

## Documentation of Medicinal Plants used to cure dental diseases in Hazara Division, Khyber Pakhtunkhwa, Pakistan - An ethnopharmacology approach

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**Abstract:** In order to identify the medicinal and aromatic plants most requested for the treatment of the most common oral pathology (diseases), an ethnobotanical survey was carried out in the economic in Hazara Division, Khyber Pakhtunkhwa, Pakistan. The semi-structured questionnaire was used to choose traditional herbalists who would provide the data base. In the research region, older community members are essentially the only ones who are familiar with traditional knowledge and cultural practises of using medicinal plants in human healthcare, whereas the younger generation is largely ignorant of the use of natural resources. We offer the first ethnomedical insights towards treating dental conditions in Pakistan. The study's main goal was to discover fresh knowledge held by people of these isolated and distant communities and to share it with the rest of the world in written form. The collection of data relating to traditional medicine was the result of extensive research conducted in numerous locations throughout the world. We have decided to identify the most popular medicinal and aromatic herbs for the treatment of oral pathology as our contribution to this crucial endeavor. The use of herbal treatments to address medical issues is widespread. They have been used for generations in Mexico to cure tooth discoloration, periodontitis, oral infections, and gingivitis. Nevertheless, there aren't many research that have gathered data on their impacts.

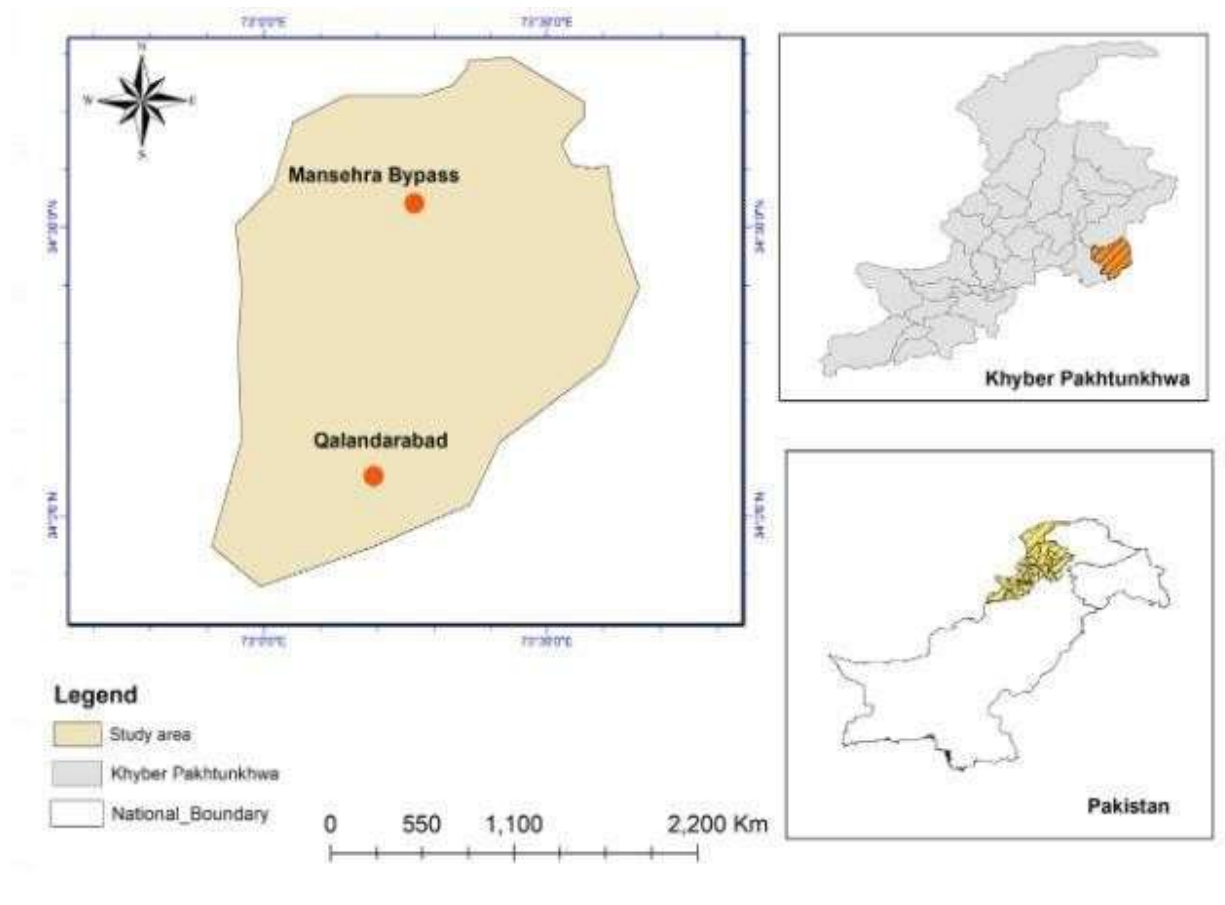
**Key words:** Documentation, novel survey, traditional medicine, dental diseases, Hazara Division, Khyber Pakhtunkhwa, Pakistan.

