Electronic Supplementary Material (ESI) for Analyst.

Supplementary Materials

Identification of traditional East Asian handmade papers through multivariate data analysis of pyrolysis-GC/MS data

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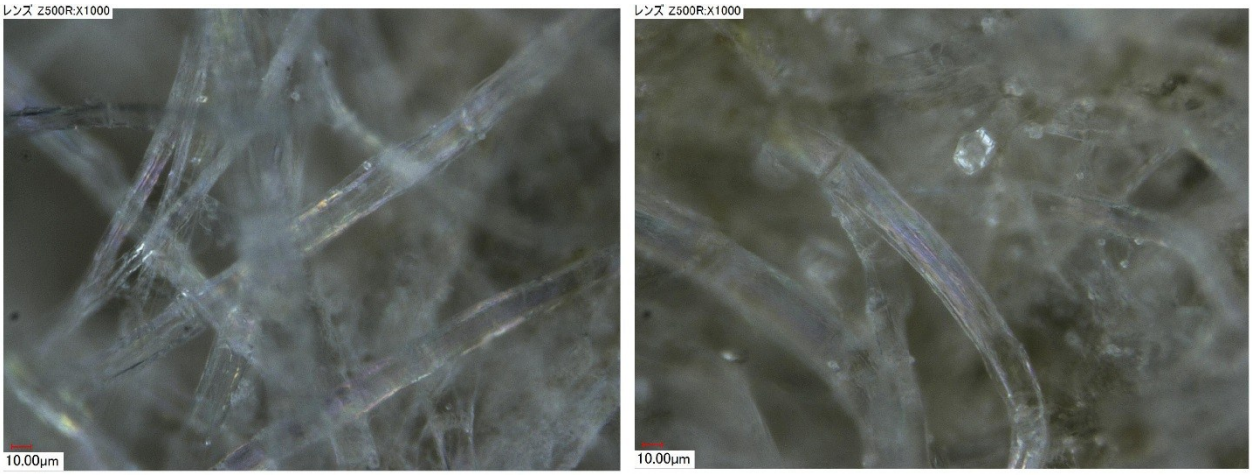
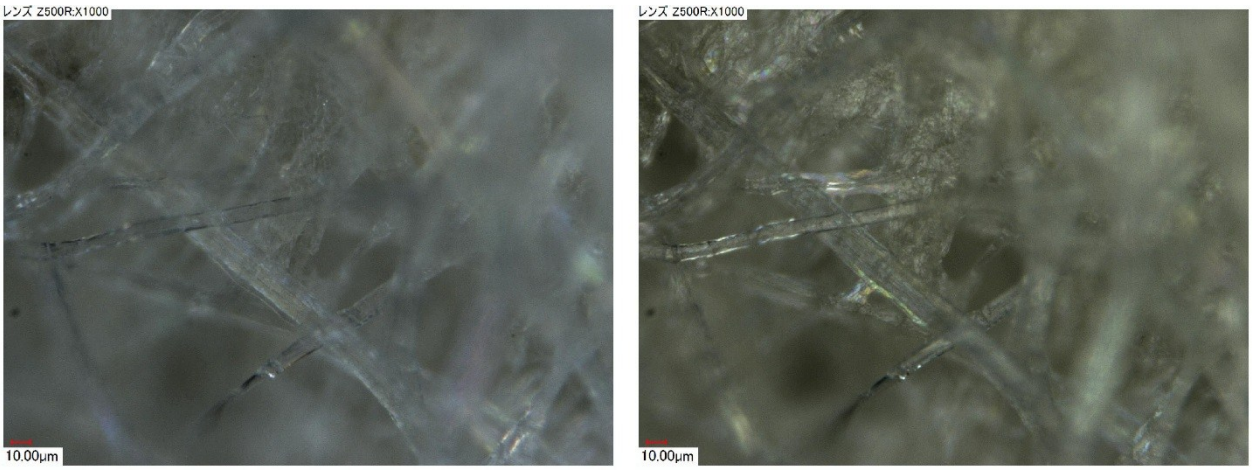
Figure S1. Morphological features of the investigated handmade paper fibers (S1-S6) under digital microscopic observation.

