

31

E226

NO. 153

*add
for the*

CIRCULAR 153

MAY 1967



**OBSERVATIONS on SPECIES
of CYPRESS INDIGENOUS
to the UNITED STATES**

Agricultural Experiment Station
AUBURN UNIVERSITY

E. V. Smith, Director

Auburn, Alabama



CONTENTS

	<i>Page</i>
SPECIES AND VARIETIES OF CUPRESSUS STUDIED	4
GEOGRAPHIC DISTRIBUTION.....	4
CONE COLLECTION.....	5
<i>Cupressus arizonica</i> var. <i>arizonica</i> (Arizona Cypress).....	7
<i>Cupressus arizonica</i> var. <i>glabra</i> (Smooth Arizona Cypress).....	11
<i>Cupressus guadalupensis</i> (Tecate Cypress).....	11
<i>Cupressus arizonica</i> var. <i>stephensonii</i> (Cuyamaca Cypress).....	11
<i>Cupressus sargentii</i> (Sargent Cypress).....	12
<i>Cupressus macrocarpa</i> (Monterey Cypress).....	12
<i>Cupressus goveniana</i> (Gowen Cypress).....	12
<i>Cupressus goveniana</i> (Santa Cruz Cypress).....	12
<i>Cupressus goveniana</i> var. <i>pygmaca</i> (Mendocino Cypress).....	12
<i>Cupressus bakeri</i> (Siskiyou Cypress).....	13
<i>Cupressus bakeri</i> (Modoc Cypress).....	13
<i>Cupressus macnabiana</i> (McNab Cypress).....	13
<i>Cupressus arizonica</i> var. <i>nevadensis</i> (Piute Cypress).....	13
GENERAL COMMENTS ON GEOGRAPHIC VARIATION.....	13
COMMENTS ON STUDYING CYPRESSES.....	19

OBSERVATIONS on SPECIES of CYPRESS INDIGENOUS to the UNITED STATES

CLAYTON E. POSEY* and JAMES F. GOGGANS
Department of Forestry

THERE HAS BEEN considerable interest in growing *Cupressus* (cypress) in the Southeast for several years.

The Agricultural Experiment Station, Auburn University, was the first institution in the Southeast to initiate work on the cypresses in 1937, and since that time many states have introduced *Cupressus* in hope of finding a species suitable for Christmas tree production. In most cases seed for trial plantings were obtained from commercial dealers without reference to seed source or form of parent tree. Many plantings yielded a high proportion of columnar-shaped trees not suitable for the Christmas tree market. It is probable that seed used in Alabama and other Southeastern States came from only a few trees of a given geographic source. This being true, there was less variation to select from than normally exists within a geographic source or within a species. With this limited variation, little progress has been made in attempts to improve the introduced plants. From observations, it appears that the seed used for trials in Alabama probably came from *Cupressus arizonica* var. *glabra* (Sudw.) in the Oak Creek Canyon area near Sedona, Arizona, and were collected mainly from columnar-shaped trees.

The Alabama Station currently has a project related to the genetic improvement of Arizona cypress (*Cupressus arizonica* Greene.) for use as a Christmas tree in the Southeastern United States.

* Resigned.

In any program involved with improvement of a given organism through selection or breeding, the rate of progress possible is dependent upon the amount of variation present. Therefore, it was necessary to study the variation existing in *Cupressus* and to have the variants represented in Alabama. To accomplish this, a collection trip was conducted in the Southwestern United States during the summer of 1964. A series of stands thought to be representative of the various species was visited, the trees observed and cones, seed, and twigs collected.