### 1. INTRODUCTION

Oral health is an integral part of general health [1–3]. According to the World Health Organization (WHO), the burden of oral disease is a major health problem at the international scale in the 21st century [4, 5]. Oral illness is also a significant public health issue in high-income countries, and it is becoming more prevalent in many low- and middle-income nations.

[6]. To be more specific, it discovered that oral tissue lesions, pharynx, oral cancer, periodontal illnesses, tooth decay, and tooth decay are serious health issues [7]. Finding out how plants are used locally by communities is the goal of ethnobotanical study of plants. The perception of the public affects the presence of medicinally significant plants and their occurrence in limited spaces. According to ancient documents, the use of medicinal plants dates back to the earliest human civilization. The Giza Pyramids' plants serve as a reminder of the ancient Egyptians' belief that medical plants were crucial to their pharaohs' health both during their lifetimes and after they passed away. To respond to the queries of how and why humans utilised the plants? Beginning with the people, ethno botanists began to gather data. Comprehensive results necessitated the creation of a road map for the prehistoric civilization and plant management practises in addition to their current usage. Additionally, it offers plant-related native knowledge. John Hershberger 1895 used the term "ethnobotany" to refer the field of study, namely: "the study of plants used by primitive and aboriginal people" [8]. The thought of ethnobotany started to progress by that time. Pakistan has approximately 6000 plant species out of which 600 are considered to be important for medicinal values [9]. The hakims, healers, and akhuns who offer health advice in rural areas prescribe these medications. In Pakistan, the majority of the rural population relies on Unani medicines, which are made either directly from medicinal plants or from their byproducts. Plants have been used for promoting oral hygiene and enhancing dental health for a very long time [10]. Many plants can reduce infection and inflammation linked to dental disorders, which is one of the natural ways to cure dental diseases. Using a single blind and crossover design, the use of miswak has a favorable impact on oral health [11]. Dental issues can be greatly avoided with good oral hygiene. The most frequently used oral hygiene product worldwide is tooth paste [12]. The primary purpose of adding antimicrobial agents to toothpastes is to have a direct inhibitory effect on plaque formation [12, 13]. Plaque, tooth decay, gingivitis, and periodontal disease are the most common dental issues affecting adults [14]. To prevent plaque buildup and the onset of gingivitis, chemicals like triclosan and Chlorhexidine are typically used as mouthwashes or added to dentifrices [15]. Few of these compounds undoubtedly have negative side effects that could affect your teeth and taste, hence Phytotherapeutic medicines with antibacterial and anti-inflammatory capabilities have been researched [16]. There has been a lot of research on medicinal plants in Pakistan's many areas, but none has been done on the flora of the Hazara Division. Additionally, this is Pakistan's first-ever report on oral

problems. Therefore, it is of paramount significance to compile all information such as collection, identification, traditional knowledge, ethno pharmacy, ethnopharmacological uses etc. This project was initiated to cover all these aspects like examination of their availability, biodiversity status, explore indigenous knowledge for traditional uses of plants, locally applied to cure suffering from dental problems and gain insights of their natural habitat and kinds of wild species in the wilderness.



