are macerated in water (1 L)/The macerate is used as enema once daily in the evening (child), or a glass (mixed with honey) is drunk a day (adult) until recovery/Beer ^e); 21 (A handful of dried leaves are pounded and decocted in water (a bottle)/The decoction is used as enema and vapor is inhaled) [15%]
<i>Paullinia pinnata</i> L. (Umusarasara, L or R, JN150)	6 (About 200 g of fresh roots are pounded and decocted in water (a bottle)/A cup is drunk a day); 12 (A handful of leaves are decocted in a bottle of water/A glass is drunk a day/Sweet products ^e) [3%]
Solanaceae	
<i>Capsicum frutescens</i> L. (Agapiripiri, S, JN083)	4 (2 g of dried seeds are powdered and mixed with a tea decoction (300 mL) and honey/A tea cup is drunk once a day/Beer ^e) [2%]
<i>Lycopersicon esculentum</i> Mill. (Inyanya, L or R, JN146)	3 (About 200 g of dried leaves or roots are calcined/Scarifications are practiced once a day); 22 (300 g of fresh plant material are macerated in water (2 glasses)/The throat is washed with the macerate) [7%]
<i>Nicotiana tabacum</i> L. (Itabi, L, JN065)	25 (A handful of dried leaves are pounded, powdered and mixed with cow butter/The mixture is rubbed on the body once a day until recovery) [2%]
<i>Physalis angulata</i> L. (Intumbaswa, L, JN031)	4 (A handful of leaves are macerated in a bottle of water/A glass (adult) or half a glass (child) is drunk twice a day (morning and evening) for 3 days) [3%]
<i>Solanum aculeastrum</i> Dunal (Umunembera, L or S, JN105)	12 (A handful of leaves are decocted in water (1 L) and used as enema twice a week in the evening); 2 (2 handfuls of fresh leaves are pounded, and/or decocted in 2 L of water/The pounded leaves are rubbed on the body, or half a cup of decoction is drunk once daily until recovery/Beer ^e) [5%]
<i>Withania somnifera</i> (L.) Dunal (Umusendabazimu, L or AP, JN058)	9 (A handful of leaves macerated in a glass of water/3 drops are instilled in the ear twice a day); 11 (300 g of dried leaves are powdered and mixed with cow butter/The mixture is rubbed on foot once a day); 18 (A handful of leaves are macerated and applied on the body once a day) [10%]
Theaceae	

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<i>Camellia sinensis</i> (L.) Kuntze (Icayi, L, JN055)	5 (A handful of fresh leaves are pounded, and/or decocted in water (a bottle)/The pounded leaves are rubbed on the body, or the decoction is used as enema once a day/ Modern medicines ^e); 13 (Maceration/Massage of the body, and enema once a day) [3 %]
Typhaceae	
<i>Typha domingensis</i> Pers. (Umuberebere, L or R, JN099)	12 (A handful of leaves are decocted in water (3 glasses)/Enema is practiced twice a week in the evening/Beer and sweet products ^e) [7%]
Verbenaceae	
<i>Lantana trifolia</i> L. (Umuhengerihengeri, L, R or AP, JN133)	4 & 8 (A handful of plant material is macerated in water (a bottle)/A glass is drunk a day for 2 days/ Beer ^e) [33%]
Vitaceae	
<i>Cissus oliveri</i> (Engl.) Gilg (Umugobore, L, JN086)	4 (A handful of fresh leaves are macerated in a bottle of water/A cup (adult) or half a cup (child) is drunk twice a day for 2 days) [2%]
<i>Cyphostemma cyphopetalum</i> (Fresen.) Desc. ex Wild & R. B. Drumm. (Agasharika, L, JN089)	4 (A handful of leaves are decocted in water (a bottle)/A tea cup (mixed with honey) is drunk twice a day for 2 days/Beer ^e) [2%]
Zingiberaceae	
<i>Aframomum angustifolium</i> (Sonn.) K. Schum (Urutake, S, T or R, JN050)	4 (50 g of plant material are decocted in water (½ L) and mixed with honey/The decoction (500 mL) is drunk twice (morning and evening) a day / Beer ^e) [27%]

^a Parts of the plant used : L, Leaves; ST, Stem; R, Roots; WP, Whole plant; AP, Aerial parts ; STB, Stem bark ; S, Seeds; T, Tuber; FP, fruit peel; FL, flowers; F, fruit. ^b Microbial diseases treated: 1, Ringworm; 2, Purulent rashes; 3, Pneumonia; 4, Cough; 5, Varicella; 6, Dysentery; 7, Tooth decay; 8, Sinusitis; 9, Otitis; 10, Fever; 11, Foot mycosis; 12, Diarrhea; 13, Measles; 14, Tonsillitis; 15, Typhus; 16, Cholera; 17, Tuberculosis; 18, Yaws; 19, Leprosy; 20, Gonorrhoea; 21, Meningitis; 22, Angina; 23, Syphilis; 24, Tetanus; 25, Skin mycosis.

^c Recipes presented were multi-herbal recipes (MUHRs) except where the acronym MOHR (mono-herbal recipe) is mentioned.

Quantification of plant material and liquid volumes were estimated from Chifundera (2001) as follows: a handful (20-35 g of fine powder or 50 g of coarse plant material); one pinch (3-5 g of fine powder); one handful of crushed fresh whole herbaceous plant or leaves (130-150 g); one local bottle (720 ml); one glass (200-250 ml); a mouthful (75 ml); spoonful/teaspoon (5 ml of liquid); one cup (about half a glass).

^dAll decoctions and macerations operations are carried out with water as solvent and followed by filtrations before use; most recipes are used as beverages. ^e Interdict cited by THs.