Sample S1



Sample S2



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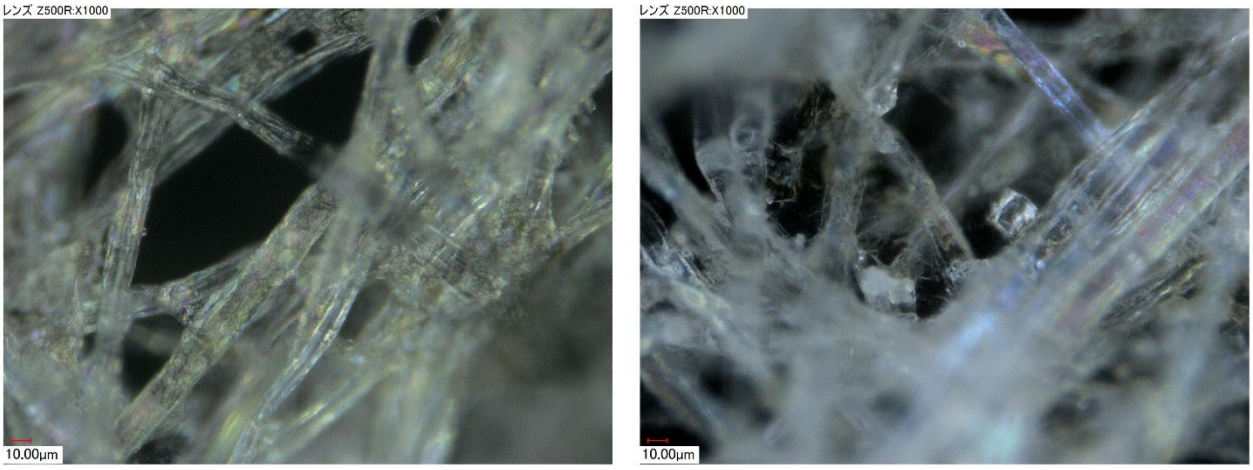

