

BOTANY

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Abstracts

Anatomy of the Stem of *Arundo donax* L. with Possible Implications for Reed Playability in Woodwind Instruments. MARILYN S. VESELACK and JERRY J. NISBET, Ball State University, Muncie, Indiana 47306.——*Arundo donax* L. has been of significance to the various cultures of the western world because of its role in the development of music. Even today the culms of this plant are still the main source of material used in making reeds for musical instruments.

The goals of our study have been to describe the anatomy of the mature stem *Arundo donax* L., and to investigate possible factors which may be related to the quality of woodwind reeds manufactured from *Arundo* stems. To acquire material for the study, woodwind reeds were obtained that had been used in performance and judged playable by professional musicians. The same musicians were also asked to supply reeds which they judged to be non-playable.

To prepare the material for study, cross sections approximately three millimeters long were sawed from the heel of each woodwind reed. These sawed pieces were then split lengthwise with a knife to make blocks of tissue approximately three millimeters wide. The central blocks of tissue from each reed were softened by chemical treatments and embedded in paraplax for sectioning.

The stem anatomy of *Arundo* is similar to that of corn and other grasses. Under ideal conditions the plant is allowed to grow for 10-20 years prior to harvesting. A prolonged period of natural curing from 1-3 years is recommended prior to using the internodes for the manufacture of woodwind reeds. Apparently much of the *Arundo* crop is currently being harvested after only a few years, and the stems are being kiln dried. Such practices probably have an adverse effect on the quality of woodwind reeds being manufactured today.

Aside from the qualities contributed by fully developed and carefully cured stem material, the proximity of the reed blank to the node, the angle of the blade cut, and the uniformity of distribution of vascular bundles appear to contribute to the playability of woodwind reeds.

The Relationship Between Climate and Growth Habit in the Carolinas. GARY E. DOLPH, Indiana University at Kokomo, Kokomo, Indiana 46901.—— Attempts to relate the leaf form of the total woody flora of the Carolinas with mean annual precipitation and mean annual temperature have not substantiated the predictions of earlier authors. However, not all botanists believe that these

major climatic variables can be related to the leaf form of the total woody flora. Some botanists believe that shrubs are better climatic indicators than trees, whereas others feel that evergreen plants are more sensitive to climate than deciduous. To test these hypotheses, data on the total woody flora of the Carolinas were subdivided in two steps. First, the available data were subdivided into information on trees, shrubs, and vines. Then, each of these categories was subdivided into deciduous and evergreen species. The use of these new data sets did not reveal a better correspondence between leaf form and climate in the Carolinas. Although broad regional correlations do exist, more field work will have to be carried out before the nature of the correlation at the local level can be substantiated.

Notes on *Dryophyllum tennesseensis* Berry (Fagaceae) from the Middle Eocene Claiborne Formation of Tennessee and Kentucky. JAY H. JONES* and DAVID L. DILCHER, Indiana University, Bloomington, Indiana 47401._____The species *Dryophyllum tennesseensis* was established by E. W. Berry in 1916 for a specific leaf type common to the Clairborne Formation of southeast North America. This species is part of a group of leaf types assigned to the genus *Dryophyllum* Debey. Early workers postulated that members of this extinct genus were ancestral to modern genera of the Fagaceae. Ball later concluded that this genus represented a dead end line of evolution which was parallel to modern genera of this family. As part of a study aimed at providing a better understanding of the nature and true position of this problematic genus we have re-examined the species *D. tennesseensis*. This involved detailed leaf architectural and cuticular analyses of many fossil specimens as well as leaves from over 175 extant species of Fagaceae and other families containing similar leaf types. The results of this investigation indicate that the cuticular and leaf architectural characteristics of *D. tennesseensis* are consistent with those commonly observed in the Fagaceae. However, when intrageneric variations are considered this leaf type can not be excluded from the modern genera *Quercus* and *Castanea* of this family. Therefore, based on the analysis thus far completed, we suggest that this leaf type can be confidently assigned to the Fagaceae. However, the question of whether *Dryophyllum* is ancestral to or evolved parallel with modern genera of the Fagaceae can not be determined on the basis of leaf characteristics alone.

Angiosperm Reproductive Organs from Middle Cretaceous Sediments. CAROLYN B. DIEFENBACH and DAVID L. DILCHER, Department of Biology, Indiana University, Bloomington, Indiana 47401, and HOWARD C. REYNOLDS, Fort Hays State University, Hays, Kansas 67601._____Two inflorescence types from the Middle Cretaceous Janssen Clay Member of the Dakota Formation have been examined and found to have a similar morphology. Although the types are from different localities (Russell and Barton Counties, Kansas), both are composed of numerous apetalous florets arranged helically on an elongate or globose axis. Each sessile floret consists of a circlet of four laminar stamens and each individual stamen contains four pollen sacs. While most of these inflorescences appear to be unisexual, other structures, as yet poorly understood, are present on some specimens. These structures may be pistillate and are presently under investigation. *Retimonocolpites* type pollen has been isolated from the florets of well preserved specimens from the Russell County

locality. This pollen is monosulcate with a reticulate sexine that tends to separate easily from the smooth nexine. The pollen grains are found most often as dyads, but single grains and occasional catasulcate tetrads have also been observed. Transmission electron microscope studies of the pollen show the presence of a nonlaminated endexine which may be indicative of angiosperm pollen. The distinctive cuticle of these inflorescences is comparable to cuticle of compound leaves which are also common at both of the localities mentioned above.

