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The Distribution of Cane, *Arundinaria gigantea* (Poaceae: Bambusoideae)

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ABSTRACT

The distribution of cane in the United States was compiled on a county basis from previous records, correspondence, and field work. Ecological correlations were considered. The range appears to be limited primarily by temperature and precipitation. Two geographic populations correlate with major drainage divisions. The broad ecologic amplitude of cane is indicated by its occurrence in many different community types.

INTRODUCTION

Arundinaria, known as cane, is the only bamboo native to the United States. The leaves and young shoots provide valuable forage for livestock and the woody culms provide material for fishing poles, garden stakes, and a variety of other construction and craft uses. The *Arundinaria* population includes several taxa which have been treated recently by McClure (1973) as a single polymorphic species, *A. gigantea* (Whalt.) Muhl., sensu lato. Within this complex an Atlantic coast population often has been recognized as a separate species, *A. tecta* (Walt.) Muhl.

The purpose of this study was to update documentation of the distribution of cane and to examine the ecological correlations of the distribution.

GEOGRAPHICAL RANGE

West (1934) mapped the known occurrences of cane on a county basis and included portions of 18 states. A distributional map by Gilly (1943) added West Virginia and showed a wider range in southern Missouri. Gilly's map did not include the county outlines. The map by Hitchcock (1951, as revised by Chase) indicates essentially the same range except for the omission of West Virginia. The distributional list by McClure (1973) included West Virginia but omitted Georgia, almost certainly an unintentional omission. All of these writers indicated the northern limit along the Atlantic coast to be in Maryland or Delaware.

The northern range of cane has been the subject of considerable discussion. Smith (1940) claimed that Anne Arundel County, Maryland, was the northern limit. Munro (1868) cited a specimen from "east of Philadelphia" which could have been near the Delaware River on either the Pennsylvania or New Jersey side. Fernald (1950) appended the range of *A. tecta* with "introd. and spreading n. to N. J." Vines (1960) included southern New Jersey as a part of the range but did not cite the source.

Dr. David E. Fairbrothers (personal correspondence), Curator of the Chrysler Herbarium at Rutgers University, cited a specimen from Cape May County, New Jersey, collected in 1968. The Chrysler Herbarium also has a 1932 specimen from Philadelphia, Pennsylvania.

In the western part of the range cane does not extend as far north as Kansas, but it persists there after planting. Dr. Ronald L. McGregor, Director of the State Biological Survey of Kansas, stated that there were no known native occurrences in Kansas but reported (personal communication) that a fair sized colony has persisted near Tonganoxie after planting.

Through the synthesis of publications and correspondence with botanists in the various states and through my own field search, 190 counties not included by West were added to the distributional map (Figure 1). Undoubtedly there are other counties which can be added within the overall range, but significant extensions of the presently known range seem unlikely.

West's map indicated the presence of cane in 54 counties of Arkansas. During my own investigation I have collected cane in the fertile phase in each of the 75 counties of Arkansas. Arkansas is the only state in which cane has been recorded for every county.

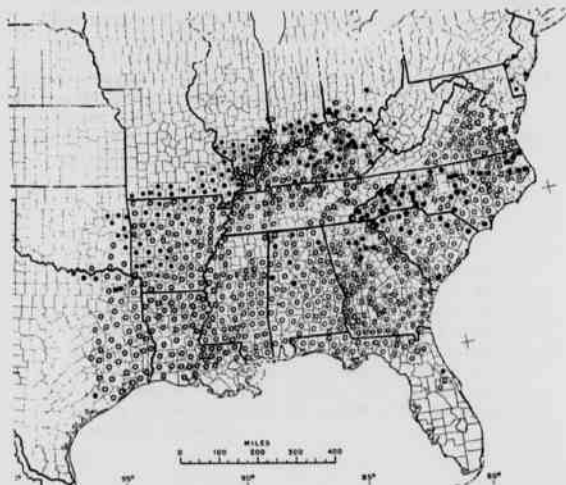
CORRELATION WITH TEMPERATURE AND PRECIPITATION

Winterringer (1952) observed that subnormal winter conditions in southern Illinois resulted in the killing back of most upper portions of cane. Dr. Vernon J. Fisher of the University of Delaware (personal communication) reported that the spread of cane in New Castle and Sussex Counties, Delaware, is checked when it is periodically killed back by low temperatures. He considered the hardiness of cane to be marginal in that area.

During the past winter (1976-77) unusually cold weather killed the normally evergreen leaves and some upper stems in large stands of cane in northwestern Arkansas. The northwestern boundary of the continental range passes through Benton County, Arkansas. According to a report from Mr. William R. Eddleman (personal communication), freezing back also occurred widely in southern Missouri and Illinois.

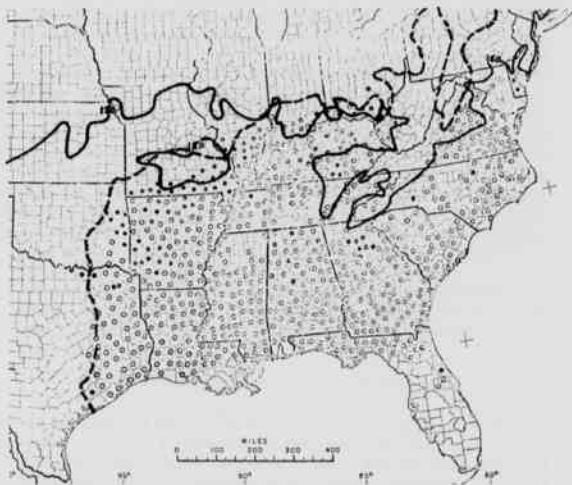
Limits of the geographic range of cane do not correspond closely with U.S. National Arboretum plant hardiness zones. The northern boundary of the Mississippi Valley portion of the range lies in zone 6 while that of the Atlantic Slope portion lies in zone 7. The approximate range of average annual minimum temperature in zone 6 is -10 degrees to 0 degrees F.; in zone 7 it is 0 degrees to 10 degrees F. This difference may suggest a difference in the temperature tolerance of the tectoid and gigantoid populations.