SPECIES AND VARIETIES OF CUPRESSUS STUDIED

It is the authors' intention to follow the taxonomic treatment given by Little.¹ Collections were made from the following species and varieties: *Cupressus arizonica* var. *arizonica* Greene (seven geographic sources); *Cupressus arizonica* var. *glabra* Sudw. (two geographic sources); *Cupressus arizonica* var. *nevadensis* Abrams; *Cupressus arizonica* var. *stephensonii* Wolf; *Cupressus quadalupensis* S. Wats.; *Cupressus sargentii* Jeps.; *Cupressus macrocarpa* Hartw.; *Cupressus goveniana* Gord.; *Cupressus goveniana* var. *pygmaea* Lemm.; *Cupressus bakeri* Jeps (two geographic sources); and *Cupressus macnabiana* A. Murr.

GEOGRAPHIC DISTRIBUTION

The present distribution of cypresses in the United States is from the Big Bend National Park in Texas, west to the southern portion of California, thence north to southern Oregon. The only known grove in Texas is in the Big Bend National Park. There have been reports of cypresses in New Mexico, but it is likely that the trees were *Juniperus* rather than *Cupressus* because after days of searching and inquiring no trace of cypresses was found. Foresters and botanists who knew their respective areas well indicated they had never seen native cypresses in New Mexico. Cypresses in Arizona are limited to the mountains of the southeastern quarter of the state except for the stands in the area of Sedona. In California, cypresses occur in scattered relatively small stands from the southern to the northern border and in Oregon near the southern border.

¹ Little, E. L., Jr. Checklist of Native and Naturalized Trees of the United States. USDA Agricultural Handbook No. 41. 472 pp. 1953.

Varietal Transfers in *Cupressus* and *Chamaecyparis*, *Madrono* 18(6): 161-167.

According to Wolf and Wagener,² there are few single characters in *Cupressus* so constant or important that they can be relied upon to differentiate species. In fact, it is much easier to determine the similarities between species than to distinguish the differences. Variation within and between sources is also large. Thus in the wild it is exceeding difficult in some instances to distinguish one species from another.

The groves of cypresses vary in size from a few isolated trees to thousands of trees spread over several square miles. Many groves occur in places well isolated from other groves and from man.

Considering the isolation of most groves, it is likely that the species of this very old group once occupied large portions of the temperate regions from western North America to Central America; but, because of their inability to evolve fast enough to meet the demands of a changing environment, the species have slowly retreated to the small environmental niches still suitable for growth and reproduction. The groves in Texas, Arizona, and inland California tend to occur on steep northeast slopes or in canyons where it is moist and where trees are not exposed to direct sunlight during the hottest part of the day. The groves in California that occur on the coast, or within a few miles, tend to be on west or southwest facing slopes.

Cypresses do not appear to be vigorous in several instances either because of the harsh environment or man or both. There are several localities where there are many extremely old decadent trees but little or no reproduction.

CONE COLLECTION

In cone collection major emphasis was placed upon obtaining seed from 10 sources of *Cupressus arizonica* including the sources that Little³ placed in the *Cupressus arizonica* group. From each of the 10 sources, 100 to 300 cones were collected from each of 12 or more trees and the cones kept separate by trees. All other *Cupressus* species indigenous to the United States were sampled but on a smaller scale.

Wherever possible cones were collected from trees located

² Wolf, Carl B. and Wagener, Willis E. The New World Cypresses. El Aliso, vol. 1, 444 pp. Rancho Santa Ana Botanic Garden, Claremont, California. 1948.

³ Op Cit.

several hundred feet apart to minimize the possibility of collecting seed from trees that might be closely related.

Within a geographic location an attempt was made to select and study trees that would represent the total phenotypic variation present at the particular source. This was an attempt to transfer the maximum amount of variation from the natural range to Alabama so that it would be available for studying genetic variation and for selection and breeding desirable variants.

Cone collection was done during June and July; therefore, all cones on a tree were available except for the present year's cones. Some few individual trees had cones still persistent after 8 years. There were very few filled seed in cones more than 4 or 5 years of age.

