Natural resources used as folk cosmeceuticals among rural communities in Vhembe district municipality, Limpopo province, South Africa

Mamokete Venolia Setshego, Adeyemi Oladapo Aremu, Obakeng Mooki and Wilfred Otang-Mbeng

Abstract

Background: Skin-related diseases affect every individual irrespective of age, gender or social status. Since time immemorial, humans have explored natural resources from their environment for the maintenance of the skin. This explorative survey was conducted to document the natural resources (plant and non-plant materials) used for folk cosmeceuticals by rural communities in Vhembe district municipality, Limpopo province, South Africa.

Methods: The research was conducted in six communities namely: Tshakuma, Shigalo, Tshamutilikwa, Luvhimbi (Maskhwa), Khakhana, and Folovhodwe in Vhembe district. Random and convenient sampling was used to access the target population. Semi-structured questionnaires were used to interview 71 participants that comprised traditional practitioners, herbalists and laypeople from the study area. Collected data were analysed using both quantitative (for e.g. frequency, use-value and relative frequency of citation) and qualitative (thematic) analytical methods.

Results: A total of 52 plants from 27 families and 22 non-plant materials were used as folk cosmeceuticals in the study area. The most cited plants included Dicerocaryum zanguebarium (Pedaliaceae), Ricinus communis (Euphorbiaceae) and Helinus integrifolius (Rhamnaceae). Trees and shrubs were the most common plant-life form while leaves were the most popular plant part. Pig fats, red ochre (Luvhundi soil) and ashes were the most cited non-plant materials. These documented natural resources are frequently prepared by crushing and mostly used to heal wounds.

Conclusion: Traditional knowledge concerning folk cosmeceuticals is mostly held by elders. The high number of natural resources documented is an indication that Vhembe district is rich in ethnopharmacological knowledge. Scientific investigation of the efficacies and safety of these natural resources is highly recommended as a drive aimed at innovations with benefits to the rural communities who are the custodians of this valuable knowledge.

Keywords: Biodiversity, Ethnopharmacognostic, Medicinal plants, Skin diseases, Indigenous knowledge systems

© The Author(s). 2020 Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article’s Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article’s Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit http://creativecommons.org/licenses/by/4.0/. The Creative Commons Public Domain Dedication waiver (http://creativecommons.org/publicdomain/zero/1.0/) applies to the data made available in this article, unless otherwise stated in a credit line to the data.
Background
The use of natural resources, especially plant material, for skin diseases and cosmeceutical purposes, is an ancient practice in many cultures globally [1]. Natural resources refer to substances that occur naturally and include plants, animals and micro-organisms. Plant derived-extracts are more common than animal derived-extracts as a source of cosmeceuticals [2]. Despite the continuous neglect of folk cosmeceuticals in favour of the synthetic ones, natural resources are still utilised for skin health in many rural areas [1, 3–5]. The ease of access and belief in the efficacy of indigenous knowledge are common reasons for the continuous dependence on these natural resources.

The bio-compounds from natural resources have been successfully used in skin-care treatment due to their effectiveness and safety. Martins et al. [6] emphasised that the suppliers of the cosmetic industry are embracing the need to include extracts from natural resources because they contain essential vitamins and minerals that exert ultraviolet and anti-oxidant protection and general anti-aging benefits. Recently, the pharmaceutical industry is embracing the ideal of incorporating antioxidants derived from natural resources into their products because they contain chemicals that are valuable in cosmeceuticals [7]. Furthermore, natural antioxidants provide health benefits such as anti-aging, anti-inflammatory, and anti-microbial properties that are suitable for cosmetic purposes [8].

The demand for natural resources for cosmeceuticals is increasing globally. The use of plant-based remedies remains entrenched in the healing practices of developing countries [9]. According to Statistics South Africa [10], South Africans consult both public health facilities and traditional practitioners for rememdies against common illnesses including skin diseases. Even though several ethnobotanical studies have been conducted in Limpopo province, including Vhembe district [11–17], specific attention on natural resources utilised as cosmeceuticals for skin diseases remains understudied. While Mabogo [16] documented 44 plants with cosmeceutical potential, Mahwasane et al. [11] and Magwede et al. [13] recorded 2 and 13 plants, respectively. A recent study by Constant and Tshisikhawe [12] did not highlight any plant with cosmeceutical value. Ndhlouvu et al. [17] focused on plants used for cosmetic and cosmeceutical purposes by the Vhavenda women. Thus, the current study aims at documenting natural resources used as folk cosmeceuticals among households in rural communities located in Vhembe district.

Methods

Study area
The study was conducted in six villages situated on the northern side of Limpopo province, South Africa (Fig. 1). Vhembe district has a population of 1,393,949 with 382,346 households and mainly dominated by the Vhavenda and VaTsongas [18]. It comprises of four local municipalities namely Thulamela, Collins Chabane, Makhado, and Musina. The district municipality is predominantly rural, with more than 85% of its population living in tribal settlements and farms, and only 5% living in urban areas [19]. Vhembe district is mainly covered with the vegetation of Savannah biome and topography and is characterised by South Pan Mountain (“Salt Pan Mountain”).

Ethnopharmacognostic survey
The survey involved 71 participants who were knowledgeable about natural resources utilised for folk cosmeceuticals. The participants included herbalists, traditional practitioners and laypeople. Convenient sampling was used to get the participants. The households were randomly chosen using every fifth (5th) house in the community because all the possible samples that were chosen came from the population that had the same probability to belong to the sample. The convenient sampling was used by asking questions from household members that were willing to participate. This sampling method was adopted to provide the community members the freedom to choose whether to participate or otherwise. In fact, those who were not interested in participating in the study referred the researcher to the people who were known to have the required knowledge.

Semi-structured questionnaires were used to collect data from the participants. The questionnaire was divided into four categories. Category A entailed the interview log that requested information about the name of the community, date of data collection, local municipality and demography of participants. Category B comprised inquiries about natural resources utilised for folk cosmeceuticals, method of preparations and administration and part used. Category C consisted of indigenous knowledge and practices involved in the formulation and use of folk cosmeceuticals, and lastly Category D comprised questions about the factors influencing the use of folk cosmeceuticals. The interview was conducted in Tshivenda and Xitsonga with the assistance of two translators. Some of the interviews were conducted in an informal gathering, although the original intention of the researcher was to interview one person at a time. Interviewing participants that gathered informally contributed a lot to the study. It was observed that some of the participants would only contribute their knowledge when they were in a group which benefited the researcher in saving time and helping to gather more data.

