

**Research Paper** 

**Medical Science** 

# Ethnobotanical Uses of *Phragmites australis* in Afyonkarahisar Province of Western Anatolia (Turkey)

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A PETDACT In this	study, ethnobotanical uses of Phraamites australis (Cay.) Trin, ex Steudel (Poaceae) used for various purposes by

ABSTRACT In this section and a people in districts Sultandaği, Çay and Bolvadin of Afyonkarahisar in West Anatolia (Turkey) were determined. The plant constitutes the source of livelihood for low-income folks living in villages around lakes Karamik and Eber. In particular, heat and sound insulation, wrapping and protecting corpses in graveyards, animal shelters, fence construction, nests for migratory birds, mat weaving, tents, neck strips used to transfer animals, roofing, diuretic, antipyretic, hydratic, foods and other similar traditional uses of the plant are remarkable. The products of Phragmites australis have been exported to some countries and yielding economic income for farmers besides putting into good use.

### KEYWORDS : Phragmites australis, Ethnobotany, Afyonkarahisar

### Introduction

Turkey is one of the richest countries in the world in terms of plant diversity. There are more than 10,000 plant species within its borders, and 30% of these are endemic[1-3]. Many plant species have been widely used as traditional medicine, tea, spice, food, firewood, dye, furniture, agricultural tools, construction materials and indoor plants by Turkish people[3-5]. Phragmites australis (common reed) is a water plant covering a vast geography extending from temperate Eurasian to tropical areas. The plant is widespread in Turkey. It is a perennial plant of herbaceous form. Its typical habitat is lakes, rivers, depressions, marshes, channel banks and sea coasts. The plant is an Euro-Siberian element[6]. It is a perennial, amphibious water weed. Rhizomes are strongly divaricated. It may reach a height of 1-2 m and contains rhizomes. Its body is lean and the plant can grow up to 3 m. Ligule at the bottom of the leaf is 0.5-1 m in length, and is in the form of a hairy root. During the plantlet emergence period, the plant is occupied by a single array of superficial virgate hairs extending up to 1 cm. Leaf blades narrow down in base section and may grow up to 60 x 3 cm. Spica (panicle) may grow up to 40 cm. Bottom portion of bundles is hairy. Spikelets are composed of 3-6 flowers. Glumes are not even, they are rough. Lower glume has a length of 5 mm in ovoid, lanceolate form with short sharp tips. The bottom outer glume doubles the inner glume by length. Hairs on the spikelet axis are 7-9 mm. The plant usually reproduces by rhizomes[7]. Historically, 40,000 years old Phragmites was recovered in Arizona[8]. Phragmites australis (common reed) is widespred in Afyonkarahisar and lakes Karamık and Eber. The use of Phragmites australis for various purposes by folks particularly in districts Sultandağı, Çay and Bolvadin of Afyonkarahisar is interesting. In these regions, the plant is at the forefront in terms of ethnobotany. In particular the medicinal, handicraft, household item and other similar traditional uses of the plant are remarkable. The plant constitutes the source of livelihood for low-income folks living in villages around lakes Karamık and Eber. People make their living through income derived from the ethnobotanical use of the plant, yielding average monthly income of 300-400 US dollars. Villagers harvest the reeds by means of special methods in June and December every year and process them into products which are then exported to European countries. Also, the plant is now employed in thermal insulation systems in many countries. Hence, both the culture can globally be proliferated and knowledge is recorded to shed light on next generations.