All groves visited were not suitable for cone collection because of lack of cones, too few trees with filled seeds, or extremely poor vigor of the trees. The groves in the following list appeared to be best suited to the research objectives and are not necessarily all of the good groves. For a complete list of known locations of groves of cypresses in the United States up to 1948, consult Wolf and Wagener.⁴

During the search for the known groves of cypresses, three new locations were found that are not recorded in the literature available:

1. The cypresses at Boot Spring in Big Bend National Park, Texas, are well known. There are only a few trees present and their vigor seems to be declining. By chance, a graduate student in ecology from Baylor University had just located an extensive grove of several thousand trees on East Rim only a few miles from the Boot Spring area.

2. Several stands were located in the Galiuro and Winchester mountains of Arizona with the help of the U.S. Forest Service Ranger at Wilcox, Arizona. These trees were some of the prettiest *C. arizonica* var. *arizonica* seen.

3. A few days before a visit to the Saquaro National Monument in Arizona, a staff member of the monument found *C. arizonica* var. *arizonica* in the Rincon Mountains. A specimen was examined but the trees were not visited.

Figure 1. is a map of the Southwestern United States showing locations of the stands studied. Brief descriptions of stands by species, elevation, approximate rainfall and aspect, and some

⁴ Op. Cit.

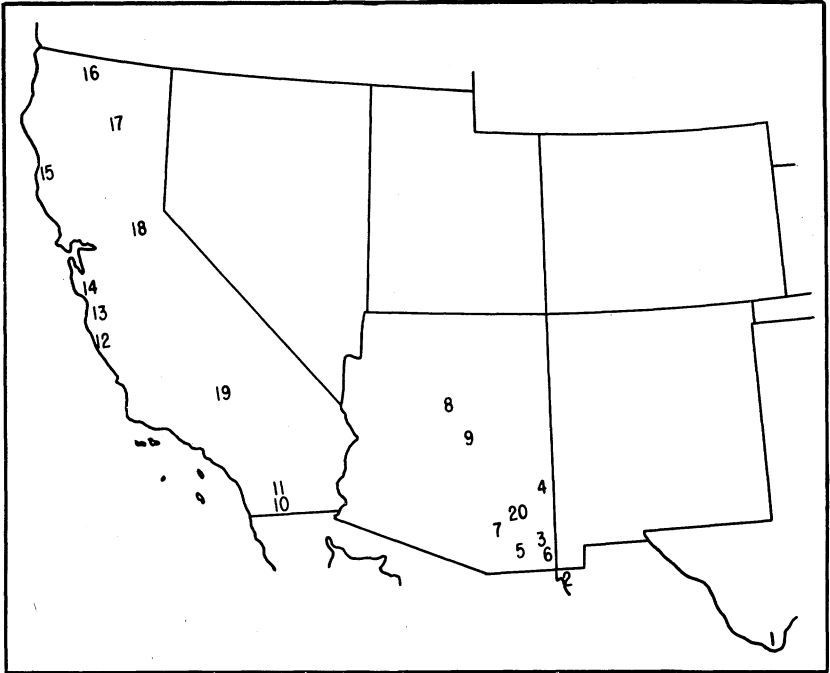


FIG. 1. Locations of *Cupressus* stands studied in 1964. Numbers correspond to source numbers in the table.

general comments are given in the table. A detailed description of the location of all 20 stands follows:

Cupressus arizonica var. *arizonica* (Arizona Cypress)

Texas, Brewster, Co., Big Bend National Park, Chisos Mountains, Boot Spring, and East Rim. Boot Spring is 4.4 miles by trail from Chisos Basin Campground. East Rim is 3.3 miles up the trail past Boot Spring. The trees at Boot Spring appear to be declining in vigor although the rate of radial growth is good. The stand is limited and cone production is extremely poor. The trees at East Rim are on a north-facing slope of 40-70°. The stand is quite extensive (several thousand trees), and is more vigorous than that at Boot Spring, but is not as vigorous as other sources of *C. arizonica* visited. The East Rim stand occurs at an elevation of about 6,800 feet and is associated with various species of *Quercus* and *Pinus*.

