

# Morphology and Anatomy of Marsilea Minuta L. - A Common Pteridophyte Found In Kota University Campus Kota, Rajasthan India

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## ABSTRACT

Genus Marsilea is well known for its morphological plasticity, commonly known as water clove face interesting diversified status due to their variable climatic conditions. Marsilea minuta Linn. an aquatic or sub-aquatic heterosporous fern which grows in less moist areas is of University campus, Kota. The present work was undertaken with the specific aim of studying morphology and anatomy of wild population of Marsilea species found in University Campus Kota Rajasthan India.

**Keywords** –Marsilea, Morphology, Pteridophytes.

## I. INTRODUCTION

Pteridophyta formed a dominant part of earth's vegetation during the Devonian period, a time when they first appeared on land (Michael Woods et.al 2008, The plant list 2013). These plants originated in the Silurian period of the Paleozoic era, are among the first vascular plants. Flora of Rajasthan is mostly confined to Mt. Abu and Hadauti plateau and University of Kota lies in Hadauti. Genus Marsilea commonly known as water clove are small plants are of unusual appearance and do not resemble common ferns. Genus Marsilea with about 60-65 species is cosmopolitan distribution mainly in warmer parts of the world such as tropical Africa and Australia (Vashishta PC 1970, Henderson RV.

1933). About 9 living species have been recorded from India, of them four from Rajasthan. Of these Marsilea minuta Linn. is the commonest and M. brachypus, M. quadrifolia, M. rajasthanensis and M. aegyptiaca are the other important Indian species. The ability to develop heterophylly is proposed as an adaptive traits enabling amphibious ferns to survive in contrasting habitats. Pteridophytes of Hadauti plateau hold a significant position with respect to their occurrence and distribution (Tropicos 2012, A. Janiak. 2014). During rainy season a number of pteridophytes grow and survive in the valleys and ravines of River Chambal. Garasia and Bheels cook their leaves as vegetable. (Bhattamisra et.al 2008, Chandra, S. 2000) The decoction of leaves along with ginger is used to cure

cough and bronchitis in many villages of Rajasthan (Madhu et.al, 2012).

## II. MATERIAL AND METHOD

### SURVEY AND COLLECTION

species of *Marsilea* populations growing at different sites in University Campus Kota were taken up for the present study. The plant specimen of *Marsilea* was collected in every stage of their growth and habitats and reproduction from different areas of University campus Kota. The plants were collected in tin vasculum, pressed flat, before their wilting between the sheets of news or blotting paper. After drying of plant material, the plant specimen were mounted on herbarium sheets of standard size. The *Marsilea* specimen were preserved in 4% formalin solution for anatomical studies.

### MORPHOLOGY

Morphological observations were carried out on fresh as well as herbarium material. All measurements were recorded in metric scale. Details of habitat, soil and commonly associated flora of the aquatic as well as the terrestrial Flora were noted during regular survey of University campus. Besides this regular field visits were carried out in campus in order to study the area of distribution of *Marsilea* species.

### ANATOMY

Sections of root, rhizome, and petiole of *M. minuta* were cut using blade. Safranin-fast green combination was employed for staining and mounting was done in DPX following Johansen (1940) and hand cut sections were also observed under the binocular microscope and photographed.

### SCIENTIFIC CLASSIFICATION

The Taxonomical Classification of *M. minuta* Linn. is as follows:

Kingdom : Plantae

Phylum : Polypodiophyta

Division : Pteridophyta

Class : Equisetopsida C. Agardh

Subclass : Polypodiidae Cronquist, Takht. & W. Zimm.

Order : Marsileales

Family : Marsileaceae Mirb.

Genus : *Marsilea*

Species : *minuta* L.

## III. OBSERVATIONS AND RESULTS

The plant body was differentiated into petiole, roots, rhizome, leaf and sporocarp (fig1). Roots adventitious borne at each node on the lower side of rhizome. rhizome - slender, branched with nodes and internodes and dichotomously branched.

Large variation was noted in length of root, petiole and rhizome of *Marsilea minuta* found in University Campus. The petioles are comparatively much longer than the roots. Petiole length was  $11.6 \pm 4.6$  cm respectively. Internodal length varied greatly in the investigated populations of *Marsilea* at various sites in the campus. internodal length was  $2.60 \pm 2.4$  cm. Leaves have large petioles terminating into four leaflets (fig2). Leaflets are obovate with smooth or crenate margins. Young leaves arise in a circinate manner. The mature leaves of *Marsilea* are quadrifoliate i.e. two leaflets being slightly higher than the lower two and are inserted in alternate fashion. The leaflets exhibit sleep movement *Marsilea*. At night the pinnae become folded upwards drooping at petiole apex. Size of leaflets and their margins show characteristic habitat and interspecific features. The leaflet margin varies with the habitat. It is observed that the leaflet margin in land form is deeply crenate while it is almost entire in aquatic form. (Fig.2) Hairs are seen in the land form which may be a conservative and characteristic feature for decreasing transpiration rate. Fig-2 represents the venation pattern of *Marsilea* leaves. The leaflet size was  $1.14 \times .80$  cm. The sporocarps were observed from September to January, and also exhibit amphiterrestrial habitat. sporocarps were ovoid in shape and measures  $0.40 \pm 0.2 \times 0.27 \pm 0.4$  cm. In land forms of *M. minuta* 3-4 sporocarps remain attached to lower portion of petiole in a linear fashion. Each sporocarp is ovoid in shape with an

upper blunt horn. *M. minuta* in the former having a central bulge and characteristic depression (ridges) which is visible externally. The sporocarp of this species is squarish in shape with a prominent blunt horn (fig3). Sporocarps are mostly two in number at each node, rarely one in many drying plants with condensed rhizomes. It is densely covered with hair when young and also at maturity. Sporocarps measure  $0.36 \pm 0.03 \times 0.30 \pm 0.01$  mm. usually crowded and in groups of 2-3.

