ANATOMICAL STUDIES OF SOME MEDICINAL PLANTS OF FAMILY POLYGONACEAE

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Abstract

Anatomical studies of the 6 different species of family Polygonacea viz., Rumex hastatus D. Don, Rumex dentatus Linn, Rumex nepalensis Spreng, Rheum austral D. Don, Polygonum plebejum R. Br and Persicaria maculosa S.F. Gay are presented. The study is based on the presence and absence of epidermis, parenchyma, collenchyma, sclerenchyma, endodermis, pericycle, xylem, phloem, pith, mesophyll cells and stone cells.

Introduction

The medicinal plants have been used by Hakims and in folklore medicines as 80% of the population lives in rural areas that mostly depend on Unani system of medicines (Soomro et al., 1997). The available literature shows that leaf epidermal features are important in systematic botany similar to the use of modern techniques and chemical composition (Edeoga & Ikem, 2001; Mbagwu & Edeoga, 2006). Epidermal structures and stomatal ontogeny of some Nigerian ferns have been found relevant in their recognition (Gill & Karatela, 1985). Olowokwudejo (1990) compared the morphology of the leaf epidermis in Annona and suggested the utilization of this character in the identification of the species. Many workers such as Edeoga (1991), Edeoga & Osawe (1996), Mbagwu & Edeoga (2006), Nwachukwu & Mbagwu (2006) stressed that epidermal and cuticular traits of plants epidermal cells, type and arrangement of stomata, size and shape of trichomes and number of vascular bundles could serve as vital tools in solving taxonomic problems in Angiosperms. Budel et al., (2007) reported chlorenchyma, sclerenchyma, vascular system and cells in Homalocladium platycladum. Yasmin et al., (2009) reported that epidermal cell shapes are variable but generally polygonal among the Aconogonon and Bistorta. Ayodele & Olowokudejo (2006) made comparative studies on the leaf epidermal features of different species of Family Polygonaceae and reported variation in various characters among species. Zhao et al., (2006) observed alterations in leaf trichomes, stomatal characteristics and epidermal cellular features of rhubarb (Rheum rhaponticum L.). As no such information is available on the anatomy of these 6 species of Polygonaceae therefore the present study was conducted to see the various anatomical features. The study would help in the identification and authentification of these medicinal plants on the basis of anatomy.

Materials and Methods

Fresh specimens of Rumex hastatus D. Don, Rumex dentatus Lin, Rumex nepalensis Spreng, Persicaria maculosa S.F. Gay and Polygonum plebejum R.Br were collected from University of Peshawar and Rheum austral D. Don from Gram Chashma (Chitral)
During March-November 2005. They were identified with the help of Flora of Pakistan (Ali & Qaiser, 2007). Free hand thin transverse sections were made from fresh materials and stained. Ten readings were taken by micrometer and minimum, maximum, mean and frequent values were determined by standard method following Puruis et al., (1966).

