

Ethiopian medicinal plants traditionally used for wound treatment: A systematic review

Helen Bitew^{1*}, Haftom Gebregergs², Kald B. Tuem², Mariamawit Y. Yeshak³

Abstract

Background: There are rich knowledge and practice in Ethiopian traditional medicine of using plants for the treatment of various ailments, including wounds. Though scholars have been working on documenting the ethnobotanical use of plants, the studies are still ongoing.

Objectives: This study systematically reviewed medicinal plants traditionally employed for the treatment of wounds in Ethiopia.

Methods: A systematic review of the literature was conducted using PubMed and Google Scholar; a search of grey literature was also carried out as part of the review. Search terms and phrases included 'traditional medicine', 'ethnomedicine', 'ethnobotany' and 'Ethiopia'. Data regarding the scientific name, family, local name, growth form of the plant, mode of administration, and availability of voucher specimen were extracted.

Results: Based on the eligibility criteria, 29 studies were retrieved from PubMed, and 25 from Google Scholar and the grey literature. Around 200 medicinal plants which are used to treat wounds in Ethiopian traditional medicine were recorded. Leaves and roots were the most commonly used plant parts to treat wounds, while shrubs and herbs were reported to be the growth forms of most plants. The mode of administration was topical in almost all cases.

Conclusions: Medicinal plants have been used extensively to treat wounds in Ethiopia. Nevertheless, the scientific exploration of plants' efficacy and safety is inadequate, and relevant activity studies ought to be conducted to provide scientific evidence to the traditional claims of these plants. [*Ethiop.J. Health Dev.* 2019; 33(2):102-127]

Key words: Ethnobotany, ethnomedicine, medicinal plants, Ethiopian traditional medicine, wound

Introduction

The flora of Ethiopia is estimated to comprise 6,500-7,000 species of higher plants, of which 12% are endemic (1). About 80-90% of the human population use traditional medicine as an alternative medicine for primary health care in Ethiopia, often in combination with modern medicine; traditional medicine is also administered to around 90% of livestock (2). A number of plant species have been proven to possess medicinal value (3). As in other parts of the world, the extensive utilization of traditional medicine by both rural and urban populations in Ethiopia could be accredited to their cultural acceptability, effectiveness against some types of diseases, availability, and affordability in comparison to modern medicine (4,5).

There is a significant interest in herbal medicines in both developed and developing countries because of their relative safety and tolerability compared to modern medicines (6). This includes wound treatments using medicinal plants. The plant-based treatment of wounds is cost-effective; moreover, the plants used are generally regarded as safe, as hypersensitive reactions are rare (7,8).

Across the world, most of the plants that are known to contain therapeutic agents are used by different communities (9). Moreover, the relevance of native medical systems on a scientific screening of medicinal plants is becoming prominent. The accessibility of the results from biological evaluation to the public is also important to the development and promotion of

traditional medicine (10). Globally, more than 400 plant species with wound healing effects were reported (11).

Ethiopia comprises people with numerous languages, cultures, and beliefs. This makes for a rich and diverse knowledge and practice of traditional medicine, including herbal remedies (12). Ethnobotanical studies conducted by different scholars show that a significant number of medicinal plants have been used to treat wounds and other illnesses in Ethiopia's traditional health care system. Hence, the medicinal plants used traditionally to treat wound in Ethiopia were systematically reviewed.

Objectives

The major objectives of this systematic review were to compile and summarize medicinal plants used for the treatment of wounds in Ethiopia; provide concise information that could be used by the research community to conduct scientific pharmacological investigation of traditionally used medicinal plants.

Methods

Study design: A systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) checklist (13).

Search strategy: PubMed, Google Scholar, and grey literature were the sources of the systematic literature review.

*¹Department of Pharmacognosy, School of Pharmacy, College of Health Sciences, Mekelle University, P.O.Box 1871, Mekelle, Ethiopia. Email: HB - helenbitew@mu.edu.et, helenitew@gmail.com

²Department of Pharmacology and Toxicology, School of Pharmacy, College of Health Sciences, Mekelle University, P.O.Box 1871, Mekelle, Ethiopia.

³Department of Pharmaceutical Chemistry and Pharmacognosy, School of Pharmacy, College of Health Sciences, Addis Ababa University, P.O. Box 9086, Addis Ababa, Ethiopia.

A search strategy was prepared using four arms, as shown in Table 1. Related publications were reviewed by title and abstract to acquire information relevant to medicinal plants used to treat wounds in Ethiopia. Relevant articles were accessed in full text and further investigated for information related to the topic of interest. The plants used to treat wounds were included based on the eligibility criteria described below.

Inclusion and exclusion criteria: Studies published from 2000 to February 2018 on medicinal plants used to treat wounds in humans in Ethiopia and published in the English language were included. Publications from 2000 onward were selected, since few articles were published before 2000, and for those that were, full texts are not typically available. Studies of medicinal plants used to treat wounds in livestock; wounds caused by conditions such as cancer, leprosy and impetigo; studies which did not describe plants by scientific names; and review articles, were all excluded.

Outcomes of interest: The major outcomes of interest of this systematic review were to collect and summarize information about medicinal plants used for the treatment of wounds in Ethiopia; provide information for the research community to conduct further scientific investigations into the wound healing, anti-inflammatory and anti-microbial effects of traditionally used medicinal plants, as well as their safety profile.

Data extraction: For each of the included studies, the following information on plants were extracted: scientific name, family, local name, growth form of the plant, mode of preparation and application (where available), voucher number (where available), as well

as the region where the study was conducted. The full Latin binominal names of the plants were confirmed using the JSTOR Global Plants website, <https://plants.jstor.org/>.

Data analysis: SPSS version 21 was used to describe the frequency distribution of medicinal plants, parts of the plants used, growth form, genus and family of the plants, as well as the region where the plants were used.

Results

As shown in the flow chart (Figure 1), a total of 54 articles were retrieved from PubMed and grey literature. In this review, ethnobotanical reports on plants used for the treatment of wounds in Ethiopia were grouped according to species within plant families and tabulated based on the part of the plant used. All of the plants are listed in Table 3 (leaves), Table 4 (roots), and Table 5 (other plant parts). The tables comprise names of the plants, families, vernacular names, growth forms, modes of preparation and application, and voucher numbers. Accordingly, a total of 236 plants were identified that are used to treat wounds with different plant parts. The plants belong to 67 families, mostly the Asteraceae, Fabaceae, and Solanaceae families (Figure 2). The majority of the plants were reported from Oromia Region (30.2%), followed by Amhara (24.8%), SNNP (19.1%), Tigray (18.2%) and Benishangul-Gumuz regions (5.7%). Shrubs were the most commonly reported (34.1%) growth form of medicinal plants used for wounds. Herbs, trees and climber plants were also commonly used plants to traditionally treat wounds. The most commonly used plant parts were leaves, which account for 48.6% of all treatments, followed by roots, fruits, flowers, stems, and latex of plants (Table 2).

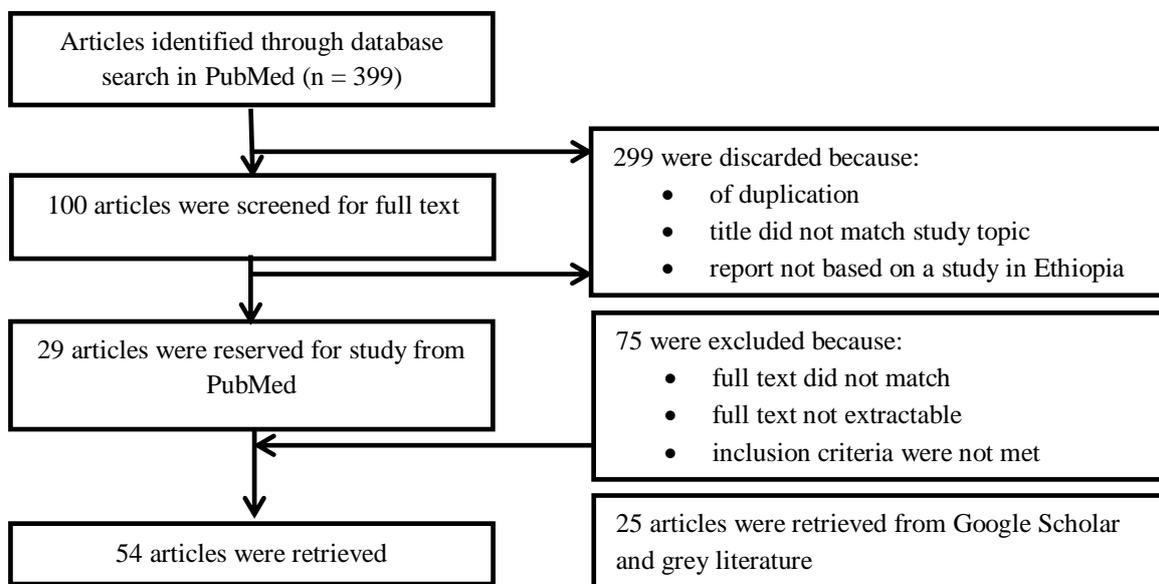


Figure 1: Selection of articles for the systematic review

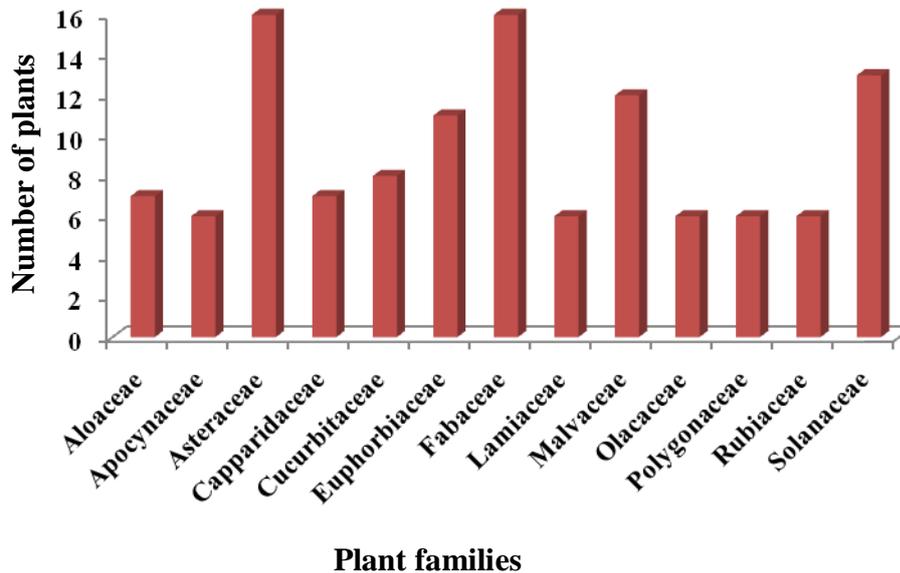


Figure 2: The common plant families of medicinal plants used to treat wounds in Ethiopia

Among the plant leaves used, the 13 plants described in more than five publications are shown in Figure 3. The roots of 40 plants were reported to be used traditionally to treat wounds. The most commonly used medicinal plants which were mentioned in at least two articles were *Asparagus africanus*, *Brucea antidysenterica*, *Capparis tomentosa*, *Cucumis ficifolius*, *Cyphostemma adenocaulis*, *Dracaena steudneri*, *Sida ovata*, and *Stephania abyssinica*. The flowers, fruits, stems, bark

and latex of 86 plants were reported. *Bersama abyssinica*, *Calotropis procera*, *Citrus aurantifolia*, *Coffea arabica*, *Cucumis ficifolius*, *Datura stramonium*, *Euphorbia abyssinica*, *Lepidium sativum*, *Prunus Africana*, *Solanum incanum*, *Stereospermum kunthianum*, and *Ximenia americana* are the medicinal plants mentioned in at least three publications.

