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Leaf architecture in Tamaricaceae

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Abstract. The leaf architectural pattern in 6 species of *Tamarix* and two species of *Myricaria* has been investigated. The leaves are simple, alternate and sessile. In *Tamarix aphylla*, *Tamarix dioica*, *Tamarix gracilis* and *Tamarix troupii* the leaves are completely or partially sheathing. In these species only the primary vein is distinguishable, the secondaries and the further orders of venation being not distinguishable from one another. In the other two species of *Tamarix* and in *Myricaria* the major venation pattern is pinnate-camptodromous type. The intercostal venation is of random reticulate type, and the marginal ultimate venation is incomplete. The areoles are polygonal to irregular in outline and randomly oriented. They may contain one or more veinlets or none. There is no direct correlation between the size of an areole and the number of vein endings. Hence, these characters cannot be said to be taxonomically significant as far as the species of *Tamarix* and *Myricaria* are concerned.

Keywords. Leaf architecture; Tamaricaceae.

1. Introduction

The use of leaf architectural patterns has been studied in many families so far. It is gaining significance in phylogeny and classification of angiosperms. Recently these characters have been successfully used by several workers in diagonosis of fossil as well as living material (see Dilcher 1974). Hickey (1973) presented a classification of the architecture of dicotyledonous leaves opening a new venue of taxonomic and morphological studies. In the family Tamaricaceae, the leaves are very small and scaly in nature, as majority of the members are xerophytic.

2. Materials and methods

The materials of *Tamarix aphylla* Karst., *T. dioica* Roxb. and *T. troupii* Hole were collected from Mathura and Ghaziabad districts, while those of *T. gracilis* Willd., *T. ramosissima* Ledeb., *T. smyrnensis* Bge and *Myricaria alopecuroides* Schrenk were sent from Moscow by Dr T Pullaiah. The material of *Myricaria germanica* Desv. was obtained from Prof. H Merker of Sweden.

For studying venation pattern the leaves were washed with water and kept in 10% KOH at 50–60°C in oven till the leaf got decoloured. Then the leaves were thoroughly washed with water and were transferred to saturated solution of chloral hydrate (prepared in 20–40 volume in hydrogen peroxide) till the leaves became transparent. Cleared leaves were stained in 1% basic fuchsin solution prepared in 90% ethanol and were mounted in Canada balsam.

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3. Results

3.1 *Gross morphology*

The terminology followed here is after Hickey (1973) with certain modifications.

The leaves are simple, alternate and sessile. They are completely sheathing in *T. aphylla* and *T. dioica* and partially sheathing in *T. gracilis* and *T. troupii*.

The lamina is symmetrical in all the species examined. The shape of leaf is ovate in *T. aphylla*, *T. dioica*, *T. troupii* and *M. germanica*; narrow ovate in *T. gracilis*; linear-lanceolate in *T. smyrnensis* and oblong in *M. alopecuroides*. The apex is acute in *T. gracilis*, *T. ramosissima* and *T. smyrnensis*, acuminate in *T. aphylla*, *T. dioica* and *T. troupii* and obtuse in *M. alopecuroides* and *M. germanica*. The margin is entire in all the species examined. Salt glands are frequently present on both the surfaces of lamina.

3.2 *Venation pattern*

The venation is unicostate reticulate type. In *T. aphylla*, *T. dioica*, *T. gracilis* and *T. troupii*, only primary veins could be distinguished, the secondaries and the further order of veins are not distinguishable from one another (figure 1D, E). In the other species of *Tamarix* and *Myricaria* examined, the major venation pattern is pinnate-camptodromous type i.e. the secondary veins do not terminate at the margin (Hickey 1973).

There is a single primary vein (mid-vein) which runs straight upto the apex in all the species studied.

The veins of the second order in *T. ramosissima*, *T. smyrnensis*, *Myricaria alopecuroides* and *M. germanica* arise alternately on both the sides of the primary vein (figure 1A, B, C, F). The secondaries are straight at basal region and recurved at the apical region (figure 1B, C, F). The intersecondary veins could not be distinguished.

The next finer branches of the secondary veins and branches of equal thickness arising from primary, vein are the tertiary veins. The angle of divergence of tertiaries varies irregularly. They freely remify towards the margin and anastomose with other tertiary veins at various angles forming random reticulate pattern (figure 1A, B, C, F). Next higher vein orders could not be distinguished in any of the species examined.

The ultimate marginal venation is incomplete or imperfect (free veinlets endings are present directly adjacent to the margin) in all the species examined.

Areoles are of variable size and polygonal to irregular in outline and are randomly oriented. The frequency, distribution and size of the areole vary in different species or even within the same species. Areoles may contain one or more veinlets and may be without veinlets in the same species. The veinlets are completely absent in the areoles in *Tamarix dioica* and *T. troupii* (figure 1E). The veinlets may be simple (linear or curved) or branched.

