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EXTERNAL NEEDLE MORPHOLOGY OF DIPLOID AND POLYPLOID JUVENILE WHITE AND BLACK SPRUCE^{1/}

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Needle samples were collected in March, 1963, from 14 juvenile white spruce and 10 juvenile black spruce growing in the greenhouse (Winton, 1963, 1964). These plants included at least one specimen from each diploid and polyploid type of each species then available. Needles were collected 1-2 cm from the top of each plant and were measured with a millimeter ruler under a dissecting scope. The purposes of these measurements were to point out those needle characters that may serve to differentiate diploids from polyploids in white and black spruce, and also to show whether there is a difference between white and black spruce plants having similar ploidy levels.

Eleven needles from six diploid white spruce had an average length of 11.5 mm and averaged 0.68 mm in width. Four needles from four black spruce diploids (one from each plant) averaged 11.0 mm x 0.55 mm. Based on these measurements, width-length ratios for white and black spruce diploids expressed in percent of needle length, are, respectively, 5.8 and 5.0. These results indicate that among diploids, needles of juvenile white spruce are slightly longer and thicker than their black spruce counterparts.

Seven triploid white spruce needles from four plants averaged 9.1 mm x 0.63 mm, giving a w/l ratio of 6.9 percent. Seven needles from five white spruce tetraploids averaged 10.9 mm x 0.69 mm, and seven needles from seven tetraploids averaged 8.2 mm x 0.73 mm, giving respective ratios of 6.3 and 8.9 percent.

These ratios support earlier subjective observations that thicker, shorter needles occur in polyploids, in contrast to the thinner, longer needles of diploids, among juvenile plants of both white and black spruce (Figure). Polyploid needles of both species were usually swollen to roundness in cross section. This condition may have caused polyploid needles to appear thicker than they actually were when compared to angular-sided diploid needles.

Other observations indicated a weak relationship between waxy needle surfaces and polyploidy, but not enough to serve as a distinguishing character. Both diploid and polyploid juvenile white spruce needles had serrulate (finely serrate) margins. Serrulation was not found on diploid needles of black spruce; however, 1-4 microserrations were observed on three of seven polyploid needles of black spruce. Gregory (1960) distinguished juvenile plants of white and black spruce by the presence of serrulate needle margins on the former and their absence on the latter. On the basis of this study, as well as three years of observation by the author, serrulation appears to be one of the very few good distinguishing characters between juvenile forms of these species. Microserrations appear to be limited to, but not necessarily found in all, polyploid needles of black spruce.

^{1/} This report is based on a portion of the author's M.S. thesis (Winton, 1963).

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Needle twist, when present, was equally distributed among diploid and polyploid needles of both species. Likewise, there appeared to be no relationship between the number of rows of stomata on the sides of the needles and the presence or absence of polyploidy. The number of stomata per millimeter, however, was greater on diploid needles from both white and black spruce. Guard cell size was not measured.

Juvenile polyploid needles of both species were generally of a darker green color than the bright green needles of diploid white spruce and the yellow-green needles of diploid black spruce.

Another character observed but not measured was the greater internode length of polyploids compared with diploids. General stunting, together with long internodes, few long and thick needles, and darker green color, serve to effectively distinguish polyploids from diploid plants of white and black spruce. With little practice, polyploid individuals of both species may easily be selected from nursery beds of uncultured transplants.

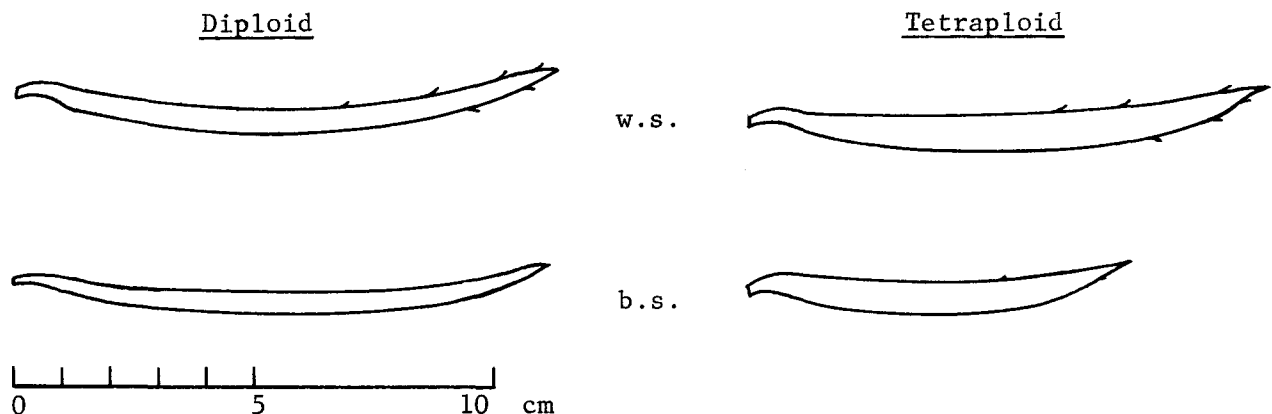


Figure. The average size and shape of needles from diploid and tetraploid juvenile white spruce (w.s.) and black spruce (b.s.). Serrulate margins are shown for both diploid and polyploid needles of white spruce, as well as microserrations on only the polyploid needles of black spruce.

Literature Cited

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