



Title	「のりうつぎ」の粘液に就て
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Citation	札幌博物学会会報, 6(2), 128-132
Issue Date	1916-07-31
Doc URL	http://hdl.handle.net/2115/61274
Type	article
File Information	Vol.6No.2_003.pdf



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ON THE MUCILAGE OF HYDRANGEA PANICULATA, SIEB.

By

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「のりうつぎ」の粘液に就て

小原 龜太郎

In the manufacture of Japanese paper, a kind of mucilage from the stem of *Hydrangea paniculata*, SIEB. is an indispensable substance. It is used to suspend in the water the fibres of which Japanese paper is made, so as to arrange them in a parallel order when they are taken out in a hand frame.¹⁾

In Hokkaido, where the plant in question grows luxuriantly, people strip the stems of their bark and cut the bast into thin slices. The mucilage obtained by squeezing the well moistened slices is mixed with the water in which the beaten fibres has already been steeped; by this, the mucilage serves, as already been said, to suspend the fibres in the water.

For the purpose of examining where and how the plant has mucilage in store, I collected several parts of the plant in the vicinity of Otaru, August, 1915. I had also an opportunity, at the end of March, 1916, to take an observation of a few old stem, 5-9 cm. in diameter, sent me by a member of the YAMAKOSHI Factory, Sapporo.

On the examination of the hand section of the stem, it was found that the mucilage produced from the plant is nothing but the contents of the crystal-containing cells, which usually attain their full development in the bast of the stem.

A well-developed crystal-containing cell exceeds adjoining parenchymatous cells two or three times in breadth. The thin membrane, which encloses the cell, and the turgidity of the contents within make the cell expand and fill the inter-

1) Saeki; An opinion on the industry of Japanese paper. (In Japanese) The journal of chemical industry. Tokyo. 1903.

cellular cavities formed by the surrounding cells. So the crystal-containing cell assumes, in the cross section of the stem, a polygonal shape.

As the crystals in the cell take the form of Raphides, each cell elongates in one direction; and, when found in the stem, it lies parallel to the long axis. According to HOLLE's²⁾ statement, these raphides-containing cells occur throughout the tribe Hydrangae and are regarded as one of the characteristics of this tribe. Raphides are enclosed by a thick, homogeneous, sometimes brown-coloured, transparent mucilage. SAWAMURA³⁾ once analyzed the mucilage and recognized in its hydrolized products galactose and arabinose. By my experiment, it shows microchemically the following reactions :

- 1). With Delafield's haematoxylin, with safranin and methylen blue more easily it can be stained.
- 2). With ruthenium red it is stained intensely red.
- 3). By the following reagents no reactions can be obtained; (a) Iodine solution. (b) Zinc chloride iodine. (c) Iodine and sulphuric acid. (d) Congo red. (e) Phloroglucin and hydrochloric acid. (f) Millon's reagent.
- 4). By the lead subacetate white precipitates can be obtained.
- 5). By the ammonium copper oxide solution it can not be dissolved.
- 6). In the water first it swells and then totally disappears, a proof of complete dissolution.

And the extract of the thin slices of the bast got by boiling them in water can be precipitated by adding some strong alcohol. After boiling the extract in diluted hydrochloric acid, it reduces the Fehlings solution, although the extract shows no reaction whatever before its treatment with the acid. By the reactions above stated it can be concluded that the mucilage belongs to the pectin compounds.

From the economical point of view, it is not unnecessary here to describe how the raphides-containing cells are distributed in a plant body, so that those who are interested in the matter may tell what part of the plant is most richly endowed with the mucilage. The following results obtained by my observation may serve as a suggestion to this point:—

2) HOLLE; Beiträge zur Anatomie der Saxifragaceen und deren Systematik. Botanisches Centralblatt. 1893.

3) SAWAMURA; in the Manufacture of Japanese paper' by YOSHII. (In Japanese) 1897.