**Fig 1: Map of study area**

## 2. MATERIAL AND METHODS

### 2.1 Study Area

Pakistan's Khyber Pakhtunkhwa province has an administrative division known as the Hazara Division. It consists of eight districts: Abbottabad, Mansehra, Haripur, Battagram, Upper Kohistan, Kolai-Palas, Lower Kohistan, and Torghar and is situated along the Indus River. The Hazara Division is bordered by Malakand and Mardan Divisions to the west, Rawalpindi

Division (Punjab) and Islamabad Capital Territory to the south, Azad Kashmir to the east, and Gilgit-Baltistan to the north (Fig.1). This geographically remote town struggles with access to basic essentials including health, education, and communication services, as well as with economic destitution and an extremely severe climate. Although our research cannot address all of these concerns, it seeks to make a major contribution to community health care.

## **2.2 Collection and identification of medicinal plants**

Throughout the first, middle, and last summers of 2021, frequent field surveys were conducted. A work plan was created, and through a questionnaire, general information about the region and cultural uses of medicinal taxa for dental problems were acquired. Plant specimens were gathered, labelled, pressed, and photographed in their natural environments. For botanical information, local experts, hakims, shepherds, farmers, and forest guards were questioned regarding vernacular names and traditional uses for dental issues. The information was also cross-checked with local informants in other locations, either by displaying plant specimens and photographs to the informants to confirm the veracity of use reports, or by collecting additional information. The Plant Prof. Dr. Ghulam Mujtaba Shah, Chairman, Department of Botany Hazara University Mansehra, Pakistan was identified the plant specimens and confirmed with the help of available literature [17, 18]. After confirmation the collected specimens were submitted to the Herbarium, Department of Botany, Hazara University Mansehra, Pakistan (HUP).

## **3. RESULTS AND DISCUSSION**

Total of 85 local inhabitants were interviewed through questionnaire, including 55 men (30- 72 years old), 20 women (34-65 years old) and 10 men local hakim. Photographs were taken of each plant species during field surveys and verified from the local informants.

### **3.1 Phyto diversity**

In present study, 24 plant species belonging to 20 families are reported, these plants are administered by the local informants for dental disorders. There were 64% herbs, 20% trees and 16% shrubs (Table 1). Herbaceous growth habit has been mentioned as the dominant growth form by many researchers [19, 20, 21, 22, 23]. Lamiaceae is dominant family used in the treatment of dental problems with 4 plant spp. (16%) while other researchers mentioned Asteraceae as the leading family with maximum number of medicinal plants species to cure diseases. However, was followed by Leguminosae 3 spp, Anacardiaceae and Compositae with 2 spp. (12%) each, (8%) while rest of 17 families were represented by single species [24, 25] (Fig. 3).

### 3.2 Dental diseases

Thirty six medicinal plant species belonging to 21 families were being used for treating 8 different dental problems by the local inhabitants and traditional practitioners ( Table 2), describes medicinal plant species used in treatment of toothache (38%), wound healing (19%), gum infections (16%), tooth brush and teeth cleaning (8%) each, jaws swelling (5%), mouth ulcer and as teeth powder (3%). All the diseases were treated orally as reported by many other researchers [26, 27, 28].

### 3.3 Phyto parts used

Leaves were the most widely used plant part in the treatment of different diseases (36%), followed by root and whole plant (12%) each; flowers, twigs and seeds (9%) respectively, whereas, minimum used parts were fruits and bark (6%) also reported leaves to be the most useful plant part of medicinal values [29].