of the Aegean region of Anatolia and phyto-geographically located on the transition zone between the Irano-Turanian and Mediterranean regions. The area also has many Euro-Siberian (Euxine) phyto-geographic elements[3]. Lake Karamık is located within the district Cay covering a surface area of 40 km<sup>2</sup>, with its deepest part being 3,00 m and an altitude of 1,000 m. Its water bodies flow into the lake Eğirdir. Swamp sections are covered by Phragmites australis. Also, in swamps and wetlands at a height of 1000 to 1100 meters, plants such as Carex distans L., Butomus umbellatusL., Typha domingensis Pers. and Juncus inflexus L. are observed. Also, myriad of migratory birds dwell in the reeds of the Lake Karamık for breeding. Some of these birds are Phalacrocorax pygmeus, Platalea leucorodia, Ardeola ralloides, Botaurus stellaris, Aythya nyroca, Sterna nilotica, Fulica atra, Oxyura leucocephala, Charadrius leschenaulti [9]. The lake Eber is named after the Afshar Turkmens. The lake is located within the boundaries of the borough Eber of Afyonkarahisar, covering a surface area of 124.5 km<sup>2</sup> The lake is fed by the Akarcay basin and spring waters in Central Anatolia. It is surrounded by Emir mountains to the north and Sultan mountains to the south. The lake surface is primarily covered by Phragmites australis. In addition, the lake further hosts other plant species such as Typha latifolia and Mentha aquatica. Many migratory birds flock to the lake Eber for reproduction in reed islands. Some of them are Phalacrocorax pygmeus, Aythya nyroca, Sterna nilotica, Charadrius leschenaultii, etc.[10]. Villagers engaged in the reed business primarily live in five settlements (Koçbeyli, İnli, Karamik, Akkonak, Çayıryazı) around the lake Karamık and two settlements (Ortakarabağ, Büyükkarabağ) around the lake Eber (Figure 1). Villages nearby the district Çay are 13-20 km far, and villagers make their living from reed industry and stockbreeding. On the other hand, villages nearby the district Bolvadin are 15-25 km far from in average, and villagers also make their living from reeds. Educational level of villages is poor with low literacy rates. In villages around the lakes Karamik and Eber (7 settlements), about 50 people were interviewed through face-toface meetings. Information was obtained from 15 informants mastering and engaged in the use of plants. Of them, 9 are male and 6 are female. They are called "master" around. Informants are generally primary school graduates and have been mediating in conveying this culture to date. Plant sampled from the study site was identified based on Flora of Turkey and the East Aegean Islands[1]. The ethnobotanical use and cultivation of the plant was observed and photographed.

Materials And Methods Study area and data collection The province of Afyonkarahisar is located in the central Western part



### Fig.1- Map of study area

Villagers arrive at the lake on their rafts early morning, cut the reeds with their special knives and bring them around noon. In order to bring more reeds from within the lake, people employ vehicles with thick rubber capable of floating (Figure 2).



# Fig. 2- Vehicles with thick rubber to bring reeds from the lake

### Processing

Reeds delivered to the site are sorted out by means of a special cutter, then combed to remove any plant residues, and stripped from useless rough parts. Reeds are cut in a specific length through the cutter, banded and then stacked. The bands are cut, pressed, tied and then compressed in the workshop into uniform blocks (Figures 3).



## Fig. 3- The reeds are cut in a specific length through the cutter

### Results

Reeds so banded are now ready for more ethnobotanical uses. In particular, the plant is utilized for various applications including heat insulation(Fig. 4), sound insulation, wrapping and protecting corpses in graveyards, medical uses, animal shelters, fence construction (Fig. 5), nests for migratory birds, mat weaving, tents (Fig. 6), neck strips used to transfer animals, roofing , and foods (Table 1). This demonstrates that the plant has a broad ethnobotanical quality. As an example of its medical use, local peasants boil Phragmites australis by the decoction method and drink 1-2 cups of its juice. It is used for its diuretic, antipyretic and hydrating effects. Plant's other fields of use valuably contribute to the economic development of local communities. Especially this is the unique region where mats are manufactured for further use in jacketing buildings. Hence, reed replaces styrofoam. It was reported that the material ensures stronger thermal insulation. In addition, the products so crafted are exported to prominent countries such as Germany and Belgium, yielding economic income besides putting into good use.



