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EFFECTS OF INCLINATION ANGLE OF STEM ON GROWTH STRESS AND ANATOMICAL CHARACTERISTICS IN THREE WOODY ANGIOSPERMS FORMING REACTION WOOD WITHOUT GELATINOUS FIBERS

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In woody angiosperms, reaction wood is formed usually on the upper side of inclined stems or branches where excessive tensile growth stress causing large promotion of radial growth generates. In general, it can be characterized by the presence of gelatinous (G) layer being formed in wood fiber cell walls and the reduction in the number and diameter of vessels. On the other hand, in some species which possibly belong to the primitive angiosperms, the G-layer is not always formed in reaction wood fibers. The detailed nature of reaction wood without G-fibers in angiosperms has not been much investigated. In addition, there are less information concerning the effects of the inclination angle of stem from the vertical on the growth stress and anatomical characteristics in reaction wood. In the present study, the reaction wood was artificially formed with inclination angle of 30, 50, and 70 degrees from the vertical in the stems of *Paulownia tomentosa* Steud., *Liriodendron tulipfera* L., and *Osmanthus fragrans* Lour. var. *aurantiacus* Makino, of which reaction wood does not form G-layer in wood fibers. Vertically straight stems were used as normall wood in each species. The effects of inclination angle of stem from the vertical were investigated on the longitudinal-released strain and the change of anatomical characteristics.

In each species, generation of large negative longitudinal-released strain was confirmed on the upper side of all the inclined stems compared to the control stems having formed normal wood. Xylem formed with inclination angle of 30 degrees showed the largest tensile stress on the upper side of the inclined stem of *P. tomentosa*, whereas, in *L. tulipfera* and *O. fragrans*, inclination angle of the 50 degrees gave the largest tensile growth stress on their stems.

In all the three species examined here, radial growth was promoted on the upper side of inclined stems. The number of vessels in all the reaction woods formed significantly decreased in comparison with that of normal wood, suggesting that the influence of stem inclination angle is greater rather than growth promotion. On the other hand, the changes in the diameter of vessels and the length of wood fibers and vessel elements were different among species and among their different inclination angles. Reaction wood of *P. tomentosa* increased vessel diameter, whereas that of *O. fragrans* decreased it compared with normal wood, and *L. tulipfera* showed no difference in vessel diameter between normal and reaction woods. The length of wood fibers and vessel elements significantly increased in reaction wood of *P. tomentosa* and *O. fragrans*, while both of them decreased significantly in reaction wood of *L. tulipfera*.

The typical three-layered structure (S1+S2+S3) was comfirmed in the secondary wall of normal wood fibers in three species. On the other hand, reaction wood fibers of *L. tulipfera* and *O. fragrans* lacked the S3 layer, whereas reaction wood fibers of *P. tomentosa* showed a three layered structure. In these species, reaction wood formed with the inclination angle of 30 and 50 degrees showed smaller microfibril angles in the S2 layer of wood fibers than that of 70 degrees. In *L. tulipfera*, reaction wood fibers formed with the inclination angle of 30 and 50 degrees showed remarkably small microfibril angle less than 10 degrees, this fact being similar to G-layer of tension wood.

In these species, secondary wall of reaction wood fibers showed weaker coloration than that in normal wood after both phloroglucinol-HCl and Mäule stainings, indicating the decrease of lignin content in the secondary wall of wood fibers by reaction wood formation, especially the decrease in syringyl unit of lignins. Visible-light microspectrophotometric analysis gave smaller values in the maximum absorbance in the secondary wall of reaction wood fibers formed with the inclination angle of 30 and 50 degrees compared to that of 70 degrees in each species. Reaction wood of *L. tulipfera* caused the marked swelling of secondary wall in reaction wood fibers formed with inclination angle of 30 and 50 degrees after the treatment of both phloroglucinol-HCl and Mäule reagents. In addition, the secondary wall of wood fibers in normal wood of *L. tulipfera* was not stained with phloroglucinol-HCl reagent, whereas the secondary wall was stained in purple red with Mäule reagent, indicating that the secondary wall is predominantly composed of syringyl unit in lignins.

Based on the results obtained in this study, it is considered that *P. tomentosa*, *L. tulipfera*, and *O. fragrans* form tension wood-like reaction wood in terms of growth stress and anatomical characteristics except for the absence of G-layer. In addition, growth stress, number of vessels, microfibril angle of S2 layer of wood fibers, and lignin distribution in the secondary wall of wood fibers were different among reaction woods formed with three different inclination angles. It was suggested, therefore, that the inclination angle of stem affected the changes of growth stress, leading to the anatomical changes, that is, difference of stem inclination angle caused difference in degree of development in reaction wood severity.

INTEGRATE-EPIGENETIC ORIGIN OF THE KARELIAN BIRCH: THE HYPOTHESIS AND THE FACTS

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Abstract. Viral and genetic hypothesis of Karelian birch origin and expressions of variability are discussed. The facts, confirming this points are given. They are based on the data of morphological, anatomical cytogenetic study of Karelian birch biomorphs and on the analyses of literature data.

ИНТЕГРАЦИОННО-ЭПИГЕНЕТИЧЕСКОЕ ПРОИСХОЖДЕНИЕ КАРЕЛЬСКОЙ БЕРЁЗЫ: ГИПОТЕЗА И ФАКТЫ

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Одной из актуальных проблем генетики является вскрытие природы фенотипической изменчивости, наблюдающейся в популяциях. Карельская берёза – таксономически не вполне определённая группировка. Локально занимая небольшие площади, она характеризуется исключительно высоким полиморфизмом по многим признакам. Одной из интересных особенностей карельской берёзы является то, что наследование признаков не подчиняется определённым закономерностям: при гибридизации вполне определённых форм в потомстве возникает практически всё разнообразие форм, но с разной частотой, в зависимости от типа скрещиваний. Такой своеобразный эффект расщепления не позволяет утверждать о наследовании какого-то определённого признака (в соответствии с менделевской теорией); вероятно, наследуется какой-то симбиотический комплекс. Сопоставление накопленных данных по биологии карельской берёзы и достижений молекулярной генетики [32] позволило предложить патогенно-генетическую гипотезу её происхождения. Высокий фенотипический полиморфизм объяснялся «индукцией мутаций (генной и геномной природы) вследствие интеграции ДНК