A systematic review of antimalarial medicinal plants in Democratic Republic of the Congo

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Photo 1.
Alchornea cordifolia, one of medicinal plants used to treat the symptoms of malaria in Democratic Republic of Congo.
Photo Konda *et al.* (2012).

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RÉSUMÉ

Revue systématique des plantes médicinales antipaludiques utilisées en République démocratique du Congo

En République démocratique du Congo (RDC), le paludisme est transmis par un parasite appelé *Plasmodium falciparum*. Le paludisme représente un problème majeur de santé publique dans ce pays en provoquant la mort de dizaines de milliers de personnes chaque année, en milieu urbain et rural. Des médicaments antipaludiques sont couramment utilisés mais des cas avérés de résistance à ces médicaments représentent un obstacle important à la lutte contre le paludisme. Il est donc impératif d'identifier de nouvelles molécules bioactives pouvant s'y substituer. De nombreuses plantes médicinales ayant des propriétés diverses s'utilisent en RDC pour traiter différentes maladies, dont le paludisme. Le présent article propose une revue systématique des ressources végétales antipaludiques en RDC. Sur la base de 28 articles sur l'ethnomédecine publiés entre 2001 et 2019, 232 espèces végétales appartenant à 67 familles de végétaux et identifiées dans 13 provinces ont été répertoriées pour le traitement du paludisme. De nombreuses espèces appartiennent aux familles des Fabacées, Astéracées, Euphorbiacées, Rubiacées et Apocynacées. Les espèces dont l'utilisation est citée pour plus de trois provinces comprennent *Cymbopogon citratus*, *Vernonia amygdalina*, *Rauvolfia vomitoria* et *Catharanthus roseus*. La plupart des espèces identifiées comme plantes antipaludiques sont des essences ligneuses, principalement des phanérophytes. D'autre part, les principaux ingrédients identifiés pour la préparation des remèdes sont les feuilles, utilisées en décoction le plus souvent administrée par voie orale.

Mots-clés : traitement antipaludique, ethnomédecine, plantes médicinales, étude systématique, République démocratique du Congo.

ABSTRACT

A systematic review of antimalarial medicinal plants in Democratic Republic of the Congo

In Democratic Republic of the Congo (DRC), malaria is caused by a parasite called *Plasmodium falciparum*. Malaria is one of the country's major public health issues and responsible for the death of tens of thousands of people every year in both rural and urban environments. Antimalarial drugs are commonly used but some recorded cases of drug resistance are a major obstacle to controlling the spread of malaria. It is therefore essential to identify new bioactive molecules as an alternative. Many medicinal plants with different properties have been used as treatments for a variety of diseases in the DRC, including malaria. This study provides a systematic review of antimalarial plant resources in the DRC. From 28 papers on ethnomedicine published between 2001 and 2019, a total of 232 plant species belonging to 67 different plant families and identified in 13 provinces was reported in the treatment of malaria. A large number of these plant species belong to the Fabaceae, Asteraceae, Euphorbiaceae, Rubiaceae, and Apocyanaceae families. Species cited in more than three provinces include *Cymbopogon citratus*, *Vernonia amygdalina*, *Rauvolfia vomitoria* and *Catharanthus roseus*. Most of the species identified as antimalarial plants were tree species, with phanerophytes predominating. In addition, leaves were identified as the main ingredients for preparing remedies, most commonly by decoction administered orally.

Keywords: antimalarial treatment, ethnomedicine, medicinal plants, systematic review, Democratic Republic of the Congo.

RESUMEN

Revisión sistemática de las plantas medicinales antipalúdicas de la República Democrática del Congo

En la República Democrática del Congo (RDC) el paludismo está causado por un parásito llamado *Plasmodium falciparum*. El paludismo es uno de los principales problemas de salud pública del país y es responsable de la muerte de decenas de miles de personas cada año, tanto en entornos rurales como urbanos. Habitualmente se utilizan fármacos antipalúdicos, aunque se registran casos de resistencia a los medicamentos, que son un obstáculo importante para controlar la propagación de la malaria. Por lo tanto, es esencial identificar nuevas moléculas bioactivas como alternativa. En la RDC se han utilizado muchas plantas medicinales con diferentes propiedades como tratamiento de diversas enfermedades, entre ellas la malaria. Este estudio realiza una revisión sistemática de los recursos vegetales antipalúdicos en la RDC. En 28 artículos sobre etnomedicina publicados entre 2001 y 2019, un total de 232 especies de plantas para el tratamiento de la malaria pertenecientes a 67 familias diferentes se identificaron en 13 provincias. Un gran número de estas especies vegetales pertenecen a las familias Fabaceae, Asteraceae, Euphorbiaceae, Rubiaceae y Apocyanaceae. Las especies citadas en más de tres provincias incluyen *Cymbopogon citratus*, *Vernonia amygdalina*, *Rauvolfia vomitoria* y *Catharanthus roseus*. La mayor parte de las plantas antipalúdicas identificadas son especies arbóreas, con predominio de las fanerófitas. Y las hojas son los principales ingredientes para la preparación de curas, mayoritariamente por decocción administrada por vía oral.

Palabras clave: tratamiento antipalúdico, etnomedicina, plantas medicinales, revisión sistemática, República Democrática del Congo.

Introduction

Malaria, a disease caused by the parasite *Plasmodium falciparum*, is one of the major public health problems in many tropical countries. This disease is spread by mosquitoes (Landis *et al.*, 2009; Messina *et al.*, 2011). According to the World Health Organization (WHO), about 228 million cases and more than 405 thousand deaths related to malaria have occurred in 2018 around the world, with the majority of deaths (93%) found in Africa (WHO, 2019).

In Democratic Republic of the Congo (DRC), reports indicated that, despite the efforts to prevent the spread of malaria, and alleviate its detrimental effects on the people's health nationwide (Swana *et al.*, 2018), other forms of challenges, such as drug resistance of the pathogen was identified as obstacle to control efficiently the spread of the disease in the sub-Saharan Africa (Alker *et al.*, 2008; Mobula *et al.*, 2009; Mvumbi *et al.*, 2015). To address this situation, there is a strong necessity to identify novel substances or bioactive molecules having the potential to overcome the drug resistance of the *Plasmodium falciparum*, eventually due to the recurrent use of similar molecules. Thus, medicinal plants could serve as an alternative to achieve this goal (Silva *et al.*, 2011; Ntie-Kang *et al.*, 2014), since they are relatively cost-effective and highly accessible (Madureira *et al.*, 2002; Muganga *et al.*, 2010).

The benefit of plants as bio-resources and their potentialities to treat different diseases has traditionally been highlighted by several research (Arshad *et al.*, 2014; Zarei *et al.*, 2017), and it is considered essential for human health care (Asadi-Samani *et al.*, 2013). The worldwide use and distribution of bio-resources enclose a large potential to unveil the undescribed aspects of medicinal plants, yet undiscovered (Balima *et al.*, 2018).

According to the WHO, around 80% of the population living in developing countries rely on traditional medicine for treating diseases (Kamatenesi-Mugisha and Oryem-Origa, 2005; Mahomoodally, 2013). Moreover, the extensive use of traditional medicines in Africa could be associated to the history and culture or customs, and economic environment (Mahomoodally, 2013). Medicinal plants still represent an important source of medical treatment in developing countries (Tabuti *et al.*, 2003).

The Congo Basin region itself is megadiverse in plant species, including medicinal plants (Light *et al.*, 2016). Screening studies for antimalarial medicinal plant species from Cameroon (Betti, 2002; Saotoing *et al.*, 2011; Titanji *et al.*, 2008; Kuete and Efferth, 2010; Betti *et al.*, 2013a), Gabon (Betti *et al.*, 2013b), the Central African Republic (Lakouéténé *et al.*, 2009), Republic of Congo (Mbatchi *et al.*, 2006; Nsonde-Ntandou *et al.*, 2005) and Guinea Equatorial (Gomez Marín and Merino Cristóbal, 1990) have demonstrated the potential of traditional medicinal plants as source of antimalarial substances. Furthermore, the DRC, with about half of the African humid forests, ranks fifth in the world for the diversity of plant species (UNESCO, 2010; Masunda *et al.*, 2019). It is estimated that the flora of the DRC comprises 377 families, 2,196 genera, and over 11,000 species (Mbala, 2003). Many plants species in the DRC have been studied and described for their beneficial impact for treating various diseases in numerous scientific papers. Thus, the purpose of this study is to develop a systematic review of scientific papers on ethnomedicine, particularly on the treatment of malaria.

Photo 2.
Illustration of a variety of medicinal plants exposed in a local market in Kinshasa.
Photo K.-T.-N. Ngbolua *et al.* (2016).

Methods

Sources of information

Through literature review and data mining, previous published papers related to the field of ethnobotanyof medicinal plants in the DRC, were collected during December 2019, using available internet browsers.

The research was extended to the identification of references listed in retrieved articles. The major key words employed during the search, either in French or in English, were: "ethno-medicinal plants in DR of Congo" OR "ethnobotanical study in DR of Congo" OR "ethno pharmacology in DR of Congo" OR "phyto therapy in DR of Congo" OR "herbal treatments in DR of Congo" OR "anti-malaria plants in DR of Congo". In addition to the published scientific papers on the subjects of interest, all information found to be necessary for the study were included as well, collected from scientific works, such as books, academic theses (Masters and doctorate thesis dissertations), while considering the year of publication, the methodology, or the study language.