Plant collections and identification
Plants were collected both from home gardens and natural vegetation during the fieldwork with the assistance of knowledge holders and translators. The permission to
collect the required specimens was granted by the Department of Environmental Affairs, Limpopo Province and the tribal authority. Voucher specimens of the plants were deposited at the herbarium of the South African National Biodiversity Institute (SANBI), Pretoria for identification. Plants were also identified with the relevant books and with the assistance of an expert (Botanist).

Ethics approval and consent to participate
The current study was approved (ethical clearance no: NWU-07740-17-A9) was by the research ethics committee of North-West University, Mmabatho, South Africa. Permission letter to access and conduct research in six communities was granted by the traditional leaders. Data were collected with full agreement with the participants and consent form was issued to them which clearly stated and explained that the participants were volunteering and the details of the study which included aim, objectives and how data were going to be collected.

Data analysis
The data analysis was carried out using both descriptive and inferential statistics utilizing percentage and frequency. Data from the questionnaire were analysed using IBM SPSS analytical tool, Microsoft Excel 2016. Ethnobotanical indices such as frequency of mention (F), use-value (UV) and Relative frequency of citation (RFC) were calculated as detailed previously [20].

Results
Socio-demographic characteristics of participants
In the current survey, the 71 participants that were interviewed had diverse demographic characteristics (Table 1). Most of the participants involved in the survey were from Shigalo and Tshakuma communities. The majority (76%) of the participants were females and the dominating (35%) age group was those individuals older than 70 years. The majority of the participants belonged to the Venda tribe (66%) and most of the participants lacked formal employment.
In total, 52 plants from 27 families were cited as being used as folk cosmeceuticals in the study area (Table 2; Fig. 2). As shown in Fig. 2, most of the plants belong to the following families: Leguminosae/Fabaceae (6), Ebenaceae (4), Poaceae (4), Euphorbiaceae (4), Anacardiaceae (3), Compositae/Asteraceae (3) and Rutaceae (3). In terms of frequency, the most cited plants were Diceroscaryum zanguebarium, Ricinus communis, Helinus integripolius, Zea mays and Annona senegalensis. Shrubs and trees constituted the most (71%) occurring plant life-forms while the proportion of herbs and grasses were 21 and 8%, respectively (Fig. 3). Even though diverse plant parts were used as cosmeceuticals, the leaves (32%), fruit (18%) and roots (13%) were the most utilised plant parts (Fig. 4). Plants with the highest UV were Aloe vera (0.084), Euclera divinorum (0.084), Bauhinia thomnii (0.070) and Citrus limon (0.056) (Table 2).

Twenty-two (22) non-plants materials were recorded as folk cosmeceuticals among rural communities (Table 3). In terms of frequency, the most common (with more than 10 citations) non-plant materials were nguluvhe/honje (pig fats), luhundi (soil), maflura tharut/ntlharo (python fat) and wood ashes/coal. In addition, nguluvhe/honje, wood, ashes/coal, soil and sandy soil had the highest (0.042–0.056) UV among the non-plant resources (Table 3).

Mode of preparation and administration of folk cosmeceuticals

The natural resources used as folk cosmeceuticals were prepared by diverse means such as infusion, grinding and maceration (Fig. 5). The most common methods of preparation of non-plant natural resources were crushing (33%), while maceration (3.5%) and infusion (3.5%) were the least common methods. These natural resources used for folk cosmeceuticals are applied in the form of powder, poultice, juice and infusion. The majority (88%) of the natural product remedies were applied topically. In terms of the broad categories, the remedies were administered for skin afflictions, cosmetics, antioxidants and hair care (Table 4).

Indigenous knowledge and practices of folk cosmeceuticals

As highlighted by some of the participants, skin diseases are believed to have an underlying spiritual cause. For instance, some skin diseases are believed to be caused by disobeying ancestors, result from misbehaving in a community and evil spells. As a result, rituals are often recommended and performed for the healing of the skin afflictions. Healers are known to perform ‘Gumululo’ which is a ritual used to remove sores from infected skin. Traditional practitioners wash the sores by sprinkling water mixed with the unspecified concoction. Some severe skin diseases require the patient to stay in an isolated area for a certain duration in order to be healed. When it is time for the patient to return home, the family members are given a similar concoction to prevent the same disease. In some instances, patients wash in a lake called ‘Dzivha la fundudzi’ in Venda because it is a sacred river, a river of gods. For them to access the lake to wash away the disease, permission is requested from the priest and traditional practitioner that guard the lake.