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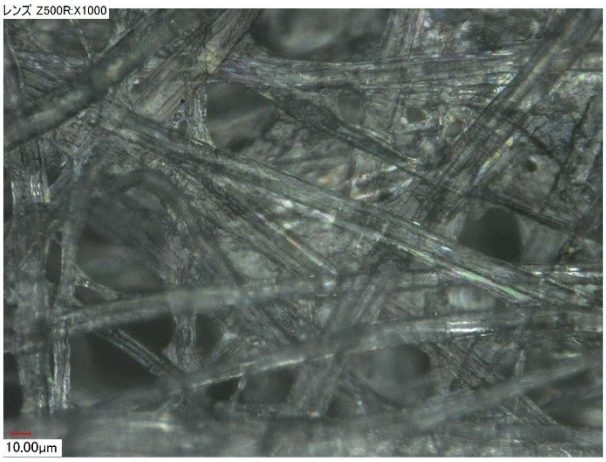
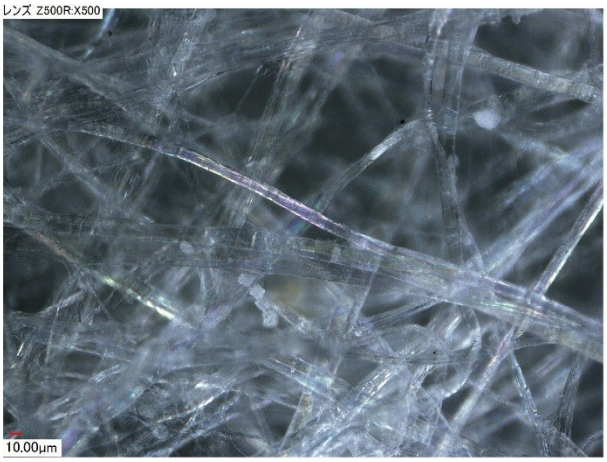
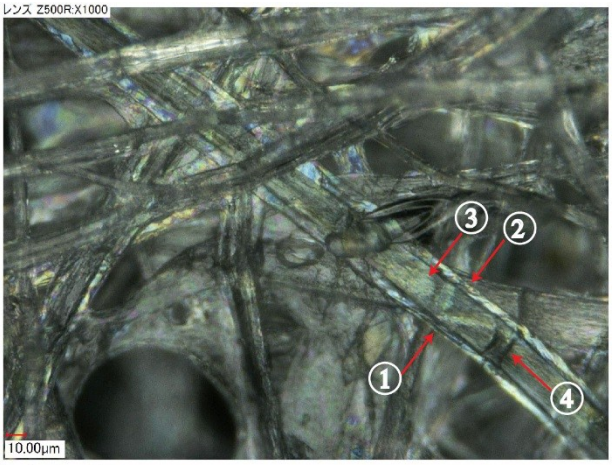
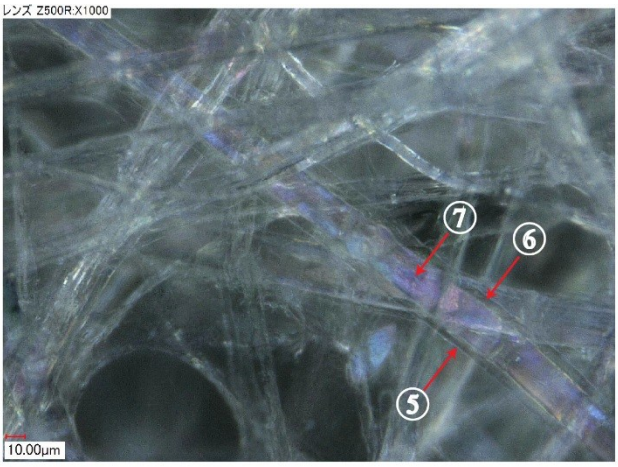
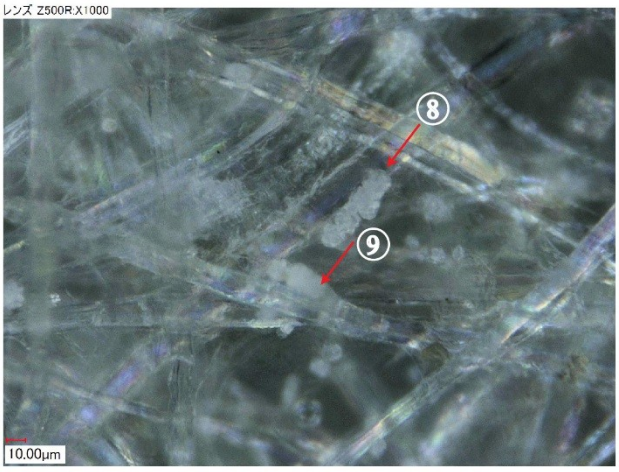