Analysis

The following ethnomedicinal information were collected from the literature: (i) plant organs used: leaves, stem, stem bark, root, root bark, flowers, fruits, seeds or grain, whole plant, upper (aboveground) part, underground part;

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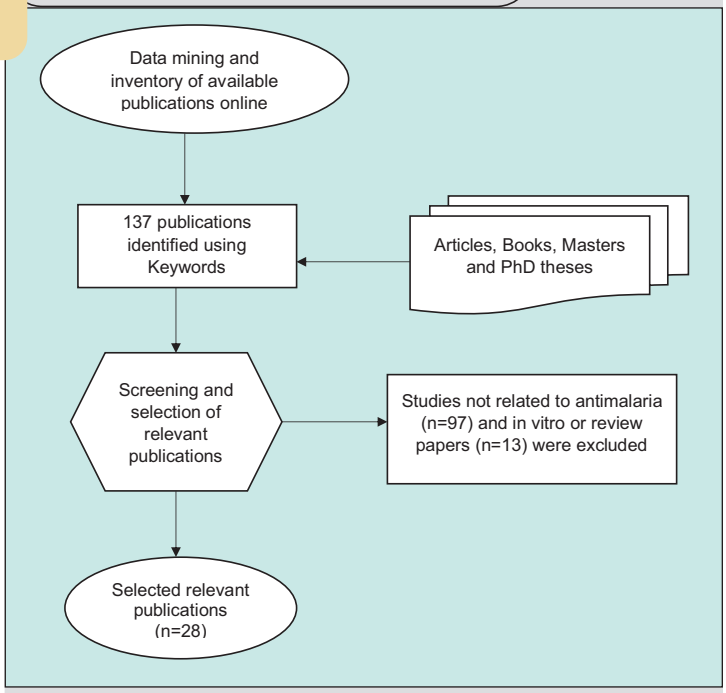

Figure 1.
Flowchart of the major steps for the selection of relevant publications.

(ii) mode of preparation: decoction, maceration, infusion, grinding, expression, extorsion, incineration, ash, etc.; (iii) way of administration: oral, enema, inhalation, bath, friction, chewing, tattoo, instillation; and (iv) the geographical location of the study. In the case of unavailability of data in one of the above groups, the corresponding field was marked "NR (not referenced)".

The dataset was taxonomically standardized (synonym and misspelling) and updated following guidelines in the online websites: the plant list[1] or/and African plant database[2]. The Angiosperm Phylogeny Group (APG III) was used to revise and update the family names (APG, 2009). The antimalarial plants species were characterized by morphology types: tree, shrub, sub-shrub, liana, herb. The life-form analysis focused on 223 species and was based on Raunkiaer's system: Phanerophytes, Chamæphytes, Hemicryptophytes, Geophytes or Cryptophytes, Therophytes, Aerophytes and Epiphytes.

The conservation status of each anti-malaria species was determined by the IUCN red list of threatened species (IUCN, 2019) and includes: Not Evaluated (NE), Data Deficient (DD), Least concern (LC), Near threatened (NT), Vulnerable (VU), Endangered (EN), Critically endangered (CR), Extinct in the Wild (EW) and Extinct (EX).

1 http://www.theplantlist.org

2 http://www.ville-ge.ch

Results

Selected antimalarial related studies

In the perspective of using only studies providing useful data and information related to the use of medicinal plants as a treatment for malaria, an initial selection was performed. As a result, all studies with no relevant data on antimalarial plants were discarded, and only 41 full-text studies were evaluated in order to verify the evidence of the antimalarial plants. In addition, another 13 studies falling either into the category of review article or in vitro studies were excluded. Consequently, after the screening and selection process, 28 publications and academic reports (Masters and Doctorate Theses) were retained for further investigations (figure 1). Of this number, the earliest article was published in 2001 but about 92.9% of the publications were released between 2010-2019. Studies were conducted on 13 different provinces in the DRC as illustrated in figure 2. Moreover, the majority of plant species (185 species, 79.7%) was reported to be used in at least one province, and 27 species (11.6%) were listed in at least two provinces (table I). Meanwhile, 20 species (8.6%) were mentioned in more than two provinces. An illustration of the top 20 plant species widely distributed across the country (used in more than 2 provinces) is given in table II.

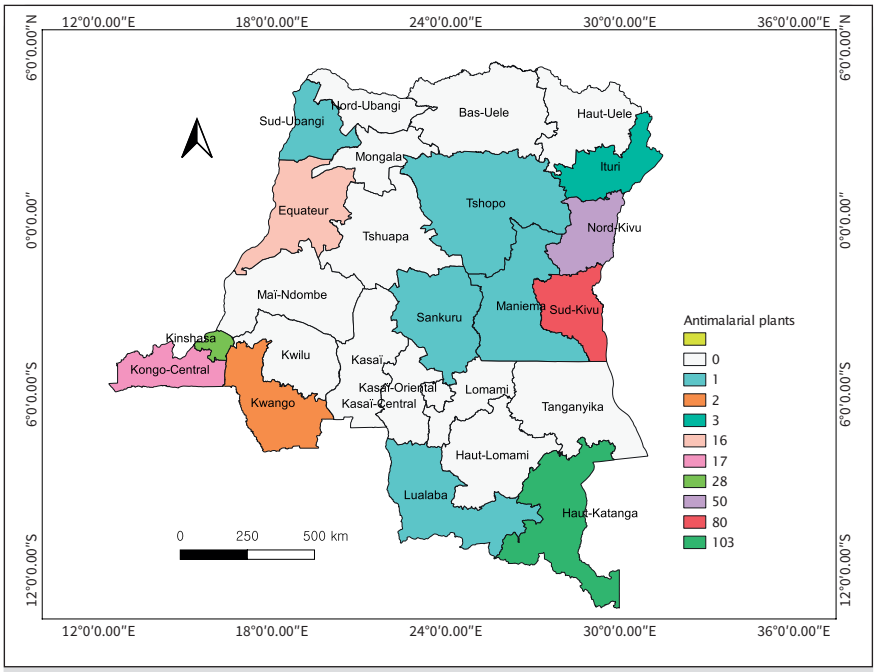

Figure 2.
Map of the spatial distribution of studies related to antimalaria treatment using plant species in the Democratic Republic of Congo. The highlighted zones on the map indicate the studies area related to antimalaria treatment using medicinal plants species. The color scheme in the legend shows the number of studies in each province.

Table I.
Level of antimalarial plants richness within each province.

Provinces	1	2	3	4	5	6	7	8	9	10	11	12	13
Species richness	103	80	50	28	17	16	3	2	1	1	1	1	1
Specific species in the province	82	48	17	19	9	7	1	0	1	0	1	0	0
Species shared by other provinces	21	32	33	9	8	9	2	2	0	1	0	1	1

Provinces: 1: Haut-Katanga, 2: Sud-Kivu, 3: Nord-Kivu, 4: Kinshasa, 5: Kongo-Central, 6: Equateur, 7: Ituri, 8: Kwango, 9: Tshopo, 10: Sud-Ubangi, 11: Lualaba, 12: Sankuru, 13: Maniema.

Table II.
List of the most distributed antimalarial plants.

Species	Number of provinces	Provinces
Senna occidentalis	5	1,2,3,5,6
Cymbopogon citratus	5	1,2,3,4
Vernonia amygdalina	4	1,2,3
Rauvolfia vomitoria	4	1,3,4,6
Catharanthus roseus	4	1,2,3,5
Carica papaya	3	1,2,3
Bidens pilosa	3	1,2,3
Alstonia boonei	3	4,7,10
Arachis hypogaea	3	2,3,5
Citrus limon	3	1,2,3
Erythrina abyssinica	3	1,2,3
Eucalyptus globulus	3	1,2,3
Harungana madagascariensis	3	1,2,6
Jatropha curcas	3	1,5,8
Lantana camara	3	1,2,3
Morinda morindoides	3	4,5,6
Persea americana	3	2,3,6
Physalis peruvianna	3	1,2,3
Psidium guajava	3	1,2,3
Tithonia diversifolia	3	1,2,3

Provinces: 1: Haut-Katanga, 2: Sud-Kivu, 3: Nord-Kivu, 4: Kinshasa, 5: Kongo-Central, 6: Equateur, 7: Ituri, 8: Kwango, 9: Tshopo, 10: Sud-Ubangi, 11: Lualaba, 12: Sankuru, 13: Maniema.

Diversity and morphology of antimalarial plants

A total of 232 species of medicinal plants, distributed in 181 genera, and belonging to 67 families were mentioned as being involved in the treatment of malaria in different parts of the DRC (figure 2; table III). Among these families, about 82% are dicots, and nearly 14% are monocots, and only 3% are gymnosperms and pteridophytes. The dicotyledonous group is represented by 55 families and 169 genera, while the monocotyledonous group is represented by 10 families and 10 genera. The investigation on the life-form of the antimalarial plants showed that Phanerophytes represent 68.3% of the species cited, followed by Therophytes (13.4%), Chamæphytes (12.9%), Geophytes (4.5%), and Hemycryptophytes (0.9%) (table III). Regarding the morphological type, figure 3 shows that woody plants (66.8%) were the dominant type (trees: 38.8%, shrubs: 16.8%, sub-shrub: 3.02%, and liana: 8.2%). About half of the reported antimalarial plant species across the country (48.3%) belong to the following families: Fabaceae (30 species), Asteraceae (27 species), Rubiaceae (15 species), Euphorbiaceae (14 species), Apocynceae (10 species), Annonaceae (8 species) and Meliaceae (8 species). Around 49.2% of the families contributed with only one species to the antimalarial plant species, while 145 genera are represented by a single antimalarial plant species. *Euphorbia* (Euphorbiaceae) and *Strychnos* (Loganiaceae) were represented by 4 plant species each. In addition to *Euphorbia* and *Strychnos, Acacia, Afromomum, Aloe, Chenopodium, Combretum, Dalbergia, Ficus, Landolphia, Morinda, Senna* and *Ziziphus* have 3 species each (appendix 1).

