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Review of Endangered Ethiopian Medicinal Plant: The Case of *Otostegia integrifolia* Benth

Dejene Tadesse*, Damtew Abewoy, Dadi Tolessa, Habtamu Gudissa

Ethiopian Institute of Agricultural Research, Wondogenet Agricultural Research Centre, Shashamene, Ethiopia

Email address:

dejenebanjaw@gmail.com (D. Tadesse)

*Corresponding author

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Abstract: Medicinal plants help global human and animal health related issues for several years. They used in both traditional and modern ways. Modern pharmaceutical industries strongly linked with the medicinal plants products. Despite more emphasis needed in the world where there are increases in health problems, some of the medicinal plants become destructed and being lost. Medicinal plants upon which majority of the world population depend on for traditional uses protected and conserved seldom. *Otostegia integrifolia* Benth is one of the very important medicinal plants traditionally recognized in Ethiopia. The economic parts of the plant include roots, leaf, twigs, and stems. Essential oil extracted from the plant also constitutes important chemical compounds that can have antimicrobials, few studies reported. For a traditional usage, people collected *Otostegia integrifolia* Benth from wild without sufficient harvesting and handling knowledge. The plant is lost from many parts of the country due to overexploitations and lack of conservation practices. This review paper is done to circulate information with respect to the current situation of *Otostegia integrifolia* Benth in Ethiopia. Therefore, for a sustainable uses of the plant, attention should be given for wise use of the wild resource; conservation practices should be done, national research system and institutes should consider policy in protecting forgotten medicinal plants like *Otostegia integrifolia* Benth in their strategic plan.

Keywords: Health Benefit, Medicinal Plant, *Otostegia integrifolia*

1. Introduction

Ethiopian is believed to be the origin of several medicinal plants [8]. The ecology, climatic conditions, and topographic setting of the country contributed to richness in flora and fauna [14]. According to Ethiopian Biodiversity Institute (EBI) report, more than 6500 species diversity presented from which endemic proportion accounts about 12% and medicinal plants account about 21% of the species [8]. Medicinal plants play great role in medical, ecological, cultural and economy aspects. Medicinal plants supported the gap related with modern drugs, such as unavailability and unaffordability. Plant derived traditional medicine largely practices in Ethiopia for treating human and livestock health related problems [6, 16]. Availability of the useful medicinal plants can be seen as an opportunity for the resource poor people. However, majority of the medicinally important plants grow wild and not included in the plant production strategies of the country [1]. The threatening factors not only affect medicinal plants availability, but also the associated knowledge [11]. They are collected from forest, bush lands, grass lands, and also from cultivated areas. For instance, *Otostegia integrifolia*, shrubby perennial plant from the family Lamiaceae, is one of the wild grown medicinal plants known for traditional medicine in Ethiopia. Sometimes people call *Otostegia integrifolia* Abyssinian rose but it is well known by the name Tinjut presently. According to the information from Global Plants (online date accessed: 30/01/2022) [7], *Otostegia integrifolia* Benth was collected from Ethiopia and documented starting from 1808 by collectors like Schimper, Steudner, and Henry Salt. Studies on similar wild grown endemic medicinal plants, like *Taverniera abyssinica* and *Echinops kebericho* Mesfin, reported as the medicinal plants were being lost because of various factors such as lack of attention in conservation and harvesting, overexploitations, and increase in farming land [21]. Any misuse and threat to these valuable resources will not only threaten the health of millions of people in Ethiopia, but will

also affect the livelihoods of resource poor farmers and communities that depend on traditional medicinal plants. On the other hand, the increasing global demand for medicinal plants products accelerated purchasing prices and impacted the economies of the developing countries, like Ethiopia. This review proposed to provide information with respect to the current status of *Otostegia integrifolia* Benth in Ethiopia.

2. Botanical Description, Distribution, Economic Parts, and Utilization of *Otostegia integrifolia* in Ethiopia

2.1. Botanical Description and Distribution

Otostegia integrifolia scientific classification:
Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Eudicots
Clade: Asterids
Order: Lamiales
Family: Lamiaceae
Genus: Otostegia
Species: O. integrifolia
Binomial name: Otostegia integrifolia Benth [19]

Otostegia integrifolia Benth is perennial plant known having deep root, greyish leaves, and branches. The above ground part of the plant is erect and it grows up to 4 meter height. The plant has yellow flowers and two and more stems at one node with sharp spines at the nodes. While the grayish colored leaves seen throughout the growing season, the plant possesses yellow flowering color at full blooming. Root, leaf, twigs, stem and wood of the plant collected and used for traditional medicine in the country. It grow in the dry evergreen woodlands of the Tigray, Gondar, Wollo and Gojjam, North Shewa, West Shewa, Kaffa and Hararghe areas at an altitudes of 1,300—2,800 meter above sea-level [14].