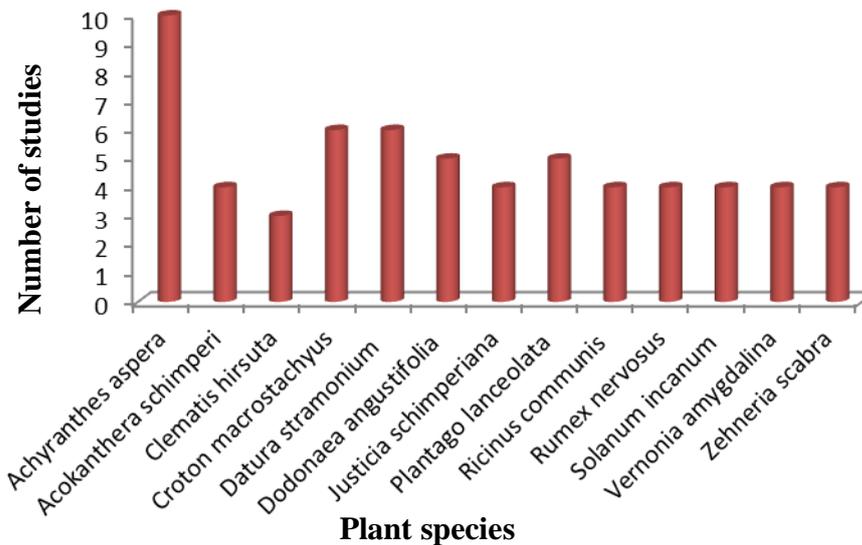


Figure 3: Commonly used plants for treatment of wound (Plant part = leaf)

Regarding the mode of preparation and use, except for 24 plants, all of the reports describe how the plants are used. Except for seven plants which are used orally, all of the plants were used topically. Leaves, fruits, and roots of *Carica papaya*, roots of *Achyranthes aspera*,

Lagenaria siceraria, *Phytolacca dodecandra*, *Rumex nepalensis*, seeds of *Brassica carinata* and *Brassica nigra* were used orally. Most of the studies mentioned the voucher numbers for the specimens of the medicinal plants.

Table 1: Search strategy for plants used for wounds in Ethiopian traditional medicine

Search arm	Search terms
Traditional medicine	“Medicine, Traditional” OR traditional medicin* OR traditional medicine
Ethnomedicine	“Ethnomedicine”
Ethnobotany	“Ethnobotany” or “ethnobotan”
Ethiopia	“Ethiopia”

Table 2: Parts and growth form of plants used to treat wounds in Ethiopia

Parts used	Frequency	%	Parts used	Frequency	%
Leaf	121	48.6	Whole part	2	0.8
Root	40	15.8	Bulbs	2	0.8
Stem	16	6.4	Root bark	1	0.4
Latex	15	6.0	Not specified	3	1.2
Bark	12	4.8	Growth form	Frequency	%
Seed	11	4.4	Shrub	85	34.1
Fruit	8	3.2	Herb	74	29.7
Flower	6	2.4	Tree	62	24.9
Exudate	5	2.0	Climber	16	6.4
Stem bark	5	2.0	Tree/shrub	4	2.0
Shoots	3	1.2	Grass	2	0.8

Table 3: Ethiopian medicinal plants used for treatment of wounds (Parts used: Leaf)

S/N	Scientific name	Family	Local name	Growth form	Mode of administration	Voucher number	Ref.
1.	<i>Abutilon fruticosum</i> Guill. & Perr.	Malvaceae	Balanbal (Sm)	Sh	Leaf is crushed and applied.	Not mentioned	(38)
2.	<i>Acalypha volkensii</i> Pax	Euphorbiaceae	Kirija/Zibute-morenshi (Mn)	Cl	Leaf is used topically.	MG-M28-006	(39)
3.	<i>Acacia nilotica</i> (L.) Will	Fabaceae	-	T	Leaves are used for skin wounds.	Not mentioned	(40)
4.	<i>Acacia lahai</i> Benth.	Fabaceae	Waaccu (Or)	T	Fresh leaves are pounded and applied to the wound.	Not mentioned	(41)
5.	<i>Acacia seyal</i> Delile	Fabaceae	Duret (Am)	T	Fresh leaves are chewed and tied/creamed.	GC229	(18)
6.	<i>Actinopteris radiata</i> (L.) P. Beauv.	Pteridaceae	-	H	Leaves are used for burns and wounds.	Not mentioned	(40)
7.	<i>Acanthus polystachius</i> Delile	Achantaceae	Kosorruu (Or)	Sh	Fresh leaf is crushed, mixed with water and rubbed on affected part.	Not mentioned	(43)
8.	<i>Acanthus sennii</i> Chiov.	Amaranthaceae	Sukoro (Or)	H	Leaves are dried, ground, mixed with butter and applied to the wound.	Not mentioned	(44)
9.	<i>Achyranthes aspera</i> L.	Amaranthaceae	Telenj (Am), Kiliche (Kw), Ziaduboe (Shk), Michelle (Tg), Ambule (Z), Dergu arba (Or)	H	Fresh/dried leaves are crushed and rubbed on the affected part.	Not mentioned DG-33 MG-S88-2006 LEB-16 AT00654 1933 MOR028 GC025 MT-006 GC025	(45) (46) (47) (48) (5) (49) (50) (15) (51) (18)
10.	<i>Acokanthera schimperi</i> (A. DC.) Schweinf.	Apocynaceae	Mebtie (Tg), Miriez (Am)	Sh	<ul style="list-style-type: none"> Leaf is pounded together with dried leaf of <i>Croton macrostachyus</i> and <i>Rumex nevosus</i> and the wound area is covered with the thick juice for seven consecutive days. Fresh/dry leaf is crushed and tied onto wound. 	DG-45 Not mentioned GC047 MT-008 SA01333	(46) (42) (18) (51) (52)
11.	<i>Adenium obesum</i> (Forssk.)	Apocynaceae	Locombolo (Ka, Kw)	Sh	The fresh leaf is crushed and rubbed.	LEB-28	(48)

	Roem. & Schult.						
12.	<i>Aerva javanica</i> (Burm.f.) Juss.	Amaranthaceae	-	Sh	Leaf is applied topically.	YA 077	(53)
13.	<i>Ageratum conizoides</i> L.	Asteraceae	Tufo (Or)	H	Leaf is crushed and juice is prepared and applied to the skin to treat bleeding wound.	Not mentioned	(54)
14.	<i>Ajuga integrifolia</i> Buch.-Ham.	Lamiaceae	Kursi-charo (Shk), Anamaro (Or)	H	Leaf is pounded into a paste and is applied to the affected part.	Not mentioned MG-S21-2004	(55) (47)
15.	<i>Alchemilla fischeri</i> Engl.	Rosaceae	Tuta (Or)	H	Leaf is smashed and put on wounds from metal objects.	16169	(44)
16.	<i>Anogeissus leiocarpa</i> (DC.) Guill. & Perr.	Combretaceae	Hanse (Tg)	T	-	ZG-032	(56)
17.	<i>Argemone mexicana</i> L.	Papaveraceae	Medafe tilian (Tg)	H	Fresh leaves are collected, crushed and paste applied to the affected part.	SA01381	(52)
18.	<i>Balanites aegyptiaca</i> (L.) Delile	Balanitaceae	Bedeno (Or), Got/Kutan (Sm)	T	Concoction is crushed and tied.	AHU11	(38)
19.	<i>Barleria eranthemoides</i> R.Br. ex C.B.Clarke	Acanthaceae	Setaf/Senkolla (Am)	H	Fresh leaf is crushed and tied.	GC180	(18)
20.	<i>Bersama abyssinica</i> Fresen.	Meliantaceae	-	Sh	Decoction is used.	Not mentioned	(1,57)
21.	<i>Bidens macroptera</i> (Sch.Bip. ex Chiov.) Mesfin	Asteraceae		H	Flower and leaf are used to remove pus from infected wounds.	16133	(44)
22.	<i>Boerhavia coccinea</i> Mill.	Nyctaginaceae	Golosso (Ka, Kw)	H	Powder/squeezed fresh leaf is applied to the injured part.	MUR-40	(48)
23.	<i>Boscia minimifolia</i> Chiov.	Capparidaceae	Meygag (Sm)	T	Leaf is crushed and tied.	AHU 07	(38)
24.	<i>Brassica rapa</i> L.	Brassicaceae	Hamli-adri (Tg)	H	-	ZG-050	(56)
25.	<i>Brucea antidysenterica</i> J. F. Mill.	Simaroubaceae	Waynos/Yedaga abalo (Or, Am)	H	Leaf is crushed, mixed with butter then creamed.	Not mentioned GC086	(58) (15)
26.	<i>Cadaba rotundifolia</i> Forssk.	Capparidaceae	Kenquele (Ka, Kw)	Sh	Fresh leaves/young twigs are crushed and applied.	LEB-05	(48)
27.	<i>Calotropis procera</i> (Aiton) W.T.Aiton	Asclepiadaceae	Ginda (Tg), Kobo (Am)	Sh	<ul style="list-style-type: none"> Leaf is crushed with leaves of <i>Ficus palmata</i> and smeared paste on affected part until healed. Squeezed fresh leaf is poured on the wound/wound is covered with burnt leaf. 	AT00612 Not mentioned	(5) (58,59)
28.	<i>Carica papaya</i> L.	Caricaceae	Paappaayyaa (Or)	T	Fresh leaf is crushed and given orally.	Not mentioned	(43,54)