**Results and Discussion**

**a. Roots:** Epidermis in roots of *R. hastatus*, *R. nepalensis*, *R. australe* and *P. maculosa* was single layered. It was two layered in *R. dentatus* and *P. plebejum*. Length of the epidermal cells was maximum in *R. hastatus* and minimum in *P. maculosa*. Width of the epidermal cells was maximum in *R. dentatus* and minimum in *P. plebejum*. Khan et al., (2001) reported epidermal tissue, collenchyma and thicked walled parenchyma cells in *Asplenium dalhousiae*. The many layered parenchyma compactly packed in all the 6 species. It was polygonal shape in *R. nepalensis*, *R. australe* and *P. maculosa*; spherical in *R. dentatus*, *P. plebejum* and *R. hastatus*. Length of the parenchyma was maximum in *R. hastatus* and minimum in *P. maculosa*. Width of the parenchyma was maximum in *R. hastatus* and minimum in *P. plebejum*. Kanwal et al., (2006) reported similar study for epidermis, parenchyma, cortex, parenchymatous pith and xylem in *Pongamia pinnata*. Collenchyma was present in *P. maculosa* and *P. plebejum* but was absent in other species. It was spherical in both species. Mean length and width of the collenchyma in *P. plebejum* and *P. maculosa* was 78.5μ; 34.4μ and 27.3μ and 15.7μ, respectively. Sclerenchyma was present in *R. hastatus* and *R. australe* and was absent in other species. It was polygonal in *R. hastatus* and spherical in *R. australe*. These cells were few in number. Mean length and width of the cells in *R. hastatus* and *R. australe* was 149μ; 62.5μ and 107.5μ and 27.7μ, respectively. Endodermis was a single layered in *R. hastatus*, *R. nepalensis*, *R. australe* and *P. plebejum*. It was two layered in *R. dentatus* and *P. maculosa*. The cells were elongated in *R. hastatus* and *P. plebejum*; oval in *R. dentatus*, *R. nepalensis* and spherical in *R. australe* and *P. maculosa*. Length of the cell was maximum in *R. hastatus* and minimum in *P. maculosa*. Width of the cells was maximum in *R. hastatus* and was minimum in *P. maculosa*. Pericycle was a single layered in *R. dentatus*, *R. nepalensis* having spherical, in *R. australe* and *P. plebejum* oval. It is absent in *R. hastatus* and *P. maculosa*. Length of the cell was maximum in *R. nepalensis* and minimum in *R. australe*. Width of the cell was maximum in *R. nepalensis* and minimum in *P. maculosa*. Xylem was oval in shape except *P. plebejum* in which it was spherical in shape. Length of the cell was maximum in *R. hastatus* and minimum in *P. maculosa*. Width of the cell was maximum in *R. hastatus* and minimum in *P. maculosa*. Phloem was elongated in *R. hastatus*; oval in *R. dentatus* and *P. plebejum* and spherical in *R. nepalensis*, *R. australe*, *P. maculosa*. Length of the cell was maximum in *R. hastatus* and minimum in *P. maculosa*. Width of the cell was maximum in *R. hastatus* and minimum in *P. maculosa*. Pith was absent in *R. hastatus*, *P. maculosa* and *P. plebejum*. It was spherical in *R. dentatus*, *R. nepalensis* and *R. australe*. Mean length and width of the cell in *R. dentatus*, *R. nepalensis* and *R. australe* was 94.5μ, 34.2μ and 83.5μ and 85.2μ, 17.7μ and 38.2μ, respectively. Stone cell was only present in *P. plebejum* and was absent in other plant species (Table 1).
b. Stem: Epidermis in stem of *R. hastatus*, *R. dentatus*, *R. nepalensis*, *R. australe* and *P. maculosa* was single layered and two layered in *P. plebejum*. The cells were spherical in *R. hastatus*, oval in *R. dentatus*, *R. nepalensis*, *R. australe* and *P. maculosa* and elongated in *P. plebejum*. Length of the cell was maximum in *R. dentatus* and minimum in *P. maculosa*. Width of the cell was maximum in *R. nepalensis* and minimum in *P. maculosa*. The many layered parenchyma was compactly packed in all species. It was polygonal in *R. hastatus*, *R. australe*, *R. dentatus* and *P. maculosa* and oval in *R. nepalensis* and *P. plebejum*. Length of the cell was maximum in *R. hastatus* and minimum in *R. nepalensis*. Width of the cell was maximum in *R. hastatus* and minimum in *P. maculosa*. Saeed & Khan (1996) reported parenchyma and epidermis in *Sonchus asper*. Collenchyma was present only in *R. hastatus* and *R. dentatus* and *R. nepalensis*. It was spherical in shape. Mean length and width of the cell in *R. hastatus*, *R. dentatus* and *R. nepalensis* was 128.5μ, 115.5μ and 129μ and 74.5μ, 39.8μ and 68.2μ, respectively. Sclerenchyma was present only in *R. australe*, *P. maculosa* and *P. plebejum*. It was spherical in shape. Mean lengths of the cells in *R. australe*, *P. plebejum* and *P. maculosa* was 106μ, 136.4μ and 97μ and mean widths of the cells were 44.7μ, 64μ and 55.4μ, respectively. Single layered endosperm is present in *R. hastatus*, *R. dentatus*, *R. nepalensis*, *P. maculosa* and *P. plebejum* and was absent in *R. australe*. The cells were elongated in *P. plebejum* and oval in *R. dentatus*, *R. nepalensis* and *R. hastatus*. Pericycle was a single layered in all six specimens and was spherical in *R. nepalensis*, *R. australe* and *P. maculosa* and oval in *R. hastatus*, *R. dentatus* and *P. plebejum*. Length of the cell was maximum in *R. hastatus* and minimum in *P. plebejum*. Width of the cell was maximum in *R. nepalensis* and minimum in *P. plebejum*. Xylem was except *P. plebejum* in which it was spherical. Length of the cell was maximum in *R. hastatus* and minimum in *P. plebejum*. Width of the cell was maximum in *P. maculosa* and minimum in *P. plebejum*. Phloem was elongated in *R. hastatus*, *R. dentatus* and *P. plebejum* and spherical in *R. nepalensis*, *R. australe*, *P. maculosa*. Length of the cell was maximum in *R. hastatus* and minimum in *R. dentatus*. Width of the cell was maximum in *R. australe* and minimum in *P. maculosa*. Pith was absent in *R. hastatus* and *R. dentatus*. It was spherical in *R. nepalensis*, *R. australe*, *P. maculosa* and *P. plebejum*. Mean length and width of the cell in *R. nepalensis*, *R. australe*, *P. maculosa* and *P. plebejum* was 52.1μ, 89μ, 70.7μ and 45μ and 16.9μ, 36.2μ, 28.4μ and 12.3μ, respectively. Stone cell was only present in *P. plebejum* and was absent in other stems (Table 2). Metcalfe & Chalk (1957) reported stone cells in *P. plebejum*, which agree with the present study.

