

PSILOTUM NUDUM:A NEW PTERIDOPHYTE RECORD FOR THE CRYPTOGAMIC FLORA OF PAKISTAN

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Abstract

The cryptogamic Flora of Pakistan is devoid of the family Psilotaceae. *Psilotumnudum* (L.) P. Beauv., is recorded for the first time from Elum Mountain, district Buner, Khyber Pakhtunkhwa. Habitat of the plant, important synonyms, morphological and palynological descriptions, plant's photograph and Scanning Electron Microscope (SEM) photographs of the spores are provided. Furthermore, the conservation of this species in Pakistan is suggested.

Key words: *Psilotumnudum*, Pteridophyte, Pakistan, Spore, SEM.

Introduction

The diversity of plants increased in the Devonian period with the appearance of vascular plants. A small group of vascular plants in which the vegetative and reproductive structures remained undeveloped, one living member of that group is known as *Psilotumnudum* (Ray *et al.*, 1983). "Psilotum" is a Greek word while "nudum" is a Latin word; both of these words mean "naked" in the respective languages (Nazarian *et al.*, 2010). *Psilotumnudum* also known as Whisk Fern (Qiu& Palmer, 1999) is a Pteridophyte belonging to family Psilotaceae of the division Psilophyta and is one of the most primitive vascular plants. It is the single living member of a populated division of the primitive times and has survived for about 400 million years (Yamazaki *et al.*, 2001). Medicinally it is important for having insulin like antigens (Silva *et al.*, 2002). People of Hawaii use its spores as talcum powder (Foster & Gifford, 1974). In India it is used for treatment of diarrhea (Mannan *et al.*, 2008).

It is widely distributed in tropics and sub-tropics of the Old and New Worlds, extending from northward to Japan and Korea (Zhang & Yatskivych, 2013). It grows as an epiphyte in the tropics and occupies rock crevices in the more temperate areas like south-eastern Australia (Fairley & Moore, 1989). In Pakistan, because of inaccessibility new species of not only angiosperms (Gilani *et al.*, 2003; Yousuf *et al.*, 2009) are seldom reported but from Pteridophytes too (Afidi *et al.*, 2007). So far, *Psilotum* has not been recorded from any part of Pakistan neither in wild nor in cultivation. In fact, family Psilotaceae is lacking in the Cryptogamic Flora of Pakistan. There is no study published literature on the spore morphology and its sculpturing. The objective of this paper is to introduce *Psilotumnudum* to the Cryptogamic Flora of Pakistan along with its palynological description. This study will also help to understand geographical range of *Psilotumnudum* and potential of adaptability to different sets of climatic conditions over the globe.

Materials and Methods

Plant material was collected, pressed, mounted on herbarium sheet and deposited in the herbarium of Qarshi Herb Research Center; Hattar, Haripur. The specimens were photographed and observed under microscope for morphological features. Palynology was carried out using the glycerin jelly stained with safranin.

Mature spores were mounted on slides and observed under compound microscope. Scanning Electron Microscope (SEM) microphotographs of the spores were taken for determination of the surface sculpturing.

Ecology and conservation status: During plant collection for research purpose, the authors had the chance to collect *Psilotumnudum* from Elum mountain of District Buner, Khyber Pakhtunkhwa. Although the area has been visited several times but only a single population of *Psilotumnudum* was encountered. The plant was present in patches on a stony rock nearby a stream. The dominant vegetation of the mountain consists of *Pinusroxburghii* in combination with small trees and shrubs such as *Mallotusphilippensis* and *Dodoneaeaviscosa*. Single population of this species in the collection area is reflecting its rarity. Therefore, the plant needs in-situ and ex-situ conservation in Pakistan.

Morphological description: *Psilotumnudum* (L.) P. Beauvois, Prodr. Aethéogam. 112. 1805.

Syn. *Lycopodiumnudum* Linnaeus., *Bernhardiaantillarum* Müll. Hal., *Bernhardiadichotoma* Willd. Ex Bernh., *Hoffmanniaaphylla* Willd., *Psilotumdomingense* Gand., *Psilotumfloridanum* Michx., *Psilotumtriquetrum* Sw., *Psilotumtriquetrum* var. *gracile* Grev. & Hook.

Perennial small or medium size herb, rhizome prostrate, rhizoides present; stem green, herbaceous, erect, dichotomously branched, glabrous, glaucous; main stem 10-11 cm x 1 mm, secondary branches 1.5-2.5 cm x 0.8 mm, tertiary branches 9-11 x 0.6 mm; internodes 3-18 mm long, longitudinal ridges irregular, stem usually leafless. Leaves spirally arranged when present, adpressed to the stem, minute, scale like, sessile, green or brownish, c. 1 x 0.4 mm, apex acute, margins entire, veins obscure. Synangia present on quaternary and upper branches, each synangium composed of three fused sporangia, sporangia yellowish, orbicular, smooth, glaucous, dehisce by single suture, bearing clusters of spores; spores white, appearing like powder, compactly arranged inside sporangia.

Spore micro-morphology: Spores are homosporous, variable in shape, mostly rod or oval shaped with obtuse ends, smooth or sometimes triangular and constricted on one or two sides. Length of the spores varies from 37 to 52 μ m while width varies from 15 to 35 micrometer. Exine thickness is also variable and ranges from 1.25 to 7.5 μ m. Surface sculpturing is verrucate-tuberculate (Figs. 3, 4).