29.	<i>Centella asiatica</i> (L.) Urb.	Apiaceae	Yeayit Gero (Am)	H	Leaf is crushed, mixed with water and decanted, then applied to the affected part.	MT-018	(51)
30.	<i>Chenopodium murale</i> L.	Ulmaceae	Hamli qiweo (Tg), Amedmado (Am)	T	Fresh leaf is crushed and applied on the wound.	AT00650 GC136 Not mentioned	(5) (15) (42,59)
31.	<i>Cissampelos pareira</i> L.	Menispermaceae	Dahere fire (Hm)	Sh	Fresh leaves are squeezed on wound.	H023	(60)
32.	<i>Clematis hirsuta</i> Guill. & Perr.	Ranunculaceae	Fiitii/Enderia (Or/Am), Azohareg (Shi, Am), Sunki (Ag)	Sh/Cl	Leaves are pounded, resulting in a solution. Half of the solution is drunk and a certain amount is applied into the hole of the wound using a syringe or other object. The residue is placed on the opening of the wound.	DG-58 GC043	(46) (15)
33.	<i>Clematis longicauda</i> Steud.	Ranunculaceae	Zina-charo/Wusho-charo (Shk)	Cl	Leaf is used topically.	MG-S7-2004	(47)
34.	<i>Clematis simensis</i> Fresen.	Ranunculaceae	Biyaqin-charo (Shk)	Cl	<ul style="list-style-type: none"> • Leaf is used topically. • Leaf is crushed and applied. 	MG-S48-2005 Not mentioned	(47) (58)
35.	<i>Clerodendrum myricoides</i> (Hochst.) Vatke	Lamiaceae	Misroch (Am)	Sh	Fresh or dry leaf is crushed, and the concoction is tied/rubbed and tied.	GC016	(18)
36.	<i>Coccinia grandis</i> (L.)	Cucurbitaceae	Buta (Ka)	Cl	Fresh leaf is crushed and externally used.	LEB-17	(48)
37.	<i>Colutea abyssinica</i> Kunth & Bouche	Fabaceae	Qaqata (Tg)	Sh	Leaf is pounded into powder and sprayed on wound.	SA01342	(52)
38.	<i>Commelina benghalensis</i> L.	Commelinaceae	Yelam andebet (Am)	H	Fresh crushed leaf and stem are applied topically.	TD9846	(61)
39.	<i>Commelina latifolia</i> Hochst.	Commelinaceae	Yewuha enkur (Am)	H	Fresh leaf is crushed and tied.	GC116	(15)
40.	<i>Cordia africana</i> Lam.	Boraginaceae	Oshwoch (Or), Awhi (Tg), Oshwoch (Mn)	T	The wound area is covered with crushed leaf.	MG-M92-2006 ZG-039	(39) (56)
41.	<i>Croton macrostachyus</i> Del.	Euphorbiaceae	Bissana (Am), Mekanissa (Or)	T	<ul style="list-style-type: none"> • Juice of fresh leaves is mixed with coconut milk and applied topically on skin. • Fresh leaf is pounded and applied to the skin. 	DG-08 Not mentioned Not mentioned Not mentioned	(46) (62) (54) (43) (3)
42.	<i>Cynoglossum amplifolium</i> Hochst. ex DC.	Boraginaceae	Perper/Girshu/Marest (Mn)	H	Fresh leaf is crushed and creamed.	MG-M8-2006	(39)

43.	<i>Cynoglossum coeruleum</i> (Hochst. ex A. Rich.) DC	Boraginaceae	Chegogit (Am)	H	Leaf is crushed and tied onto wound.	GC114	(15)
44.	<i>Cyphostema adenanthum</i> (Fresen.) Descoings	Vitaceae	Aserkuch-tebeteb (Am)	Cl	Leaf is used topically.	DG-46	(46)
45.	<i>Datura stramonium</i> L.	Solanaceae	Atsafaris/Astenagir (Am), Mestenagr/Mezerbae (Tg), Banji (Or)	H	Fresh/dry leaf is crushed and used to wash the body with infected open wounds, or crushed and applied to the affected part.	16363 AT00672 Not mentioned Not mentioned GC124 Not mentioned	(63) (5) (64) (57) (15) (58)
46.	<i>Dregea rubicunda</i> K. Schum.	Asclepiadaceae	Kuandira (Am)	Cl	Fresh leaf is crushed and tied onto wound.	GC044	(15)
47.	<i>Desmodium barbatum</i> (L.) Benth.	Fabaceae	Balengua bereka (Tg, Ku)	T	Crushed leaf is used to cover the wound area.	Not mentioned	(42)
48.	<i>Dichrostachys cinerea</i> (L.) Wight. & Arn.	Fabaceae	Gonok (Tg)	Sh	-	ZG-005	(56)
49.	<i>Dichrocephala integrifolia</i> (L.f.) Kuntze	Asteraceae	Biaqincharo/Tsuqigncharo/Mezi/Titi -charo (Shk)	H	Leaf is used topically.	MG-S24-2004	(47)
50.	<i>Dissotis senegambiensis</i> (Guill. & Perr.) Triana	Melastomataceae	-	H	Leaf is used topically.	MG-M1-2006	(39)
51.	<i>Dobera glabra</i> (Forssk.) Poir.	Salvadoraceae	-	Sh	Leaf is used topically.	YA 042	(53)
52.	<i>Dodonaea angustifolia</i> L.f.	Sapindaceae	Tahsos (Tg), Itacha (Or), Kitkita (Am)	Sh/T	<ul style="list-style-type: none"> Leaf powder is sprayed on wound or powdered leaf is mixed with honey and applied as paste. Burnt fresh/dry leaves' ash is painted. 	Not mentioned SA01327 Not mentioned Not mentioned GC036	(62) (52) (43) (58) (18)
53.	<i>Dombeya torrida</i> (J.F. Gmel.) P. Bamps	Sterculiaceae	Biwak (Tg)	T	Leaf is crushed and the fine powder is applied to the wound area by washing.	Not mentioned	(42)

54.	<i>Englerina woodfordioides</i> (Schweinf.) Balle	Loranthaceae	Yekinchib teketila (Am)	H	Dry leaf is powdered and painted.	GC200	(18)
55.	<i>Eucalyptus camaldulensis</i> Dehnh.	Myrtaceae	Keyh kelamitos (Tg)	T	Leaf is used topically.	ZG-031	(56)
56.	<i>Euphorbia tirucalli</i> L.	Euphorbiaceae	Tuzi (Hm)	T	Fresh juice is applied to the wound.	H033	(60)
57.	<i>Erythrina brucei</i> Schweinf.	Fabaceae	Korch (Am)	T	Leaf is crushed with the leaves of <i>Solanum incanum</i> and <i>Phytolacca dodecandra</i> and applied to the wound once for 3 days.	MW-015	(65)
58.	<i>Guizotia scabra</i> (Vis.) Chiov.	Asteraceae	Adaa (Or), Shesha-a (Km)	Sh	Fresh leaf is squeezed and its juice is applied topically.	BA 53	(66)
						MM348	(67)
59.	<i>Ficus palmata</i> Forssk.	Moraceae	Beles adgi (Tg)	Sh	Crushed and mixed with leaves and latex of <i>Calotropis procera</i> and paste applied to the affected part.	AT00665	(5)
60.	<i>Heliotropium cinerascens</i> D.C	Boraginaceae	Nechilo (Am)	H	Fresh leaf is crushed and tied.	GC199	(18)
61.	<i>Heliotropium steudneri</i> Vatke	Boraginaceae	Amam gime (Tg)	H	Paste (dressing).	MOR009	(50)
62.	<i>Hibiscus macranthus</i> Hochst. ex A. Rich.	Malvaceae	Nacha (Am)	Sh	Fresh leaf is chewed and applied with cotton.	GC064	(15)
63.	<i>Hibiscus micranthus</i> Lf.	Malvaceae	Shigot adgi (Tg)	Sh	Leaf is crushed in the mouth, mixed with saliva, and applied to the wound.	AT00620	(5)
64.	<i>Hypoestes forskalii</i> (Vahl) Roem. & Schult.	Acanthaceae	Girbia (Tg)	H	Leaf is crushed and applied to the affected part.	AT00603	(5)
65.	<i>Indigofera spicata</i> Forssk.	Fabaceae	Chaki Aka (Ka), Sharka Nigush (Kw)	Sh	Fresh leaf is squeezed on the wound.	MJI-13	(48)
66.	<i>Jasminum grandiflorum</i> subsp. <i>floribundum</i> (R. Br.ex. Fresen.) P.S. Green	Oleaceae	Habitselim (Tg)	Sh	Leaf is roasted on iron sheet, ground into powder and sprayed on wound.	Not mentioned	(59)
						SA01326	(52)
67.	<i>Juniperus procera</i> Hochst.	Cupressaceae	Ted (Am)		Ground dried leaf is applied to wounds.	Not mentioned	(68)
68.	<i>Justicia schimperiana</i> (Hochst. Ex Nees) T.Anders.	Acanthaceae	Shimieya (Tg), Smiza (Am)	Sh	Boil with roots of <i>Withania somnifera</i> and wash; crush and powder; then cream.	Not mentioned	(69)
						AT00632	(5)
						GC154	(15)
69.	<i>Kalanchoe</i> spp.	Crasulacea	Dawula (Am)	Sh	Leaf is pounded and held on wound.	Not mentioned	(54)
70.	<i>Kedrostis foetidissima</i> (Jacq.) Cogn	Cucurbitaceae	Shuntee (M)	H	Leaf is applied topically to mouth wound.	84	(70)
71.	<i>Maeura sessiliflora</i>	Capparidaceae	Mandech (Ka, Kw)	T	Powdered leaf or young twig is applied.	DUS-07	(48)

72.	Gilg <i>Malva verticillata</i> L.	Malvaceae	Enkiaftha (Tg)	H	Crush and rub on/apply to the affected part.	AT00625	(5)
73.	<i>Maytenus arbutifolia</i> (A. Rich)	Apocynaceae	Kombollechae (Gd)	Sh	Powdered dry leaf mixed with butter is applied topically.	FM138	(71)
74.	<i>Maytenus senegalensis</i> (Lam.) Exell	Apocynaceae	Kombolcha (Or)	Sh	Leaf and bark juice is applied topically.	Not mentioned	(43)
75.	<i>Melia azadrachta</i> L.	Meliaceae	Limo, Nim (Tg)	T	Crush and apply.	AT00695	(5)
76.	<i>Mikania</i> spp.	Asteraceae		Cl	Leaf is used for burn or wound.	Not mentioned	(40)
77.	<i>Momordica foetida</i> Schumach.	Cucurbitaceae	Wori rebuta (Km)	Sh/H	Leaf is used topically.	MM01	(67)
78.	<i>Nicotiana tabacum</i>	Solanaceae	Tinbaho (Am)	Sh	Crush the leaf, powder, then cream.	GC080	(15)
79.	<i>Ocimum lamiiifolium</i> Hochst ex. Benth.	Lamiaceae	Damakasse (Tg, Hd)	H	-	Not mentioned	(72)
80.	<i>Olea europaea</i> subsp. <i>cuspidata</i>	Oleaceae	Ejersa (Or)	T	Decoction of leaf is applied as paste.	Not mentioned	(62)
81.	<i>Oncocalyx kellri</i> (Engl.) M. Gilbert	Loranthaceae	Haarmobandaa (Or)	H	Crushed and coated.	Not mentioned	(59)
82.	<i>Ormocarpum pubescens</i> (Hochst.) Cuf.ex. Gillett	Fabaceae	Murna (Am)	Sh	Crush fresh leaf and powder, then tie to wound.	GC014	(15)
83.	<i>Phytolacca dodecandra</i> L'Herit	Phytolacaceae	Handoodee (Or)	H	Leaf concoction is applied topically.	Not mentioned	(43)
84.	<i>Plantago lanceolata</i> L.	Plantaginaceae	Gorteb (Or), Wonberet (Am), Nilikfti (Tg)	Sh/H	<ul style="list-style-type: none"> The fresh leaves are pounded and wound is washed and the powder is applied to the wound. Leaves are crushed, squeezed and solution applied to the wound. 	AT00631 SA01358 GC117 Not mentioned	(5) (52) (15) (1)
85.	<i>Pulicaria schimperi</i> DC.	Asteraceae	-	H	Pounded fresh leaf is pasted on wounded part.	MT-058 Not mentioned	(51) (16)
86.	<i>Plumbago zeylanica</i> L.	Plumbaginaceae	Amera (Am)	H	Dry leaf is burned and painted with butter; cream concoction	GC128 GC128	(15) (18)
87.	<i>Polysphaeria parvifolia</i> Hieron.	Rubiaceae	-	Sh	Pound fresh leaves and put on the wound.	Not mentioned	(41)
88.	<i>Premna schimperi</i> Engl.	Lamiaceae	Chocho (Am)	Sh	Crush, powder, then cream with butter or	GC126	(15)

