AN ANATOMICAL METHOD FOR DIFFERENTIATING WOODS OF WESTERN AND MOUNTAIN HEMLOCK[1] A RESEARCH NOTE

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(Received 6 May 1980)

ABSTRACT

The presence of styloid crystals in ghost cells or tracheary cells marginal to the rays in the last-formed latewood of mountain hemlock [*Tsuga mertensiana* (Bong.) Carr.] has proved to be a means of separating the wood of this species from that of western hemlock [*T. heterophylla* (Raf.) Sang.].

Keywords: Anatomy, western hemlock, mountain hemlock, wood identification.

The two species of *Tsuga* indigenous to western North America are western hemlock [*T. heterophylla* (Raf.) Sarg.] and mountain hemlock [*T. mertensiana* (Bong.) Carr.]. The geographical range of both species is similar, extending along the Pacific Coast from southern Alaska to northern California and eastward in the Columbia River drainage, including western Montana and southeastern British Columbia.

Throughout most of the range the species exhibit overlapping altitudinal ranges, but mountain hemlock tolerates higher elevations and is a part of the subalpine and alpine communities. It has been concluded by Taylor (1972) that hybridization between the two species is a possible but rare phenomenon.

Although the identification of the trees is relatively straightforward, the wood of the two species has been considered indistinguishable. Since the species may be graded into separate species combinations, according to the Western Wood Products Association lumber grading rules (WWPA 1979), occasions may well arise where verification between the two hemlocks may be required. Such an inquiry led to an interest in determining whether separation of the species on the basis of wood anatomy was possible.

PROCEDURES AND RESULTS

The first examination made was of several samples of mountain hemlock obtained from the wood collections at the Western Forest Products Laboratory and the Faculty of Forestry, University of British Columbia. Study of radial microtome sections revealed the presence of styloid crystals contained in ghost cells (Bannon 1934) or tracheary cells marginal to the rays in the last-formed latewood (Fig. 1). These groups of crystals were not widespread, but were readily found in all sections with the aid of a polarizing microscope. The crystals were found to be soluble in hydrochloric acid. X-ray energy-dispersive analysis of these crys-

[1] The authors would like to acknowledge the assistance of Mrs. J. S. Gonzalez for the preparation of the micrograph and the X-ray energy-dispersive analysis of the styloid crystals.

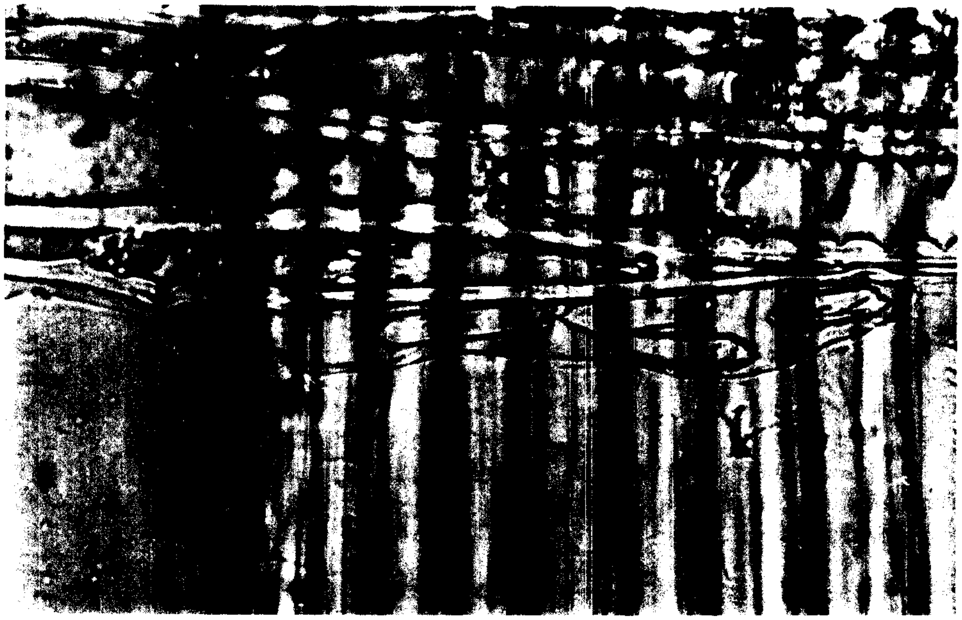

FIG. 1. Styloid crystals in mountain hemlock [*Tsuga mertensiana* (Bong.) Carr.] wood.

tals revealed the presence of calcium. These facts, plus the crystals' characteristic shape, indicated that they are crystals of calcium oxalate.

During the course of our examination and identification of literally thousands of western hemlock wood samples, crystals had never been noticed. To ensure that our experience with western hemlock was correct, a systematic examination of coastal western hemlock samples was carried out. Sapwood material was available from ten mature western hemlock trees from each of the three coastal B.C. sites—Port Renfrew, southern Vancouver Island; Maple Ridge, 40 miles east of the city of Vancouver; and near Kitimat, representative of the north-coastal region. Radial sections were prepared from a single sample from all thirty trees. Essentially no crystals were observed after systematic study of at least three radial sections from each sample. However, nature must abhor the absolute, since in one of the three sections from one Kitimat-site sample a single styloid crystal was discovered.

To further clarify the question, ten trees of each species were sampled in an area of elevational overlap on Hollyburn Ridge, West Vancouver, B.C. Samples were secured with a 12-mm increment borer. Radial sections approximately 8 × 14 mm in size were prepared from each sample, containing from eight to eighteen annual rings. Three radial sections were systematically studied from each sample. Several groups of styloid crystals were observed in every mountain hemlock section. The examination of the western hemlock radial sections revealed the presence of a single crystal in a single section. Further sections of the western hemlock samples were made and examined. In total, four times as many sections of western hemlock as of mountain hemlock were examined. In all of these observations, only two radial sections from different western hemlock trees were found to contain single styloid crystals.

These infrequent observations of crystals in the western hemlock samples prevent establishing a simple presence or absence criterion as a basis for the separation of western hemlock and mountain hemlock wood. However, the infrequency of crystal observation in western hemlock still permits a firm basis of species separation.

CONCLUSIONS

When it is desired to determine whether an unknown wood sample is western hemlock or mountain hemlock, three radial sections should be prepared from a sample containing at least eight growth rings. Since the crystals occur at the ray margins in the last-formed latewood, it is essential that either the size or number of the radial sections be such that the number of growth rings observed approximates the number made in our observations. If systematic study of these sections, using a polarizing microscope, reveals the presence of styloid crystals in two or more of the sections, it safely can be assumed the sample is mountain hemlock. If crystals are observed in none or one of the sections, the sample is western hemlock.

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