Fig. 4- The usage of reeds for heat insulation



Fig. 5- The usage of reeds for fence construction



Fig. 6- The usage of reeds for tents

### Table 1- Various ethnobotanical uses of Phrogmites australis

Purposes of Usage	Manner of Usage
Animal Shelter	It is used for providing living space for animals by building shelters. Additionally used as garden fence (wall).
Heat Insulation	Especially used for sheathing for the exterior parts of the houses instead of Styrofoam and heat loss is prevented. Especially thatch of the houses are covered with common reed in order not to get affected by rain and snow.
Sound Insulation	Sound penetration is prevented by covering the inside of walls.
Mats Manufacturing	At the stage of burying the corpses, the right side is covered by common reed for providing protection. Additionally, it is used for keeping warm by placing under the carpets in houses of which grounds are made of concrete. Additionally, the Muslims pray on them in the mosques.
Food Purposes	Starch is obtained of the roots and syrup is made.
Herding of Livestock	In livestock farms, the animals' necks are tied by cordage and are controlled to do work. Also it is used for herding them.
Using as Tents	Common reed is bundled with special techniques and people maintain their livings by making tents.
Medicinal (diuretic, antipyretic, hydratic)	Water by decoction method from sheaths and leaves is drunk. As it is used 1 cup a day for 3-4 weeks, it features as diuretic. It is also used as antipyretic by the infusion method. It is also stated that it quenches thirst.

### Discussion

Phragmites australis widely prevails as a predominant species in swamps and on shore around the lakes Eber and Karamik in Afyonkarahisar. Folks in nearby villages utilize the plant for various ethnobotanical purposes. Methods employed to obtain the product are also interesting[11].

Plant's curative juice is obtained by means of the decoction method. Drinking one cup of the juice daily for 3-4 weeks is characterized with diuretic effects. It is also used as an antipyretic agent when administered by infusion. Its hydrating effect is also reported[12].

P. australis is a widespread vascular plant[13]. Boulos[14] reports the medicinal use of Phragmites australis against hair problems. It is reported to be one of the plants employed to ensure the coupling of pigeons[15]. In another study, its contribution to pond and mussel farming is reported[16]. Phragmites australis is remarkable for its distinct ethnobotanical uses in North America. Different uses of the plant in particular by indigenous American Indians are reported. In addition, enriched ethnobotanical aspects of Phragmites especially in North America are mentioned[17]. In food applications, its seeds and young shoots are used to derive sugar, and its leaves are dried into flour[18]. As fishing and hunting equipment, arrowshaft[17-19]. Call (plunged in water to attract fish), call (for rabbit), basketry, cordage carrying net, mat for drying food, mat sleeping, mat table[17-20]. Native American Indian tribes utilize the plant to construct musical instruments; in particular arrow to play musical bow, (clapper, flageolet, flute mouth bow, serial whistle)[17,21]. The use of the plant by American Indian tribes for various purposes including shelter construction (door covering, frame material, roofing, thatch), clothing and personal adornment (apron, basketry hat, beads for fringe of dress, ear ornament, necklace etc.) are reported[22]. Games (counting stick for games, dice, ring and pin game, tube for flipping shell into, tubes to hide object in guessing game). Ceremonial items (cloud blower, flute used by shaman, frame for mountain chant, medicine bundle (big black meteoric star, medicine bundle wonderful leggings, object associated with bow and arrow, prayer stick, twirling wand). North Americans use the plant P. australis in smoking equipment, container for tobacco storage, canoe, container for pollen or pigment, drinking straw, fire drill shaft, knife (various uses), loom of perforated culms, mnemonic devices, paintbrush handle, soaking seed maize, toy harpoon, toy (pea shooter), toy gun for shooting slivers, tweezers for beard, vent for cooking coyote, walking stick for elderly, weaving rods etc.[17].