89.	<i>Ranunculus stagnalis</i> Hochst. Ex A. Rich.	Ranunculaceae	Gudign (Am)	H	honey. Burnt fresh leaves' ash is crushed and tied to the wound.	GC182	(18)
90.	<i>Rhamnus prinoides</i>	Rhamnaceae	Gesho (Am)	Sh	Crush the leaf and apply to the wound till the wound cures.	MW-026	(65)
91.	<i>Rhus ruspolii</i> Engl.	Anacardiaceae	-	Sh	Leaf is topically used.	MG-M98-2006	(39)
92.	<i>Ricinus communis</i> L.	Euphorbiaceae	Guile (Tg), Tsamo desho (M), Qobbo'o (Hd)	H/T	Crush and apply to the wound.	ZG-047 AT00688	(56) (5)
93.	<i>Ritchiea albersii</i> Gilg	Capparidaceae	Dalsach (Mn)	T	-	MG-M5-2006	(72) (39)
94.	<i>Ruellia patula</i> Jacq.	Acanthaceae	Duaduatie/ Goregondie (Am)	H	Fresh leaves are crushed and tied to the wound.	GC225	(18)
95.	<i>Rumex nepalensis</i> Spreng.	Polygonaceae	Tult (Am)	H	Crush the concoction of dried leaf then tie/rub and tie alone.	GC029	(18)
96.	<i>Rumex nervosus</i> Vahl	Polygonaceae	Ambacho (Tg, Am) Enbuacho (Am)	T	<ul style="list-style-type: none"> • Fresh/dry leaf is crushed, squeezed between palms and applied to the wound (pound then tie). • Crush the leaf and mix with benzene; then boil it; finally, wash the wound with it. 	GC177 Not mentioned GC177 MW-028	(15) (1) (18) (65)
97.	<i>Sansevieria ehrenbergii</i> Schweinf. ex Baker	Dracaenaceae	Alko/Algi (Hm)	T/Sh	Fresh leaves are pounded, and juice is applied to the wound.	H018	(60)
98.	<i>Schinus molle</i> L.	Anacardiaceae	Kundoberbere (Am)	T	Fresh leaf is pounded and tied to the wound.	GC155	(15)
99.	<i>Sericocomopsis pallida</i> (S. Moore) Schinz	Amaranthaceae	-	Sh	Leaf is used topically.	YA 002	(53)
100.	<i>Sida collina</i> Schlechtend.	Malvaceae	Sese (Mn)	H	Leaf is used topically.	MG-M100-2006	(39)
101.	<i>Sida cuneifolia</i> Roxb.	Malvaceae	Gurjejit (Am)		Leaf is crushed and applied to the affected area.	MT-076	(51)
102.	<i>Sida ovata</i> Forssk.	Malvaceae	Chifrig (Am)	H/Sh	Leaf is used topically.	DG-35	(46)
103.	<i>Sida rhombifolia</i> L.	Malvaceae	Gorgegit (Am), Chifrig sese (Am, Or)	Sh	Leaves are pounded and tied.	Not mentioned GC120	(39) (15)

104.	<i>Sida tenuicarpa</i> Vollesen	Malvaceae	Chifrig (Am)	Sh	Fresh leaf is crushed and tied.	GC153	(15)
105.	<i>Sida urens</i> L.	Malvaceae	Sese (Mn)	H	Leaf is used topically.	MG-M26-2006	(39)
106.	<i>Solanum anguivi</i> Lam.	Solanaceae	Zerch embuay (Am)	Sh	Fresh/dry leaf is crushed and tied.	GC174	(15)
107.	<i>Solanum incanum</i> L.	Solanaceae	Hiddii/Yehabesha embuay (Or, Am), Edi (Am)	Sh	<ul style="list-style-type: none"> • Pound the fresh leaf and fruit and drip a drop of the extract on the wound. • Fresh leaf juice is applied topically. 	16319	(44)
						GC059	(15)
						AK 151	(2)
						GC059	(18)
108.	<i>Solanum nigrum</i> L.	Solanaceae	Awut (Am)	Sh	Fresh/dried leaf is crushed and tied.	GC140	(18)
109.	<i>Stereospermum kunthianum</i> Cham.	Bignoniaceae	Washinte (Am), Zana (Ag, Aw), Adgi-zana (Tg)	Sh	Crushed and applied to the affected part.	MT-098	(51)
110.	<i>Terminalia brownie</i> Fresen.	Combretaceae	Weyba (Tg)	T	Leaf is dried, powdered, applied to the wound, and tied using its stem bark.	Not mentioned	(62,73)
111.	<i>Urtica simensis</i> Steudel	Urticaceae	Sama (Am)	H	Grind and cream with butter.	GC179	(15)
112.	<i>Vangueria madagascariensis</i> J.F.Gmel.	Rubiaceae	Bururii (Or)	Sh	Pound the fresh leaves and apply to the wound.	Not mentioned	(41)
113.	<i>Verbascum sinaiticum</i> Benth.	Scrophulariaceae	Tirnake/Handega (Tg)	H	Crush and apply to the affected part.	AT00634	(5)
114.	<i>Vernonia amygdalina</i> Del.	Asteraceae	He'ba (Km), Lbicha (Z), Buzut (Mn)	T	Fresh leaf is externally applied.	Not mentioned	(45)
						MG-M64-2006	(39)
						Not mentioned	(54)
						MM374	(67)
115.	<i>Vernonia auriculifera</i> Hiern	Asteraceae	Rejja/Barawa (Km)	Sh	-	MM177	(67)
116.	<i>Vernonia galamensis</i> (Cass.) Less.	Asteraceae	Busnta (Ka)	Sh	Fresh leaf is crushed and applied.	LEB-11	(48)
117.	<i>Vernonia leopoldii</i> (Sch.Bip. ex Walp.) Vatke	Asteraceae	-	Sh	Fresh leaf is crushed and pounded, and then tied on the injured part.	Not mentioned	(16)
118.	<i>Zehneria scabra</i> (L.f.) Sond.	Asteraceae	Hareg resa/ Harresa (Am), Michqarar'e (Hd),	Cl	<ul style="list-style-type: none"> • Powdered leaf is applied as a cream. • Crush and apply to the affected part. 	AT00655	(5)
						Not mentioned	(58)

			Hafaflo (Tg)				Not mentioned	(72)
							GC149	(18)
119.	<i>Ziziphus mauritiana</i> Lam.	Rhamnaceae	Amurusam (Br)	Sh	Leaves are ground, dispersed in water and applied to the wound.		TF-189	(79)
120.	<i>Ziziphus mucronata</i> Willd.	Rhamnaceae	Huqunqura (Or)	Sh	Chop the fresh/dry leaves and apply to the wound.		Not mentioned	(41,72)
121.	<i>Ziziphus spina-christi</i> (L.) Desf.	Rhamnaceae	Geba (Tg)	T	Crush and rub it on the affected part.		AT00622	(5)
							Not mentioned	(72)

Table 4: Ethiopian medicinal plants used for treatment of wound (Parts used: Root)

S/N	Scientific name	Family	Local name	Growth form	Mode of preparation	Voucher number	Ref.
122.	<i>Achyranthes aspera</i> L.	Amaranthaceae	Maxxanee (Or), Michelle (Tg)	H	<ul style="list-style-type: none"> The fresh root is chopped and bound together with a leaf of <i>Commicarpus podunculosus</i>, mixed with water and applied topically. The root is taken orally. 	Not mentioned	(43,50)
123.	<i>Asparagus africanus</i> Lam.	Asparagaceae	Saritii (Gd, Or)	Sh	Powder of dry root with butter is applied to the wound.	FM206 GENENE B.43	(71) (75)
124.	<i>Brucea antidysenterica</i> J.F.Mill	Simaroubaceae	Aballo (Or), Kapparro (Gd)	Sh	Powdered fresh root bark mixed with water is applied topically.	FM202 GENENE B.93	(71) (75)
125.	<i>Bersama abyssinica</i> Fresen.	Meliantaceae	-	Sh	Root is used as a decoction.	Not mentioned	(57)
126.	<i>Calotropis procera</i> (Aiton) W.T.Aiton	Asclepiadaceae	Bunagadhee (Or)	Sh	Root is used topically.	Not mentioned	(59)
127.	<i>Capparis fascicularis</i> DC.	Capparidaceae	Hida sere (Or)	Cl	Root is crushed and tied.	Not mentioned AHU 09	(59) (38)
128.	<i>Caparis tomentosa</i> Lam.	Capparidaceae	Haarangaaguraach (Or) Goora (Or), Gumero (Am),	Sh	<ul style="list-style-type: none"> Root powder mixed with latex of <i>Euphorbia tirucallii</i> and pasted on the wound (crushed and coated). Root is used topically. 	Not mentioned AK 243	(59) (2)
129.	<i>Carica papaya</i> L.	Caricaceae	Papaya (Am)	T	Fresh root is crushed and given orally.	Not mentioned	(54)
130.	<i>Cayratia gracilis</i> (Guill. & Perr.) Suess.	Vitaceae	-	Cl	Root is used topically.	MG-S89-2006	(47)
131.	<i>Coreopsis</i> sp.	Asteraceae	Imbaboadey (Tg)	H	Root powder is mixed with water and applied as an ointment.	MOR003	(50)
132.	<i>Cucumis ficifolius</i> A. Rich.	Curcubitaceae	Yemdir embuay (Am)	H	<ul style="list-style-type: none"> The fruit of <i>Bersama abyssinica</i> mixed with root of this plant are pounded to powder and mixed with honey or butter and applied to the wound. Root is crushed and mixed with water and applied. 	TD916 Not mentioned GC139	(76) (58) (15)
133.	<i>Cyphostema adenanthum</i> (Fresen.) Descoings	Vitaceae	Aserkuch-tebeteb (Am)	Cl	Root is applied topically.	Not mentioned DG-46	(1) (46)