Parts used, mode of preparation, and route of administration

The utilization of plant parts and their mode of preparation is subjected to their accessibility and the knowledge of indigenous people (Umair *et al.*, 2019). The results of the analysis of the plant parts used show that the leaves were the most used parts of plant by traditional healers, which accounted for about 60% of the total parts of plants used, followed by roots (32.7%), and stems/bark (22.4%). A few plants were harvested for their fruits or seeds/grains (6.5%) or used whole (5.2%). In 3.4% of cases, the parts of the plant used were not referenced (figure 4).

Table III.
Summary of the antimalarial plants used in Democratic Republic of Congo.

	Pteridophytes	Gymnosperms	Angiosperms		Total
			Dicotyledons	Monocotyledons	
Family	1	1	55	10	67
Genus	1	1	169	10	181
Species	1	1	211	19	232
Phanerophyte	-	1	148	4	153
Chamaephyte	-	0	25	3	28
Hemycryptophyte	-	0	2	0	2
Therophyte	-	0	28	2	30
Geophyte	-	0	0	10	10

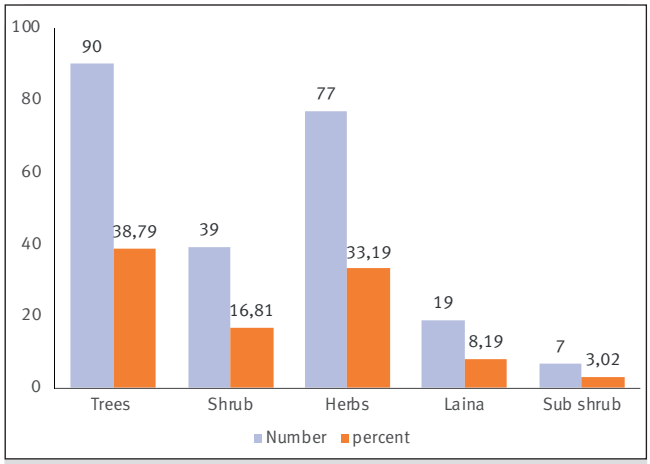

Figure 3.
Morphology of the most cited antimalarial plants species.

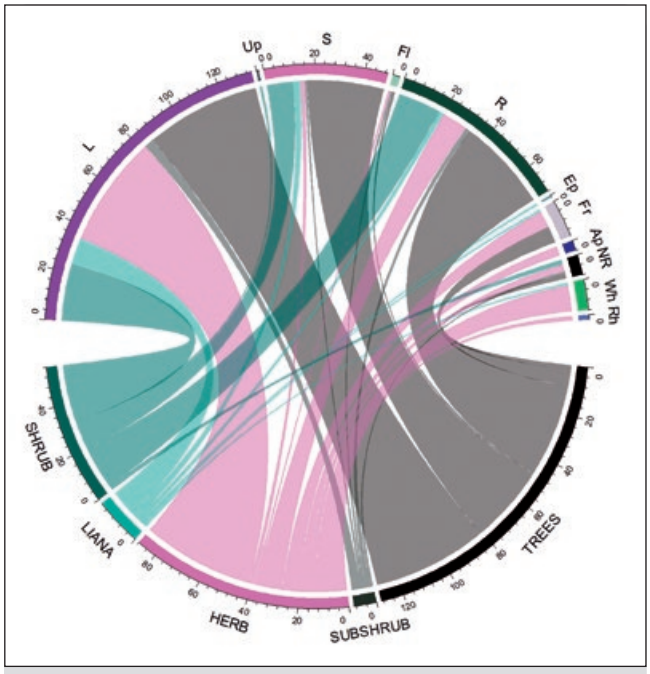

Figure 4.
Distribution of plant parts commonly used in ethnomedicine by morphological types. Eleven parts used (top half of circle) include (left to right): leaves (L), underground part (Up), stems (S), flower (Fl), roots (R), external part (Ep), fruit, seed, grains (Fr), aerial part (Ap), not recorded (NR), whole plant (Wh), and rhizomes (Rh). Morphological types (bottom half of circle). Scale numbers around the circle indicate cited time.

Sixteen methods were used to prepare plant materials. Among these, the majority used decoction (169 reported), followed by maceration (48), infusion (27), grinding and sap (4 each), powder (3) expression, extorsion, and spray (2 each); chewing, ash, incineration, milling, paste, pounding, and leaves roasted in palm oil (1 each); and 19 were not referenced (NR) (figure 5). The majority (156) of antimalarial remedies were taken orally, followed by enema/anal/suppository (12), bath, inhalation, and instillation (7 each). In rare instances, treatment was administered by rubbing leaves all over the body (2) and by tattoo (1). Sixty-five reports failed to indicate the mode of administration of the plant medicines.

Threat status

The unsustainable exploitation of plant species has resulted in a high vulnerability for certain species (Raj *et al.*, 2018). It was found that 49 plant species used as a remedy for treating malaria in the DRC were reported in the IUCN's Red List (table IV). According to the IUCN list, one species was classified as "data deficient", 43 as "least concern", three as "vulnerable", one as "near threatened", and one as "critically endangered". The other species were not included yet in the list. The international trade in a few of the species studied is also banned by the CITES treaty[3]: *Aloe christianii, Aloe dawei, Dalbergia boehmii, Dalbergia chapelieri, Dalbergia nitidula, Euphorbia ingens, Euphorbia tirucalli,* and *Prunus africana.*

[3] www.cites.org

Table IV.
The conservation status of some medicinal plants used to treat malaria in the Democratic Republic of Congo.

Species	Status
Autranella congolensis	Critically endangered
Dalbergia chapelieri	Near threatened
Lebrunia buchaie, *Prunus africana*, *Pseudospondias microcarpa*	Vulnerable
Annona senegalensis, *Annickia chlorantha*, *Azadirachta indica*, *Bobgunnia madagascariensis*, *Cassia alata*, *Cassia sieberiana*, *Carapa procera*, *Combretum molle*, *Combretum zeyheri*, *Eucalyptus citriodora*, *Eucalyptus globulus*, *Euphorbia ingens*, *Euphorbia tirucalli*, *Erythrina abyssinica*, *Ficus exasperate*, *Ficus thonningii*, *Harungana madagascariensis*, *Hymenocardia acida*, *Isoberlinia angolensis*, *Isolona hexaloba*, *Julbernardia paniculata*, *Melia azedarach*, *Monodora laurentii*, *Monodora myristica*, *Ochna schweinfurthiana*, *Parinari curatellifolia*, *Parkia zenkeri*, *Pentaclethra macrophylla*, *Pericopsis angolensis*, *Persea americana*, *Piper capense*, *Pterocarpus angolensis*, *Pterocarpus tinctorius*, *Ranunculus multifidus*, *Raphia gentiliana*, *Rauvolfia caffra*, *Terminalia mollis*, *Thomandersia hensii*, *Spathodea campanulata*, *Syzygium guineense*, *Xylopia aethiopica*, *Ziziphus abyssinica*, *Ziziphus mucronata*	Least concern
Mangifera indica	Data deficient

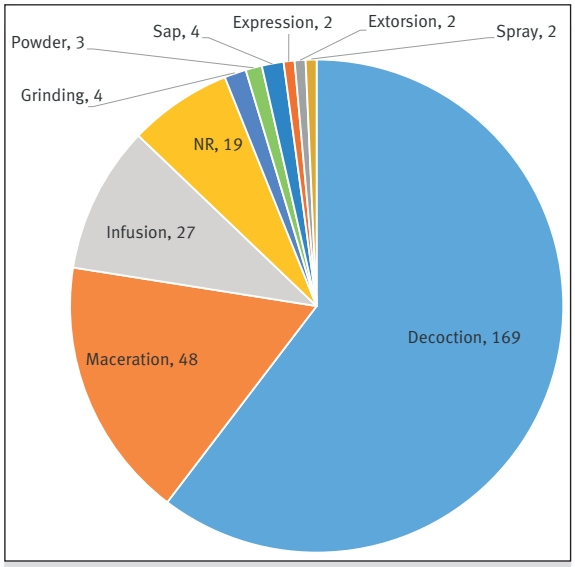

Figure 5.
Preparation methods of the most cited antimalarial plants.

Table V.
The number of species (Ndjele, 1988) and the number of antimalarial plants per family in the terrestrial flora of the Democratic Republic of Congo.