Figure 1. Distribution of *Arundinaria gigantea*, sensu lato, by counties. Open circles indicate the counties shown by West (1934). Closed circles are additions taken from later literature, personal correspondence, and field collecting. A total of 190 counties were added to the original map of West.



The eastern portion of the northern limit of cane does not deviate far from the isogram marking a growing season of 180 days (Figure 2). While temperature is not the only factor limiting the northern range of the eastern populations, it is probably as important as any other. The western limit of cane correlates very well with the isogram of 40 inch normal annual total precipitation and deviation is not great in the central portion of the northern limit. From the greater elevation of the Appalachians and eastward, temperature becomes more important than precipitation.

Figure 2. Correlation of the distribution of cane with the length of growing season and with normal annual total precipitation. The solid isogram marks a mean growing season of 180 days between the last 32 degree F. temperature in the spring and the first 32 degree temperature in the autumn. Except for a disjunct area in Missouri, all the region south of the transcontinental isogram has a growing season greater than 180 days. The broken line indicates a normal annual total precipitation of 40 inches.



MISSISSIPPI-TYPE AND ATLANTIC-TYPE

Gilly (1943) distinguished two contrasting populations of cane which he provisionally designated as "mississippi-type" and "atlantic-type." The cane of the Atlantic Coastal Slope is distinguished from that of the great Mississippi Basin by the presence of peripheral air canals in the rhizomes. The "atlantic-type" population was designated subspecies *tecta* by McClure (1973).

The correlation with drainage patterns suggests that the "mississippi-type" of cane developed in the lowlands and migrated into the highlands with the extensions of the streams. The ecological distribution of cane corresponds largely with stream patterns.

The correlation of geographic ranges of different species may indicate similarities of past migrations. Comparison of the geographic range of cane with bald cypress, *Taxodium distichum* (L.) Rich., is suggestive not only of a relationship between the phytogeographical history of the two populations, but also certain similarities of their broad ecological amplitudes. Their ranges are not exactly congruent, but both are predominantly species of the Gulf-Atlantic Division.

Bald cypress fossils found in swamp deposits of the Pleistocene (Berry, 1923) indicate a more extensive range in the past, both northward and into the interior. This extension enhances the correlation of the range with that of *Arundinaria*.

Of special interest in the comparison of cane with bald cypress is the inclusion in both species, interpreted in the broad sense, of a sub-specific form of comparable range on the Atlantic Coastal Plain, each sometimes recognized as a separate species. Indeed, one could

recognize within *Taxodium distichum*, sensu lato, a "mississippi-type" and an "atlantic-type" just as Gilly (1943) proposed for *Arundinaria gigantea*.

The "atlantic-type" of bald cypress, known as pond cypress, has been variously designated by *Taxodium distichum* var. *nutans* (Ait.) Sweet, and other names. Along the Atlantic Coastal Plain the range limit is very similar to *Arundinaria gigantea* subsp. *tecta*. Its extension along the Gulf Coast to eastern Louisiana corresponds to an area of intermediate-form cane, reported to have discontinuous air canals in the rhizomes.

Another worthwhile range comparison involves four diploxylon pines, the loblolly, longleaf, shortleaf, and pond pines. The pond pine, *Pinus serotina* Michx., has a range comparable to the *tecta* cane and pond cypress. Much of the range of the longleaf pine, *P. palustris* Mill., is similar, but it extends westward into Louisiana and Texas. The loblolly pine, *P. taeda* L., shares the range of the pond pine and longleaf pine, but has a broader range than either. The broadest range among the four is that of the shortleaf pine, *P. echinata* Mill., which overlaps the ranges of the other three, but extends through most of the remainder of the range of cane. Together, the range of these four pines embraces all the range of cane except a gap across the Mississippi Valley, and part of the northern cane populations. Although each of these pines is a separate species, the loblolly pine forms hybrids with the other three, providing evidence of relationship in addition to the overlapping ranges. The migration history of the eastern pines given by Mirov (1967) is comparable to that postulated for cane.

COMMUNITY TYPES

In the framework of the entire range, the broad ecologic amplitude of cane is indicated by its appearance in a great diversity of community types, varying from culms widely scattered among other plants to nearly pure stands in dense thickets. Cane is found in open areas, fields, roadsides, fencerows and in dense forests. It occurs in relatively early stages of primary and secondary successions and also in later stages, apparently including climax communities.

Cane stands may be reduced greatly by clearing, burning, grazing, and prolonged flooding. In contrast, disturbed areas often afford habitats for rapid vegetative invasions by cane, once the agent of disturbance has subsided.

In Arkansas cane occurs along every major stream and many of the smaller ones. In wetlands cane grows in higher areas protected from prolonged inundation. A rich variety of cane communities is found in Arkansas, varying from dense forest to open and disturbed areas. Cane occurs in almost every kind of forest community occurring on the banks and floodplains of streams. It also occurs in a variety of communities on upland slopes where there is sufficient moisture. Descriptions of a large number of communities in all physical divisions of the State reveal that cane occurs with a majority of the tree species of the State ranging from various combinations of oaks, hickories, pines, and sweetgum on slopes and in valleys to birch, ash, elm, sycamore, and cottonwood on floodplains to bald cypress and water tupelo in swamps. With the addition of shrubs, vines, herbs, and lower plants, cane occurs with a very large number of plants in many different community types.

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