134.	<i>Cyphostemma adenocaula</i> (Steud.ex A. Rich) Descoings ex Wild and Drummond	Vitaceae	Aserkuka fetahkuka (Tg)	Cl	Dried root is ground into powder, mixed with butter and dressed on affected area.	SA01346	(52)
135.	<i>Cyphostemma oxyphyllum</i> (A. Rich.) Vollesen	Vitaceae	Efchiche/Reno (Tg)	Cl	Crush and apply to the wound.	AT00601 and AT00672	(5)
136.	<i>Dombeya torrida</i> (J.F.Gmel.) P.Bamps	Sterculiaceae	Biwak (Tg)	T	Dry roots are crushed; the fine powder is applied to the wound area by washing.	Not mentioned	(42)
137.	<i>Dracaena steudneri</i> Engl.	Dracaenaceae	Afracartu (Or)	T	Powder of dry root is applied to the wound.	FM37	(71)
138.	<i>Habenaria</i> sp.	Orchidaceae	Yeurba-medhanit (Ag)	H	Root is used topically.	GENENE.B.09 DG-52	(75) (46)
139.	<i>Hydnora johannis</i> Becc.	Hydnoraceae	Tuka (Or), Likki/ Likeh/ Dise (Sm)	RP	Root is crushed and tied.	AHU28	(38)
140.	<i>Impatiens ethiopica</i> Grey-Wilson	Balsaminaceae	Yehensho shilaa zer (Or)	Sh	Fresh root is pounded, warmed in a dish on a fire, and creamed on palms.	AK 206	(2)
141.	<i>Impatiens rothii</i> Hook. f.	Balsaminaceae	Buri(Or), Gesharit (Am)	Sh	Fresh root is pounded into pieces and thoroughly warmed on fire and applied to dry the wound.	AK 080	(2)
142.	<i>Impatiens tinctoria</i> subsp. <i>abyssinica</i>	Balsaminaceae	Ensosilla (Or)	Sh	Fresh root is pounded, warmed in a dish on a fire, and oiled on the palms.	AK 235	(2)
143.	<i>Kalanchoe laciniata</i> L.	Crassulaceae	Bosoqqee (Or)	H	Fresh or dried root of <i>Kalanchoe laciniata</i> , seed of <i>Capsicum frutescens</i> , <i>Allium sativum</i> and leaves of <i>Croton macrostachyus</i> powdered together and mixed with water and given topically.	Not mentioned	(43)
144.	<i>Lagenaria siceraria</i> (Molina) Standl.	Cucurbitaceae	Qil (Ag)	Cl	Root is mixed with <i>Phytolacca dodecandra</i> (root) and taken orally.	DG-32	(46)
145.	<i>Linum usitatissimum</i> L.	Linaceae	Telba (Am)	H	Crush, mix with honey, then cream.	GC184	(15)
146.	<i>Malva</i> sp.	Malvaceae	Lut (Or)	H	Root is crushed and applied to skin to heal dry wounds.	16130	(44)
147.	<i>Ormocarpum pubescens</i> (Hochst.) Cufod. ex J.B. Gillett	Fabaceae	Alendia (Tg)	Sh	Root is used topically.	ZG-055	(56)
148.	<i>Pavetta gardeniifolia</i> Hochst. Ex A.Rich.	Rubiaceae	Qadiidaa (Or)	Sh	Pound the fresh root and put on the infected part.	Not mentioned	(41)
149.	<i>Pentas lanceolata</i> (Forssk.) Deflers	Rubiaceae	Afi deshe/Gaina deshe (Ar)	H	-	277, 243, 250, 276, 249	(70)

150.	<i>Phytolacca dodecandra</i> L'Herit.	Phytolaccaceae	Endod (Ag)	Sh	Root is mixed with <i>Lagenaria siceraria</i> (fruit) and taken orally.	DG-66	(46)
151.	<i>Plumbago zeylanica</i> L.	Plumbaginaceae	Amera (Am)	H	Cream concoction.	GC128	(15)
152.	<i>Ricinus communis</i> L.	Euphorbiaceae	Qobbo'o (Hd)	H	-	Not mentioned	(72)
153.	<i>Rubia cordifolia</i> L.	Rubiaceae	Enchiberii/Enchibir (Or)	H	Dry root is ground and powder sprinkled on the wound.	AK 111	(2)
154.	<i>Rumex nepalensis</i> Spreng.	Polygoniaceae	Timbilki (Ag), Kashala go'echu (Km)	H	<ul style="list-style-type: none"> Fresh roots are used topically. Roots are taken orally. 	DG-14	(46)
						MM 18	(67)
155.	<i>Rumex nervosus</i> Vahl	Polygonaceae	Dhangagoo (Or)	Sh	-	AK 103	(59)
156.	<i>Salvia nilotica</i> Jacq.	Lamiaceae	Hulegebe (Or)	H	Dry root powder mixed with butter is applied to the wound.	AK 104	(2)
157.	<i>Schinus molle</i> L.	Anacardiaceae	Kundoberbere zaf (Or)	T	Fresh root powder mixed with resin of <i>Euclea racemosa</i> subsp. <i>schimperi</i> and applied to the wound once a day.	AK 152	(2)
158.	<i>Sida ovata</i> Forssk.	Malvaceae	Dekidaeo (Tg) Chifrig (Am)	H/Sh	Root is used topically.	DG-35	(46)
						ZG-020	(56)
159.	<i>Stephania abyssinica</i> (Quart.-Dill. & A. Rich.) Walp.	Menispermaceae	Kalaala (Or), Engochit/eait-hareg (Am)	Cl	<ul style="list-style-type: none"> Either powdered or fresh root boiled with leaf of <i>Smilax aspera</i> used to wash the wound. Root is crushed and applied topically. 	DG-37	(46)
						Not mentioned	(58)
						AK 189	(2)
160.	<i>Stereospermum kunthianum</i> Cham.	Bignoniaceae	Washinte (Am)	T	Root is applied topically.	DG-06	(46)
161.	<i>Ximenia americana</i> L.	Olacaceae	Hudaa (Or)	T	-	Not mentioned	(59)

Table 5: Ethiopian medicinal plants used for treatment of wound (Parts used: Fruit, flower, bark, stem, seed, and latex)

S/N	Scientific name	Family	Local name	Growth form	Mode of preparation	Voucher number	Ref.
162.	<i>Acacia tortilis</i> (Forssk.) Hayne	Fabaceae	-	T	Bark is used for skin wounds.	Not mentioned	(40)
163.	<i>Adenium obesum</i> (Forssk.)	Apocynaceae	Locombolo (Ka, Kw)	Sh	Fresh latex is applied externally.	LEB-28	(48)
164.	<i>Adiantum capillus-veneris</i> L.	Adiantaceae	Joroasfit (Am)	H	Insert the stem into new jewelry hole (ear).	GC027	(15)
165.	<i>Albizia sp.</i>	Fabaceae	Ambalaa (Or)	T	Dried bark is powdered and applied to the affected part.	Not mentioned	(77)
166.	<i>Allium sativum</i> Linn.	Alliaceae	Tsa'da shegurti (Tg)	H	<ul style="list-style-type: none"> • Bulbs are crushed, squeezed and wound is washed with the liquid until healed. • Bark is used topically. 	Not mentioned SA01368	(78) (52)
167.	<i>Aloe macrocarpa</i> Tod.	Aloaceae	Eret (Am)	H	Latex is creamed on the wound.	GC034	(15)
168.	<i>Aloe megalacantha</i> Baker	Aloaceae	Ere (Tg), Eret (Am)	Sh	Exudate is smeared on wound.	AT00707 SA01384	(5) (52)
169.	<i>Aloe otallensis</i> Baker	Aloaceae	Welqante (Hm)	Sh	Exudate is applied to the wound.	H002	(60)
170.	<i>Aloe pubescens</i> Reynolds	Aloaceae	Haamaaresaa (Or)	H	Flower and bulbs are used topically.	Not mentioned	(59)
171.	<i>Aloe pulcherrima</i> Gilbert & Sebsebe	Aloaceae	Eret (Am)	T	Apply the latex to the wound.	Not mentioned MW-002	(16) (65)
172.	<i>Aloe weloensis</i> Sebsebe	Aloaceae	Eret tafa (Am)	H	Latex is applied as paint.	GC210	(18)
173.	<i>Anogeissus leiocarpa</i> (DC.) Guill. & Perr.	Combretaceae	Hanse (Tg)	T	Bark is used topically.	ZG-032	(56)
174.	<i>Argemone mexicana</i> L.	Papaveraceae	Medafe/Eshok tilian (Tg)	T	<ul style="list-style-type: none"> • Stem is macerated in water and applied in the form of drops and a poultice. • Latex is applied topically. 	AT00615 MOR019	(5) (50)
175.	<i>Avena sativa</i> L.	Poaceae	Ankerdad (Am)	G	Dried seed is crushed and applied to the wound till the wound cures.	MW-004	(65)

176.	<i>Bersama abyssinica</i> Fresen.	Meliantaceae	Abalo (Am), Lolchiisaa (Or)	Sh	<ul style="list-style-type: none"> • Leafy-stem tip is squeezed and creamed on wound. • Stem bark is used as decoction. • Fruit is also used topically. 	Not mentioned	(1,57,66)
177.	<i>Bidens macroptera</i> (Sch.Bip. ex Chiov.)	Asteraceae		H	Flowers and leaves are used to remove pus from infected wounds.	16133	(44)
178.	<i>Brassica carinata</i> A. Braun	Brassicaceae	Gomenzeera (Or)	H	Seed is crushed and its juice is applied topically or taken orally.	Not mentioned	(43)
179.	<i>Brassica nigra</i> Koch	Brassicaceae	Sanafica (Or, Am)	H	Seed is crushed and its juice is applied topically or taken orally.	Not mentioned	(43,68)
180.	<i>Brucea antidysenterica</i> J. F. Mill.	Simaroubaceae	Aballo (Am)/Yedaga aballo/Woynos (Am)	T	Stem is crushed and butter paste is used for dressing.	TD905	(76)
181.	<i>Buddleja polystachya</i> Fresen.	Loganiaceae	Anfar (Am)	Sh	Fresh shoots are crushed and tied to the wound.	GC062	(15)
182.	<i>Caralluma speciosa</i> N.E. Br.	Asclepiadaceae	Ya'ii bera (Or)	H	Sap is extracted and used as ointment.	AHU111	(79)
183.	<i>Calotropis procera</i> (Aiton) W.T. Aiton	Asclepiadaceae	Ginda (Tg)	Sh	Dress the wound with latex.	Not mentioned AT00612 SA01375 GC035	(59) (56) (52) (15)
184.	<i>Commiphora kua</i> (R. Br. ex Roy	Burseraceae	-	Sh	Exudate is used for skin wounds.	Not mentioned	(40)
185.	<i>Commiphora</i> <i>habessinica</i> (Berg) Engl.	Burseraceae	-	Sh	Exudate is used for skin wounds.	Not mentioned	(40)
186.	<i>Capparis</i> <i>fascicularis</i> DC.	Capparidaceae	Kedela (Ka)	T	Fresh stem ash is used externally.	DUS-05	(48)
187.	<i>Carica papaya</i> L.	Caricaceae	Paappaayyaa (Or)	T	Fruit juice is taken orally.	Not mentioned	(54)
188.	<i>Carissa spinarum</i> (Forssk.) Vahl.	Apocynaceae	Agam (Tg)	Sh	Fruit is crushed, dried, pounded into powder and sprayed on wound.	SA01316	(52)
189.	<i>Citrus aurantifolia</i> (Christm.) Swingle	Rutaceae	Lemon (Am), Lemin (Tg), Loomii (Or)	T	<ul style="list-style-type: none"> • Crush by mixing with seeds of <i>Vicia faba</i> and apply to the affected part. • Fruit paste is applied to the affected area; concoction is applied. 	Not mentioned AT00711 Not mentioned GC169	(59) (5) (43) (15)
190.	<i>Clematis hirsuta</i> Perr.	Ranunculaceae	Yeazo areg (Am)	T	The wound is touched with a hot thread and	Not mentioned	(1)