The Bud.	Abundant in scaly leaves.		
Tree Leaf.	Abundant (mildly) in the mesophyll and veins.		
The Petaloid Calyx.	Abundant in the mesophyll.		
The Root.	Abundant in the bast.		
The Stem.		Young. 0.3 cm. in diam.	Old. 1-5 cm. in diam.
	Bark.		Very abundant.
	Cortex.	scarce.	Most abundant.
	Bast.	Along the cambium ring abundant.	
	Wood.	Nil.	Nil.
	Pith.	Scarce.	Nil.

It is interesting to note that many cells in the thick cork layer of the bark contain some mucilage and crystals and they are already differentiated when found in the layer next to the cork-cambium. By the reaction with phloroglucin and hydrochloric acid, it can be proved that their cell-walls show the lignification, in contrast to the fact that the cell-walls adjacent to those mentioned react as the suberized membrane. Sudan III as well as several reagents for cellulose can not stain the cell-wall of the raphides-containing cell. When it is placed between crossed nicols, and the gypsum plate is inserted, the interference colour shown by the cell-walls becomes higher, in the same direction with the greatest elasticity axis of gypsum; while other cells in the layer show the lower interference colour and can be stained with sudan III.

From the foregoing statement, I can conclude that it is impossible to obtain mucilage from the stem merely by injuring the bark like the method usually adopted in the collection of gum arabic and its allies. As the bast of the stem contains mucilage most abundantly, it is advisable to utilize this layer chiefly; next to this, the bark can not be neglected if it is freed from dirty admixtures. In comparing the numbers of the crystal-containing cells with one another, older stems are preferable.

As to the season, the climate and the soil favourable to the collection of mucilage, they are now left for the further investigation.

April, 1916.

The Otaru Higher Commercial School.

摘 要

和紙製造の際に於ては各種の植物粘液を使用するものなるが就中のりうつぎ (*Hydrangea paniculata*, Sieb.) の粘液を以て最も優良なるものとせらる。該樹の多産地なる北海道に於ては先伐採したる莖の樹皮を脱離したる後韌皮部を削りて細片となしこれを製紙業者に供給するものなり、製紙業者はこれを布袋に詰めて水槽中にて粘液を絞り出すものにして叩解せる繊維をこの内にて漉くときはよく繊維を水中にて保持し漉框上にて取扱ふときに均一平等にして且並行ならしむるに資するものなり。

余の観察によれば粘液は蓆酸石灰の針晶体を有する細胞中に存在し結晶を包圍する粘稠の透明なる物質に起源するものなり。

粘液は Safranin, methylen blue, ruthenium red, Delafield's haematoxylin 等により染着するも沃度沃度加里液、鹽化亞鉛沃度、沃度及硫酸、コンゴ赤、フロ、グルシン及鹽酸、ミロン氏液によりて反應を呈せず、過剰の酒精、鹽基性醋酸鉛によりて沈澱を起し、酸化銅アムモニア液に溶解せず、フエーリング氏液を還元せざれどもこれを稀鹽酸と共に熱するときは還元す、以上により粘液はペクチン化合物なることを知るべし。

結晶細胞の植物体中に於ける分布を見るに最も莖の韌皮部に多く樹皮中にも多量に含有せらる若き莖にありては髓及原初皮層にもあり根に於ては韌皮部最も多く葉及花辨狀萼に於ては Mesophyll 中にあり芽に於ても鱗片中に多量に

存在す。樹皮中にあるものは既にろの栓皮形成層に亞ぐ層に存在せるときに細胞膜分化し周囲の細胞が**コルク**化せるにも關せず木質の反應を示す。

經濟上より見るに本植物を利用するには老莖の韌皮部を以て最も佳良なりとし夾雜物を除去するを得ば樹皮も亦利用すべく而して樹皮を傷けて粘液を流出せしむるが如き企は全く不可能の事に屬す。

大正五年四月