Discussion

As emphasized by Fongnzossie et al. [5], there is inadequate documentation of the ethnobotanical knowledge on cosmeceuticals. Furthermore, Lall and Kishore [21] highlighted the existing research gaps that involve both the inadequacies in ethnobotanical documentation and scientific evaluation of the plants used skincare in South Africa. The current ethnopharmacognostic survey
| Scientific name (Voucher number) | *Common name(s) | Family       | Part(s) used | Use-value | RFC Method of preparation and administration | Life-form | Location |
|----------------------------------|-----------------|--------------|--------------|-----------|---------------------------------------------|-----------|----------|
| Acmella caulirhiza Delile Syn: Eclipta filicaulis Schumach. & Thonn. (MVS 007) | Tshishengeraphofu (V) | Compositae/ Asteraceae | Leaves 2 | 0.042 | The leaves are crushed and mixed with water to wash wounds to enhance healing. The crushed leaves are infused in water to wash sores. The powder of the crushed leaves is mixed with saliva and applied topically for wound healing | Herb      | LVB      |
| Albizia harveyi E.Fourn. (MVS 019) | Molela (X) paperbark false-thorn (E) | Leguminosae/ Fabaceae | Roots 1 | 0.014 | The roots are burned and applied to remove rash | Tree      | SGL      |
| Aloe vera (L.) Burm.f. Syn: Aloe barbadensis Mill. (MVS 031) | Mhangani (X)/ Tshikopa (V) Aloe (E) | Xanthorrhoeaceae | Leaves 5 | 0.084 | The liquid from the leaves is applied topically to remove ringworms, moisturize the skin, remove stretch marks, rash and to heal burned skin and wound | Herb      | LVB      |
| Annona senegalensis Pers. (MVS 005) | Muembe (V) African Custard-apple (E) | Annonaceae | Twigs 11 | 0.014 | The twig is crushed and used as a toothbrush to clean the teeth | Shrub     | TKM      |
| Bauhinia thonningii Schum. Syn: Piliostigma thonningii (Schum.) Milne-Redh (MVS 018) | Xidengana/ denga (X) camel’s foot (E) | Leguminosae/ Fabaceae | Fruit 5 | 0.070 | The fruit is burned and mixed with oil which is applied on ringworms, sores and for treating skin irritation. The liquid from fruit applied to remove pimples and wounds | Shrub     | SGL      |
| Bidens pilosa L. (MVS 047) | Mushidzhi (V) Black jack (E) | Compositae/ Asteraceae | Leaves 1 | 0.038 | The leaves are crushed and the liquid is applied on wounds. The fruit juice is applied on the skin to clean and soften it | Herb      | LVB      |
| Citrus limon (L.) Osbeck (MVS 002) | Tshikavhave (V) Lemon (E) | Rutaceae | Fruit 3 | 0.056 | Juice from the fruit is applied on the skin for moisturizing, removing wrinkles, scars and pimples | Tree      | TKM      |
| Citrus reticulata Blanco (MVS 050) | Swiri (V) Orange (E) | Rutaceae | Fruit 2 | 0.038 | The fruit juice is applied on the skin to clean and soften it | Tree      | LVB      |
| Combretum imberbe Wawra (MVS 038) | Mondzo (X) Leadwood (E) | Combretaceae | Bark 1 | 0.014 | The bark is ground and mixed with water to remove sores by bathing | Tree      | SGL      |
| Cussonia spicata Thunb (MVS 040) | Musenzhe (V) Cabbage tree (E) | Araliaceae | Leaves 1 | 0.014 | The leaves are crushed and applied as a paste on ringworms | Tree      | TKM      |
| Dicenocaryum zanguebarianum (Lour.) Merr. (MVS 022) | Dinda (X) /museto (V) Boot protectors (E) | Pedaliaceae | Leaves 61 | 0.042 | The leaves are mixed with water for bathing, also relaxes hair and removes dandruff | Herb      | TKM      |
| Dichrostachys cinerea (L.) Wight & Arn. Syn: Acacia cinerea (L.) Spreng. (MVS 011) | Murenzhe (V) Sickle bush (E) | Leguminosae/ Fabaceae | Fruit 2 | 0.042 | The fruit is burned and the ashes applied for wound healing. The bark is crushed and mixed with oil to remove ringworms. The bark is boiled and water used to wash the wound | Shrub     | KKN      |
| Diospyros lycioides Desf. (MVS 025) | Muthala (V) Quilted Bluebush (E) | Ebenaceae | Twigs 3 | 0.038 | The twig is crushed to clean the teeth. The fruit juice is mixed with water to wash wounds | Shrub     | TKM      |
| Diospyros | Ntoma (X) Musuma | Ebenaceae | Fruit 5 | 0.042 | Liquid from the leaves and fruit are | Tree      | TMTK     |
Table 2 Plants used as folk cosmaceuticals among rural communities in Vhembe district municipality, Limpopo province, South Africa (Continued)

| Scientific name | Family | Part(s) used | Part(s) used | RFC Method of preparation and administration | Life-form | Location |
|-----------------|--------|--------------|--------------|-----------------------------------------------|----------|----------|
| *Mespiliformis* Hochst. ex A. DC. (MVS 017) | | | | applied on skin for eradicating ringworms. The twig is crushed to clean the teeth | TKM | SGL |
| *Diospyros natalensis* (Harv.) Brenan (MVS 043) | | | | The tip of twig is crushed and used to clean the teeth | Tree | SGL |
| *Dombeya ratundifolia* (Hochst.) Planch (MVS 036) | | | | The leaves are crushed and mixed with water to wash and dye hair | Tree | KKN |
| *Euclea divinorum* Hiern (MVS 013) | | | | The crushed leaves are mixed with water or the leaves are boiled and used for bathing to remove skin irritation, ringworms, rash, pimples, chickenpox | Shrub | TKM |
| *Eugenia capensis* subsp. *natalitia* (Sond.) F.White Syn: *Eugenia natalitia* Sond (MVS 001) | | | | The flower is mixed with water to bathe for controlling odour | Tree | FLVD |
| *Gardenia volkensii* K. Schum. (MVS 020) | | | | The fruit called *thomba liquid*, it is applied on the skin for removing pimples | Shrub | TKM |
| *Helinus integrifolius* (Lam.) Kuntze (MVS 032) | | | | The leaves are squashed and applied as a paste for wound healing | Tree | LVB |
| *Heteromorpha arborescens* (Spreng.) Cham. & Scheldl. (MVS 008) | | | | The leaves are infused in water for bathing | Shrub | LVB |
| *Hyperacanthus amoenus* (Sims) Bridson (MVS 049) | | | | The twig is crushed and used to clean the teeth. The tip of the twig is crushed and is dipped in ashes to clean teeth The leaves are infused in water for bathing | Herb | TKM |
| *Indigofera arrecta* Hochst. A. Rich (MVS 034) | | | | The leaves are crushed and smeared on wounds for healing | Tree | SGL |
| *Jatropha curcas* L. Syn: *Castillonia lobata* Ruiz & Pav. (MVS 004) | | | | Liquid from crushed leaves and stems are applied to moisturize the skin. The roots are ground and soaked in water to wash wounds | Shrub | TMTK |
| *Jatropha zeyheri* Sond. Syn: *Jatropha brachyadenia* Pax & K.Hoffm. (MVS 052) | | | | The leaves are squashed and applied as a paste for wound healing | Herb | SGL |
| *Lannea schweinfurthii* var. *stuhlmannii* (Engl.) Kokwaro Syn: *Lannea stuhlmannii* Engl. (MVS 039) | | | | The leaves are crushed and smeared on wounds for healing | Tree | SGL |
| Scientific name (Voucher number) | * Common name(s) Family | Part(s) used | Life-form | Location |
|----------------------------------|-------------------------|-------------|-----------|----------|
| Lippia javanica (Burm. f.) Spreng (MVS 041) | Musudzungwane (V) | Leaves | 4 | 0.038 | 0.05 | The leaves are rubbed on the skin for the treatment of rash. The leaves are crushed and rubbed with oil on the body for the treatment of rash. |
| Musa acuminata Colla (MVS 028) | Muova (V) | Flowers | 4 | 0.038 | 0.05 | Liquid from leaves and flower are applied for treating wounds and burned skin |
| Obtia tenax Friis Syn: Ureia tenax N.E. Br. (MVS 006) | Thanga (V) | Seeds | 2 | 0.014 | 0.03 | The seeds are ground to moisturize the skin |
| Peltophorum africanum Sond. (MVS 012) | Musese (V) | Bark | 1 | 0.014 | 0.01 | The bark is boiled and drunk to heal mouth sores |
| Persea americana Mill. (MVS 052) | Aflukhada (V) | Seeds | 6 | 0.042 | 0.08 | The seeds are crushed and used as face-wash to remove blackheads on the skin. The fruit is rubbed on the skin to moisturize and soften it |
| Phragmites mauritianus Kunth (MVS 014) | Lutanga (V) | Thorns whole plant | 3 | 0.038 | 0.04 | The thorn is used to prick and remove moles. The whole plant is burned and the ashes applied for removal of stretch marks. |
| Pouzolzia mixta Solms Syn: Pouzolzia huillensis Hiern (MVS 009) | Muthanzwa (V) | Roots | 1 | 0.014 | 0.01 | The roots are crushed to powder and applied on a wound to heal it. |
| Ricinus communis L. (MVS 016) | Nhlapfuruha (X) | Seeds | 20 | 0.042 | 0.28 | Oil from the fried seeds are used for moisturizing the skin and hair |
| Salacia rehmannii Schinz. (MVS 026) | Phathatsimima (V) | Roots | 1 | 0.014 | 0.01 | The roots are ground and mixed with water to wash sores |
| Sclerocarya birrea (A.Rich.) Hochst. (MVS 033) | Murula (V) | Stem | 2 | 0.042 | 0.03 | The stem is burned and applied to wounds. The seeds are ground and mixed with water till it becomes soft to moisturize the skin and as anti-aging |
| Searsia lancea (L.) F.A.Barkley (MVS 045) | Mushakaladzane (V) | Leaves | 5 | 0.042 | 0.07 | The leaves are crushed and mixed with water to clean the skin and to treat rashes. The leaves are boiled in water to bathe to remove pimples |
| Senna occidentalis (L.) Link Syn: Cassia occidentals L. (MVS 037) | Nembrumenbe (X) | Leaves | 2 | 0.038 | 0.03 | The leaves are crushed and made as a paste to apply on burned skin and for wound healing |
| Setaria acromelaena (Hochst.) T.Durand & Schinz (MVS 046) | Xihovane (X) | Stem | 1 | 0.014 | 0.01 | The stem is crushed and infused with water to remove sores. |
| Sida cordifolia L. (MVS | Mutudo (V) | Roots | 1 | 0.014 | 0.01 | The roots are burned and the ashes are applied for wound healing |
| Solanum | Mututulwa (V) | Fruit | 2 | 0.042 | 0.03 | The fruit is burned and applied after |
indicated that the custodians of knowledge on natural resources with cosmeceutical potential were females and elders (above 70 years). Indigenous knowledge often held by the elders in the communities is transmitted orally from generation to generation but its practice seems to be declining due to the lack of interest by the youth [22].