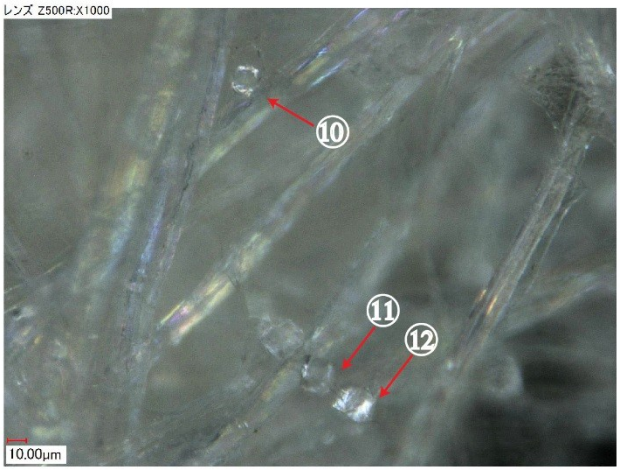


Sample S5

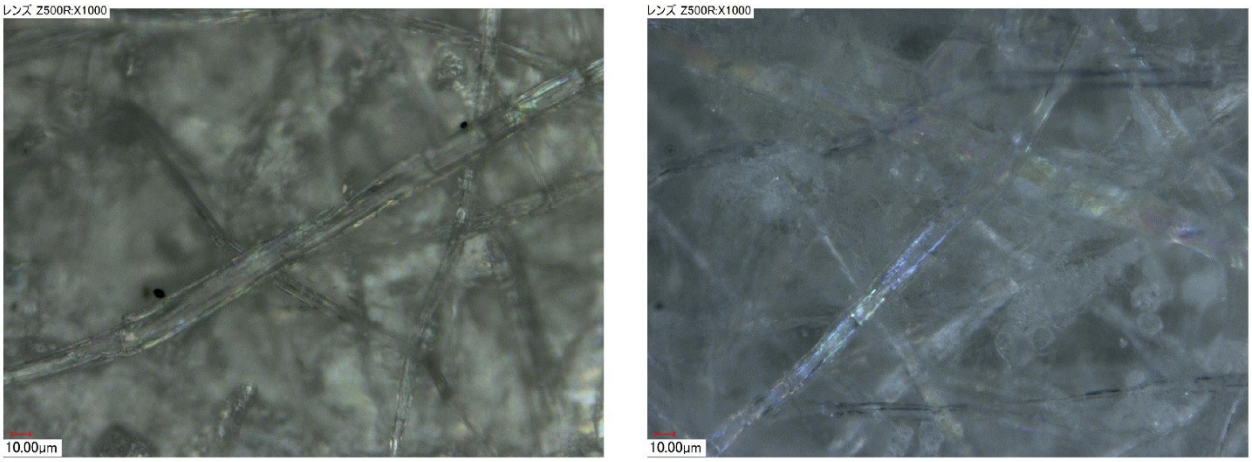








Sample S6



Short discussion of Fig.S1:

1. Test conditions

Microscopic analysis of Hanji samples were performed by a digital microscope (VHX-1000, Keyence, Japan). The samples were placed directly onto the microscope platform. For the fiber identification, the observation was conducted in reflection mode with halogen lamp as light source. Polarized light microscopy was utilized to identify the papermaking fibers under both Crossed Nicol and Open Nicol conditions.

2. The microscopic feature (the following is explained with the example of sample S5 in Fig.S1)

Under the direct microscopic observation, the paper mulberry fibers were characterized to be covered with a translucent membrane which usually appears to be polychromatic under Open Nicol conditions (point 1, 2 in Fig.S1) while appears to be transparent under Crossed Nicol conditions (point 5, 6 in Fig.S1). The fiber shows longitudinal striations, cross-markings (point 3 in Fig.S1) and dislocation (point 4 in Fig.S1) on the surface. The dislocation and wrinkles may visually fade away when the fiber takes on polychromatic colors under Open Nicol conditions (point 7 in Fig.S1).

Some cluster crystals (Calcium Oxalate) (point 8, 9 in Fig.S1) and cubic crystals (point 16-19 in Fig.S1) were also observed. They are more easily detected under Crossed Nicols conditions than under Open Nicol conditions. Many cubic and cluster crystals are frequently observed in handmade mulberry papers that constitute features for their identification when compared with other plant fibers.

The similar morphological features has been observed within S1 to S6: under the microscopic observation, each morphology of paper,i.e. fibre and crystal morphology, made from moraceae families has similer feature. It gives us difficulty of classification among them.

Figure S2. Score plot (A) and loading plot (B) resulting from the PCA treatment of peak areas as variables using variables weighting as 1/STD in the ROI from the EICs of the Ma group handmade paper samples showing the PC1 vs PC2. S11-S14 are corresponding to Table 1. In Figure 5B, the number before '- -' corresponding to the numbering in Table 2 and the number after '- -' represents the chosen EIC (m/z).

