Studies on the developmental anatomy of Umbellifers. II. Stem-node-leaf continuum

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Abstract. The node in 7 species of Umbellifers is multilacunar multitrace. The number of traces increases from the lower foliar nodes reaching a maximum at the node bearing the largest foliage leaf, and then decreases gradually till the node bearing the inflorescence, which is trilacunar three trace. The vasculature of the primary rachis has many traces which anastomose to form a diaphragm at the ‘node’ where secondary rachii arise. From the diaphragm three traces go to the next distal ‘internode’ of the primary rachis but become five due to division of the lateral traces.

Keywords. Multilacunar multitrace; diaphragm; continuum; umbellifers.

1. Introduction

In a previous paper the seedling anatomy of some members was described (Pillai and Kumar 1980). In this paper the stem-node-leaf continuum is described, the importance of which has been emphasized by Howard (1974) and Neubauer (1979). Haeckus (1954) has drawn attention to some monocotyledonous characters exhibited by some Umbellifers and this has an added interest in the study.

2. Material and methods

Materials of the following species were collected from plants grown in the botanical garden:

- *Ammi majus* Linn.
- *Anethum sowa* Linn.
- *Carum copticum* Benth.
- *Coriandrum sativum* L.
- *Cuminum cyminum* L.
- *Foeniculum vulgare* Gaertn.
- *Pimpinella monoica* Wall.

They were fixed in formalin-acetic acid-alcohol, processed through the ethanol-xylol series and embedded in paraffin. 7-12 μm thick sections were stained with safranin and light green. All nodes from the first foliar node to the one at the top of individual plants were studied. Whole materials were also cleared and stained with basic fuchsin for gross study of vasculature.
3. Observations

3.1 External morphology of the leaves

The leaves are highly compound, with a highly dissected lamina, the ultimate leaflets having about 1 to 1 1/2 mm width in many cases. The leaves have sheathing bases, a characteristic of monocotyledons. In some plants like Coriandrum the youngest leaves differ from the mature ones, the former having broader lamina.

3.2 Vasculature of the stem

A transection of the internode shows a number of vascular bundles arranged in a ring with fairly broad medullary rays, the typical herbaceous dicotyledonous structure (figure 1A).

3.3 Vasculature of the node

As the course of vascular bundles is traced from the internode to the node above, an odd number of vascular bundles, usually 3 to 11, bend out into the cortex and enter the base of the leaf sheath (table 1). Each trace leaves by a separate gap. So, the node is multilacunar multitrace, a condition common in monocotyledons. If the vascular bundles are traced from the leaf into the stem, the median trace and a few traces immediately lateral to it proceed directly down the internode after reaching the vascular cylinder of the stem. Only a few of the lateral traces fuse with other bundles in the stem. Thus the number of vascular bundles in the stem is kept constant, unlike in monocotyledons where the number is unlimited.

The number of traces at the node differs from plant to plant as also from one node to another of the same plant. At the lower foliar nodes the number is less, 3 in Cuminum, 5 in Anethum, Coriandrum, Pimpinella and Foeniculum, 7 in Ammi and 9 in Carum (table 1). The number of traces increases from the base distally, reaching 11 in Foeniculum and Ammi (figure 1). The maximum number of traces occurs at the nodes which bear the biggest foliage leaf. In all the plants examined, at still higher nodes the number of traces gradually decreases and reaches the trilacunar condition in the node where the inflorescence arises (figure 5 A-C).

Table I. The number of traces at successive nodes of individual plants.

<table>
<thead>
<tr>
<th>Species</th>
<th>Foliar nodes</th>
<th>Floral nodes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 5 6 7</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Anethum sowa Linn.</td>
<td>5 7 8 9 7</td>
<td>5 3 3</td>
</tr>
<tr>
<td>Coriandrum sativum L.</td>
<td>5 7 6 5 5</td>
<td>5 3 3</td>
</tr>
<tr>
<td>Carum copticum Benth.</td>
<td>8 7 7 8 9 7</td>
<td>7 5 5 3 3</td>
</tr>
<tr>
<td>Cuminum cyminum L.</td>
<td>3 5 5 5</td>
<td>5 3 3</td>
</tr>
<tr>
<td>Pimpinella monoica Wall.</td>
<td>5 5 5 7 7 9 9</td>
<td>7 7 5 5 3</td>
</tr>
<tr>
<td>Foeniculum vulgare Gaertn.</td>
<td>5 7 7 7 7 9 11</td>
<td>7 5 5 3</td>
</tr>
<tr>
<td>Ammi majus Linn.</td>
<td>7 7 9 9 9 11</td>
<td>7 5 5 3 3</td>
</tr>
</tbody>
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