### 3.4 Traditionally plant extracts medicinal dosages

During interviews the local inhabitants and especially the cultural practitioners were inquired about the safe dosages of the medicinal plants. Locally and traditionally prescribed dosages of various plants are; 1 tea spoon /twice a day leaves extract of *Abies pindrow* is applied to treat mouth ulcers, ½ tea spoon powder/ day of *Achyranthes aspera* is used as a tooth paste for teeth cleaning and instead of tooth brush the root is used, ½ tea spoon/twice a day leaves extract of *Astragalus grahamianus* applied on infected gums, *Azadirachta indica* twigs are used as a tooth brush, 1 tea spoon / twice a day leaves extract of *Corydalis cornuta* applied on wounded gums and 15-20 flowers/day taken orally for toothache. Furthermore, 1-2 leaves/day and bark of *Juglans regia* are used for teeth cleaning and its bark is locally known as dandasa, 40-50 seeds/day of *Lathyrus aphaca* are eaten orally for teeth pain, leaves of *Prunella vulgaris* are used for teeth cleaning while 2 tea spoon/day of plant extract is used for wound healing and 5 flowers/day of *Ranunculus muricatus* are used for teeth cleaning. Dried leaves powder two times/day of *Rumex dentatus* and *Rumex hastatus* are used against tooth pain and it also helps in wound healing of gums, extract of 3-5 flowers /day of *Taraxacum officinale* are applied on gums to treat jaw swelling, twigs of *Zanthoxylum armatum* are used as a tooth brushes while its 5 fruits/day is eaten for toothache. All these mentioned dosages were then confirmed via asking questions from patients who ever suffered dental disorders and have sought traditional medication from the local healers. Data regarding dose efficacy of the ethnomedicines was

inferred from the questionnaires and percentage of patients with positive interviews and success percentage are given (Table 1). However, until a comprehensive risk assessment including tolerance tests are carried out these doses must not be recommended as most plants contain various types of chemicals, which might be toxic for human health (Table 1).

Despite improvements in dentistry, oral illnesses such dental caries, periodontitis, bleeding gums, toothaches, ulcers in the mouth, foul breath, tooth sensitivity, tooth loss, and oral cancer continue to be serious health issues in the world [1, 2]. More than 530 million children and over 2.3 billion adults are said to be affected by primary tooth decay, according to statistics from the World Health Organization (WHO) [3]. There is a wealth of data demonstrating the connection between oral disorders and the risk of colorectal cancer, gum bleeding, toothaches, and preterm birth in expectant moms, chronic renal disease, myocardial infarction, and stroke [4–9]. Even before the advent of modern medicine, people have used plants and products derived from plants to enhance human health for ages. Through hundreds of years of unproblematic use, the majority of the therapeutic properties of medicinal herbs have been discovered [17, 18]. According to reports from the World Health Organization (WHO), 65–80% of the inhabitants in underdeveloped nations rely on conventional treatments, primarily those based on plants [17]. Because of this, the WHO has advised that nations create national policies and legislation to incorporate plant-based treatments into their healthcare systems [19].

### **3.5 Plant extracts biological activities, safe dosages and known toxicity**

Ninety-one previously published articles were carefully examined, and significant conclusions were drawn from them. (Table 1). A review of the literature indicated that most plants contain chemical components that are essential for biological processes as well as the treatment of several infectious disorders like Glucopyranoside, chalcone glycoside, bioflavonoids, flavonoids, pindrolactone, pentacyclic triterpenoids, and phenolic compounds are only a few of the significant substances found in *Abies pindrow* [29, 30], While this plant also has excellent anti-oxidant potential [31]. Flavonoids, terpenoids, lignans, amino acid derivatives, fatty acids, and alkamides are all present in *Achillea millefolium* [33]. The extract has the potential to be genotoxic; however a safe dosage of 10mg/kg has also been noted [34]. Azadirachtin is present in *Azadirachta indica* [35], Through these extracts, nimbin and nimbidin, anti-bacterial, anti-fungal, and anti-inflammatory effects have been shown. Many researches have also documented the hazardous doses of *Azadirachta indica* extracts, including the deadly