Families	Democratic Republic of Congo	Antimalarial plants	Rank
Fabaceae	893	30	1
Asteraceae	729	27	2
Rubiaceae	674	15	3
Euphorbiaceae	377	14	4
Apocynaceae	187	10	5
Annonaceae	119	8	6
Meliaceae	47	8	6
Lamiaceae	307	6	7
Myrtaceae	31	6	7
Solanaceae	96	6	7

Discussion

Two hundred thirty-two medicinal plants associated with the treatment of malaria in DRC that distributed across 181 genera and 67 families were identified. From these families, Fabaceae, Asteraceae, Euphorbiaceae, and Rubiaceae had the highest number of antimalarial plants species. These findings are similar to those obtained by Asase *et al.* (2010), Traore *et al.* (2013), and Taek *et al.* (2018) who reported that the Fabaceae had a high number of antimalarial plants species compared to other families. In a converse approach, Iyamah and Idu (2015) indicated that Fabaceae counts the highest number of antimalarial plants in Southern Nigeria, followed by Asteraceae. The predominance of medicinal plants from Fabaceae, Asteraceae ad Rubiaceae is due to the highest number of species disseminated throughout the DRC (table V) (Bakwaye *et al.*, 2013).

Similar to observations from other countries (Adekunle, 2008; Tabuti, 2008; Kodi *et al.*, 2017), woody plants constituted the largest source of antimalarial medicinal plants. From an ecological perspective, the life-forms profile of the plant allows a better appreciation of ecological conditions in which they live (Kami Kanda *et al.*, 2019). The high percentage of phanerophytes in antimalarial plants could be due to permanence of those plants throughout year (Mamadou *et al.*, 2019). The predominance of woody species and phanerophytes shows a forest physiognomy (Kikufi *et al.*, 2017; Lassa *et al.*, 2019), while the therophytes correspond to the ruderal strategy (Kikufi and Lukoki, 2008; Masharabu *et al.*, 2010).

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Although several plant parts were used in the Congo, leaves were the most commonly used in malaria treatment. This is similar to other studies from African countries that have demonstrated leaves to be the most frequently used plant part in plant remedies (Saotoing *et al.*, 2011; Adia *et al.*, 2014; Anywar *et al.*, 2016). This contrasts with the findings of Ngarivhume *et al.* (2015) in Zimbabwe where roots were the most commonly used plant part. The preference for the utilization of leaves is justified by their effortless to collect, to store, and to process, but also, their action in photosynthesis and their bioactive compounds (Kayani *et al.*, 2014; Bibi *et al.*, 2015; Vijayakumar *et al.*, 2015; Amjad *et al.*, 2017; Faruque *et al.*, 2019). Further, cutting leaves is less harmful to the plant development and growth (Alalwan *et al.*, 2019).

It was found in this study that the most commonly used mode of preparation of antimalarial plants was decoction. This affirmation corroborates the reports from the other African countries (Koudouvo *et al.*, 2011; Yetein *et al.*, 2013; Alebie *et al.*, 2017; Okello and Kang, 2019) and Asian countries (Bora *et al.*, 2007; Ong *et al.*, 2018). Decoction is largely used because of it is easy to prepare by mixing herbs with water, tea, or soup (Umair *et al.*, 2019).

The primary administration route is oral. These results are consistent with the observations reported by other countries (Bora *et al.*, 2007; Tor-anyiin *et al.*, 2003; Idowu *et al.*, 2010).

Among the recorded plant species, some have already been studied *in vitro* by Congolese Scientists, however, the phytochemical study of many antimalarial plant species has not yet been documented in vitro and/or in vivo.

Conclusion

This systematic review of medicinal plants provides a comprehensive insight into the existing antimalarial plants species in the Democratic Republic of the Congo (DRC). The 28 ethnobotanical studies published in the last two decades used in the study, highlighted the diversity of commonly used plant species with pharmacological effects, and their spatial distribution across the DRC (cultures and provinces), and represent an alternative mean for malaria prevention and a remedy for its treatment in the DRC. In addition, plants remain the major therapeutic remedy for malaria. Nevertheless, there are likely more sources of traditional knowledge and articles not published online that may contain precious information in the Phyto pharmacopeia against malaria that could serve as a basis for future studies.

Acknowledgments
The authors are grateful to all of the scholars whose work contributed to this systematic review, and Rusaati B. I. also thanks the Korea Forestry Promotion Institute (KOFPI) for providing his PhD scholarship.

Appendix 1 – List of antimalarial plants

Plant family	Botanical name	Morphological type	Life form	Part used	Preparation mode	Used methods	Provinces	References
Acanthaceae	*Hygrophila auriculata* (Schumach.) Heine	H	Ch	AP	NR	NR	2	Karhagomba *et al.* (2013); Manya *et al.* (2020)
Acanthaceae	*Hypoestes triflora* (Forssk.) Roem. & Schult.	H	Ch	WP	De	Oral	2	Manya *et al.* (2020)
Acanthaceae	*Thomandersia hensii* De Wild. & T. Durand	Sh	Ph	L	De	Oral	4	Ngbolua *et al.* (2014)
Acanthaceae	*Justicia insularis* T. Anderson	H	Th	SB	De	Oral	1	Mbuyi *et al.* (2019)
Amaranthaceae	*Chenopodium album* L.	H	Th	WP	De	Enema	1	Mbuyi *et al.* (2019)
Amaranthaceae	*Chenopodium opulifolium* Schrad. ex W.D.J. Koch & Ziz	H	Th	L	De	Oral	2	Manya *et al.* (2020)
Amaranthaceae	*Cyathula prostrata* (L.) Blume	H	Th	L	De	Oral, noise	6	Konda *et al.* (2012)
Amaranthaceae	*Dysphania ambrosioides* (L.) Mosyakin& Clemants	H	Th	L	De	Oral	2, 3	Kasali *et al.* (2014a); Kasali *et al.* (2014b); Manya *et al.* (2020)
Amaryllidaceae	*Allium sativum* L.	H	Ge	Bulds	Pounding	NR	2, 3	Kasali *et al.* (2014a); Kasali *et al.*(2014b)
Amaryllidaceae	*Allium cepa* L.	H	Ge	WP	Inf	Enema	1	Mbuyi *et al.* (2019)
Anacardiaceae	*Pseudospondias microcarpa* (A. Rich.) Engl.)	T	Ph	L, B	De, Ma	Oral, anal	6	Konda *et al.* (2012)
Anacardiaceae	*Mangifera indica* L.	T	Ph	L, RB, SB	De, Ma	Oral	1	Mbuyi *et al.* (2019)
Anisophylleaceae	*Anisophyllea pomifera* Engl. & Brehmer	T	Ph	L, R, SB	De, Ma	Oral, enema	1	Chiribagula *et al.* (2017); Kalonda *et al.* (2014); Mbuyi *et al.* (2019)
Annonaceae	*Monodora myristica* (Gaertn.) Dunal	T	Ph	Fr, Gr	NR	NR	4	Ngbolua *et al.* (2015)
Annonaceae	*Hexalobus monopetalus* (A. Rich.) Engl. & Diels	Sh	Ph	R	De	Oral	1	Mbuyi *et al.* (2019); Kalonda *et al.* (2014)
Annonaceae	*Annona senegalensis* Pers.	Sh	Ph	R, SB	NR	Oral	4	Ngbolua *et al.* (2015); Ngbolua *et al.* (2016)
Annonaceae	*Annickia chlorantha* (Oliv.) Setten & Mass	T	Ph	SB	De	Oral	4	Ngbolua *et al.* (2014)
Annonaceae	*Isolona hexaloba* (Pierre) Engl. & Diels	T	Ph	SB	De	Oral	4	Ngbolua *et al.* (2014)
Annonaceae	*Monodora laurentii* De Wild.	T	Ph	SB	De	Oral	4	Ngbolua *et al.* (2014)

Appendix 1 (continued)