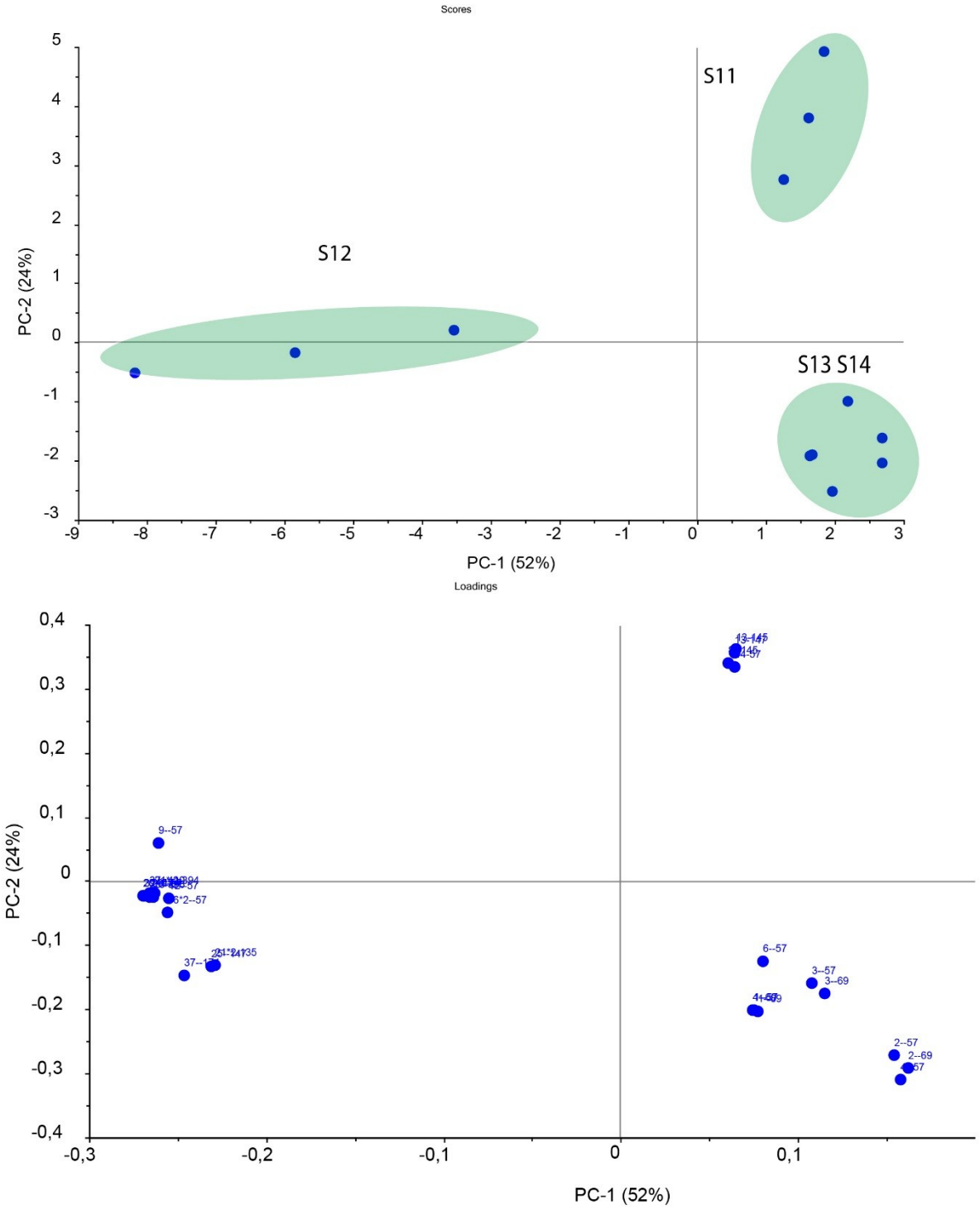


Figure S3. Score plot (A) and loading plot (B) resulting from the PCA treatment of peak areas as variables using un-normalized variables weighting as 1 in the ROI from the EIC (m/z 218) of the Moraceae family S1-S5 and S6.

