A TAXONOMIC STUDY OF THE GENUS MATONIA (MATONIACEAE)

MASAHIRO KATO
Botanical Gardens, Faculty of Science, University of Tokyo, 3-7-1 Hakusan, Tokyo 112, Japan

SUMMARY

A morphological comparison shows that Matonia consists of two species, M. foxworthyi and M. pectinata, which are distinguished by a few characters including the number of pinnae and the presence/absence of hairs on the costae.

INTRODUCTION

Matonia is a small genus which together with Phanerosorus, with two species (Kato & Iwatsuki, 1985), constitutes the phylogenetically and systematically isolated family Matoniaceae (Andrews & Boureau, 1970; Kramer, 1990). A few species have been described under Matonia. Matonia pectinata was first described from the Malay Peninsula by R. Brown (Wallich, 1829) who established the genus Matonia. Matonia sarmentosa was a second species, described by Baker (1887) and later transferred to the genus Phanerosorus by Copeland (1908). Matonia foxworthyi was described from Sarawak by Copeland (1908). Matonia differs distinctly from Phanerosorus in its pedate leaves with a central pinna.

The species taxonomy of Matonia is not settled. Christensen & Holttum (1934) and Kramer (1990) doubted distinctness of M. pectinata and M. foxworthyi, and Parris et al. (1992) combined the two species into M. pectinata. Copeland (1908), Holttum (1968) and Tan & Tolentino (1987) regarded them as independent species. The differences in these treatments are due to different evaluation of whether the variation of diagnostic characters is continuous or discontinuous between the species (Christensen & Holttum, 1934). The most disputed character is the shape of pinna-segments: they are falcate in M. pectinata and only weakly so in M. foxworthyi. In an attempt to revise the taxonomy of Matonia, the author tested in the present study whether the two species are morphologically separable or not.

MATERIALS AND METHODS

The following 16 characters were measured using herbarium specimens: the thickness (excluding hairs) of the rhizomes, the length of the internodes, the length of the petioles, the thickness of the basal portion of the petioles, the length and width of the lamina, the number of pinnae (Fig. 1), the length and width of the central pinna, the distance between two adjacent costules, the projected length of pinna-segments on
the costa (A in Fig. 1) and that on the axis perpendicular to it (B), the width of the inter-segmental lamina (C), the diameter of the indusium, the width of the membranous indusial margin, and the number of indurated annulus cells of sporangia. The length of the pinna-segments relative to the width of the inter-segmental lamina (B/C) and the ratio of the two projected lengths of the pinna-segments (B/A) were evaluated based on these data. Spore size was also measured in two fully fertile specimens available of each species. Besides, the presence or absence of hairs on the costae was ex-

Fig. 2. Comparison of the three characters of *Matonia foxworthyi* vs. *M. pectinata*. Mean values, SD, maximum and minimum values are shown. 1: Number of pinnae. 2: Relative length of pinna-segments to width of inter-segmental lamina. 3: Ratio of projected lengths of pinna-segments. F, *Matonia foxworthyi*; P, *M. pectinata*. Data based on Table 1.
The measurements are based on specimens kept in the following herbaria, B, BM, BO, GH, K, KYO, L, MICH, NY, P, SING, TI, U, UC, US, and Z.

Dried spores were coated with gold and observed in a scanning electron microscope (SEM) ABT-55 (14 kV).

RESULTS AND DISCUSSION

The results of measurements of the 18 characters are shown in Table 1. Although in 15 of the characters examined there are no apparent differences between M. pectinata and M. foxworthyi, significant differences (t-test, p < 0.001) are found in the
remaining three characters: the number of pinnae, the length of the pinna-segments relative to the width of the inter-segmental lamina and the ratio of the two projected lengths of the pinna-segments (Fig. 2). The present statistically tested data indicating that the pinnules of *M. pectinata* are more falcately oblique than those of *M. foxworthyi* accord with previous conclusions by Copeland (1909) and Tan & Tolentino (1987).

Another noteworthy character is the crisped, brown, multicellular hairs on the abaxial side of the costae. The hairs are usually present in *M. foxworthyi*, whereas they are lacking in *M. pectinata*. Rarely the old leaves of *M. foxworthyi* are glabrous and the young leaves of *M. pectinata* are hairy. The costal hairs of *M. foxworthyi* are an overlooked, taxonomically useful character (Tan & Tolentino, 1987).

The number of sporangia is 5–10 in one layer in each sorus in both species. The spores are 53 ± 4 μm in diameter in *M. pectinata* (N = 64, 2 plants) and 61 ± 5 μm in *M. foxworthyi* (N = 61, 2 plants). There appears to be a difference in spore size between the species, although a statistic comparison based on ample plants is needed. In both species the spores are tetrahedral and trilette, the three proximal facets being depressed and the distal one convex (Fig. 3), as described by Tryon & Lugardon (1991) for *M. pectinata*. The surface has granulate deposits, which are only slightly denser in *M. foxworthyi* than in *M. pectinata*.

These comparisons indicate that *M. pectinata* and *M. foxworthyi* are morphologically distinct from each other in a few characters, although the species are very similar in overall characters. Based on this evidence it is concluded that the two species are taxonomically distinct.