### Diversity of natural resources used for folk cosmeceuticals

The high quantity of natural resources as well as the diversity of flora identified, is an indication that the study area has rich indigenous knowledge on folk cosmeceuticals. As an addition to existing surveys in Vhembe district [11–17], the current study documented new plants (for e.g. Zea mays, Eugenia natalitia, Salacia rehmannii) for the first time, as natural resources for folk cosmeceuticals. Some of these plants were previously documented as medicine without the details of the diseases in recently study by Magwede et al. [13]. The current study indicated that the natural resources used to treat the same skin problems differ among the rural communities. It was also evident that a single plant is utilised for more

| Scientific name (Voucher number) | Common name(s) | Family | Part(s) used | F Value | RFC | Method of preparation and administration | Life-form | Location |
|----------------------------------|----------------|--------|--------------|---------|-----|------------------------------------------|-----------|----------|
| panduraeforme Dunal (MVS 035)    | Apple of Sodom (E) | Solanaceae | Tuber | 1 | 0.014 | Incision on ringworms. The liquid is applied to heal a wound and chickenpox. | Herb    | SGL      |
| Solanum tuberosum L. (MVS 048)  | Potato (E) | Solanaceae | Tuber | 2 | 0.014 | The peels of potatoes are rubbed on rash for their removal | Herb    | TMTK     |
| Striga asiatica (L.) Kunze (MVS 044) | Vhuri (V) Red witchweed (E) | Orobanchaceae | Whole plant | 2 | 0.014 | The plant is burned and applied for healing of a wound. | Herb    | FLVD     |
| Stychnos spinosa Lam. (MVS 023) | Muramba (V) Red witchweed (E) | Loganiaceae | Fruit | 1 | 0.014 | Fruit juice is applied on ringworms for their removal | Tree    | SGL      |
| Synadenium cupulare (Boiss.) L.C. Wheeler (MVS 042) | Muswoswo (V) Crying Tree (E) | Euphorbiaceae | Stem | 2 | 0.014 | Liquid from the cut stem is applied on the skin for the removal of moles | Shrub   | LVB      |
| Tabernaemontana elegans Stapf (MVS 029) | Muhatu (V) Toad tree (E) | Apocynaceae | Stem | 4 | 0.014 | Liquid from the cut stem is applied to the skin for the removal of ringworms. The roots are burned, ground and applied on the skin for the removal of ringworms | Shrub   | LVB      |
| Terminalia sericea Burch, ex DC (MVS 015) | Nkonono (X) mususu (E) silver cluster-leaf (E) | Combretaceae | Roots | 3 | 0.038 | The roots are burned and applied on the skin for the removal of pimples. The leaves are crushed and mixed with oil to moisturize the skin | Tree    | SGL      |
| Trichilia emetica Vahl (MVS 027) | Nkuhlu (X) Natal mahogany (E) | Meliaceae | Seeds | 1 | 0.014 | The seeds are ground to produce oil for moisturizing the skin | Tree    | SGL      |
| Unidentified plant species (MVS 003) | Grass (E) | Poaceae | Whole plant | 4 | 0.038 | The grass is burned and the ashes are applied for healing of sores and wounds. | Grass   | SGL      |
| Vernonia fastigiata Oliv. & Hiern (MVS 021) | Tanyi (V) Narrow-leaved Vernonia (E) | Compositae/ Asteraceae | Leaves | 2 | 0.014 | The leaves are crushed and smoothly rubbed on the skin for the removal of wound scars. | Herb    | TMTK     |
| Zanthoxylum davyi Waterm. (MVS 024) | Munungu (V) Fever Tree Knobwood (E) | Rutaceae | Roots | 4 | 0.038 | The roots are ground and the leaves are crushed and applied for wound healing. The crushed stem is used to wash the teeth. | Tree    | LVB      |
| Zea mays L. (MVS 48) | Muflumbu ha mavhele (V) Maize (E) | Poaceae | Fruit | 12 | 0.038 | Cob is ground and mixed with water and used for bathing in order to treat rash. Cob is ground and applied directly to pimples. | Grass   | TTMK     |

*Common name: V = Venda, E = English, X = Xitsonga; *F* = Frequency; *RFC* = Relative frequency citation

*Location: TTMK Tshakuma, TMTK Tshamutilikwa, LVB Luvhimbi (Masikhwa), SGL Shigalo, KKN Khakhanwa, FLVD Folovhodwe*
**Fig. 2** Frequency of plant families used as folk cosmeceuticals among rural communities in Vhembe district municipality, Limpopo province, South Africa.