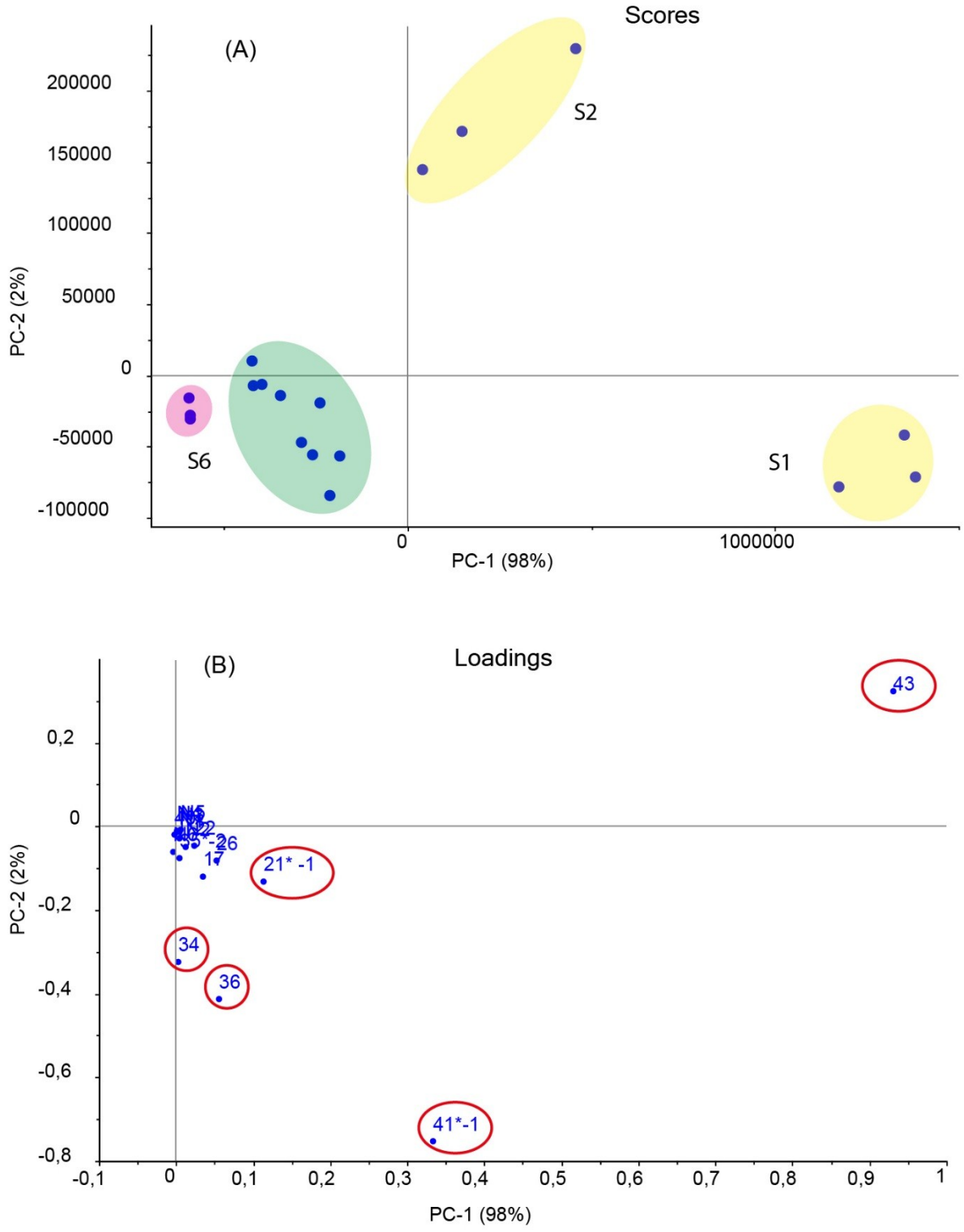
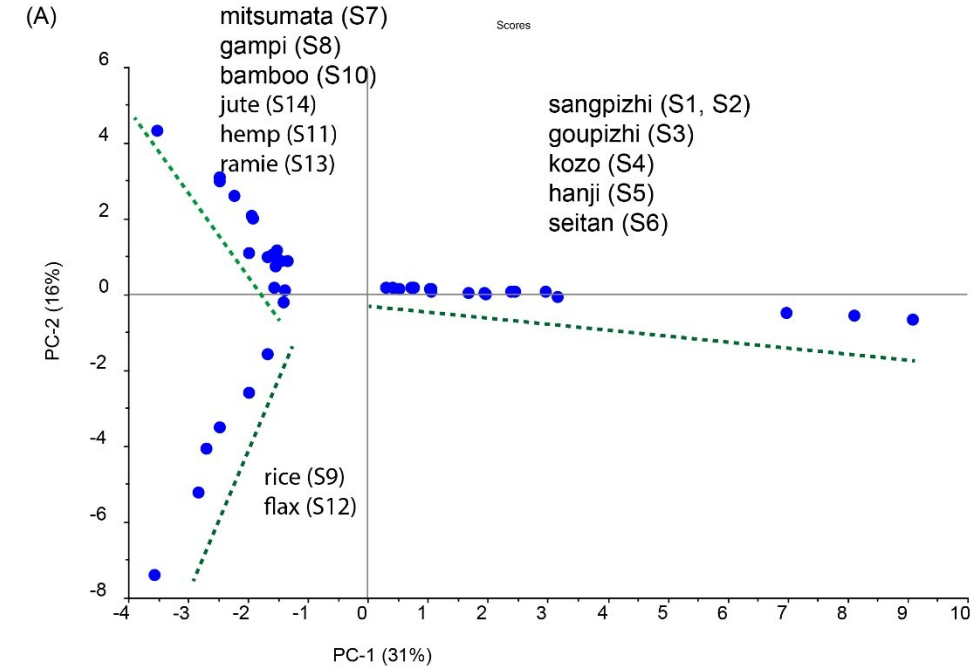