P. australis is also far-flung in Europe, and its similar ethnobotanical uses are intensively observed[23]. Also in Africa, at least the economic benefits of the plant are also reported[24]. Zola and Gott[25] reports the economic contribution of the plant in Australian countries. P. australis is also a prominent plant employed for public health purposes around the globe. Kiviat and Hamilton[17] also report the use of the plant by physicians, particular as a medicine blowing tube, splint for fractures used by the Cahuilla, Chumash, tube for magical powder of shaman, tube for suction by shaman etc.

The ecological services of P. australis should also be noted. In particular, non-habitat services, and habitat functions or biodiversity support. Phytoremediation[26]. It is a good feedstock for bioenergy[27-28]. Suggested the use of Phragmites in Sweden for fuel pellets or other solid biofuels[28]. Phragmites (perhaps combined with other organic wastes) should be a good feedstock for methane generation by anaerobic digestion[27]. Phragmites may protect tidal marshes from erosion associated with sea-level rise, as well as helping to mitigate global climate change[27-29]. Phragmites in North America is in constructed systems for dewatering sludge from sewage treatment plants[30], less frequently for removing nutrients from partially treated sewage[31], waste treatment[27]. Phragmites also serves as a feed article for myriad of organisms. There are various plants feeding on Phragmites[32]. The plant's useful bioenergy potential good biofuel quality are also reported[33]. Wide presence of P. australis on earth signifies its superior ethnobotanical properties accompanied by a widespread culture. Western Anatolia (Afyonkarahisar) has brought a new dimension in the functionality of the plant through distinctive methods for derivation, processing and ethnobotanical uses. Particularly low-income people living in the region play an active role in economic development. While similar ethnobotanical uses are reported by other studies worldwide, the plant has gained a higher significance in the region and the world for its diversified uses particularly including thermal insulation, jacketing, sound insulation, fencing, wrapping and protection of corpses in graveyards, and construction of animal shelters.

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1. Davis PH, Flora of Turkey and the East Aegean Islands. Vol 10, (Edinburgh University Press, Edinburgh), 1988. 2. Güner A, Özhatay N, Ekim T