Plant family	Botanical name	Morphological type	Life form	Part used	Preparation mode	Used methods	Provinces	References
Annonaceae	*Uvaria scabrida* Oliv.	L	Ph	SB	De	Oral	4	Ngbolua *et al.* (2014)
Annonaceae	*Xylopia aethiopica* (Dunal) A. Rich.	T	Ph	SB	De	Oral	1	Mbuyi *et al.* (2019)
Apiaceae	*Centella asiatica* (L.) Urb.	H	Ch	L, R	Ma	NR	1	Kalonda *et al.* (2014)
Apiaceae	*Steganotaenia araliacea* Hochst.	T	Ph	L, R	De	Oral	1	Mbuyi *et al.* (2019)
Apiaceae	*Agrocharis incognita* (C. Norman) Heywood and Jury)	H	Th	NR	NR	NR	2	Karhagomba *et al.* (2013)
Apocynaceae	*Alstonia boonei* De Wild.	T	Ph	B	De	Oral	4, 7, 10	Terashima and Ichikawa (2003); Ngbolua *et al.* (2014); Mongeke *et al.* (2018)
Apocynaceae	*Mondia whitei* (Hook. f.) Skeels	L	Ph	B	NR	NR	4	Ngbolua *et al.* (2019)
Apocynaceae	*Landolphia kirkii* Dyer	L	Ph	L	De, Ma	Oral	1	Chiribagula *et al.* (2017)
Apocynaceae	*Landolphia parvifolia* K. Schum.	L	PH	L	De	Oral	1	Mbuyi *et al.* (2019)
Apocynaceae	*Catharanthus roseus* (L.) G. Don	Ssh	Ph	L, R	De	Oral	1, 2, 3, 5	Kasali *et al.* (2014a); Ngbolua *et al.* (2013a); Kasali *et al.* (2014b); Mbuyi *et al.* (2019)
Apocynaceae	*Rauvolfia caffra* Sond	T	Ph	L, RB, SB	De	Oral	1	Mbuyi *et al.* (2019)
Apocynaceae	*Rauvolfia vomitoria* Afzel.	Sh	Ph	L, RB, SB	De	Oral	1, 3, 4, 6	Kasali *et al.* (2014a); Makumbelo *et al.* (2008); Ilumbe Bayeli (2010); Kasika *et al.* (2015); Mbuyi *et al.* (2019)
Apocynaceae	*Landolphia congolensis* (Stapf) Pichon	L	Ph	L, S	De	NR	1	Kalonda *et al.* (2014)
Apocynaceae	*Diplorhynchus condylocarpon* (Müll. Arg.) Pichon	T	Ph	RB	De	Oral	1	Mbuyi *et al.* (2019)
Apocynaceae	*Picralima nitida* (Stapf) T. Durand & H. Durand	T	Ph	Se	Chewing	Oral	4	Ngbolua *et al.* (2014)
Araceae	*Amorphophallus angolensis* N.E. Br.	H	Ge	Tubers	NR	Oral	2	Chifundera (2001)
Arecaceae	*Raphia sudanica* A. Chev.	Sh	Ph	L	De	Oral	5	Nzuki (2016)
Arecaceae	*Raphia gentiliana* De Wild.	T	Ph	NR	De	Oral	5	Nzuki (2016)
Aristolochiaceae	*Aristolochia hockii* De Wild.	H	Ch	RB	De	Oral	1	Mbuyi *et al.* (2019)
Aristolochiaceae	*Aristolochia* sp.	H	Ph	Se	De	NR	3	Kasali *et al.* (2014a)
Asphodelaceae	*Aloe* sp.	H	Ge	AP	De	NR	2	Kasali *et al.* (2014b)
Asphodelaceae	*Aloe buettneri* A. Berger	H	Ge	L	sap	Friction	5	Nzuki (2016)
Asphodelaceae	*Aloe dawei* A. Berger	H	Ge	L	De	NR	3	Kasali *et al.* (2014a)
Asphodelaceae	*Aloe christianii* Reynolds	H	Ge	L, R	De	Oral	1	Mbuyi *et al.* (2019)
Asteraceae	*Conyza sumatrensis* (S.F. Blake) Pruski & G. Sancho	H	Ch	L	De	Oral	3	Kasali *et al.* (2014a); Kasika *et al.* (2015)
Asteraceae	*Crassocephalum monthuosum* (S. Moore) Milme-Redh	H	Ch	L	De, Ma, Ash	Oral	2, 3	Kasali *et al.* (2014a); Manya *et al.* (2020)
Asteraceae	*Mikania cordata* (Burm. f.) B.L. Rob.	L	Ch	L	De	NR	3	Kasali *et al.* (2014a)
Asteraceae	*Tithonia diversifolia* (Hemsl.) A. Cray.	Ssh	Ch	L, R	De, Ma	Oral, enema	1, 2, 3	Kasali *et al.* (2014a); Kasali *et al.* (2014b); Mbuyi *et al.* (2019)
Asteraceae	*Dichrocephala integrifolia* (L. f.) O. Ktze.	H	Hc	NR	NR	Hit a patient	3, 7	Kasika *et al.* (2015); Terashima and Ichikawa (2003)
Asteraceae	*Chamaemelum nobile* (L.) All.	H	Ph	Fl	Inf	NR	2	Kasali *et al.* (2014b)
Asteraceae	*Achillea millefolium* L.	H	Ph	L	De	NR	3	Kasali *et al.* (2014a)
Asteraceae	*Artemisia annua* L.	H	Ph	L	Inf	Oral	2, 3	Kasali *et al.* (2014a); Karhagomba *et al.* (2013); Kasali *et al.* (2014b); Manya *et al.* (2020)
Asteraceae	*Baccharoides adoensis* (Sch. Bip. ex Walp.) H. Rob.	H	Ph	L	Ma	Enema, oral	1	Mbuyi *et al.* (2019); Muya *et al.* (2014)
Asteraceae	*Microglossa pyrifolia* (Lam.) Kuntze	T	Ph	L	De	NR	3	Kasali *et al.* (2014a)
Asteraceae	*Sambucus canadensis* L.	T	Ph	L	De	NR	3	Kasali *et al.* (2014a)
Asteraceae	*Mikania microptera* DC.	H	Ph	L	sap	Put in eyes	7	Terashima and Ichikawa (2003)
Asteraceae	*Matricaria chamomilla* L.	H	Ph	L, Fr	De, Inf	NR	2, 3	Kasali *et al.* (2014a); Kasali *et al.* (2014b)
Asteraceae	*Vernonia amygdalina* Del.	Sh	Ph	L, R	De, Inf	Oral	1, 2, 3, 5	Kasali *et al.* (2014a); Karhagomba *et al.* (2013); Ngbolua *et al.* (2013b); Kasali *et al.* (2014b); Ngbolua *et al.* (2014); Manya *et al.* (2020); Kalonda *et al.* (2014)
Asteraceae	*Acanthospermum glabratum* (DC.) Wild	H	Th	L	De	Oral	2	Manya *et al.* (2020)
Asteraceae	*Ageratum conyzoides* (L.) L.	H	Th	L	De	NR	2, 3	Kasali *et al.* (2014a); Kasali *et al.* (2014b)

Appendix 1 (continued)

Plant family	Botanical name	Morphological type	Life form	Part used	Preparation mode	Used methods	Provinces	References
Asteraceae	*Bidens pilosa* L.	H	Th	L	De	Oral	1, 2, 3	Kasali *et al.* (2014a); Kasika *et al.* (2015); Kasali *et al.* (2014b); Mbuyi *et al.* (2019); Manya *et al.* (2020); Kalonda *et al.* (2014)
Asteraceae	*Cyanthillium cinereum* (L.) H. Rob.	H	Th	L	Ma	Oral	1	Mbuyi *et al.* (2019)
Asteraceae	*Synedrella nodiflora* (L.) Gaertn.	H	Th	L	De	Oral	2	Manya *et al.* (2020)
Asteraceae	*Artemisia* sp.	H	Th	WP	De	NR	5	Ngbolua *et al.* (2013a)
Asteraceae	*Aspilia kotschyi* (Sch. Bip. ex Hochst.) Oliv.	H	Th	WP	De	Oral	2	Manya *et al.* (2020)
Asteraceae	*Bidens oligoflora* (Klatt) Wild	H	Th	WP	De	Oral	2	Manya *et al.* (2020)
Asteraceae	*Crassocephalum picridifolium* (DC.) S. Moore	H	Th	WP	De	Oral	2	Manya *et al.* (2020)
Asteraceae	*Polydora serratuloides* (DC.) H. Rob	H	Th	WP	De	Oral	2	Manya *et al.* (2020)
Asteraceae	*Porphyrostemma chevalieri* (O. Hoffm.) Hutch. & Dalziel	H		L	De	Oral	2	Manya *et al.* (2020)
Asteraceae	*Anisopappus chinensis* Hook & Arn.	H		WP	NR	NR	11	Lusakibanza (2012)
Bignoniaceae	*Spathodea campanulata* P. Beauv.	T	Ph	L	De, Inf	Oral	2	Manya *et al.* (2020)
Bignoniaceae	*Newbouldia laevis* (P. Beauv.) Seem.	T	Ph	R	Ma	NR	4	Makumbelo *et al.* (2008)
Boraginaceae	*Cynoglossum lanceolatum* Forssk.	H	Th	L	De	NR	3	Kasali *et al.* (2014a)
Bromeliaceae	*Ananas cosmesus* (L.) Merr.	H	Ch	L, Fr	Exp, ext	NR	2, 3	Kasali *et al.* (2014a); Kasali *et al.* (2014b)
Caricaceae	*Carica papaya* L.	T	Ph	L, R, Fl	De, Inf, Ma	Oral	1, 2, 3	Kasali *et al.* (2014a); Kasika *et al.* (2015); Kasali *et al.* (2014b); Mbuyi *et al.* (2019); Manya *et al.* (2020); Ilumbe Bayeli (2010); Muya *et al.* (2014); Kalonda *et al.* (2014)
Chrysobalanaceae	*Parinari curatellifolia* Planch. ex Benth.	T	Ph	R	De	Oral	1	Mbuyi *et al.* (2019)
Clusiaceae	*Garcinia huillensis* Welw.	T	Ph	L, RB	De	Oral	2	Manya *et al.* (2020)
Clusiaceae	*Lebrunia buchaie* Staner	T	Ph	NR	NR	NR	2	Mangambu *et al.* (2015b)
Clusiaceae	*Garcinia kola* Heckel	T	Ph	SB, Fr	De	Chewing, oral	4, 6	Ngbolua *et al.* (2015); Ngbolua *et al.* (2016); Ngbolua *et al.* (2019); Ilumbe Bayeli (2010)
Combretaceae	*Combretum haullevilleanum* De Wild.	Sh	Ph	L, S, SB	De	Oral	1	Mbuyi *et al.* (2019)
Combretaceae	*Combretum zeyheri* Sond.	T	Ph	L, S, SB	De	Oral	1	Mbuyi *et al.* (2019)
Combretaceae	*Combretum molle* R. Br. ex G. Don	T	Ph	L, SB	De	Oral	2	Manya *et al.* (2020)
Combretaceae	*Terminalia mollis* M.A. Lawson	T	Ph	L, SB	De	Oral	1	Mbuyi *et al.* (2019)
Commelinaceae	*Tradescantia zebrina* Bosse	H	Ch	L, Fr	De	NR	3	Kasali *et al.* (2014a)
Convolvulaceae	*Ipomoea indica* (Burm.) Merr.	H	Ch	WP	De	Oral	2	Manya *et al.* (2020)
Crassulaceae	*Kalanchoe crenata* (Andrews) Haw.	H	Ch	L	De, Sap	Oral, instillation	2	Manya *et al.* (2020)
Cucurbitaceae	*Oreosyce africana* Hook. f.	L	Ph	WP	De	Oral	2	Chifundera (2001)
Cucurbitaceae	*Momordica foetida* Schumach.	H	Th	L	ext	NR	2	Kasali *et al.* (2014b)
Cupressaceae	*Cupressus lusitanica* Mill.	T	Ph	L	De, Inf	NR	2, 3	Kasali *et al.* (2014a); Kasali *et al.* (2014b)
Ebenaceae	*Diospyros mespiliformis* Hochst. ex A. DC.	T	Ph	R	Ma	Oral	1	Mbuyi *et al.* (2019)
Euphorbiaceae	*Acalypha brachiata* Krauss	Sh	Hc	L	De	Oral	1	Mbayo *et al.* (2016)
Euphorbiaceae	*Croton* sp.	T	Ph	B	De	NR	3	Kasali *et al.* (2014a)
Euphorbiaceae	*Acalypha homblei* De Wild.	H	Ph	L	De	Oral	2	Manya *et al.* (2020)
Euphorbiaceae	*Alchornea cordifolia* (Schumach. & Thonn.) Müll. Arg.	Sh	Ph	L	De	Oral	6	Konda *et al.* (2012)
Euphorbiaceae	*Ricinus communis* L.	Sh	Ph	L	Ma	Bath	1	Mbuyi *et al.* (2019)
Euphorbiaceae	*Antidesma venosum* E. Mey. ex Tul.	T	Ph	L, R, RB	De, Inf	Oral	1, 2	Mbuyi *et al.* (2019); Mbayo *et al.* (2016); Manya *et al.* (2019); Kalonda *et al.* (2014)
Euphorbiaceae	*Maprounea africana* Müll. Arg.	T	Ph	L, RB	De	Oral	2	Manya *et al.* (2020)
Euphorbiaceae	*Jatropha curcas* L.	Sh	Ph	L, SB	De	Rub the leaves on the body, oral	1, 5, 8	Ndombe *et al.* (2016); Mbuyi *et al.* (2019); Mbayo *et al.* (2016); Nzuki (2016)
Euphorbiaceae	*Phyllanthus muellerianus* (Kuntze) Exell.	Sh	Ph	L, SB	De, Ma, Gri	Oral, fomentation	1	Chiribagula *et al.* (2017); Mbuyi *et al.* (2019); Mbayo *et al.* (2016)
Euphorbiaceae	*Manihot esculenta* L.	Sh	Ph	NR	NR	NR	5	Nzuki (2016)
Euphorbiaceae	*Euphorbia ingens* E. Mey. ex Boiss.	T	Ph	R	Ma	Oral	1	Mbuyi *et al.* (2019)