**Fig. 3** Frequency of plant life-forms used as folk cosmeceuticals among rural communities in Vhembe district municipality, Limpopo province, South Africa.
than one skin problem; and a single skin problem has more than one natural resource as the recommended remedies.

Some of the plants were used in almost all of the rural communities where the survey was conducted. These plants included *Dicerocaryum zanguebarium* (Museto), *Ricinus communis* (Nhlampfurha/mupfure), *Zea mays* (mavhele), *Euclea divinorum* (Nhlangula/mutangule) and *Diospyros mespiliformis* (Musuma). These commonly used plants have been recorded by other authors, which is an indication of their cosmeceutical value. For instance, Chigora et al. [23] stated that the whole plant of *Dicerocaryum zanguebarium* (Museto) is used to make foam which is inserted into the vagina to dilate the birth canal, in Zimbabwe. The juice from the plant is used as shampoo by people of Gazankulu in Limpopo province [24]. The current study affirmed the use of *Dicerocaryum zanguebarium*, as the participants indicated the use of the whole plant to wash their hair. Many surveys have identified and documented *Ricinus communis*, [25–28], which suggests that the plant has high medicinal and cosmeceutical values. According to Maroyi [29], the roots of *Ricinus communis* are used indigenously to clean the teeth and to heal tooth-ache. The seeds are used as oil which is applied on sore eyes in Zimbabwe. The leaves are burned, seeds and bark are pulverised and applied as poultices to relieve soreness and inflammation [30]. Similarly, the leaves are mixed with water to wash and cure boils on the skin by the Xhosa people in Eastern Cape, South Africa [31]. The different plant parts used from the same plant for different cosmeceutical purposes is evidence of the variety of indigenous knowledge possessed among different communities and ethnic groups.

The commonly used non-plant resources included wood ashes, pig fat, stones, ochre (Luvhundi soil) and soot (Tshinyae). Ochre is commonly used in initiation schools in South Africa. As stated by the participants, it is used for skin protection from sun and insect bites. The cosmeceutical value of ochre has been recorded in several studies [32, 33]. In Western Sahara, Volpato et al. [34] indicated that Sahrawi refugees apply red ochre around their eyes to reduce solar radiance. The participants mentioned that the wood ashes are utilised to dye hair and make it soft, darken their eyebrows as make-up and for teeth whitening. As part of the remedies for healing skin diseases in the inland Marches, Central-Eastern Italy, Pieroni et al., (2004) indicated that the mixture of ashes and water is used to soften the hair. As indicated by Zhang et al. [35], the people of Bulang, China used soot to blacken their teeth to ensure health of the teeth.

**Distribution of plant families, life-forms and plant parts**

The documented plants belong to 27 families and the dominant family was Fabaceae. This plant family was
| Local/common name(s) | Type of natural resource | Use-value | RFC | Method(s) of preparation and administration | Location(s) |
|----------------------|--------------------------|-----------|-----|---------------------------------------------|-------------|
| Cattle fat           | Cattle fat               | 9         | 0.014 | 0.12 The milk is fermented and boiled to make oil which is applied as a skin moisturiser. | Tshakuma Luvhimbi Khakhanwa Tshamutilikwa Folovhodwe Shigalo |
| Cow dung             | Manure                   | 3         | 0.038 | 0.04 The moist manure is applied on the feet and washed with water to remove cracks. Manure is also mixed with menstruation blood to remove silver stripes. | Tshakuma |
| Cow milk             | Milk                     | 5         | 0.014 | 0.07 The milk is cooked to make a cream and applied topically as a skin moisturiser. | Tshakuma |
| Goat                 | Manure                   | 1         | 0.014 | 0.01 The manure is burned and applied for the removal of rash | Khakhanwa |
| Green algae of river (Hololo) | Fungi                   | 3         | 0.038 | 0.04 Hololo is burned and mixed with leaves of musuma to treat ringworms. The algae are burned and applied on wounds for healing | Luvhimbi |
| Khedi                | Soil                     | 1         | 0.014 | 0.01 Soil particles are ground to a fine powder and applied on the face for enhancing the complexion | Tshakuma |
| Lizard manure        | Manure                   | 1         | 0.014 | 0.01 The manure is crushed and applied directly to a wound for healing. | Tshamutilikwa |
| Luvhundi soil        | Soil                     | 17        | 0.042 | 0.23 The soil is mixed with oil or water and applied on the feet to remove cracks. It is also applied as a sun protector. Soil is mixed with oil to remove rash. | Tshakuma Luvhimbi Khakhanwa Folovhodwe Shigalo |
| Mafhura thanu/ntlharo | Python fat               | 13        | 0.042 | 0.18 Python fat is extracted by frying the python and the oil is applied on burned skin and wounds for healing and removal of scars. | Tshakuma Tshamutilikwa Khakhanwa Folovhodwe Shigalo |
| Marumbuda White/green substance on stones usually after heavy rain | Fungi                  | 1         | 0.042 | 0.01 Applied to the skin for the removal of stretchmarks, ringworms and rash. | Tshakuma Folovhodwe |
| Mtaba (sand)         | Soil                     | 1         | 0.014 | 0.01 The soil is rubbed on the teeth for cleansing. | Tshakuma |
| Munyaka soil         | Yellow and brown soil    | 2         | 0.014 | 0.03 The soil is applied directly to the face as a make-up foundation. | Khakhanwa |
| Munyaka stone        | Stone                    | 2         | 0.014 | 0.01 The stone is crushed to a fine powder and mixed with water to soften the skin. | Luvhimbi |
| Ngulube daka         | Oil/fat                  | 1         | 0.014 | 0.01 Pig fat is applied as skin moisturiser. | Tshakuma |
| Nguluvhe/Honje       | Pig fat                  | 50        | 0.056 | 0.70 The oil is extracted by cooking and used as a skin moisturiser and to remove cracks. Also used as soap to soften and protect the skin. | Tshakuma Tshamutilikwa Luvhimbi Khakhanwa Shigalo Folovhodwe |
| Salt water/sea water | Water                    | 2         | 0.038 | 0.03 Salt and seawater are used to remove rash and ringworms. | Shigalo |
| Sandy Soil           | Soil                     | 11        | 0.014 | 0.15 The sandy soil is rubbed on the teeth for cleansing. It is mixed with water and rubbed on the skin for the removal of dirt | Tshakuma Luvhimbi Folovhodwe Shigalo |
| Stone                | Stone                    | 18        | 0.038 | 0.25 The stone is used to scrub the feet to remove cracks and dirt removal. | Tshakuma Luvhimbi Khakhanwa Folovhodwe Shigalo |
| Tshinyai             | Soot                     | 3         | 0.038 | 0.04 Soot is mixed with oil and applied on the skin to remove rash and stretchmark. | Tshakuma Luvhimbi Tshamutilikwa |
also the most dominant among the study areas in South West Nigeria [36]. On the other hand, Afolayan et al. [37] indicated that Fabaceae is the third most common family after Solanaceae and Asteraceae, among plant families used by the Xhosas for skin diseases. Generally, the Fabaceae is regarded as one of the families with diverse economic and medicinal value [38]. The life-form that dominated was woody plants (trees and shrubs) and most of the remedies were prepared using the leaves. Similarly, high utilisation of the leaves was recorded as folklore phytocosmetics among the communities of South West Nigeria [36]. The use of leaves as folk cosmeceutical emboldens conservation practices, unlike using roots and bark which may cause the death of plants when done indiscriminately. According to Mathabe et al. [39], remedies were commonly prepared from bark collected at any time and though, in some instances, some plants were not collected because the formulation requires the use of the roots be collected.