Figure S4. Score plot obtained from the PCA of all groups of samples (un-normalized values set as 1/STD from the EICs of markers in the ROI). In Figure S4B, the number before '--' corresponding to the numbering in Table 2 and the number after '--' represents the chosen EIC (m/z).



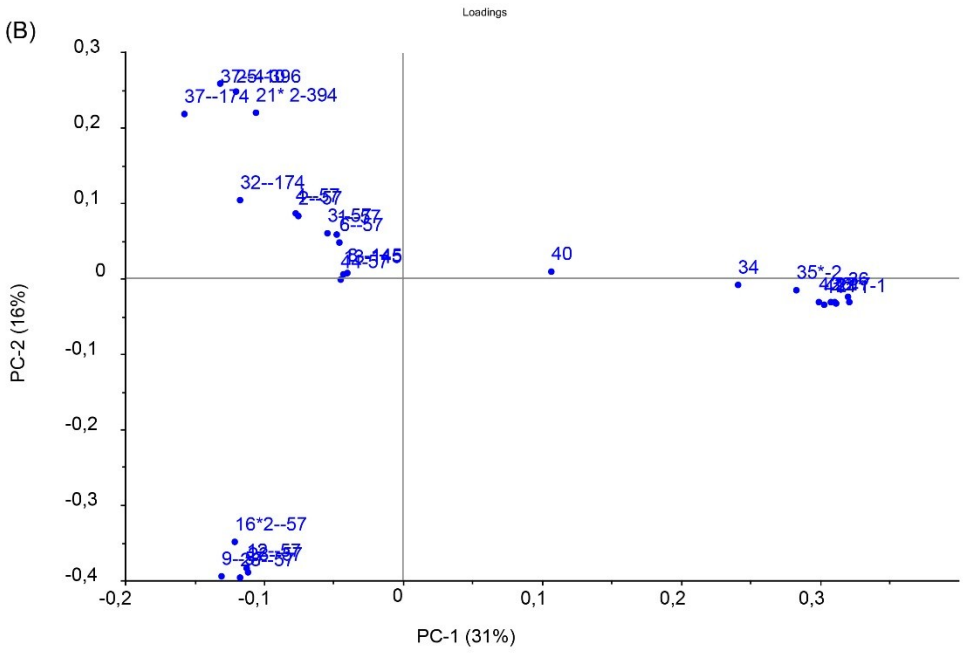


Fig.S5, The illustration of identification of hand papermaking fibers within the Moraceae family using Py-GC/MS and microscopic observation, for the microscopic features, refer to Fig.S1.