191.	and Guill. <i>Coffea arabica</i> L.	Rubiaceae	Buna (Am,Tg, Or)	Sh	the latex is applied to the wound. Seed is roasted, pounded into powder and paste, and applied to the affected part.	SA01397 Not mentioned Not mentioned	(52) (43) (41)
192.	<i>Commelina bengalensis</i> L.	Commelinaceae	Yelam andebet (Am)	T	Fresh crushed leaf and stem are applied topically.	TD9846	(61)
193.	<i>Commiphora schimperi</i> (Berg) Engl.	Burseraceae	Anqa (Tg)	T	Latex is smeared on wound.	SA01323	(52)
194.	<i>Cordia africana</i> Lam.	Boraginaceae	Awhi (Tg)	T	Flower/bark is used topically.	ZG-039	(56)
195.	<i>Croton macrostachyus</i> Del.	Euphorbiaceae	Bisana (Am), Bakkannisa (Or)	T	<ul style="list-style-type: none"> • Bark is used topically. • Powdered leafy-stem is mixed with water and butter, filtered and applied topically. • Stem bark is used topically. 	DG-08 TD906 BA38	(46) (76) (66)
196.	<i>Cucumis ficifolius</i> A. Rich.	Cucurbitaceae	Ramboambo (Tg), Yemidir embuay (Am), Han'chote (Or)	H	<ul style="list-style-type: none"> • Apply fruit juice to the affected part. • Fruit is warmed in the fire and then smeared on infected wound. • The affected part inserted into the fruit. 	16359 SA01321 GC139	(63) (5) (15)
197.	<i>Cucumis prophetarum</i> L.	Cucurbitaceae	Hidi (Or)	H	Flower is warmed and placed on wound/swollen part while warm.	AHU217	(79)
198.	<i>Cynodon dactylon</i> (L.)	Poaceae		G	Stem is used as concoction.	Not mentioned	(57)
199.	<i>Datura stramonium</i> L.	Solanaceae	Astefaris/Astenagir (Am)	H	<ul style="list-style-type: none"> • Fruit is crushed and creamed. • The whole plant is used topically. 	Not mentioned	(62,64,68)
200.	<i>Dregea rubicunda</i> Schum.	Asclepiadaceae	Kuandira (Am)	Sh	Dry stem with leaf is powdered and tied.	GC124 GC044	(15) (15)
201.	<i>Descopodium penninervum</i> Hochst.	Solanaceae	Aluma (Am)	T	Crush the dried seed and apply the powder to the affected area for three days.	MW-022	(65)
202.	<i>Dichrostachys cinerea</i> (L.) Wight & Arn.	Fabaceae	Gonok (Tg)	Sh	Stem is used topically.	ZG-005	(56)
203.	<i>Dobera glabra</i> (Forssk.) Poir.	Salvadoraceae			Bark is used topically.	YA 042	(53)
204.	<i>Dodonea angustifolia</i>	Sapindaceae	Tehases (Tg)	T	Bark is roasted and pasted.	MOR012	(50)

205.	L.f. <i>Dyschoriste radicans</i> Nees	Acanthaceae	Taetaeta Bayta (Tg)	H	Whole plant is crushed and pounded with leaf of <i>Kalanchoe petitiiana</i> and pasted on the injured parts.	Not mentioned	(16)
206.	<i>Euphorbia abyssinica</i> J.F.Gmel.	Euphorbiaceae	Qulqual (Tg, Am)	T	<ul style="list-style-type: none"> • Crush the flower, mix with honey and apply to the affected part. • Exudate/latex is applied topically. 	AT00706 Not mentioned	(5) (58)
207.	<i>Euphorbia cactus</i> Boiss	Euphorbiaceae	Kolqual hamat (Tg)	Sh	<ul style="list-style-type: none"> • Add little latex drops on wound. • Latex is smeared on affected area. 	SA01386	(52)
208.	<i>Euphorbia crotonoides</i> Boiss	Euphorbiaceae	Anno (Ko)	H	Paste of exudates is applied to edge of wounds.	Not mentioned	(62)
209.	<i>Euphorbia tirucalli</i> L.	Euphorbiaceae	Kinchib (Am)	Sh	<ul style="list-style-type: none"> • Fresh latex is painted on the affected area. • Fresh latex of stem is applied to the wound. 	GC131 H033	(15) (60)
210.	<i>Ficus carica</i> L.	Moraceae	Beles (Am)	Sh	Cream the affected area with latex.	GC104	(15)
211.	<i>Ficus palmata</i> Forssk.	Moraceae	Beless (Tg)	T	Latex is applied to the wounded part.	SA01304	(52)
212.	<i>Ficus vasta</i> Forssk	Moraceae	Warka (Am)	T	Fresh latex is painted on the affected area	GC090	(15)
213.	<i>Grewia erythraea</i> Schweinf.	Tiliaceae	-	Sh	Stem/bark is used topically.	YA 062	(53)
214.	<i>Guizotia abyssinica</i> L.	Asteraceae	Nuugii (Or)	T	Seed is roasted, powdered and the decoction is drunk.	Not mentioned	(43)
215.	<i>Hagenia abyssinica</i> (Bruce) J.F. Gmel.	Rosaceae	Heto (Or), Koso (Am)	T	Flower is used topically.	Not mentioned	(80)
216.	<i>Lactuca intermis</i> Forssk	Asteraceae	Dememerarit (Am)	H	Latex is creamed after removing the ticks.	GC118	(15)
217.	<i>Lepidium sativum</i> L.	Brassicaceae	Shimfa (Tg), Feto (Am), Silfa (Mn)	H	<ul style="list-style-type: none"> • Crush seed of <i>L. sativum</i> with leaf of <i>Dyschoriste radicans</i> and bulb of <i>Allium sativu</i>, and tie on the affected part. • Powder of seed mixed with latex of <i>Euphorbia abyssinica</i> and bandage once daily every other day. • Seed is used topically. 	Not mentioned AT00708	(39) (5)

						MW-050	(65)
218.	<i>Linum usitatissimum</i> L.	Linaceae	Telba (Am)	Sh	Seed is used to treat “Kola kusil” as a bandage.	Not mentioned	(1)
219.	<i>Malva verticillata</i> L.	Malvaceae	-	H	Chopped and pounded stem bark is pasted with powdered <i>Usea</i> sp. on wound.	Not mentioned	(16)
220.	<i>Millettia ferruginea</i> (Hochst.) Baker	Fabaceae	Ziyagu (Shk), Birbira (Ar)	T	Stem bark is used; seed is used topically.	MG-S94-2006	(47)
						Not mentioned	(70)
221.	<i>Oxalis corniculata</i> L.	Oxalidaceae	Shimale (Km)	H	Fresh shoots are used topically.	MM170	(67)
222.	<i>Plumbago zeylanica</i> L.	Plumbaginaceae	Amera (Am)	H	Dry stems are burned and painted with butter.	GC128	(18)
223.	<i>Premna schimperi</i> Engl.	Lamiaceae	Chocho (Am), Urgessa (Shi)	Sh	Crush barks, powder, then cream with butter or honey.	DG-74 GC126	(46) (15)
224.	<i>Prunus africana</i> (Hook. f.) Kalkm.	Rosaceae	Hoomii (Or), Dongicho (Sd)	T	Part of bark is powdered and tied for five days.	MM016	(77)
225.	<i>Prunus persica</i> (L.) Batsch	Rosaceae	Kokil (Am)	T	Paste is used topically.	Not mentioned	(3,43) (68)
226.	<i>Rhus retinorrhoea</i> Steud. Ex A.Rich.	Anacardiaceae	Tilum (Am)	T	Rubbed in hands and then put on wound.	2009	(49)
227.	<i>Rumex nepalensis</i> Spreng.	Polygonaceae	Dangago (Gd, Or)	H	Paste of fresh/dry stem powder with butter is applied topically.	FM10 GENENE B.81	(71) (75)
228.	<i>Rumex nervosus</i> Vahl.	Polygonaceae	Embwacho	H	-	FM10	(49)
229.	<i>Sansevieria erythraeae</i>	Dracaenaceae	Chiret (Am)	Sh	Heat, pound and squeeze, then insert the stem when cool.	2011	(15)
230.	<i>Solanum incanum</i> L.	Solanaceae	Hiddii (Or), Yehabesha embuay/Yekolla enboy (Am), Niesheton engule (Tg), Gerante (Hm)	Sh	<ul style="list-style-type: none"> • Pound the fresh fruit and drip a drop of the extract on the wound. • Ripe fruit squeezed on wounds. • Root bark is dried, ground and applied to the affected part. 	TD9812 MM118 AT00617 GC059 AK 151 H001	(61) (77) (5) (15) (2) (60)
231.	<i>Solanum mariginatum</i> L.f.	Solanaceae	Abyungule (Tg)	Sh	Stem is ground and applied to the affected part.	AT00716	(5)

232.	<i>Stereospermum kunthianum</i> Cham.	Bignoniaceae	Zana (Tg, Am)	T	Bark is used topically.	Not mentioned ZG-042	(69,81) (56)
233.	<i>Vicia faba</i> L.	Fabaceae	Ater/Alqay (Tg)	H	Seed is crushed by mixing with fruits of <i>Citrus aurantifolia</i> and applied to the affected part.	AT00702	(5)
234.	<i>Ximenia americana</i> L.	Olacaceae	Enkoy (Am), Hudaa (Am, Or), Mekela (Ka), Waljoweljo (Kw)	Sh	<ul style="list-style-type: none"> • Fresh fruit is crushed, ground and creamed. • Bark is crushed, ground and applied. • Apply 1mm powder of stem bark to the wound. 	Not mentioned MUR-54 GC054 MT-068 TB 017	(59) (48) (15) (51) (82)
235.	<i>Ximenia caffra</i> Sond.	Olacaceae	Mukalle (M)	T	Seed is applied topically.	22	(70)
236.	<i>Zehneria scabra</i> (L.f.) Sond.	Cucurbitaceae	Hareg resa (Am), Michqarar'e (Hd)	Cl	Stem is used.	Not mentioned	(72)

Key to growth forms: Cl = Climber; G= Grass; H = Herb; RP = Root parasite of trees; Sh = Shrub; T = Tree

Key to languages used for local names of plants: Ag = Agawegna; Am = Amharic; Ar = Afaregna; Aw = Awi; Br = Berta; Gd = Gedeoffa; Hd = Hadiyigna; Hm = Hamar; Ka = Kara; Km = Kambatissa; Ko= Koorete; Kw = Kwego; Ku = Kunama; M = Maale; Mn = Meinit; Or = Oromo; Shk = Sheko; Shi = Shinasha; Sm = Somali; Sd = Sidamigna; Tg = Tigrigna; Z = Zay

Discussion

Most of the traditionally used medicinal plants for the treatment of wounds in Ethiopia belong to the families of Asteraceae, Fabaceae, and Solanaceae. This might be due to the wider distribution and abundance (14) of those plant families in terms of number of taxa in the Ethiopian flora (15). This shows that the plant species which are easily available tend to be preferred by people, provided that they are not poisonous (16). More plant species were reported from Oromia Region, which might be due to the fact that the region is the largest region in the country, with geographical diversity that comprises arid lowlands, fertile and well-vegetated areas with high rainfall and cool mountain regions (17).