intraperitoneal dosage of 31.95 g/kg and the acute oral toxicity induced by 13 g/kg. Important phytochemicals found in *Lathyrus aphaca* include flavonoids, tannins, glycosides, alkaloids, and terpenoids [36], and plant extracts from this species have substantial antibacterial properties. [37]. According to reports, *Prunella vulgaris* contains the active ingredient 2, 3, 23-Trihydroxy-12-oleanen-28-oic acid, which inhibits the growth of skin tumours. Its acute toxicity dose was listed as 169.6g/kg, and the recommended safe dosage was listed as 92.58g/kg. An oral intake of 60–100 mg/kg of *Ranunculus muricatus* extract has toxicological effects, but a concentration of more than 20 mg/kg of dry plant material can produce phytotoxicity [38].

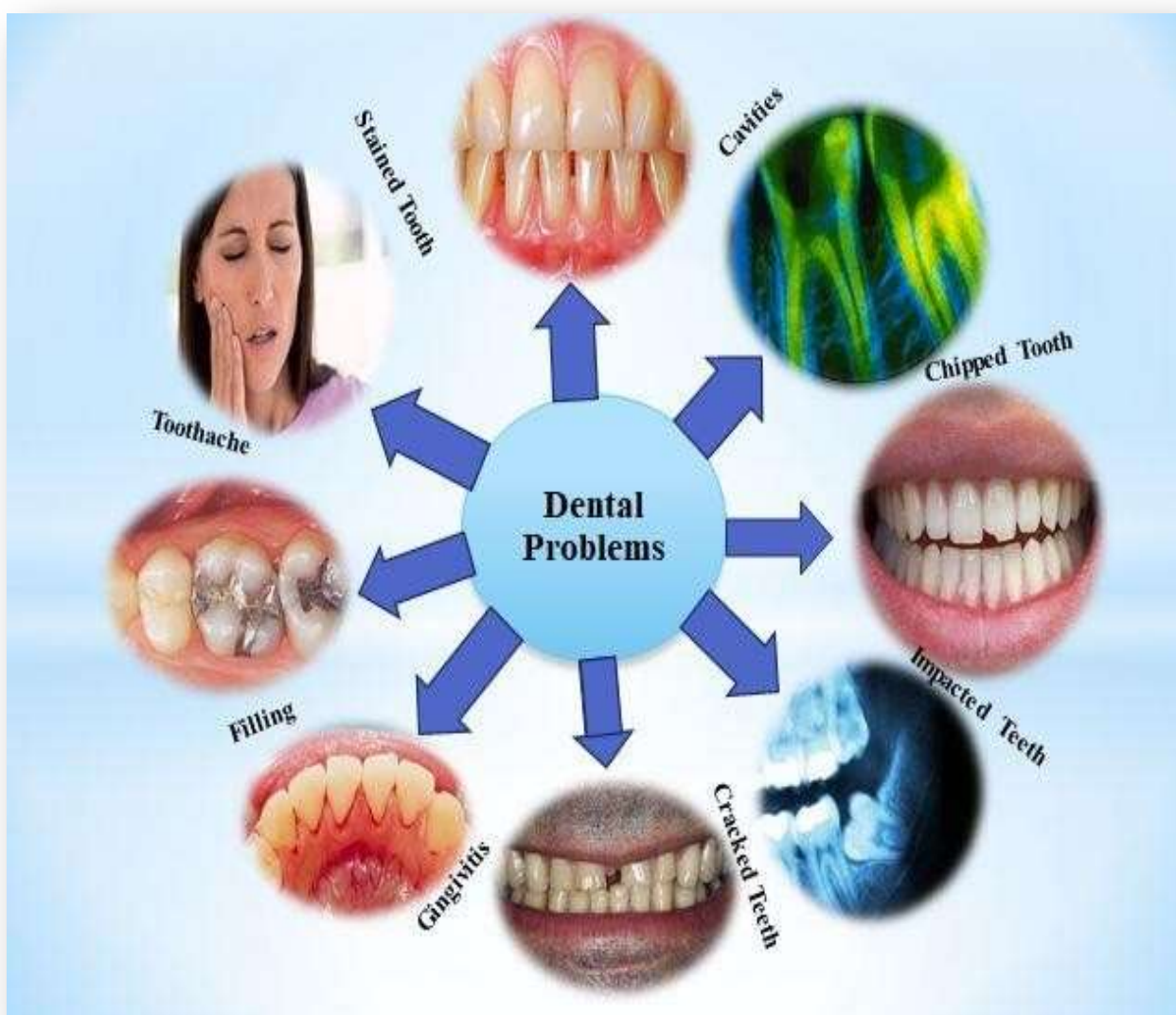


Fig 2: Common Dental Problems in Hazara Division

**Table 1: Medicinal plants used in the treatment of the oral disease (Dental Problems)**

S.No	Scientific name	Family name	Common name	Used part	Indications
1	<i>Astragalus graveolens</i> Buch.	Papilionaceae	Gavan	Leaf	Toothaches
2	<i>Otostegia limbata</i> (Benth) Boiss.	Lamiaceae	Chiti booti	Leaf	Antinflammatory, pain
3	<i>Pimpinella stewartii</i> Nasir.	Apiaceae	Trachyspermum	Leaf	Tooth pain and griping pain
4	<i>Rhus cotinus</i> L.	Anacardiaceae	smoke tree	Leaf	Treatment of wounds
5	<i>Acacia cornigera</i> (L.) Willd	Leguminosae	Cornezuelo	Leaf	Inflammation of gums
6	<i>Acacia farnesiana</i> (L.) Willd	Leguminosae	Huizache	Stem	Cold sore and toothache