Detection of Soil Moisture Variations from Vegetative Soil Cover of Multi-Temporal Landsat Data. STEVAN J. KRISTOF, Laboratory for Applications of Remote Sensing, Purdue University, West Lafayette, Indiana 47907. _____ A study was conducted to determine the feasibility of using machine-aided processing of Landsat data to observe soil moisture conditions via soil vegetative cover. Multispectral Landsat data were collected over Vigo County, Indiana in 1973 on January 16, May 4, June 9 and September 7. A clustering procedure was applied to divide data into 21 groups of sample points of similar spectral characteristics. The statistics processor computed statistics for each of these cluster groups. Those groups then were used in the pattern classifier to classify each of the data points of the entire county into one of 21 spectral classes. The results of classification were compared with ground observations. This study has confirmed that the Landsat data taken at different times of the year are influenced by the sun elevation. The radiations are smaller in the Spring than in the Summer. Relative values representing magnitude of reflected energy showed seasonal variations which are intimately connected with the changes in the surface features. The results showed that the magnitude of all kinds of vegetative soil cover depends on type of vegetation, its age and the soil present. The magnitude of reflectance from soil decreases with increasing amount of organic matter content and especially with moisture content because water greatly decreases reflectance from soil. Based on this information it can be seen that the computer-aided analysis of Landsat data can provide a great deal of information about soil moisture conditions.

Effects of Nutrient Regimes and Ectomycorrhizal Inoculation on Growth Parameters of Three Oak Species. R. W. DOUGLASS, Research Assistant and P. E. POPE, Assistant Professor, Department of Forestry and Natural Resources, Purdue University, West Lafayette, Indiana 47907. _____ Northern red (*Quercus rubra*), black (*Q. velutina*) and white oak (*Q. alba*) seedlings were grown in 10 cm X 10 cm X 26 cm containers under 16 hour photoperiod. Within species comparison of seedlings subjected to varying nutrient regimes (0, 1/2X, 1X, and 2X Hoagland's solution) and fungal inoculation rates (0 to 634 ml/ft³ *Pisolithus tinctorius*) indicated that stem height, leaf area, number of growth flushes, total dry weight and shoot to root ratio (S/R) increased with increasing amounts of available nutrients. Mycorrhizal development was slight and demonstrated no significant effect on the growth parameters measured. Among species, differences were significantly influenced by nutrient regime. Generally, black oak exhibited the greatest response to increased levels of available nutrients, followed in order by red and white oak. On the average, correlation between growth parameters differed among species. The within species correlations for

the aboveground components improved with increased nutrient status while the aboveground to root component was unaffected.

Intensive Culture Influences Growth and Nutrition of Containerized Black Walnut. J. M. BRAUN, Research Forester and P. E. POPE, Assistant Professor, Department of Forestry and Natural Resources, Purdue University, West Lafayette, Indiana 47907.——Successful production of high quality hardwood seedlings through the use of intensive culture and containerization has lagged far behind the accomplishments of coniferous nurseries using these techniques. However, the rewards of producing high quality seedlings *ie.* excellent survival after outplanting, and good early growth, continues to spur research towards this end. The objective of this study is to quantify the impact of a series of nutrient regimens on intensively cultured seedlings.

Pre-germinated black walnut (*Juglans nigra* L.) seeds were grown in 10 x 10 x 25 cm paper containers for a period of 13 weeks. Seedling density varied between 0.46 and 0.75/m² (5-8/ft²). Supplemental lighting provided a 16 hr. daylength. The nutrient treatments consisted of a distilled water control, a standard Hoagland's formulation and ¼x, ½x, and 2x the standard solution. Nutrient levels significantly affected stem length and stem, leaf, and total dry weight. The 2x Hoagland solution increased stem length and total dry weight by 50% and 45% respectively over the control. Foliar N, P, and K and food reserves in the stem and taproot were evaluated with regards to nutrient treatment and the physical characteristics of the seedlings.

Ambient-Temperature Storage-Not Good for Black Walnut Seed. ROBERT D. WILLIAMS, USDA Forest Service, North Central Forest Experimental Station, Bedford, Indiana 47421.——Black walnut (*Juglans nigra*) seed did not germinate after one full year in ambient temperature storage. Seedlots stored under roof but subject to outside temperatures, in Georgia, Tennessee, Illinois, Indiana, and Minnesota from January until April (seedlots were bagged in April and placed in cold storage until they were sown) and from January until October were fall sown at the Vallonia Nursery in Indiana. About 6% of the seed stored at outside temperature until April germinated but none of the seed stored at ambient temperature until October germinated.

Evaluation of the Suitability of Cooling Pond Water for Growth of Various Algae. RICHARD WHITMAN, Division of Science and Mathematics, Indiana State University, Evansville, Indiana 47701.——This study attempts to demonstrate the suitability of water parcels collected from the Cedar Bayou Generating Station's cooling lake for algae isolated from that study area. The algae were incubated at three different temperatures (25°, 29°, and 32° C) and in five different media representing four field water parcels collected plus an enriched nutrient medium which functioned as a control. In addition to the three different phytoplankton populations isolated from the field, a fourth laboratory grown algae served as the control algae.

The overall data suggests that caution should be exercised when laboratory reared species are used for test organisms. Differences in the algal growth potential may be related to the population's adaptive history and not to the quality of the test medium. Similarly, artificial media does not always demonstrate deficiencies in natural media and may, in fact, be less suitable for the existing population.