### Cosmeceutical applications, method of preparation and administration

Skin-related diseases are diverse and occur without any discrimination relating to the age, gender or social status of an individual. As shown in Table 4, the highest cosmeceutical application mentioned by the participants was wounds (27) and body creams (16). The current

---

*Table 3 Non-plant resources used as cosmeceuticals in Vhembe district municipality, Limpopo province, South Africa (Continued)*

| Local/common name(s) | Type of natural resource | Frequency (F) | Relative frequency (RFC) | Method(s) of preparation and administration | Location(s) |
|----------------------|--------------------------|---------------|-------------------------|---------------------------------------------|-------------|
| Urine                | Urine                    | 3             | 0.014                   | The urine is applied to burned skin for healing. | Shigalo     |
| White mountain stone | Stone                    | 5             | 0.038                   | The stone is ground into powder form and rubbed on the teeth for cleaning and whitening. | Shigalo     |
| Wood ashes/coal      | Ashes                    | 11            | 0.056                   | The wood coal is ground and rubbed on the teeth for cleansing. It is also applied around the eyes as make-up. | Tshakuma   |
|                      |                          |               |                         | The wood coal is ground and mixed with oil to dye and soften the hair.                  | Luvhimbi   |

*F Frequency, RFC Relative frequency citation, Location: Luvhimbi = Masikhwa (on the map in Fig. 1)*

---

*Fig. 5 Frequency of the preparation methods used as folk cosmeceuticals among rural communities in Vhembe district municipality, Limpopo province, South Africa*
study revealed that natural resources are popular remedies for diverse skin diseases among the local communities. Thus, ethnopharmacological information from surveys remains a valuable source to explore for potential cosmeceutical products that may possess commercial value [40].

The natural resources are prepared as single component remedies or in combination with other natural resources. The study shows that both plants and non-plants are mostly mixed with water and oil to enhance their penetration across the skin layers. The non-plant materials such as urine and cow dung are mixed with the other plant materials to potentiate its effect [15]. Crushing was the most dominating preparation method and these remedies are mostly applied topically as pastes directly on the skin. Based on existing literature on medicinal plants used for skin problems, the method of administrations includes powder, paste, ointment, poultice and infusion [25, 37, 41, 42]. These aforementioned studies indicated that the majority of administration methods are similar to the current study. Mongalo and Makhafola [14] investigated the ethno-botanical knowledge of laymen in Blouberg (Pedi tribe), Limpopo and indicated that the medicinal plants are applied topically on the skin while others are used to wash and rinse the infected body part(s).

### Table 4 Frequency of citations for natural resources used for skin conditions in Vhembe district municipality, Limpopo province, South Africa

| Category          | Use              | Number of natural resource |
|-------------------|------------------|-----------------------------|
| Skin afflictions  | Wounds           | 27                          |
|                   | Burn             | 7                           |
|                   | Ringworms        | 12                          |
|                   | Moles            | 2                           |
|                   | Pimples          | 8                           |
|                   | Chickenpox       | 1                           |
|                   | Rash             | 13                          |
|                   | Cracks on feet   | 6                           |
|                   | Stretchmark      | 4                           |
|                   | Skin irritation  | 3                           |
|                   | Scar removers    | 2                           |
|                   | Sores            | 12                          |
| Cosmetic uses     | Teeth hygiene    | 11                          |
|                   | Soaps            | 6                           |
|                   | Facial scrubs and mask | 3               |
|                   | Body creams      | 16                          |
| Hair care         | Shampoo and dye  | 6                           |
| Antioxidants      | Skin protection  | 3                           |
|                   | Wrinkles removal | 1                           |
|                   | Skin softening   | 6                           |

### Potential of documented plants with high use-value

Plants with high UV included *Aloe vera* and *Euclea divinorum*, *Bauhinia thonningii* and *Citrus limon*. These aforementioned plants are known for their diverse therapeutic values. *Aloe vera* is an ancient medicinal plant that is used externally for different skin problems. In the current study, the gel of the plant is used to moisturise the skin, remove stretch marks, wounds, ringworm and rash as well as to heal burned skin. Likewise in India, Bhowmik [43] indicated that *Aloe vera* is a ‘miracle’ plant with different cosmeceutical applications (to heal cuts, burns, eczema, inflammation, sunburns and as hair styling gel). Furthermore, *Aloe vera* is used in many natural products for the skin which include make-up, moisturisers, sunscreens, shampoos and lotions [43]. *Aloe vera* is known to be involved in a coordinated cascade of cellular and molecular events that interact with re-epithelialisation and reconstitution processes of the tissue to ensure wound healing [44]. As reviewed by Amoo et al. [45], *Aloe* species are generally used for skin ailments because they exert pharmacological properties such as antimicrobial, anti-inflammatory, and antioxidant activities.