7	<i>Amphipterygium adstringens</i> Schiede	Anacardiaceae	Cuachalalate	Stem	Periodontitis
8	<i>Asclepias curassavica</i> L.	Asclepiadaceae	Quiebra muelas	Latex	Caries and toothache
9	<i>Bidens odorata</i> Cav.	Compositae	Aceitilla	Latex	Canker sores
10	<i>Byrsonima crassifolia</i> (L.) Kunth	Malpighiaceae	Nanche	Leaf	Toothache
11	<i>Caesalpinia pulcherrima</i> (L.) Swartz	Leguminosae	Tabachin	Leaf	Canker sores
12	<i>Capsicum frutescens</i> L.	Solanaceae	Chile de arbol	Fruit	Toothache
13	<i>Carica papaya</i> L.	Caricaceae	Papaya	Leaf	Canker sores
14	<i>Chenopodium graveolens</i> (Willd.)	Chenopodiaceae	Epazote	Leaf	Toothache
15	<i>Chiranthodendron pentadactylon</i> Lam.	Sterculiaceae	Flor de manita	Leaf	Toothache
16	<i>Dorstenia contrajerva</i> L.	Moraceae	Contrayerba	Flower	Caries, toothache
17	<i>Heterotheca inuloides</i> Cass.	Compositae	Arnica	Root	Canker sores
18	<i>Heliopsis longipes</i> (A. Gray) S.F. Blake.	Asteraceae	Chilcuague	Flower	Toothache
19	<i>Jatropha gaueri</i> Greenm.	Euphorbiaceae	Pamolche	Root	Canker sores, oral candidiasis
20	<i>Lobelia laxiflora</i> Kunth.	Campanulaceae	Aretillo	Leaf	Canker sores and toothache
21	<i>Opuntia ficus-indica</i> (L.) Miller	Cactaceae	Nopal	Leaf	Oral ulcer and tooth abscess
22	<i>Persea americana</i> Miller.	Lauraceae	Aguacate	Fruit	Gingivitis, periodontal disease
23	<i>Sida rhombifolia</i> L.	Malvaceae	Escobilla	Fruit	Gingivitis and toothache
24	<i>Theobroma cacao</i> L.	Sterculiaceae	Cacao	Leaf	Oral ulcer and toothache