Appendix 1 (continued)

Plant family	Botanical name	Morphological type	Life form	Part used	Preparation mode	Used methods	Provinces	References
Euphorbiaceae	*Euphorbia tirucalli* L.	T	Ph	R	Ma	Oral	1	Mbuyi *et al.* (2019); Muya *et al.* (2014)
Euphorbiaceae	*Euphorbia hirta* L.	H	Th	R	Ma	Oral	1	Mbuyi *et al.* (2019)
Euphorbiaceae	*Euphorbia parviflora* L.	H		AP	Ma (oil)	NR	2	Kasali *et al.* (2014b)
Fabaceae	*Indigofera arrecta* Hochst. ex A. Rich.	H	Ch	L	Inf	NR	2	Kasali *et al.* (2014b)
Fabaceae	*Hylodesmum repandum* (Vahl) H. Ohashi & R.R. Mill	Ssh	Ch	L, FL	De, Inf	Oral	2	Manya *et al.* (2020)
Fabaceae	*Dialium angolense* Oliv.	T	Ph	L	De	Oral	2	Manya *et al.* (2020)
Fabaceae	*Julbernardia paniculata* (Benth.) Troupin	T	Ph	L	De, Inf	Oral	2	Manya *et al.* (2020)
Fabaceae	*Parkia bicolor* A. Chev.	T	Ph	L	De	Oral	1	Mbuyi *et al.* (2019)
Fabaceae	*Senna spectabilis* (DC.) H.S. Irwin & Barneby	H	Ph	L	De	NR	2	Kasali *et al.* (2014b)
Fabaceae	*Bobgunnia madagascariensis* (Desv.) J.H. Kirkbr. and Wiersema	T	Ph	L, R	De, Ma, Spray	Oral, bath	1	Chiribagula *et al.* (2017); Mbuyi *et al.* (2019)
Fabaceae	*Dalbergia nitidula* Baker	Sh	Ph	L, R	De	NR	1	Kalonda *et al.* (2014)
Fabaceae	*Bauhinia reticulata* DC.	T	Ph	L, R, SB	De, Ma	Oral	1, 4	Mbuyi *et al.* (2019); Ngbolua *et al.* (2014); Muya *et al.* (2014)
Fabaceae	*Pterocarpus angolensis* DC.	T	Ph	L, R, SB	De	Oral	1	Chiribagula *et al.* (2017)
Fabaceae	*Pterocarpus tinctorius* Welw.	T	Ph	L, R, SB	De	Oral	1	Mbuyi *et al.* (2019)
Fabaceae	*Senna occidentalis* (L.) Link	Ssh	Ph	L, R, SB	De, Ma	Oral	1, 2, 3, 5, 6	Manya *et al.* (2020); Nzuki (2016); Konda *et al.* (2012); Kasali *et al.* (2014a); Kasali *et al.* (2014b); Chiribagula *et al.* (2017); Mbuyi *et al.* (2019)
Fabaceae	*Cajanus cajan* (L.) Mill sp.	Sh	Ph	L, R, SB, Gr	Milling and maceration	Oral, instillation	1	Chiribagula *et al.* (2017); Mbuyi *et al.* (2019); Muya *et al.* (2014)
Fabaceae	*Isoberlinia angolensis* (Welw. ex Benth.) Hoyle & Brenan	T	Ph	L, RB	De	Oral	2	Manya *et al.* (2020)
Fabaceae	*Acacia polyacantha* Willd.	T	Ph	L, RB, SB	De, Inf, Ma	Oral	1	Chiribagula *et al.* (2017); Mbuyi *et al.* (2019); Muya *et al.* (2014)
Fabaceae	*Cassia sieberiana* L.	T	Ph	L, SB	De	Oral	1	Mbuyi *et al.* (2019)
Fabaceae	*Dalbergia boehmii* Taub.	T	Ph	L, SB	De, Ma	Oral	1	Mbuyi *et al.* (2019); Kalonda *et al.* (2014); Manya *et al.* (2020)
Fabaceae	*Acacia buchananii* Harms	T	Ph	R	De, Ma	Enema	1	Mbuyi *et al.* (2019)
Fabaceae	*Acacia karroo* Hayne	Sh	Ph	R	De, Ma	Enema	1	Mbuyi *et al.* (2019)
Fabaceae	*Amblygonocarpus andongensis* (Oliv.) Exell & Torre	T	Ph	R	De	Oral	1	Mbuyi *et al.* (2019)
Fabaceae	*Entada abyssinica* A. Rich.	Sh	Ph	R	Spray	Instillation (ear, nose)	1	Chiribagula *et al.* (2017); Mbuyi *et al.* (2019)
Fabaceae	*Pericopsis angolensis* (Baker) Meeuwen	T	Ph	R	De, Ma	Oral	1	Mbuyi *et al.* (2019)
Fabaceae	*Senna* alata (L.) Roxb.	T	Ph	R	De	Oral	1	Mbuyi *et al.* (2019)
Fabaceae	*Erythrina abyssinica* DC.	T	Ph	R, B, Fr	De, Inf, Ma	Oral, enema	1, 2, 3	Kasali *et al.* (2014a); Kasali *et al.* (2014b); Mbuyi *et al.* (2019)
Fabaceae	*Albizia adianthifolia* (Schum.) W.F. Wight	T	Ph	RB	De	Oral, fumigation, bath	1	Chiribagula *et al.* (2017); Mbuyi *et al.* (2019)
Fabaceae	*Pentaclethra macrophylla* Benth.	T	Ph	RB	De	Oral	4	Ngbolua *et al.* (2014)
Fabaceae	*Bauhinia thonningii* Schum.	T	Ph	RB, SB	De, Ma	Oral	1	Mbuyi *et al.* (2019); Muya *et al.* (2014)
Fabaceae	*Dalbergia chapelieri* Baill.	Sh	Ph	S	Inf	Oral	2	Manya *et al.* (2020)
Fabaceae	*Arachis hypogaea* L.	H	Th	Se	Paste	NR	2, 3, 5	Kasali *et al.* (2014a); Kasali *et al.* (2014b); Nzuki (2016)
Fabaceae	*Droogmansia giorgii* De Wild.	Ssh		L, R, SB	De	Oral	1	Mbuyi *et al.* (2019)
Fabaceae	*Baphia capparidifolia* Baker	L		L, SB	De	Oral	1	Mbuyi *et al.* (2019)
Fabaceae	*Rhynchosia insignis* (O. Hoffm.) R.E. Fr.	H		R	Ma	Oral	1	Muya *et al.* (2014)
Hypericaceae	*Psorospermum corymbiferum* Hochr.	Sh	Ph	L	Inf	Oral	2	Manya *et al.* (2020)
Hypericaceae	*Harungana madagascariensis* Lam. ex Poir.	T	Ph	L, R, SB	De	Oral	1, 2, 6	Kasali *et al.* (2014b); Muya *et al.* (2014); Konda *et al.* (2012); Mbuyi *et al.* (2019)
Icacinaceae	*Pyrenacantha staudtii* (Engl.) Engl.	L	Ph	L	De	Oral	6	Ilumbe Bayeli (2010)
Lamiaceae	*Kalaharia uncinata* (Schinz) Moldenke	Sh	Ch	L	De	Oral	1	Mbuyi *et al.* (2019)
Lamiaceae	*Ocimum gratissimum* L.	Ssh	Ch	L	De, Inf, Ma, Gri	Poultice, oral, enema, bath	1	Chiribagula *et al.* (2017); Manya *et al.* (2020)
Lamiaceae	*Tetradenia riparia* (Hochst.) Codd	T	Ph	L	Exp	NR	2, 3	Kasali *et al.* (2014a); Kasali *et al.* (2014b)