As described below, *M. pectinata* is distributed in the Malay Peninsula and Sumatra, while *M. foxworthyi* ranges from Borneo and the Philippines to the Moluccas and New Guinea. The distribution pattern suggests a geographical speciation in West Malesia. The range of *Matonia* is similar to that of *Phanerosorus* *Phanerosorus sarmientosus* (Baker) Copel. occurs in West Malesia (Sarawak), while *P. major* Diels is distributed in East Malesia (Moluccas and New Guinea) (Kato & Iwatsuki, 1985), and thus the vicariance is in accord with the general floristic demarcation of Malesia (Van Steenis, 1950). The present range of Matoniaceae is a consequence of contraction from the much wider past range: Malesia is probably a refugium for this relict family. The fossils are known from scattered places in the Northern Hemisphere during the Upper Triassic and the Upper Cretaceous (Andrews & Boureau, 1970). The megafossils resemble *Matonia*.

**KEY TO THE SPECIES**

1a. Number of pinnae 15 or less, rarely up to 17; pinna-segments subpatent or oblique, straight or only moderately falcate; costae usually hairy beneath

1. *M. foxworthyi*

b. Number of pinnae 19 or more, rarely fewer in extremely small leaves; pinna-segments usually strongly oblique and falcate; costae glabrous beneath at maturity ................................................. 2. *M. pectinata*
Table 1. Comparison of 18 characters between *Matonia foxworthyi* and *M. pectinata*.

<table>
<thead>
<tr>
<th>Character</th>
<th><em>M. foxworthyi</em></th>
<th><em>M. pectinata</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean ± SD</td>
</tr>
<tr>
<td>Rhizome thickness (mm)</td>
<td>30</td>
<td>5.8 ± 1.4</td>
</tr>
<tr>
<td>Internode length (cm)</td>
<td>25</td>
<td>3.0 ± 0.7</td>
</tr>
<tr>
<td>Petiole length (cm)</td>
<td>34</td>
<td>85.2 ± 35.9</td>
</tr>
<tr>
<td>Petiole thickness (mm)</td>
<td>44</td>
<td>4.6 ± 1.4</td>
</tr>
<tr>
<td>Lamina length (cm)</td>
<td>78</td>
<td>35.4 ± 8.4</td>
</tr>
<tr>
<td>Lamina width (cm)</td>
<td>67</td>
<td>40.6 ± 9.5</td>
</tr>
<tr>
<td>Number of pinnae</td>
<td>83</td>
<td>12.7 ± 2.0*</td>
</tr>
<tr>
<td>Length of central pinna (cm)</td>
<td>78</td>
<td>35.3 ± 8.4</td>
</tr>
<tr>
<td>Width of central pinna (cm)</td>
<td>75</td>
<td>3.9 ± 1.2</td>
</tr>
<tr>
<td>Distance of costules (mm)</td>
<td>79</td>
<td>5.3 ± 0.8</td>
</tr>
<tr>
<td>Projected length of pinnules on costa (mm)</td>
<td>76</td>
<td>6.1 ± 2.6</td>
</tr>
<tr>
<td>Projected length of pinna-segments</td>
<td>76</td>
<td>19.8 ± 5.7</td>
</tr>
<tr>
<td>on axis perpendicular to costa (mm)</td>
<td>78</td>
<td>1.3 ± 0.3</td>
</tr>
<tr>
<td>Width of inter-segmental lamina (mm)</td>
<td>42</td>
<td>1.1 ± 0.1</td>
</tr>
<tr>
<td>Indusium diameter (mm)</td>
<td>39</td>
<td>0.37 ± 0.06</td>
</tr>
<tr>
<td>Width of membranous indusial margin (mm)</td>
<td>33</td>
<td>18.7 ± 2.5</td>
</tr>
<tr>
<td>Number of annulus cells</td>
<td>76</td>
<td>16.0 ± 5.4*</td>
</tr>
<tr>
<td>Relative length of pinna-segments to</td>
<td>76</td>
<td>3.6 ± 1.2*</td>
</tr>
<tr>
<td>width of inter-segmental lamina</td>
<td>76</td>
<td>16.0 ± 5.4*</td>
</tr>
<tr>
<td>Ratio of projected lengths of pinna-segments</td>
<td>76</td>
<td>3.6 ± 1.2*</td>
</tr>
</tbody>
</table>

*) Significantly different (t-test, p < 0.001).


Distribution — Borneo (Sarawak, Sabah, Kalimantan), Philippines (Mindoro, Sibuyan), Moluccas (Ambon), New Guinea (Irian Jaya). New Guinean specimens (Vogelkop Peninsula, *Van Royen & Sleumer 7204*, L; Arfak Mts, *Kanehira & Hatutima 14039*, BO) have small leaves with 11 pinnae and hairy costae. One specimen (anonymous collector, BM) was collected from Mt Ophir, Malay Peninsula, where many specimens of *M. pectinata* were collected; detailed field observations and new collections are required.

Habitat — In open places, often in clearings, and in and at edge of mossy forest on mountain ridges or summits; altitude (420-)750–2100 m.


Distribution – Malay Peninsula, Sumatra, Lingga Archipelago, Riau Archipelago. One specimen (*Lobb* 481, BM) was collected in Java but without indication of exact locality. The report from New Guinea (Tan & Tolentino, 1987) is perhaps due to misidentification.

Habitat – In exposed areas or in scrub on mountain ridges or summits; altitude (90–)750–2000 m.

ACKNOWLEDGEMENTS

I am grateful to Dr. H. Akiyama for his assistance with SEM examination, to Dr. K. Inoue for his assistance with statistics, and to the Directors of B, BM, BO, GH, K, KYO, L, MICH, NY, P, SING, U, UC, US, and Z for sending specimens on loan for my study. This study was supported in part by a Grant under the Monbusho International Scientific Research Program.

REFERENCES


Wallich, N. 1829. Plantae Asiaticae rariores. 1: t. 16.