*Euclea divinorum* is a traditional medicine that is used for several ailments, including skin diseases. The current findings also indicated that the plant removes skin irritation, ringworms, rash, pimples and chickenpox. Wolde-medhin et al. [46] affirmed the healing property of *Euclea divinorum* by revealing its usefulness against skin ailments such as inflammation of the skin, eczema and scabies in Ethiopia. A study by Otang and Afolayan [47] affirmed the therapeutic value of *Citrus limon* for skin diseases based on the antimicrobial efficacy against a panel of microbes. In the Amathole District, Eastern Cape, South Africa, *Citrus limon* is utilized for diverse purposes. For instance, it is used to reduce skin itching, for skin nourishment, and the pulp left after extraction of the juice is used for the treatment of pimples and wrinkles and to soften facial skin [48]. Similar uses were also recorded in the current study whereby the participants indicated that *Citrus limon* is used for moisturising the skin, removing wrinkles, scars and pimples. Furthermore, Otang and Afolayan [47] demonstrated that *Citrus limon* has high anti-oxidant property which is relevant to the effective treatment of skin ailments.

### Indigenous knowledge and practices on folk cosmeceuticals used against skin diseases

According to Rankoana et al. [49], some of the indigenous aetiology of disease are ancestral spirits, witches and sorcerers. Shenefelt and Shenefelt [50] affirmed that since ancient times, skin diseases have had spiritual and religious origins. There are several ways that Africans explain and understand the causes of diseases. For
instance, evil spirits and disobedience to ancestors are believed to cause different diseases [51, 52]. Good-health and well-being is usually understood in terms of the relationship with one’s ancestors and as a result of good behaviour, i.e. if one lives in accordance with the values and norms of the traditions of the community [51]. Quave et al. [53] affirmed that if diseases are observed as superstitious or spiritualistic, they are treated differently. Some of the manifestations of skin inflammation are believed to be caused by wind illness or dead fire illness which requires the performance of rituals accompanied by natural resources [53]. Hence, Reyes-García [54] asserted that the choice of treatment is often related to an understanding of the cause of disease in African indigenous health systems. African indigenous healing system is addressed via two perspectives, which are the spiritual and physical perspectives [51]. Ethnomedicine practices form the basis of indigenous healthcare across different ethnic groups globally [49, 55–57]. The participants stated that their knowledge about folk cosmeceuticals comes from their ancestors, hence, they find it necessary to trust it, otherwise, they will lose their culture and which ultimately will dishonour their ancestors. Furthermore, they mentioned that traditional practitioners use folk cosmeceuticals to honour and obey ancestors. The participants consult traditional practitioners or use folk cosmeceuticals before using western medicine or consulting western practitioners. Some skin diseases cannot be healed by applying conventional cosmeceuticals, hence, indigenous people use folk cosmeceuticals because they believe that folk cosmeceuticals have spiritual modes of action that ensures effectiveness.

Conclusions
This explorative study documented the natural resources (plant and non-plant materials) used for folk cosmeceuticals by six rural communities in Vhembe district municipality, Limpopo province, South Africa. The study identified the natural resources used as folk cosmeceuticals in Vhembe district for future investigation for potential solutions to dermatological problems. In total, 52 plants and 22 non-plant materials were recorded as folk cosmeceuticals. The high number of natural resources is an indication that the area of study is rich in folk cosmeceuticals. As commonly observed with many ethnobotanical surveys, most of the participants were elders. This is an indication that a great deal of effort is needed to document the folk knowledge. However, scientific investigations in terms of the efficacy of natural resources is strongly recommended. For example, toxicity assay of the natural resources will provide insight and understanding of the safety of the folk cosmeceuticals, which may guarantee the safety of local users.
2. Aburjai T, Natsheh FM. Plants used in cosmetics. Phytother Res. 2003;17: 987–1000.

3. Mahomedally MF, Ramjuttun P. A quantitative ethnobotanical survey of phytoocosmetics used in the tropical island of Mauritius. J Ethnopharmacol. 2016;193:45–59.

4. De Wet H, Nicke S, van Vuuren SF. Medicinal plants used for the treatment of various skin disorders by a rural community in northern Maputaland. S Afr J Ethnobiol Ethnomed. 2013;9:51.

5. Fongnossie EF, Tize Z, Fogang Nde PJ, Nyangono Beyege CF, Boulet Ntsima IS, Dibong SD, Nkongmeneck BA. Ethnobotany and pharmacognostic perspective of plant species used as traditional cosmetics and cosmeceuticals among the Gbaye ethnic group in eastern Cameroon. S Afr J Bot. 2017;112:29–39.

6. Martins A, Vieira H, Gaspar H, Santos S. Marketed marine natural products in the pharmaceutical and Cosmeceutical industries: tips for success. Marine Drugs. 2014;12:1066.

7. Loh Teng-Hern T, Kok-Gan C, Chim Kei C, Tahir Mehmood K, Learn-Han L, Bey-Hing G. Antioxidative potential of a Streptomyces sp. MUM292 isolated from mangrove soil. Biomed Res Int. 2018;2018:1–13.

8. Costa R, Santos L. Delivery systems for cosmetics – from manufacturing to the skin of natural antioxidants. Powder Technol. 2017;322:402–16.

9. Makunga NP, Philander LE, Smith M. Current perspectives on an emerging cosmetic and cosmeceutical purposes by Xhosa women in the Eastern Cape, South Africa. S Afr J Bot. 2013;88:69–75.

10. Constant NL, Tshikhawhe MP. Hierarchies of knowledge: ethnobotanical knowledge, practices and beliefs of the Vhembe in South Africa for biodiversity conservation. J Ethnobiol Ethnomed. 2018;14:1–28.

11. Magwede K, van Wyk BE, van Wyk AE. An inventory of Vhaven ḡevelünsta, Limpopo province, South Africa. S Afr J Bot. 2013;89:365–75.

12. Mangwedze K, van Wyk BE, van Wyk AE. An inventory of Vhaven ḡevelünsta, Limpopo province, South Africa. S Afr J Bot. 2013;89:365–75.

13. Arnold H-J, Gulumian M. Pharmacopoeia of traditional medicine in Venda. J Ethnopharmacol. 1994;1:23–54.

14. Mbogo DEN. The ethnobotany of the Vhembe (Doctoral dissertation, University of Pretoria). Pretoria. 1990.

15. Ndlovo PT, Kook O, Otang Mbeng W, Aremu AO. Plant species used for cosmetic and cosmecetical purposes by the Vhembe women in Vhembe District municipality, Limpopo, South Africa. S Afr J Bot. 2019;122:22–41.