c. Petiole: Petiole was absent in *P. plebejum*. Epidermis in stem of *R. hastatus* was two layered and single layered in *R. dentatus*, *R. nepalensis*, *R. australe* and *P. maculosa*. The cells were oval. Length of the cell was maximum in *P. maculosa* and minimum in *R. dentatus*. Parenchyma in all species was compactly packed. It was polygonal in *R. hastatus*, *R. dentatus*, *R. australe* and *P. maculosa* and spherical in *R. nepalensis*. Length of the cell was maximum in *R. australe* and minimum in *R. hastatus*. Collenchyma was present in *R. hastatus* and *R. dentatus*, *R. nepalensis* and was absent in *P. maculosa* and *R. australe*. It was spherical in shape. Mean length and width of the cell in *R. hastatus*, *R. dentatus* and *R. nepalensis* was 27.7μ, 23.7μ and 50.1μ and 11.7μ, 11.3μ and 23.9μ,
respectively. Sclerenchyma was present in only *R. australe* and *P. maculosa*. Endodermis was two layered in *R. hastatus* and was single layered in *R. dentatus*, *R. nepalensis* and *P. maculosa*. The cells were oval in *R. dentatus*, *R. nepalensis* and *R. hastatus* and spherical in *P. maculosa*. It was absent in *R. australe*. Pericycle was a single layered in all specimens and was spherical in *R. nepalensis*, *R. hastatus* and *P. maculosa* and oval in shape in *R. australe* and *R. dentatus*. Length of the cell was maximum in *P. maculosa* and minimum in *R. dentatus*. Width of the cell was maximum in *R. australe* and minimum in *R. dentatus*. Xylem was oval in shape except *R. australe* in which it was spherical. Length of the cell was maximum in *P. maculosa* and minimum in *R. hastatus*. Width of the cell was maximum in *R. hastatus* and minimum in *R. nepalensis*. Phloem was spherical in *R. hastatus*, *R. dentatus* and *R. nepalensis* and *P. maculosa* and oval in *R. australe*. Length of the cell was maximum in *R. australe* and minimum in *R. hastatus*. Width of the cell was maximum in *R. australe* and minimum in *R. hastatus*. Pith was absent in *R. dentatus* and *R. hastatus*. It was spherical in shape in *R. nepalensis*, *P. persicaria* and *R. nepalensis*.

d. Leaf: In leaves epidermis was single layered in all six leaves. The cells were spherical in *R. nepalensis* and *P. maculosa* and elongated in *R. hastatus*, *R. dentatus*, *R. australe* and *P. plebejum*. Length of the cell was maximum in *R. dentatus* and minimum in *R. hastatus*. Width of the cell was maximum in *R. dentatus* and minimum in *R. hastatus*. Mesophyll was elongated. Length of the cell was maximum in *P. plebejum* and minimum in *P. maculosa*. Width of the cell was maximum in *R. australe* and minimum in *R. hastatus*. Pereira et al., (1997) reported that the leaflet blade consisted of the unicellular upper epidermis and lower epidermis-enclosing palisade and spongy mesophyll in *Pueraria phaseoloides*. Collenchyma was present only in *R. hastatus* and *P. plebejum*. Sclerenchyma was present only in *R. australe*, *P. plebejum* and *P. maculosa* and was oval in shape. Endodermis was single layered in *R. hastatus*, *R. dentatus*, *R. nepalensis* and *P. maculosa*. It was absent in *R. australe* and *P. plebejum*. Pericycle was oval and single layered in *R. hastatus*, *R. dentatus*, *R. nepalensis*, *R. australe* and *P. maculosa*. It was absent in *P. plebejum*. Xylem was oval in *R. hastatus*, *R. nepalensis* and *P. maculosa* and spherical in *R. dentatus*, *R. australe* and *P. plebejum*. Length of the cell was maximum in *R. hastatus* and minimum in *R. australe*. Width of the cell was maximum in *R. nepalensis* and minimum in *R. australe*. Phloem was spherical in *R. hastatus*, *R. nepalensis*, *P. maculosa* and oval in *R. dentatus*, *R. australe* and *P. plebejum*. Length of the cell was maximum in *R. dentatus* and minimum in *R. australe*. Width of the cell was maximum in *R. nepalensis* and minimum in *R. australe*. Pith was absent from *R. hastatus* and *R. nepalensis* and was present *R. dentatus*, *R. australe*, *P. maculosa* and *P. plebejum*. Mean length and width of the cell in *R. dentatus*, *R. australe*, *P. maculosa* and *P. plebejum* were 41.5μ, 53.3μ, 49.2μ and 59.5μ and 22.3μ, 17.1μ, 20.7μ and 14.3μ, respectively. Metcalfe & Chalk (1957) reported the stem and leaf anatomy of the family Polygonaceae.
Table 1. Microscopical measurement (μm) of the roots of the various species of Polygonaceae.

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Table 2. Microscopical measurement (μm) of the stems of the various species of Polygonaceae.

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ISHFAQ HAMEED ET AL.
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<td>121.5 22.6</td>
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</tbody>
</table>

M = Maximum, m = minimum, * = Mean, ** = Frequent value.
10 readings were taken for each cell length and width.
References


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