The free vein endings are composed of simple tracheidal elements as in the species of *Myricaria* (figure 1G). In species of *Tamarix* the tracheidal elements may be dilated as storage tracheids (Esau 1965) or tracheidal idioblasts (Foster 1956). These tracheidal idioblasts may be solitary or in bunches (figure 1H, I). There is no

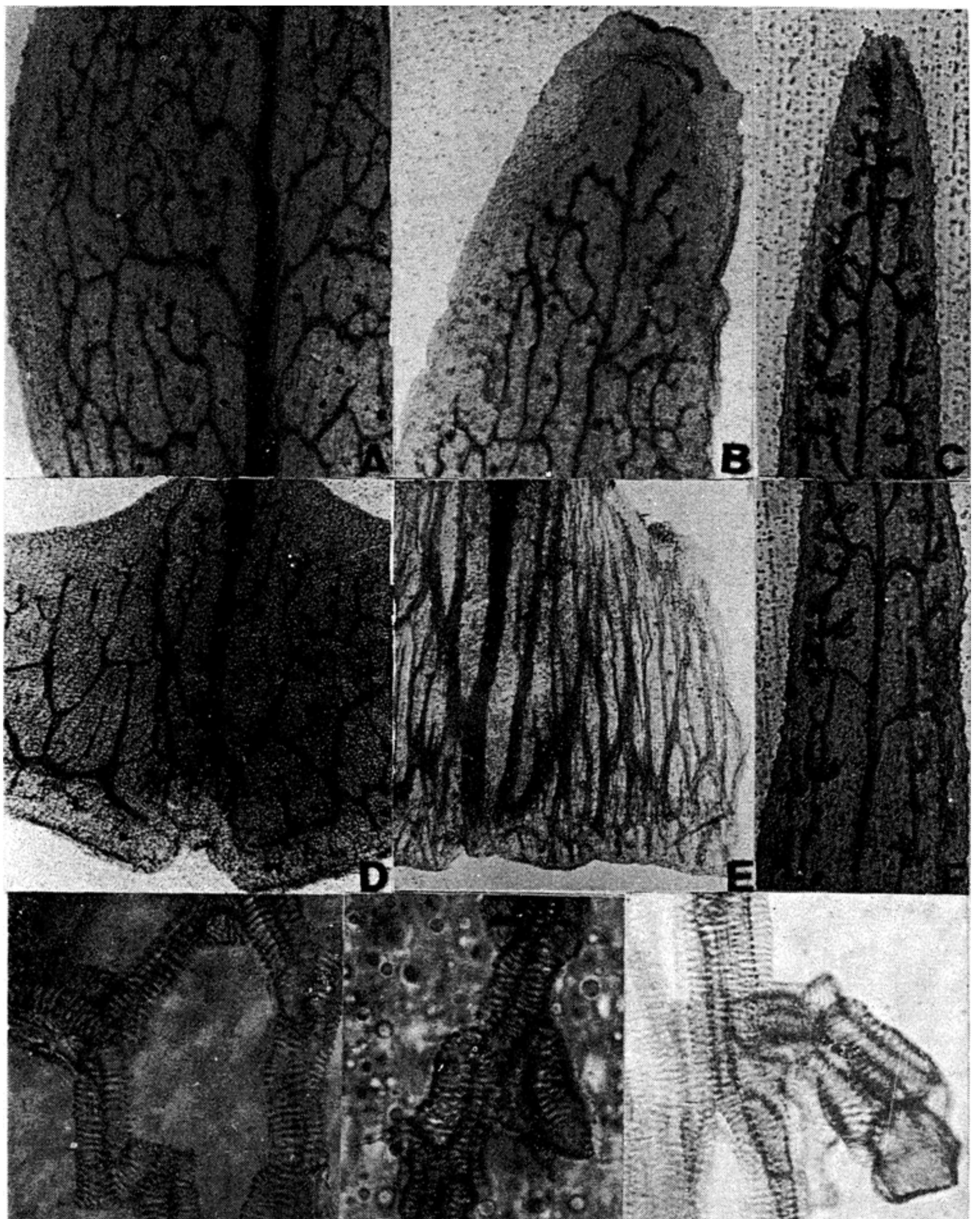

Figure 1. A–F. Portions of cleared leaves showing venation patterns (× 60). **A.** *M. germanica.* **B.** *M. alopecuroides* (apical portion). **C.** *T. smyrnensis* (apical portion). **D.** *T. aphylla.* **E.** *T. dioica.* **F.** *T. smyrnensis* (middle portion). **G.** Veinlet endings of *Myricaria germanica* (× 320). **H and I.** Tracheidal idioblasts of **(H)** *Tamarix aphylla* (× 320) and **(I)** *T. smyrnensis* (× 640).

correlation between the size of areole, the number of veins, veinlets and free vein endings. The thickening of tracheids are spiral or annular. A bundle sheath is absent in all the species examined.

4. Discussion

The present investigations show that the size of areoles, the number of vein ending in each areole and structure of vein endings differ not only in different leaves but in different parts of the same leaf. Further, no direct correlation has been observed between the size of areole and the number of vein endings. Therefore, these characters cannot be said to be taxonomically significant, as far as the species of *Tamarix* and *Myricaria* are concerned.

Tracheidal idioblasts have been found either singly or in bunches in *T. aphylla*, *T. gracilis*, *T. smyrnensis* and *T. ramosissima*. These idioblasts are generally attributed to a function of protection and water storage associated with xeromorphism. Their occurrence has been considered to be taxonomically useful by investigators. Varghese (1966) stated that in *Pedicularis* and *Euphorbia* the number of tracheidal idioblasts increased with increase in xerophytic conditions. Kakkar and Paliwal (1972) from their studies on *Euphorbia* species concluded that the occurrence of these elements and xeromorphism are interlinked. The present observation also supports these conclusions.

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