16. Stats-SA. Community Survey 2016. Pretoria: Statistics South Africa; 2016.

17. Ndhlovu PT, Mooki O, Otang Mbeng W, Aremu AO. Plant species used for cosmeceutical purposes by the Vhembe women in Vhembe District, Eastern Cape, South Africa. S Afr J Bot. 2017;112:29–39.

18. Otang WM, Grierson DS, Afolayan AJ. Ethnobotanical survey of medicinal plants used in the management of skin disorders among the Vhembe communities of the Amathole District, Eastern Cape, South Africa. J Ethnopharmacol. 2014;153:220–32.

19. Kuate V, Villent K, Effrerd T. Antiproiferative Potential of African Medicinal Plants. In: Kuate V, ed. Medicinal Plant Research in Africa. Oxford: Elsevier; 2013. p. 711–24.

20. Mathabe MC, Nikolova RV, Lali N, Nyazema NZ. Antibacterial activities of medicinal plants used for the treatment of diarrohea in Limpopo Province, South Africa. J Ethnopharmacol. 2006;105:286–93.

21. Güzê Y, Güzêlemeêmme M, Mîskî M. Ethnobotany of medicinal plants used in Antakya a multicultural district in Hatay province of Turkey. J Ethnopharmacol. 2015;174:118–52.

22. Omwenga EO, Hensel A, Shitandi A, Goycoolea FM. Ethnobotanical survey of traditionally used medicinal plants for infections of skin, gastrointestinal tract, urinary tract and the oral cavity in Borabu sub-county, Nyamira county, Kenya. J Ethnopharmacol. 2015;162:508–14.

23. Aygere C, Asare A, Lechtenberg M, Niehues M, Deters A, Hensel A. An ethnopharmacological studies of folkloric phytoocosmetics of South West Nigeria. Pharm Biol; 2015;53:313–8.

24. Afelayan AJ, Grierson DS, Mbeng WO. Ethnobotanical survey of medicinal plants used in the management of skin disorders among the Xhosa communities of the Amathole District, Eastern Cape, South Africa. J Ethnopharmacol. 2014;153:220–32.

25. Kuate V, Villent K, Effrerd T. Antiproiferative Potential of African Medicinal Plants. In: Kuate V, ed. Medicinal Plant Research in Africa. Oxford: Elsevier; 2013. p. 711–24.

26. Bhowmik D. Medicinal plants used by the Ovahimba tribes of northern Namibia. 2015.

27. Fred-Jayesimis A, Ajibesin KK, Tolulope O, Gbemisola O. Ethnobotanical studies of folklore phytoocosmetics of South West Nigeria. Pharm Biol; 2015;53:313–8.

28. De Wet H, Nciki S, van Vuuren SF. Medicinal plants used for the treatment of skin diseases. J Ethnopharmacol. 2011;136:347–54.

29. Mabona U, Van Vuuren SF. Southern African medicinal plants used to treat skin diseases. S Afr J Bot. 2013;87:175–93.

30. Bhat RB. Medicinal plants and traditional practices of Xhosa people in the Transkei region of Eastern Cape, South Africa. Indian J Tradit Knowl. 2014;12:29–82.

31. Bhat RB. Medicinal plants and traditional practices of Xhosa people in the Transkei region of Eastern Cape, South Africa. Indian J Tradit Knowl. 2014;12:29–82.

32. Morekhure-Mphahele RWF. Wiebke Grote: characterisation of vumba and ubumla clays used for cosmetic purposes. S Afr J Sci. 2015;113:8–15.

33. Mofele O. Physico-chemical characterization of African traditional cosmetics produced by the Ovahimba tribes of northern Namibia. 2015.

34. Volpato G, Koukouv P, Zeleny V. Healing war wounds and perfuming exile: the use of vegetal, animal, and mineral products for perfumes, cosmetics, and skin healing among Sahrawi refugees of Western Sahara. J Ethnobiol Ethnomed. 2011;28:49. https://doi.org/10.1186/1746-4269-8-49.

35. Zhang S, Lo ECM, Chu CH. Traditional oral health beliefs and practices of Bulang people in Yunnan, China. J Invest Clin Dent. 2018;9:e12281. https://doi.org/10.1111/jicd.12281.

36. Otang WM, Grierson DS, Afolayan AJ. A survey of plants responsible for causing allergic contact dermatitis in the Amathole District, Eastern Cape, South Africa. J Ethnopharmacol. 2015;174:118–52.

37. Aygere C, Asare A, Lechtenberg M, Niehues M, Deters A, Hensel A. An ethnopharmacological studies of folkloric phytoocosmetics of South West Nigeria. Pharm Biol; 2015;53:313–8.

38. Statistiques South Africa (Stats SA): General Household Survey; 2017.

39. Ndhlovu PT, Mooki O, Otang Mbeng W, Aremu AO. Plant species used for cosmeceutical purposes by Xhosa women in the Eastern Cape, South Africa. S Afr J Bot. 2019;124:6–10.

40. Lalli N, Kirshor N. Are plants used for skin care in South Africa fully explored? J Ethnopharmacol. 2014;153:61–84.

41. Amold H-J, Guluminia M. Pharmacopoeia of traditional medicine in Venda. J Ethnopharmacol. 1994;1:23–54.

42. Mothanka DMT, Ntholwa GP. Ethnobotanical survey of medicinal plants of Tswaing north, in eastern Botswana: a case of plants from Mosweu and Seolowane villages. Eur J Med Plants. 2013;3:10–24.

43. Chiogora P, Mascoha R, Mutenhiler F. The role of indigenous medicinal knowledge (IMK) in the treatment of ailments in rural Zimbabwe: the case of many ethnic groups in the Mutirikwi communal lands. J Sustainable Dev Aff. 2007;9:26–43.

44. Liengerme CA. Plants used by the Tsonga people of Gazankulu. 1981:1318.

45. Abbas AM, Khan MA, Ahad MA, Zafar MA, Jahan S, Sultana S. Ethnopharmacological application of medicinal plants to cure skin diseases and in folk cosmetics among the tribal communities of North-West Frontier Province, Pakistan. J Ethnopharmacol. 2010;128:322–35.

46. Ilavarsam R, Mallick M, Venkataraman S. Anti-inflammatory and free radical scavenging activity of Ricinus communis root extract. J Ethnopharmacol. 2006;103:478–80.

47. Scarpa A, Guerci A. Various uses of the castor oil plant (Ricinus communis L) as a review. J Ethnopharmacol. 1982;5:117–37.

48. Jena J, Gupta AK. Ricinus communis Linn: a phytopharmacological review. Int J Pharm Pharm Sci. 2012;4:25–9.
Publisher’s Note
Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.