Leaves are the most common plant part used to treat wounds in Ethiopia. This might be attributed to the better availability of leaves, ease of preparation and effectiveness of their phytoconstituents (18). Fresh plants were used in most of the reported studies in spite of the fact that drying might be beneficial by protecting phytochemical's effectiveness and reducing transportation and storage costs (19). However, the therapeutic potential of plants is believed to be higher in fresh plant materials due to the expectation that the concentration of the active principles is higher and remains unchanged (2).

Almost all of the reported medicinal plants are used topically. This route of administration might be preferable because it has less potential for absorption and toxicity, and it is easy to apply by patients or caregivers (20).

Regarding the scientific investigation, only a few Ethiopian medicinal plants have been investigated. For instance, *Achyranthes aspera*, one of the common medicinal plants used to treat wounds, was reported to cause a significant percentage of wound contraction and tensile strength compared to a negative control (21). A study conducted by Mekonnen and colleagues on a crude extract and fractions of *Kalanchoe petitiiana* showed that the crude extract, and the methanol and aqueous fractions, increased wound contraction, hydroxyproline content and decreased epithelialization time (22). A study conducted in India on the wound healing activity of *Anogeissus leiocarpus* revealed that a complete wound healing was achieved by the aqueous leaf extract in 15 days at a dose of 100 mg/ml (23). Chloroform, methanol, and aqueous leaf extracts of *Argemone mexicana* were reported to have wound healing effects. (24). The wound healing activity of *Carica papaya* has been reported by different authors. The aqueous leaf extract of the plant has been found to shorten the healing time of wounds compared to the standard drug (25). The aqueous extract of unripe *C. papaya* fruit was also reported to reduce the wound area and period of epithelialization in diabetic rats (26). It has also been reported that the latex obtained from this plant increases wound contraction, hydroxyproline content and shortens epithelialization time (27). Methanolic leaf extract of *Melia azadirachta* was also reported to promote wound healing in alloxan-induced

diabetic rats (28). Asiaticoside isolated from *Centella asiatica* has been studied in normal as well as delayed-type wound healing. It has been reported that topical applications of a 0.2% solution of the compound produced a 56% increase in hydroxyproline, 57% increase in tensile strength and better epithelialization (29). Other plants such as the leaves of *Calotropis procera* (30), *Calotropis gigantean* (31), *Centella asiatica* (32), *Croton macrostachyus* (33), *Euphorbia tirucalli* (34), *Jasminum grandiflorum* (35), *Balanites aegyptiaca* (36), and *Ageratum conyzoides* (37) are reported to possess wound healing properties in different wound models. Note that these are not the only medicinal plants that have been scientifically evaluated, and are provided merely as examples to consider their frequency of use in Ethiopian traditional practice.

Conclusions

This ethnobotanical review shows that Ethiopian medicinal plants are being extensively used in the treatment of wounds. More than 200 plant species have been used traditionally to treat wounds and almost all of the plants were used topically. The most commonly used plant part was leaves followed by roots. *A. aspera*, *C. macrostachys*, *D. stramonium*, and *Dodonaea angustifolia* were the most frequently used medicinal plants. However, only a few of them have been scientifically proven to provide wound healing activity, including *A. aspera*, *K. petitiiana*, *Anogeissus leiocarpus*, *A. mexicana*, *C. gigantean*, *C. procera* and *J. grandiflorum*, indicating that the great majority of plants used traditionally in Ethiopia have not been studied scientifically. As history shows, a number of pharmaceutical drugs have been obtained from traditionally used medicinal plants. Hence, wound healing, anti-inflammatory, and antibacterial effect of Ethiopian medicinal plants ought to be evaluated to substantiate their traditional claim and to attain effective and safe lead compounds.

Availability of data and material: The datasets generated or analyzed in the current study are available from the corresponding author on reasonable request.

Conflicts of interest: The authors declare that they have no competing interests.

Funding: No funding has been received to conduct this study.

Authors' contributions: HB developed the concept of the research protocol, study design, literature review, data collection, data extraction, data analysis and interpretation, and drafted the manuscript. HG and KBT conducted data analysis and interpretation. HB, HG, KBT, and MYY edited the manuscript. All authors read and approved the manuscript.

References

1. Limenih Y, Umer S, Wolde-Mariam M. Ethnobotanical study on traditional medicinal plants in Dega Damot Woreda, Amhara Region,

- north Ethiopia. *Int J Res Pharm Chem.* 2015;5:258-73.
2. Kefalew A, Asfaw Z, Kelbessa E. Ethnobotany of medicinal plants in Ada'a District, East Shewa Zone of Oromia Regional State, Ethiopia. *J Ethnobiol Ethnomed.* 2015;11:25.
 3. Kewessa G, Abebe T, Demessie A. Indigenous knowledge on the use and management of medicinal trees and shrubs in Dale District, Sidama Zone, southern Ethiopia. *Ethnobot Res Appl.* 2015;14:171-82.
 4. World Health Organization. WHO Traditional Medicine Strategy: 2014–2023. Geneva: World Health Organization. 2013. www.who.int/medicines/publications/traditional/trm_strategy14_23/en/. Accessed 12 Dec 2017.
 5. Teklay A, Abera B, Giday M. An ethnobotanical study of medicinal plants used in Kilde Awulaelo District, Tigray Region of Ethiopia. *J Ethnobiol Ethnomed.* 2013;9:65.
 6. Gurib-Fakim A. Medicinal plants: traditions of yesterday and drugs of tomorrow. *Mol Aspects Med.* 2006;27:1-93.
 7. Nagori BP, Solanki R. Role of medicinal plants in wound healing. *Res J Med Plant.* 2011;5:392-405.
 8. Maver T, Maver U, Stana Kleinschek K, Smrke DM, Kreft S. A review of herbal medicines in wound healing. *Int J Dermatol.* 2015;54:740-51.
 9. Heinrich M. Ethnobotany and its role in drug development. *Phytother Res.* 2000;14:479-88.
 10. Tadeg H, Mohammed E, Asres K, Gebre-Mariam T. Antimicrobial activities of some selected traditional Ethiopian medicinal plants used in the treatment of skin disorders. *J Ethnopharmacol.* 2005;100:168-75.
 11. Ghosh PK, Gaba A. Phyto-extracts in wound healing. *J Pharm Pharm Sci.* 2013;16:760-820.
 12. Taye B, Giday M, Animut A, Seid J. Antibacterial activities of selected medicinal plants in traditional treatment of human wounds in Ethiopia. *Asian Pac J Trop Biomed.* 2011;1:370-5.
 13. Moher D, Shamseer L, Clarke M, Ghersi D, Liberati A, Petticrew M, *et al.* Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Syst Reviews.* 2015;4:1.
 14. Lulekal E, Kelbessa E, Bekele T, Yineger H. An ethnobotanical study of medicinal plants in Mana Angetu District, southeastern Ethiopia. *J Ethnobiol Ethnomed.* 2008;4:10.
 15. Chekole G, Asfaw Z, Kelbessa E. Ethnobotanical study of medicinal plants in the environs of Taragedam and Amba remnant forests of Libo Kemkem District, northwest Ethiopia. *J Ethnobiol Ethnomed.* 2015;11:4.
 16. Meragiaw M, Asfaw Z, Argaw M. The status of ethnobotanical knowledge of medicinal plants and the impacts of resettlement in Delanta, northwestern Wello, northern Ethiopia. *Evid Based Complement Alternat Med.* 2016;2016:5060247.
 17. Ashton RA, Kefyalew T, Tesfaye G, Pullan RL, Yadeta D, Reithinger R, *et al.* School-based surveys of malaria in Oromia Regional State, Ethiopia: a rapid survey method for malaria in low transmission settings. *Malar J.* 2011;10:25.
 18. Chekole G. Ethnobotanical study of medicinal plants used against human ailments in Gubalafto District, northern Ethiopia. *J Ethnobiol Ethnomed.* 2017;13:55.
 19. Chan EW, Lim YY, Wong SK, Lim KK, Tan SP, Lianto FS, *et al.* Effects of different drying methods on the antioxidant properties of leaves and tea of ginger species. *Food Chem.* 2009;113:166-72.
 20. Lipsky BA, Hoey C. Topical antimicrobial therapy for treating chronic wounds. *Clin Infect Dis.* 2009;49:1541-9.
 21. Fikru A, Makonnen E, Eguale T, Debella A, Mekonnen GA. Evaluation of *in vivo* wound healing activity of methanol extract of *Achyranthes aspera* L. *J Ethnopharmacol.* 2012;143:469-74.
 22. Mekonnen A, Sidamo T, Asres K, Engidawork E. *In vivo* wound healing activity and phytochemical screening of the crude extract and various fractions of *Kalanchoe peltata* A. Rich (Crassulaceae) leaves in mice. *J Ethnopharmacol.* 2013;145:638-46.
 23. Barku VY, Boye A, Ayaba S. Phytochemical screening and assessment of wound healing activity of the leaves of *Anogeissus leiocarpus*. *Euro J Exp Bio.* 2013;3:18-25.
 24. Dash GK, Murthy PN. Evaluation of *Argemone mexicana* Linn. Leaves for wound healing activity. *J Nat Prod Plant Resour.* 2011;1:46-56.
 25. Mahmood AA, Sidik K, Salmah I. Wound healing activity of *Carica papaya* L. aqueous leaf extract in rats. *Int J Mol Med Adv Sci.* 2005;1:398-401.
 26. Nayak BS, Pereira LP, Maharaj D. Wound healing activity of *Carica papaya* L. in experimentally induced diabetic rats. *Indian J Exp Biol.* 2007;45:739-43.
 27. Gurung S, Škalko-Basnet N. Wound healing properties of *Carica papaya* latex: *in vivo* evaluation in mice burn model. *J Ethnopharmacol.* 2009;121:338-41.
 28. Vijaya VT, Srinivasan D, Sengottuvelu S. Wound healing potential of *Melia azadirachta* L. leaves in alloxan induced diabetic rats. *Glob J Res Med Plants Indig Med.* 2012;1:265.
 29. Shukla A, Rasik AM, Jain GK, Shankar R, Kulshrestha DK, Dhawan BN. *In vitro* and *in vivo* wound healing activity of asiaticoside isolated from *Centella asiatica*. *J Ethnopharmacol.* 1999;65:1-11.
 30. Rasik AM, Raghubir R, Gupta A, Shukla A, Dubey MP, Srivastava S, *et al.* Healing potential of *Calotropis procera* on dermal wounds in Guinea pigs. *J Ethnopharmacol.* 1999;68:261-6.
 31. Deshmukh PT, Fernandes J, Atul A, Toppo E. Wound healing activity of *Calotropis gigantea* root bark in rats. *J Ethnopharmacol.* 200;125:178-81.