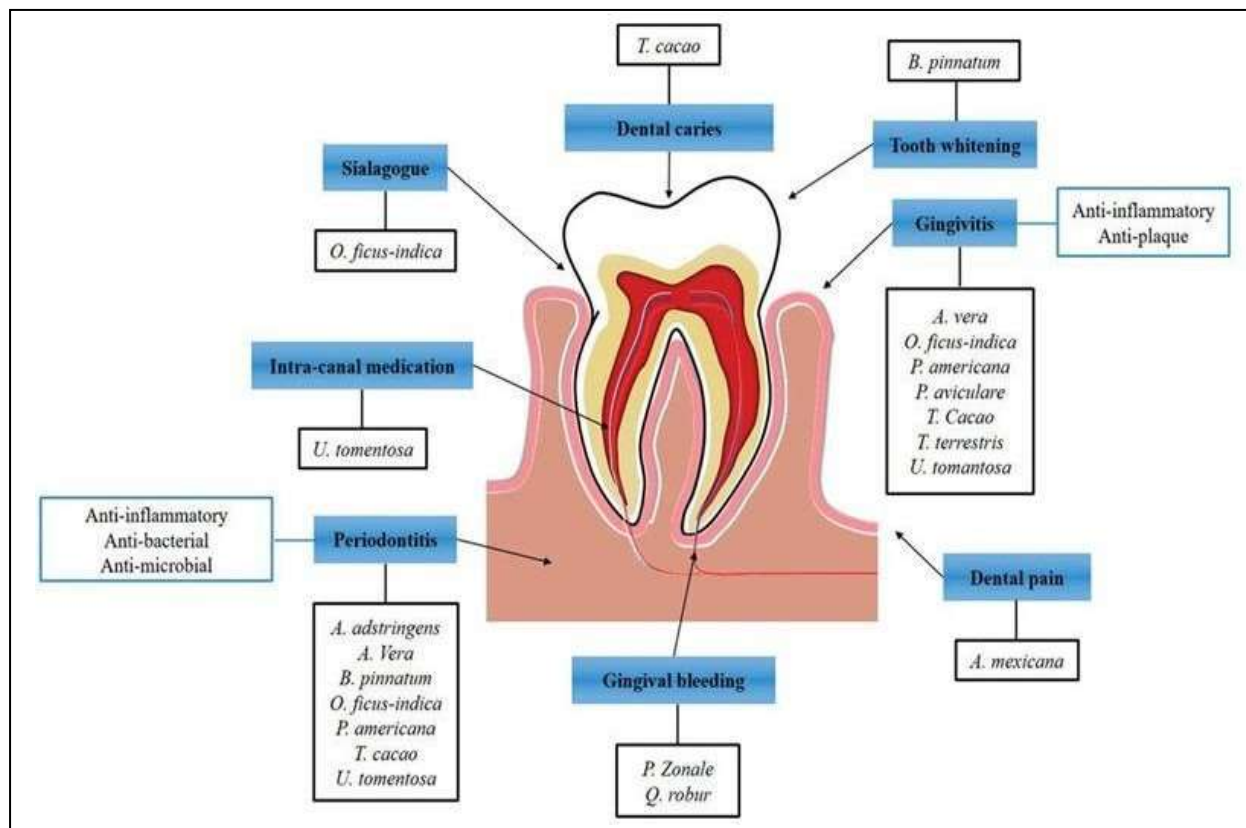


Fig 3. Summary of the plants that are traditionally used in the treatment of diverse oral disease.

## CONCLUSION

The present study is the first ever documentation of ethno medicinal practices aiming at the dental diseases in Pakistan, which resulted in 74% of medicinal uses new claims. So, the reported species of remote valley should be further evaluated for proper experimentation and pharmacological activities to authenticate their current traditional usage. Field observation revealed vegetation of the area was generally threatened due to its unwise use by the local communities. Trends like deforestation, over grazing; habitat fragmentation and introduction of the exotic taxa were the visible threats. So conservation of such an important natural God gifted treasure is mandatory.

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