2.2. Economic Parts and Uses of Abyssinian Rose (Otostegia integrifolia)

The wild harvestable economic parts of the plant include roots, leaf, twigs, and stems [14]. Moreover, the whole plant part of the Abyssinian rose (*Otostegia integrifolia* Benth) traditionally used for its well aroma during coffee ritual, for fumigating pots and milk utensils to advance product taste, and also often gathered and burnt to fumigate homes as insect repellent [10]. Studies reported as *Otostegia integrifolia* Benth was the most preferred medicinal plant for mosquito repellent in Kolla Temben district of Tigray region [8]. In addition to traditional uses of the *Otostegia integrifolia* Benth for insect repellent in Ethiopia, experimental findings clearly revealed that the leaves of *Otostegia* integrifolia Benth have a potent repellent efficiency against *Anopheles arabiensis*, a principal malarial vector in Ethiopia (90.10%) and was the most effective [9]. The experiment was done by applying the smoke into the repellent "test" mosquito cage by direct burning of 25gm of dried leaves of *Otostegia integrifolia* Benth until plant materials are completely burnt.

Kidane *et al*. [12] also reported the traditional uses of *Otostegia integrifolia* Benth for mosquito repellent by using the stem and leaves of the plant in different application methods. The most common methods reported include smoking stem and leaves, macerating with water and spraying, and also putting fresh leaves inside the house. Another traditional practice, tendency of smoking a mother with *Otostegia integrifolia* Benth on the tenth day after giving birth to a child, has been reported in Ethiopia [18].

Furthermore, in their findings [13], Meresa et al. reported that blood glucose level reducing potential of the *Otostegia integrifolia* Benth leaf extracts that could be good source of anti-diabetic product in the pharmaceutical industries. Habit of the plant products for stomach ache, tonsillitis, malaria, ascariasis, and lung diseases treatments also reported [14, 2]. Besides, while a study suggested as *Otostegia integrifolia* Benth leaf extract has potential against bacterial infection [3], other also reported that *Otostegia integrifolia* Benth leaf juice useful for the treatment of stomachache [5].

Other important aspect of *Otostegia integrifolia* Benth is that the plant can also be used by extracting essential oil as experimental proven 0.02% (V/W) essential oil was obtained from its fresh leaf [16]. According to their chemical composition findings, α-pinene (31.33%), 1-octen-3-ol (11.78%), trans-caryophyllene (11.35%), linalool (6.58%), and cis-β-ocimene (5.91%) were the major constituents that play great role in a pharmaceutical industry as the compounds exhibit antimicrobial activities. In addition, the authors reported that the oil possesses an excellent broad-spectrum activity against bacteria and fungi and also significant free radical scavenging activity [4]. Besides, chemistry and pharmacology studying of *Otostegia integrifolia* Benth air dried leaves also identified a total of 40 constituents including monoterpenes, sesquiterpenes, diterpenes and their derivatives [17, 3]. Another studies by Demeke and Haimanot [5] showed that leaf extracts from *O. integrifolia* Benth showed good total flavonoid content, good DPPH radical scavenging activity and weak to moderate antibacterial activity.

3. Opportunities and Future Prospects for Sustainable Use of Otostegia integrifolia in Ethiopia

3.1. Opportunities

Ethiopian has diverse agro-ecologies suitable for growth and development of many medicinal plants. According to the ministry of agriculture (MoA) [15], there are traditionally known agro-ecologies in the country. These are:

3.1.1. Bereha

It includes hot low land areas <500metre above sea level, < 200mm average annual rainfall.

3.1.2. Kolla

This includes lowland areas in the range of 500-1500metre above sea level, 200-800mm average annual rainfall.

3.1.3. WoinaDega

Midaltitude areas from 1500-2300metre above sea level, 800-1200mm average annual rainfall.

3.1.4. Dega

Highland areas 2300-3200metre above sea level, 1200-2200mm average annual rainfall.

3.1.5. Wurch

Highland areas of 3200-3700 metre above sea level, above 2200mm average annual rainfall.

