Distribution of the suberin in phellem of *Cerasus jamasakura* (Siebold ex Koidz.) H. Ohba

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Abstract

The purpose of this study is to investigate the spatial distribution of chemical components in the phellem tissues in the bark. Especially, characteristics of suberin which accounts for a large portion of the phellem still has a lot of unclear issues. The phellem specimens were prepared from the bark in the stem and branches of *Cerasus jamasakura* (Siebold ex Koidz.) H. Ohba. Analyzed results of chemical components showed that branches had higher proportion of suberin compared to the stem; the former was 32.3%, while the latter was 12.4%. It was also found that the inner layer of phellem tissues contains higher proportions of suberin from the micro-Raman spectroscopic analysis.

1. Introduction

In the wood industry, the use of trees enables us to produce various products for daily use, e.g. structural timber, furniture, and so on. Most of them usually consisted of xylem, while the use of bark is thought to be limited such as the traditional craft products, the cork products from the phellem. However, some scientific verifications on the properties of bark are still insufficient due to the few example in use. It is known that the bark of some kinds of species, such as *Quercus suber*, forms a thick phellem containing a large amount of suberin (Figure 1). Our previous works focused on the effects of this complex biopolymer on the mechanical properties of phellem tissues1-3), and we considered that the large deformation found in the case of tensile loading was induced by the presence of suberin. Thus, the purpose of this study is to investigate the distributions of suberin in the phellem tissues to make further understanding of its mechanical role based on various analyses of chemical components.

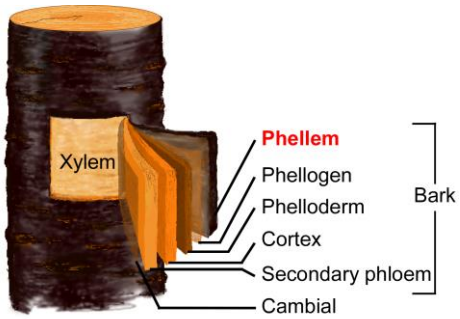

Figure 1. Schematic of the tissues in bark.

2. Experiment

The phellem specimens were prepared from the parts of stem and branches of 38-year-old of *Cerasus jamasakura* (Siebold ex Koidz.) H. Ohba grown in Kuwana, Mie Prefecture, Japan. The ground specimen passing through #42 of particle size was used for the following analysis. Quantitative analyses of extractives, lignin, suberin, and holocellulose were performed using oven-dried specimens after each treatment. Raman microscopic analysis was performed using 3-μm-thickness of the phellem section prepared using a sliding microtome. The scattered Raman light derived from the suberin was detected at several points along radial direction in the same section.

3. Results and discussion

Table 1 showed the results of quantitative analysis of the phellem tissues. It was found that the amounts of each extractive were almost the same values between phellem of stem and branches. However, the higher amount of suberin was found in the branches than in the stem. This difference reminds us of the characteristics of the formation of reaction wood in xylem cell walls induced by the gravitational response, although the rigorous verifications are our next challenges at this time.

Table 1. Chemical composition of the phellem of *Cerasus jamasakura.*

	Extractives	Suberin	Lignin	Holocellulose	Others
Stem phellem	11.6	12.4	30.8	30.2	15.0
Branch phellem	12.3	32.3	23.0	22.3	10.2

Figure 2 showed the typical results of Raman microscopic measurement of the phellem tissue. The surface of phellem section was irradiated with a 532 nm laser. It should be noted that higher values of the Raman intensity at 1632 cm-1 derived from suberin were found at the inner areas in the radial direction when compared in the same section. This suggests a possibility that accumulations of phellem cell walls extrude the older cells to the external side in phellem, then the amount of suberin was reduced.

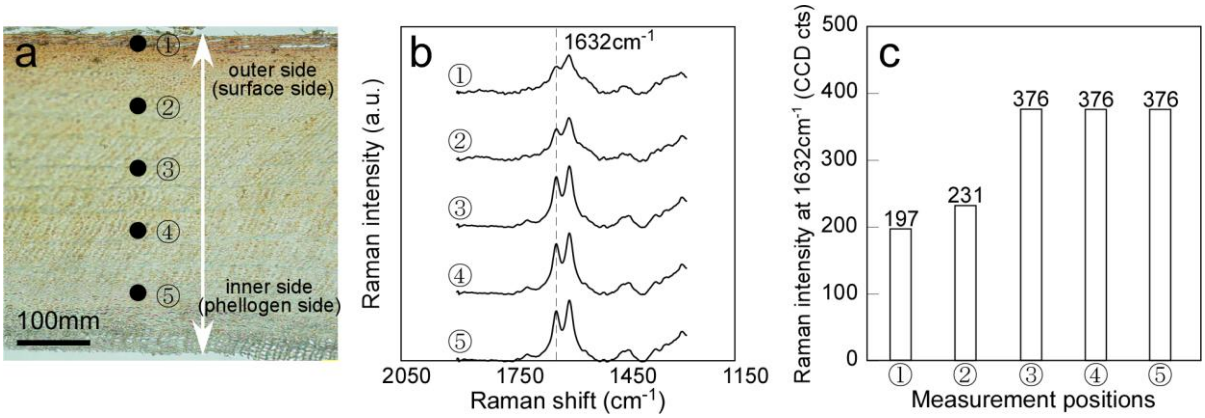

Figure 2. Results of micro-Raman spectroscopy. a: measurement position in a phellem. Each numbered circle shows measurement areas, b: Raman spectra at each position, c: Raman intensity at 1632cm^{-1} at each position.

4. Conclusions (or Summary)

This study investigated the distribution of the suberin in the phellem tissue using micro-Raman spectroscopy in addition to the analysis of the chemical components. The following findings were drawn based on the obtained results:

- Higher amount of suberin in the phellem tissues was found in the branches than in the stem.
- Distribution of suberin had gradient in the phellem, and the amount of suberin was low at the external side in phellem.

References

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