#### 1. Anatomy 1. Petiole

Petiolar anatomy has revealed that the epidermal cells and cuticle is almost round and well defined. The shape of air chambers are irregularly round. Middle cortex is single layered with prominent vascular zone. (fig4)

#### 2. Rhizome (fig 5)

The epidermis of *Marsilea minuta* is continuous and single layered. Air chambers shows variation in shape and size. These are irregularly round. The cortical region consists of a middle zone which is 2-3 layered thick. xylem ring is single layered. while tracheidal cell of different sizes are found. Phloem is 2-3 layered with sieve cells and sclerotic pith.

#### 3. Root- (fig6)

Root anatomy reveals a zone of thick walled cells in the inner cortex which is 2-3 layered. Stele is diarch and exarch.

### IV. DISCUSSION

The range of morphological plasticity is pronounced in *Marsilea* populations growing under diverse habitat conditions (Abdusalam A, Li Q. 2018). This has led to species polymorphism having wide ecological amplitude with a wider range of tolerance to varied habitat features resulting into hydrophytic, amphibious and xerophytic populations. There are reports of *Marsilea* populations which exhibit great variation in the length, thickness and branching of rhizomes, the number of roots formed at the node and internode, the thickness and height of the petiole and

the margin of leaflets under aquatic and terrestrial conditions (Lin et al. 2007)

### V. CONCLUSION

Severity of the threat to pteridophytic flora of Kota Rajasthan India is demanded to conserve this species. This plastic genus *Marsilea* which is well known for its adaptive capabilities of growing on land as well as in aquatic habitats. Anatomical studies of ferns with special reference to the stellar system needs to be extensively investigated to understand this beauty of nature.

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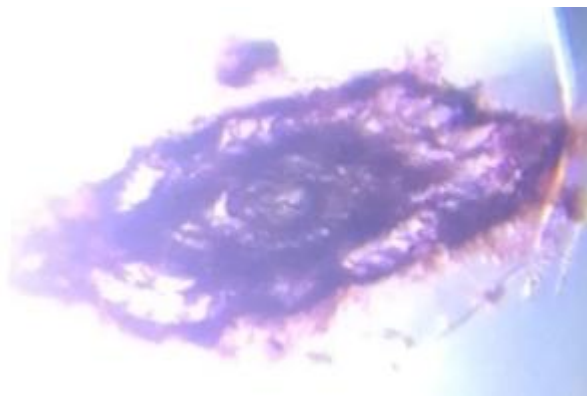
**Fig2** four leaflet



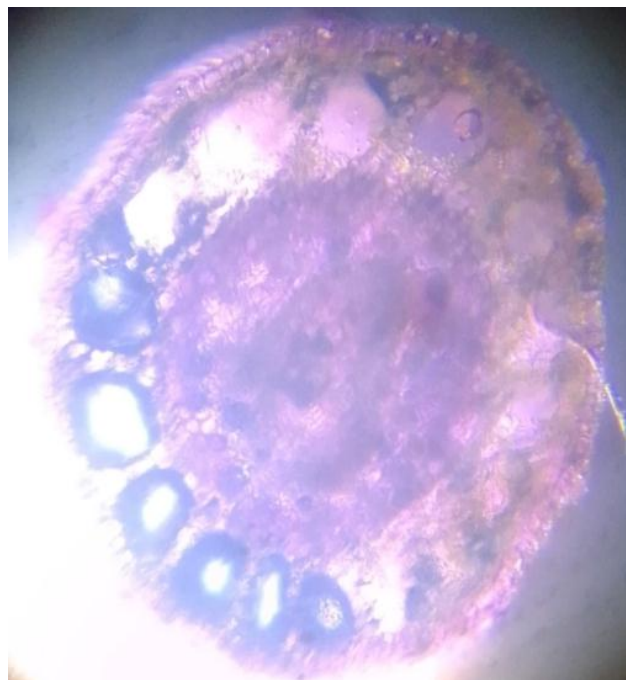
**Fig 1** external morphology of *Marsilea minuta*



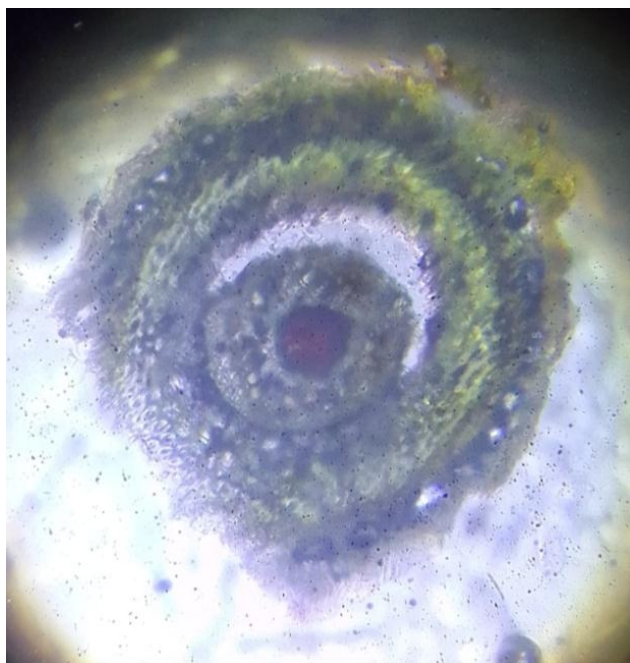
**Fig 3** *Marsilea* sporocarp



**fig 6**Marsilea minuta root TS



**Fig 4** TS of petiole



**fig 5** Marsilea minuta rhizome TS