3.1.6. Kur

Highland >3700metre above sea level.

Therefore variation in the agro-ecologies is an opportunity for agriculture of the country, for biodiversity conservation, and for research purposes.

Besides, the current increased demand for medicinal plants against COVID-19 in rural and urban parts of the country could be an opportunity for awaking attention for the forgotten *Otostegia integrifolia* Benth sustainable use. The presence of green legacy project, biodiversity conservation institute, traditional medicinal plant collectors and growers, national medicinal plants research program, availability of water sources, and the pharmaceutical industry could be good opportunities for *Otostegia integrifolia* Benth maintenance, cultivation, processing, and marketing in Ethiopia. Biotechnology institute of the country is also an opportunity for mass propagation and conservation of the plant. Moreover, *Otostegia integrifolia* Benth grows with minimum growth requirements.

3.2. Prospects for Sustainable Use of Otostegia integrifolia Benth

There is long lasting history of using *Otostegia integrifolia* Benth for various purposes like traditional medicine, fumigation of utensils, and as insect repellent**.** However**,** it is harvested from wild in bulk and there is no conservation measures for those wild harvest medicinal plants in the country currently [5]. Over exploitations of the medicinal plant, particularly for root product without replacing or replanting leads to total demolition [20]. Numerous uses of the *Otostegia integrifolia* Benth in Ethiopia becoming in difficulties as there is no policy guide in using the plant from its natural environment, no prominent conservation practices so far, and there is lack of research focus. Due to population pressure, increase in farming practices, over exploitations, and deforestation practices, the sustainability of *Otostegia integrifolia* Benth in Ethiopia needs further investigation like that of *Taverniera abyssinica* and *Echinops kebericho* Mesfin, the endangered medicinal plants which is due to lack of attention despite the presence of recognized and registered traditional healer, research and academic institutions in the country. Loss of a medicinal plant leads to several consequences in traditional knowledge, economy, and biodiversity as well.

Therefore, currently national strong conservation strategies are very important for the sustainable use of the medicinal plant. Coordinated in-situ and ex-situ conservation strategies are important to save from extinction. Similarly, Sustainable use of the plant is helpful for the limited supply and availability of the medicinal plants products for the fast growing population when nature`s supply is being lower than demand for most medicinal plants. The Ethiopian green legacy strategy should revise its components and incorporate the forgotten medicinal plants like *Otostegia integrifolia* Benth for the livelihood improvement and biodiversity conservation. Academic, biodiversity, and research institutes should strongly and sustainably work for conservation of the forgotten and threatened medicinal plants. Coordination and support of traditional medicinal plant practitioners both in rural and urban, awareness creation and community based conservation practices, are crucial. Training and capacity building on cultivation, harvest, and marketing is critical in order to make *Otostegia integrifolia* Benth sustainable for future. Traditional knowledge of using *Otostegia integrifolia* Benth should be documented and communicated to create awareness among various regions in the country.

4. Conclusion

Global health associated problem was being increased. On the other hand, the supply of modern medicines is unaffordable and inaccessible for many resource poor people. However, numerous medicinal plants that have significant potential to combat disease and those used for several years essentially seen as a good opportunity for health associated issues today particularly for developing countries, like Ethiopia.

Otostegia integrifolia Benth is one of the important multipurpose medicinal plants in Ethiopia [21]. All plant part and the essential oil of the leaves are usable for various purposes. It plays great role in health related issues both traditional and modern medicine preparations. It can be used in either herbal or essential oil forms. Because of the medicinal values people collected it from Ethiopia and documented to the world`s largest data base of digitalized plant specimens about two hundred years [7]. However, the current situation of the plant availability and sustainability statuses in the country needs attention. The plant is not cultivated and protected, but harvested continuously from natural habitat for every market in the country. Hence, there should be in-situ and ex-situ conservation of the plant as well as production strategies in agriculture policies of the country. In addition, national research system should give attention in consideration of the identification and utilization possibilities of the important chemical compound of versatile medicinal plant *Otostegia integrifolia* Benth. The newly planned pharmaceutical industry in the country expected to open door to the conservation and utilization of forgotten medicinal plants, like *Otostegia integrifolia* Benth. *Otostegia*

integrifolia Benth, the uncultivated and the wild harvested medicinal plants, need strong attention for conservation and proper utilization, otherwise, there might be complete loss of the plant duet to natural and manmade factors.

Conflict of Interest

The authors declare that they have no competing interests.

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