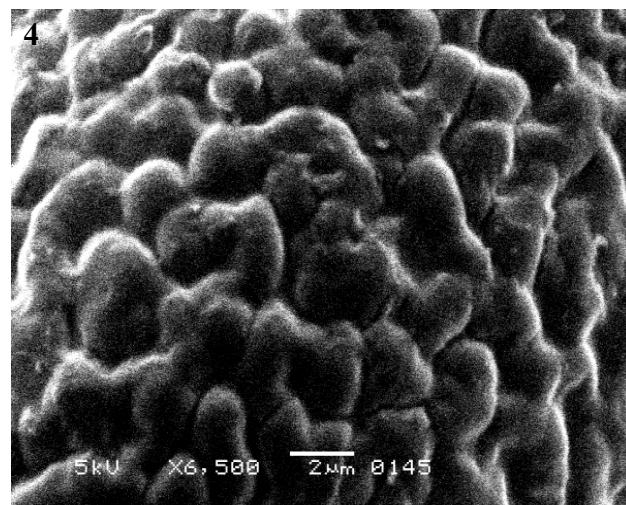
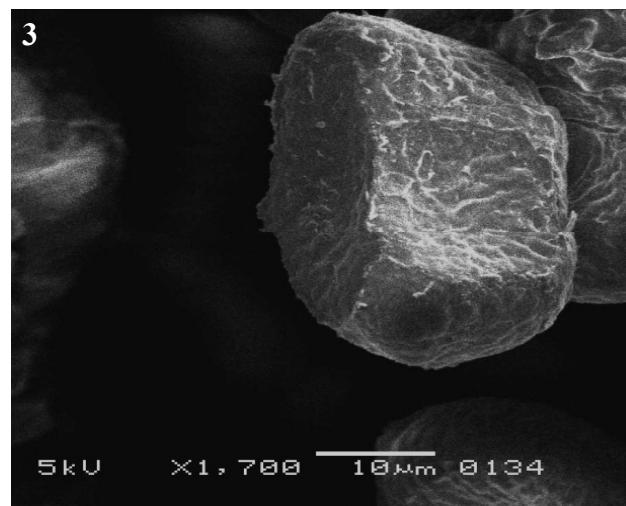


Fig. (1-4) *Psilotum nudum*. (1) Field photograph (2) Specimen (3) SEM photograph of spore (4) SEM photograph of spore surface sculpturing.

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References

- Afridi, H.R., S.S. Gilani, Z. K. Shinwari and J. Shah. 2007. *Hedwigiaciliata* (Hedw.) P. Beauv. A New Addition to the Moss Flora of Pakistan. New national and regional bryophyte records, 16 J. Bryology UK. 29: 198-204.
- Fairley, A. and P. Moore. 1989. Native plants of the Sydney district (1st ed.), Kangaroo Press, p. 27.
- Foster, A. and E.M. Gifford. 1974. Comparative morphology of vascular plants. The Psilopsida. San Francisco, CA: W.H. Freeman and Company.
- Gilani, S.S., M.A. Khan, Z.K. Shinwari and A. Nasim. 2003. A new subspecies of *Digitaria sanguinalis* from Pakistan. Pak. J. Bot., 35(3): 279-282.
- Mannan, M., M. Maridass and B. Victor. 2008. A review on the potential uses of ferns. Ethnobotanical Leaflets, 12: 281-285.
- Nazarian, H., R. Taghavizad and E. Khosravi. 2010. The first anatomical report and morphological reexamination of *Psilotum nudum* L., in Iran. Pak. J. Bot., 42(6): 3723-3728.
- Qiu, Y.L. and J.D. Palmer. 1999. Phylogeny of basal land plants: insights from genes and genomes. Trends in Plant Science, 4: 26-30.
- Ray, P.M., T.A. Steeves and S.A. Fults. 1983. Early vascular plants: Evolution and modern survivors. Botany, Ch., 28: 552.
- Silva, L.B., S.S.S. Santos, C.R. Azevedo, M.A.L. Cruz, T.M. Venâncio, C.P. Cavalcante, A.F. Uchôa, S. A. Filho, A.E.A. Oliveira, K.V.S. Fernandes and J. Xavier-Filho. 2002. The leaves of green plants as well as a *Cyanobacterium*, a red alga, and fungi contain insulin-like antigens. Braz. J. Med. Biol. Res., 35: 297-303.
- Yamazaki, Y., D.Y. Suh, W. Sitthithaworn, K. Ishiguro, Y. Kobayashi, M. Shibuya and U. Sankawa. 2001. Diverse chalcone synthase superfamily enzymes from the most primitive vascular plant, *Psilotum nudum*. Planta., 214(1): 75-84.
- Yousuf, Z., M.A. Khan and Z.K. Shinwari. 2009. A new variety of *Solanum surattense* Burm. From Pakistan. Pak. J. Bot., 41(6): 2097-2103.
- Zhang, L.B. and G. Yatskievych. 2013. Psilotaceae. In: *Flora of China*, (Eds.): Wu, Z.Y., P.H. Raven and D.Y. Hong. Vol. 2-3: (Pteridophytes). Beijing: Science Press; St. Louis: Missouri Botanical Garden Press, p. 81.

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