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Appendix 1 (continued)

Plant family	Botanical name	Morphological type	Life form	Part used	Preparation mode	Used methods	Provinces	References
Lamiaceae	*Vitex madiensis* Oliv.	Sh	Ph	L	De	Oral, spray on the body	1	Mbuyi *et al.* (2019); Kalonda *et al.* (2014)
Lamiaceae	*Mentha piperita* L.	H	Th	L	De	NR	2, 3	Kasali *et al.* (2014a); Kasali *et al.* (2014b)
Lamiaceae	*Ocimum americanum* L.	H	Th	L, RB	Gri	Rub the leaves all over the body	1	Mbuyi *et al.* (2019)
Lamiaceae	*Leucas martinicensis* (Jacq.) R. Br.	H	Th	L, S	De	NR	3	Kasali *et al.* (2014a)
Lamiaceae	*Plectranthus barbatus* var. *grandis* (L.H. Cramer) Lukhoba & A.J. Paton	H		L, R	De	Oral, suppository	1	Mbuyi *et al.* (2019); Muya *et al.* (2014)
Lauraceae	*Persea americana* Mill.	T	Ph	L, Fr	De	Oral	2, 3, 6	Kasali *et al.* (2014a); Kasali *et al.*(2014b); Ilumbe Bayeli (2010)
Loganiaceae	*Strychnos cocculoides* Baker	Sh	Ph	RB	De	Oral	1	Mbuyi *et al.* (2019); Kalonda *et al.* (2014)
Loganiaceae	*Strychnos icaja* Baill.	L	Ph	RB	NR	NR	6	Lusakibanza Manzo (2012)
Loganiaceae	*Strychnos potatorum* L. f.	T	Ph	RB	De, powder	Oral, instillation (eyes, noise)	1	Mbuyi *et al.* (2019)
Loganiaceae	*Strychnos spinosa* Lam.	T	Ph	RB	De, powder	Oral, instillation (eyes, noise)	1	Mbuyi *et al.* (2019)
Lycopodiaceae	*Lycopodium clavatum* L.	H		NR	NR	NR	2	Mangambu *et al.* (2012)
Malvaceae	*Sida acuta* Burm. f.	Ssh	Ch	NR	NR	NR	3	Kasika *et al.* (2015)
Melastomataceae	*Memecylon flavovirens* Baker	Sh	Ph	L, R	Ma	Oral	1	Mbuyi *et al.* (2019)
Meliaceae	*Ekebergia benguelensis* Welw. ex C. DC.	T	Ph	L	De	NR	1	Kalonda *et al.* (2014)
Meliaceae	*Melia azedarach* L.	T	Ph	L	NR	NR	2, 13	Karhagomba *et al.* (2013); Kasali *et al.* (2014b); Lusakibanza (2012)
Meliaceae	*Azadirachta indica* A. Juss.	T	Ph	L, RB, SB	De, Ma	Oral	1, 3	Kasali *et al.* (2014a); Chiribagula *et al.* (2017); Mbuyi *et al.* (2019)
Meliaceae	*Entandrophragma palustre* Staner	T	Ph	SB	De	Oral	4, 12	Ngbolua *et al.* (2014); Lusakibanza (2012)
Meliaceae	*Khaya nyasica* Stapf ex Baker f.	T	Ph	SB	De	Oral	1, 3	Kasika *et al.* (2015); Mbuyi *et al.* (2019); Muya *et al.* (2014)
Meliaceae	*Carapa procera* DC.	T	Ph	SB, Se	De	Chewing, oral	6	Ilumbe Bayeli (2010)
Menispermaceae	*Cissampelos owariensis* P. Beauv. ex DC.	L	Ph	EP	De	NR	1	Kalonda *et al.* (2014)
Menispermaceae	*Triclisia dictyophylla* Diels	L	Ph	L	De	Oral	4	Ngbolua *et al.* (2014)
Menispermaceae	*Stephania abyssinica* (Quart. -Dill. & A. Rich.) Walp.	L	Ph	L, R, SB	De	Enema	1	Mbuyi *et al.* (2019)
Menispermaceae	*Penianthus longifolius* Miers	Sh	Ph	RB	De	Oral	4	Ngbolua *et al.* (2014)
Moraceae	*Ficus exasperata* Vahl	T	Ph	L	Ma	Oral	2	Manya *et al.* (2020)
Moraceae	*Ficus thonningii* Blume	T	Ph	L, RB	De	Oral	1	Mbuyi *et al.* (2019)
Moraceae	*Ficus sur* Forssk.	Sh	Ph	L, RB, SB	De	Oral	1	Mbuyi *et al.* (2019)
Musaceae	*Musa x paradisiaca* L.	H	Ph	L	Leaves roasted in palm oil	Oral	1	Mbuyi *et al.* (2019)
Myristicaceae	*Pycnanthus marchalianus* Ghesq.	T	Ph	SB	De	Oral	6	Ilumbe Bayeli (2010)
Myrtaceae	*Callistemon speciosus* (Sims) Sweet	T	Ph	L	De	NR	3	Kasali *et al.* (2014a)
Myrtaceae	*Corymbia citriodora* (Hook.) K.D. Hill & L.A.S. Johnson	T	Ph	L	De	Oral, inhalation	1	Mbuyi *et al.* (2019)
Myrtaceae	*Eucalyptus globulus* Labill.	T	Ph	L	De	Inhalation, oral	1, 2, 3	Kasali *et al.* (2014a); Kasali *et al.* (2014b); Mbuyi *et al.* (2019)
Myrtaceae	*Psidium guajava* L.	T	Ph	L	De	Oral	1, 2, 3	Kasali *et al.* (2014a); Kasali *et al.* (2014b); Mbuyi *et al.* (2019)
Myrtaceae	*Syzygium guineense* (Willd.) DC.	T	Ph	L, RB, SB	De	Oral	1, 3	Kasali *et al.* (2014a); Mbuyi *et al.* (2019)
Myrtaceae	*Eucalyptus* sp.	T	Ph	S	Inf	NR	3	Kasali *et al.* (2014a)
Nyctaginaceae	*Mirabilis jalapa* L.	Sh	Ch	L	De	NR	2	Kasali *et al.* (2014b)
Ochnaceae	*Ochna schweinfurthiana* F. Hoffm.	Sh	Ph	L, R	De, Ma	Oral	1, 2	Mbuyi *et al.* (2019); Manya *et al.* (2020)
Oleaceae	*Schrebera trichoclada* Welw.	Sh	Ph	L, S	De, Ma	NR	1	Kalonda *et al.* (2014)
Passifloraceae	*Passiflora edulis* Sims	L	Ch	L	De	NR	3	Kasali *et al.* (2014a)
Passifloraceae	*Passiflora foetida* L.	H	Th	L	Inf	NR	2	Kasali *et al.* (2014b)
Pentadiplandraceae	*Pentadiplandra brazzeana* Baill.	Sh	Ph	R, S	De	Oral	6, 8	Ilumbe Bayeli (2010); Ndombe *et al.* (2016)

Appendix 1 (continued)