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### REFERENCES

& Baser KHC, Flora of Turkey and the East Aegean Islands, Vol 11, (Edinburgh University Press, Edinburgh), 2001. 3. Ari S, Kargioğlu M, Temel M & Konuk M, Traditional Tar Production from Anatolian Black Pine [Pinus nigra Arnold subsp. pallasiana (Lamb.) Holmboe var. pallasiana] and its Usages in Afyonkarahisar, Inner-West of Turkey, J Ethnobiol and Ethnomed, 2014; 10:29 1-9. | 4. Yesilada E, Honda G, Sezik E, Tabata M, Fujita T et al, Traditional medicine in Turkey V. Folk medicine in the inner Taurus Mountains, J Ethnopharmacol, 1995; 46(4)133–152. | 5. Sargın SA, Akçicek E, Selvi S. An ethnobotanical study of medicinal plants used by the local people of Alasehir (Manisa) in Turkey, J Ethnopharmacol, 2013; 3860–874. | 6. www.tubives.com/.2015.Turkish Plants Data Service (TÜBİVES). Version 2.0 BETA. | 7. Özer Z, Önen H, Tursun N, Uygur FN. Türkiye'nin Bazı Önemli Yabancı Otları, (Gaziosmanpaşa Üniversitesi. Ziraat Fakültesi yayınları), 1999; 38 (16). | 8. Hansen RM, Shasta ground sloth food habits, Rampart Cave, Arizona. Paleobiology, 1978;4: 302–319. | 9. Uzun N, Çevre Durum Raporu. (Afyonkarahisar Valiliği İl Çevre ve Orman Müdürlüğü), 2007. | 10. Clements JF. Birds of the World: A Checklist. (Cornell University Press), 2000; 880. | 11. Kargıoğlu M, Cenkci S, Dayan S. Endemic plant species and theirendangered categories vegetated in the boundary of Afyonkarahisar province in Turkey. Afyon Kocatepe University, Journal Sci, 2008; 6:307–332. | 12. Anonymous. Afyon İli Yıllığı. (Mina Ajans, Ankara), 2001. | 13. Clevering OA, Lissner J. Taxonomy, chromosome numbers, clonal diversity and population Dynamics of Phragmites australis, Aquatic Bot, 1999; 63: 1–24. 14. Boulos L. Medicinal Plants of North Africa, (Michigan: Algonac), 1983. | 15. Belda A. Cortes C, Ethnobotanic importance of plants used in pigeon-breeding in Eastern Spain, J Ethnobiol and Ethnomed, 2013 ;9:33. | 16. Savo V, La Rocca A, Caneva G, Rapollo F , Cornara L. Plants used in artisanal fisheries on the Western Mediterranean coasts of Italy, J Ethnobiol and Ethnomed, 2013; 9-9. | 17. Kiviat E, Hamilton E. Phragmites use by Native North Americans, Aquatic Bot, 2001; 69: 341–357. | 18. Heizer RF. Honey-dew "sugar" in Western North America, Masterkey, 1945; 19: 140-145. | 19. Shipek F. Kumeyaay plant husbandry, In: Fire, water, and erosion management systems, edited by TC Blackburn and K Anderson, (Menlo Park, CA: Ballena Press), 1993;379-388. 20. Anderson, K, Blackburn TC. Before the Wilderness; Environmental Management by Native Californians, (Menlo Park, Ca: Ballena Press), 1993; 476. | 21. Gifford E, Culture element distributions. XII. Apache-Pueblo, Anthropol Recreation, 1940; 4: 1–207. | 22. Tanner CL. Southwestern Indian basketry, In: Porter III, F.W. (Ed.), The Art of Native American Basketry, (Greenwood Press, New York), 1990;193–212. | 23. Rodewald-Rudescu L. Das Schilfrohr Phragmites communis Trinius, (Die Binnengewässer Band 27. E.Schweizerbart'sche Verlagsbuchhandlung, Stuttgart), 1974. | 24. Rodin RJ. The Ethnobotany of the Kwanyama Ovambos. Missouri Botanical Garden Monographs in Systematic Botany, 1985; 9, 2. | 25. Zola N, Gott B. Koorie plants, Koorie people, In: Traditional Aboriginal food, fibre and healing plants of Victoria, Koorie Heritage Trust, (Melbourne Vic. Australia), 1992. | 26. Weis JS, Weis P. Metal uptake, transport and release by wetland plants: implications for phytoremediation and restoration, Environment International, 2004; 30: 685–700. | 27. Kiviat E. Ecosystem services of Phragmites in North America with emphasis on habitat functions. AoB Plants, 2013;5 - 29. | 28. Granéli W. Reed Phragmites australis (Cav.) Trin. ex Steudel as an energy source in Sweden, Biomass, 1984;4 :183–208. | 29. Dibble KL, Meyerson LA. Tidal flushing restores the physiological condition of fish residing in degraded salt marshes, PLoS ONE7, 2012; e46161. | 30. Burgoon PS, Kirkbride KF, Henderson M, Landon E. Reed beds for biosolids drying in the arid northwestern United States, Water Sci Technol, 35 (1997) 287–292. 31. Gersberg RM, Elkins BV, Lyon SR, Goldman CR. Role of aquatic plants in waste water treatment by artificial wetlands, Water Res, 20 (1986) 363–368. 32. Balme GR. Insects on Phragmites australis, (MSc Thesis, University of Rhode Island, USA). 2000. 33. Vaičekonyte R, Kiviat E, Nsenga F, Ostfeld A. An exploration of common reed (Phragmites australis) bioenergy potential in North America, Mires and Peat, 13 (12) (2014) 1-9.