32. Somboonwong J, Kankaisre M, Tantisir B, Tantisira MH. Wound healing activities of different extracts of *Centella asiatica* in incision and burn wound models: an experimental animal study. *BMC Complement Altern Med*. 2012;12:103.
33. Mechesso AF, Tadese A, Tesfaye R, Tamiru W, Eguale T. Experimental evaluation of wound healing activity of *Croton macrostachyus* in rat. *Afr J Pharm Pharmacol*. 2016;22:832-8.
34. Sauaia Filho EN, Santos OJ, Barros Filho AK, Rocha AD, Silva RC, Santos RH, *et al*. Evaluation of the use of raw extract of *Euphorbia tirucalli* L. in the healing process of skin wounds in mice. *Acta Cir Bras*. 2013;28:716-20.
35. Mishra SB, Mukerjee A, Vijayakumar M. Wound healing activity of the aqueous alcoholic extract of *Jasminum grandiflorum* Linn leaves. *Pharmacologyonline*. 2010;3:35-40.
36. Kommu S, Gowrishankar NL, Kamala D, Saritha B, Srinivasulu V, Naresh B, *et al*. Evaluation of wound healing activity of methanolic extract of *Balanitesaegyptiaca* L. leaves. *Int J Pharm Pharm Sci*. 2013;5:52-3.
37. Dash GK, Murthy PN. Wound healing effects of *Ageratum conyzoides* Linn. *Int J Pharma Bio Sci*. 2011;2:369-83.
38. Belayneh A, Asfaw Z, Demissew S, Bussa NF. Medicinal plants potential and use by pastoral and agro-pastoral communities in Erer Valley of Babile Wereda, eastern Ethiopia. *J Ethnobiol Ethnomed*. 2012;8:42.
39. Giday M, Asfaw Z, Woldu Z. Medicinal plants of the Meinit ethnic group of Ethiopia: an ethnobotanical study. *J Ethnopharmacol*. 2009;124:513-21.
40. Gemedo-Dalle T, Maass BL, Isselstein J. Plant biodiversity and ethnobotany of Borana pastoralists in southern Oromia, Ethiopia. *Econ Bot*. 2005;59:43-65.
41. Eshete AM, Kelbessa E, Dalle G. Ethnobotanical study of medicinal plants in Guji Agro-pastoralists, Blue Hora District of Borana Zone, Oromia Region, Ethiopia. *J Med Plants Stud*. 2016;4:170-84.
42. Gidey M, Beyene T, Signorini MA, Bruschi P, Yirga G. Traditional medicinal plants used by Kunama ethnic group in northern Ethiopia. *J Med Plants Res*. 2015;9:494-509.
43. Birhanu T, Abera D, Ejeta E, Nekemte E. Ethnobotanical study of medicinal plants in selected Horro Gudurru Woredas, western Ethiopia. *J Biol Agric Healthc*. 2015;5:83-93.
44. Luizza MW, Young H, Kuroiwa C, Evangelista P, Worede A, Bussmann R, *et al*. Local knowledge of plants and their uses among women in the Bale mountains, Ethiopia. *Ethnobot Res Appl*. 2013; 11:315-39
45. Giday M, Asfaw Z, Elmqvist T, Woldu Z. An ethnobotanical study of medicinal plants used by the Zay people in Ethiopia. *J Ethnopharmacol*. 2003;85:43-52.
46. Giday M, Teklehaymanot T, Animut A, Mekonnen Y. Medicinal plants of the Shinasha, Agew-awi and Amhara peoples in northwest Ethiopia. *J Ethnopharmacol*. 2007;110:516-25.
47. Giday M, Asfaw Z, Woldu Z. Ethnomedicinal study of plants used by Sheko ethnic group of Ethiopia. *J Ethnopharmacol*. 2010;132:75-85.
48. Teklehaymanot T, Giday M. Quantitative ethnobotany of medicinal plants used by Kara and Kwegu semi-pastoralist people in lower Omo River Valley, Debub Omo Zone, Southern Nations, Nationalities and Peoples Regional State, Ethiopia. *J Ethnopharmacol*. 2010;130:76-84.
49. d'Avigdor E, Wohlmuth H, Asfaw Z, Awas T. The current status of knowledge of herbal medicine and medicinal plants in Fiche, Ethiopia. *J Ethnobiol Ethnomed*. 2014;10:38.
50. Moravec I, Fernández E, Vlkova M, Milella L. Ethnobotany of medicinal plants of northern Ethiopia. *Bol Latinoam Caribe Plantas Me Aromát*. 2014;13:126-34.
51. Mekuanent T, Zebene A, Solomon Z. Ethnobotanical study of medicinal plants in Chilga District, northwestern Ethiopia. *J Nat Remedies*. 2015;15(2):88-112.
52. Araya S, Abera B, Giday M. Study of plants traditionally used in public and animal health management in Seharti Samre District, southern Tigray, Ethiopia. *J Ethnobiol Ethnomed*. 2015;11:22.
53. Teklehaymanot T. An ethnobotanical survey of medicinal and edible plants of Yalo Woreda in Afar Regional State, Ethiopia. *J Ethnobiol Ethnomed*. 2017;13:40.
54. Gabriel T, Guji T. Ethnopharmacological survey of medicinal plants in Agaro district, Jimma Zone, south west Ethiopia. *Int J Pharm Sci Res*. 2014;5:3551.
55. Gedif T, Hahn HJ. The use of medicinal plants in self-care in rural central Ethiopia. *J Ethnopharmacol*. 2003;87:155-61.
56. Zenebe G, Zerihun M, Solomon Z. An ethnobotanical study of medicinal plants in Asgede Tsimbila District, northwestern Tigray, northern Ethiopia. *Ethnobot Res Appl*. 2012;10:305-20.
57. Wabe N, Mohammed MA, Raju NJ. An ethnobotanical survey of medicinal plants in the southeast Ethiopia used in traditional medicine. *Spatula DD*. 2011;1:153-8.
58. Getaneh S, Girma Z. An ethnobotanical study of medicinal plants in Debre Libanos Wereda, central Ethiopia. *Afr J Plant Sci*. 2014;8:366-79.
59. Wondimu T, Asfaw Z, Kelbessa E. Ethnobotanical study of medicinal plants around 'Dheeraa' town, Arsi Zone, Ethiopia. *J Ethnopharmacol*. 2007;112:152-61.
60. Paulos B, Fenta TG, Bisrat D, Asres K. Health seeking behavior and use of medicinal plants among the Hamar ethnic group, South Omo Zone, southwestern Ethiopia. *J Ethnobiol Ethnomed*. 2016;12:44.
61. Teklehaymanot T. Ethnobotanical study of knowledge and medicinal plants use by the people in Dek Island in Ethiopia. *J Ethnopharmacol*. 2009;124:69-78.

62. Mesfin F, Seta T, Assefa A. An ethnobotanical study of medicinal plants in Amaro Woreda Ethiopia. *Ethnobot Res Appl.* 2014;12:341-54.
63. Bussmann RW, Swartzinsky P, Worede A, Evangelista P. Plant use in Odo-Bulu and Demaro, Bale region, Ethiopia. *J Ethnobiol Ethnomed.* 2011;7:28.
64. Mesfin K, Tekle G, Tesfay T. Ethnobotanical study of traditional medicinal plants used by indigenous people of Gemad District, northern Ethiopia. *J Med Plants Stud.* 2013;1:32-7.
65. Wubetu M, Abula T, Dejenu G. Ethnopharmacologic survey of medicinal plants used to treat human diseases by traditional medical practitioners in Dega Damot District, Amhara, northwestern Ethiopia. *BMC Res Notes.* 2017;10:157.
66. Abera B. Medicinal plants used in traditional medicine by Oromo people, Ghimbi District, southwest Ethiopia. *J Ethnobiol Ethnomed.* 2014;10:40.
67. Maryo M, Nemomissa S, Bekele T. An ethnobotanical study of medicinal plants of the Kembatta ethnic group in Enset-based agricultural landscape of Kembatta Tembaro (KT) Zone, southern Ethiopia. *Asian J Plant Sci Res.* 2015;5:42-61.
68. Kandari LS, Negi T, Thakur AK, Yilma E. Ethnobotanical and indigenous knowledge of important plants in East Hararghe, eastern Ethiopia. *J Mt Sci.* 2015;12(6):1521-33.
69. Ragnathan M, Abay SM. Ethnomedicinal survey of folk drugs used in Bahirdar Zuria District, northwestern Ethiopia. *Indian J Tradit Know.* 2009; 8:281-4.
70. Kidane B, van Andel T, van der Maesen LJ, Asfaw Z. Use and management of traditional medicinal plants by Maale and Ari ethnic communities in southern Ethiopia. *J Ethnobiol Ethnomed.* 2014;10:46.
71. Mesfin F, Demissew S, Teklehaymanot T. An ethnobotanical study of medicinal plants in Wonago Woreda, SNNPR, Ethiopia. *J Ethnobiol Ethnomed.* 2009;5:28.
72. Temam T, Dillo A. Ethnobotanical study of medicinal plants of Mirab-Badwacho District, Ethiopia. *J BioSci Biotechnol.* 2016;5:151-8.
73. Tewelde F, Mesfin M, Tsewene S. Ethnobotanical survey of traditional medicinal practices in LaelayAdi-yabo District, northern Ethiopia. *Int J Ophthalmol Vis Sci.* 2017;2:80-7.
74. Flatie T, Gedif T, Asres K, Gebre-Mariam T. Ethnomedicinal survey of Berta ethnic group Assosa Zone, Benishangul-Gumuz Regional State, mid-west Ethiopia. *J Ethnobiol Ethnomed.* 2009;5:14.
75. Bekele G, Reddy PR. Ethnobotanical study of medicinal plants used to treat human ailments by Guji Oromo tribes in Abaya District, Borana, Oromia, Ethiopia. *Univers J Plant Sci.* 2015;3:1-8.
76. Teklehaymanot T, Giday M, Medhin G, Mekonnen Y. Knowledge and use of medicinal plants by people around Debre Libanos monastery in Ethiopia. *J Ethnopharmacol.* 2007;111:271-83.
77. Megersa M, Asfaw Z, Kelbessa E, Beyene A, Woldeab B. An ethnobotanical study of medicinal plants in Wayu Tuka District, East Welega Zone of Oromia Regional State, west Ethiopia. *J Ethnobiol Ethnomed.* 2013;9:68.
78. Zerabruk S, Yirga G. Traditional knowledge of medicinal plants in Gindeberet District, western Ethiopia. *S Afr J Bot.* 2012;78:165-9.
79. Belayneh A, Bussa NF. Ethnomedicinal plants used to treat human ailments in the prehistoric place of Harla and Dengego valleys, eastern Ethiopia. *J Ethnobiol Ethnomed.* 2014;1:18.
80. Assefa B, Glatzel G, Buchmann C. Ethnomedicinal uses of *Hagenia abyssinica* (Bruce) J.F. Gmel. among rural communities of Ethiopia. *J Ethnobiol Ethnomed.* 2010;6:20.
81. Teklehaymanot T, Giday M. Ethnobotanical study of medicinal plants used by people in Zegie Peninsula, northwestern Ethiopia. *J Ethnobiol Ethnomed.* 2007;3:12.
82. Berihun T, Molla E. Study on the diversity and use of wild edible plants in Bullen District northwest Ethiopia. *J Bot.* 2017; Article ID 8383468.