Plant family	Botanical name	Morphological type	Life form	Part used	Preparation mode	Used methods	Provinces	References
Phyllanthaceae	*Hymenocardia acida* Tul.	Sh	Ph	L	De	Oral, inhalation, bath	1	Mbuyi *et al.* (2019)
Phytolaccaceae	*Phytolacca dodecandra* L'Hérit.	Sh gr	Ch	R	De	NR	2	Kasali *et al.* (2014b)
Picrodendraceae	*Oldfieldia dactylophylla* (Welw. ex Oliv.) J. Léonard	T	Ph	RB, SB	De	Oral, bath	1	Mbayo *et al.* (2016)
Piperaceae	*Piper guineense* Schum. and Thonn.	L	Ph	L, Se	De	Oral	2, 6	Kasali *et al.* (2014b); Ilumbe Bayeli (2010)
Piperaceae	*Piper nigrum* L.	L	Th	L	NR	NR	4	Ngbolua *et al.* (2015)
Piperaceae	*Piper capense* L. f.	Sh	Th	NR	NR	NR	2, 3	Karhagomba *et al.* (2013); Kasika *et al.* (2015)
Plantaginaceae	*Plantago palmata* Hook. f.	H	Ph	L	De	Oral	2	Kasali *et al.* (2014b); Manya *et al.* (2020)
Poaceae	*Cymbopogon densiflorus* (Steud.) Stapf	H	Ch	AP	De, Inf, Ma	Inhalation, oral	1	Mbuyi *et al.* (2019); Muya *et al.* (2014)
Poaceae	*Cymbopogon citratus* (DC.) Stapf	H	Th	L	De, Inf	Oral, inhalation, friction	1, 2, 3, 4, 5	Ngbolua *et al.* (2016); Ngbolua *et al.* (2019); Mbuyi *et al.* (2019); Kasali *et al.* (2014); Kasali *et al.* (2014b); Nzuki (2016)
Polygalaceae	*Securidaca longipedunculata* Fresen.	T	Ph	L, SB	De	Inhalation, oral	1	Mbuyi *et al.* (2019); Muya *et al.* (2014)
Proteaceae	*Faurea rochetiana* (A. Rich.) Chiov. ex Pic. Serm.	T	Ph	SB	De, Ma	Oral	1	Mbuyi *et al.* (2019)
Ranunculaceae	*Ranunculus multifidus* Forssk.	H	Ph	L	De	NR	3	Kasali *et al.* (2014a)
Rhamnaceae	*Ziziphus abyssinica* Hochst. ex A. Rich.	Sh	Ph	R	Ma	Oral	1	Mbuyi *et al.* (2019)
Rhamnaceae	*Ziziphus mucronata* Willd.	T	Ph	R	Ma	Oral	1	Mbuyi *et al.* (2019)
Rhamnaceae	*Zizyphus resinosa* Hochst. ex A. Rich.	T	Ph	R	De, Ma	Oral	1	Chiribagula *et al.* (2017)
Rosaceae	*Prunus africana* (Hook. f.) Kalkman	T	Ph	B	NR	NR	2	Mangambu *et al.* (2015a)
Rosaceae	*Rubus rigidus* Sm.	L	Ph	L	De	NR	3	Kasali *et al.* (2014a)
Rubiaceae	*Fadogiella stigmatoloba* (K. Schum.) Robyns	H	Ch	L	De	Oral	2	Manya *et al.* (2020)
Rubiaceae	*Otiophora pauciflora* Baker	H	Ch	L	Ma	Oral	2	Chifundera (2001)
Rubiaceae	*Spermacoce princeae* (K. Schum.) Verdc.	H	Ch	L	De, Sap	Instillation	2	Manya *et al.* (2020)
Rubiaceae	*Cinchona calisaya* Wedd.	T	Ph	B	De	NR	2, 3	Kasali *et al.* (2014a); Kasali *et al.* (2014b)
Rubiaceae	*Leptactina benguelensis* (Welw. ex Benth & Hook. f.) R.D. Good.	T	Ph	L	De	Oral	4	Ngbolua *et al.* (2014)
Rubiaceae	*Morinda longiflora* G. Don	climbing shrub	Ph	L	De	NR	4	Makumbelo *et al.* (2008)
Rubiaceae	*Morinda morindoides* (Baker) Milne-Redh.	L	Ph	L	De	Oral, chewing	4, 5, 6	Ngbolua *et al.* (2013b); Ngbolua *et al.* (2016); Ngbolua *et al.* (2019); Ngbolua *et al.* (2014); Ilumbe Bayeli (2010)
Rubiaceae	*Rothmannia engleriana* (K. Schum.) Kea	T	Ph	L, RB	De, Ma	Oral	2	Manya *et al.* (2020)
Rubiaceae	*Cinchona officinalis* L.	T	Ph	L, SB	De	Oral	2	Manya *et al.* (2020)
Rubiaceae	*Morinda lucida* Benth.	Sh	Ph	L, UP	De	Oral, friction	4, 5	Ngbolua *et al.* (2019); Nzuki (2016)
Rubiaceae	*Gardenia ternifolia* Schumach. & Thonn.	Sh	Ph	R	De	Oral	1	Mbuyi *et al.* (2019)
Rubiaceae	*Hymenodictyon floribundum* (Hoscht. & Steud) B.L. Rob.	Sh	Ph	R	De	NR	1	Kalonda *et al.* (2014)
Rubiaceae	*Sarcocephalus latifolius* (Sm.) E.A. Bruce	Sh	Ph	R	De	NR	5	Ngbolua *et al.* (2013a)
Rubiaceae	*Crossopteryx febrifuga* (Afzel. ex G. Don) Benth.	T	Ph	SB	De	Oral	1	Mbuyi *et al.* (2019); Kalonda *et al.* (2014)
Rubiaceae	*Nauclea diderrichii* (De Wild.) Merr.	Sh	Ph	SB	De	Oral	4	Ngbolua *et al.* (2014)
Rutaceae	*Citrus aurantium* L.	T	Ph	Fr	Ma	NR	2	Kasali *et al.* (2014b)
Rutaceae	*Citrus limon* (L.) Osbeck	T	Ph	L	De	Oral	1, 2, 3	Kasali *et al.* (2014a); Kasali *et al.* (2014b); Mbuyi *et al.* (2019)
Rutaceae	*Citrus medica* L.	T	Ph	L	Inf	Bath	9	Mbula *et al.* (2015)
Sapindaceae	*Zanha africana* (Radlk.) Exell	T	Ph	RB	Inc	Tatoo	1	Mbuyi *et al.* (2019)
Sapotaceae	*Autranella congolensis* (De Wild.) A. Chev.	T	Ph	SB	De	Oral	4	Ngbolua *et al.* (2014)

Appendix 1 (continued)

Plant family	Botanical name	Morphological type	Life form	Part used	Preparation mode	Used methods	Provinces	References
Simaroubaceae	*Quassia Africana* (Baill.) Baill.	T	Ph	L, R	NR	Oral	4	Ngbolua *et al.* (2015); Ngbolua *et al.* (2016)
Solanaceae	*Solanum sisymbriifolium* Lam.	H	Ch	Fr	Inf	Oral/reactally applied	2	Chifundera (2001)
Solanaceae	*Capsicum annuum* L.	T	Ch	L	Ma, Inf	NR	1	Kalonda *et al.* (2014)
Solanaceae	*Solanum incanum* L.	H	Ch	R	De, Ma	Enema	1	Mbuyi *et al.* (2019)
Solanaceae	*Nicotiana tabacum* L.	H	Th	L	Gri	Noise	1	Mbuyi *et al.* (2019)
Solanaceae	*Physalis peruvianna* L.	H	Th	L, R	De, Inf	Oral	1, 2, 3	Kasali *et al.* (2014a); Kasali *et al.* (2014b); Mbuyi *et al.* (2019); Manya *et al.* (2020)
Solanaceae	*Physalis angulata* L.	H	Th	WP	NR	NR	5	Lusakibanza Manzo (2012)
Tropaeolaceae	*Tropaeolum majus* L.	H	Ch	L	De	NR	2, 3	Kasali *et al.* (2014a); Kasali *et al.* (2014b)
Verbenaceae	*Lantana camara* L.	Sh	Ph	L	De, Inf	Inhalation, oral	1, 2, 3	Kasali *et al.* (2014a); Kasali *et al.* (2014b); Mbuyi *et al.* (2019); Manya *et al.* (2020)
Verbenaceae	*Lippia multiflora* Moldenke	H		L	De	Oral	5	Nzuki (2016)
Zingiberaceae	*Curcuma longa* L.	H	Ge	L	Ma	Oral	5	Nzuki (2016)
Zingiberaceae	*Aframomum melegueta* K. Schum.	H	Ge	L, R	De	Oral	1	Mbuyi *et al.* (2019)
Zingiberaceae	*Aframomum alboviolaceum* (Ridl.) K. Schum.	H	Ge	L, R, Fr	Ma	Oral	4, 6	Ngbolua *et al.* (2016); Ngbolua *et al.* (2019); Illumbe Bayeli (2010)
Zingiberaceae	*Aframomum laurentii* (De Wild. & T. Durand) K. Schum.	H	Ph	L	De, Inf, powder	Oral, topical application	2	Manya *et al.* (2020)

Morphological type (H: herb, T: tree, Sh: shrub, Ssh: sub-shrub, L: liana), life-form (Ph: Phanerophyte, Ch: Chamaephyte, Hc: Hemicryphophyte, Th: Therophyte, Ge: Geophyte), part used (L: leaves, R: root, RB: root bark, WP: whole plant, Fr: fruit, AP: arial part, B: bark, Gr: grain, Se: seed, Fl: flower, S: stem, SB: stem bark, UP: underground part, EP: external part), preparation mode (De: decoction, Ma: maceration, Inf: infusion, Gri: grinding, Exp: expression, Ext: extorsion, Inc: incineration), Provinces (1: Haut-Katanga, 2: Sud-Kivu, 3: Nord-Kivu, 4: Kinshasa, 5: Kongo-Central, 6: Equateur, 7: Ituri, 8: Kwango, 9: Tshopo, 10: Sud-Ubangi, 11: Lualaba, 12: Sankuru, 13: Maniema).

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