Mexico, Chihuahua, Sierra Madre, Devil's Canyon. This stand is reached by driving to the south end of Animas Valley in extreme southern Hidalgo County, New Mexico. The stand is located about 4 miles, South 30° East, from the United States-

LOCATION OF CUPRESSUS STANDS VISITED

[8]

Source	Species	Location	Approx. elev.	Approx. annual rainfall	Aspect	General observations
			<i>Feet</i>	<i>Inches</i>		
1.	<i>C. arizonica</i> var. <i>arizonica</i>	Big Bend National Park, Texas	6800	18-20	North facing slope	Limbs long, stiff, flat angle, some drooping.
2.	<i>C. arizonica</i> var. <i>arizonica</i>	Chihuahua, Mexico	5800	18-20	In bottom of canyon	Limbs long, stiff, flat angle, but none drooping.
3.	<i>C. arizonica</i> var. <i>arizonica</i>	Chiricahua National Monument, Arizona	5300	16-20	In bottom of canyon	Limbs long, stiff, slightly upturned.
4.	<i>C. arizonica</i> var. <i>arizonica</i>	Greenlee Co. Arizona	4900	16-20	All slopes and ridgetops	Limbs long, limber, upturned (70°) Trees poorly pruned.
5.	<i>C. arizonica</i> var. <i>arizonica</i>	Cochise Stronghold, Arizona	5100	16-20	Northeast slope	Limb angle more acute and blue cast on foliage greater than sources 1, 2, 3, and 4.
6.	<i>C. arizonica</i> var. <i>arizonica</i>	Portal, Arizona Cave Creek, Cochise Co.	5000	16-20	In bottom of canyon	Limbs long, slightly upturned. Most individuals have not produced heavy cone crop in years.
7.	<i>C. arizonica</i> var. <i>arizonica</i>	Pima Co., Arizona, Bear Canyon	5600	20-24	In bottom of canyon	Limbs long slightly upturned. More variation in color than most sources.
8.	<i>C. arizonica</i> var. <i>glabra</i>	Oak Creek Canyon, Arizona	4200	16-20	In bottom of canyon	Limbs upturned, some trees cylindrical form, bark scaly pinkish red, much resin on limbs and leaves.
9.	<i>C. arizonica</i> var. <i>glabra</i>	Gila County, Arizona	5100	20-24	Ridgetops and creek bottoms	Limbs long, fairly stiff, upturned (60°) pruned better than source No. 8, pinkish red bark.
10.	<i>C. guadalupensis</i>	Guatay Mtn., San Diego Co., California	3800	18-20	North slope	Most trees do not have dominant leader, or central stem. Limbs long, multiple forked, acute angle (50°).

11.	<i>C. arizonica</i> var. <i>stephensonii</i>	Cuyamaca Peak San Diego Co., California	6000	30-34	Southwest slope	Limbs long, no central stem, crown broader than trees are tall.
12.	<i>C. sargentii</i>	Cypress Creek Monterey Co., California	2600	30-34	Southwest slope	Limbs long with flat angle as in <i>C. arizonica</i> from Texas.
13.a	<i>C. macrocarpa</i>	Monterey Co., California	100	28-32	Rocky Bluff on Pacific Coast	Limbs slightly upturned. Foliage tufted and darker green in color than other species collected.
13.b	<i>C. goveniana</i>	Monterey Co., California	500	28-32	West slope	Limbs slightly upturned, some drooping.
14.	<i>C. goveniana</i>	Santa Cruz Co., California	2500	50-60	Southwest slope	Limbs slightly upturned. Foliage dark green.
15.	<i>C. goveniana</i> var. <i>pygmaea</i>	Mendocino Co., California	600	36-40	Plateau	Small trees with cane-like stems. Short limbs are extremely stiff. Fol- iage dark green with little blue cast.
16.	<i>C. bakeri</i>	Siskiyou Co., California	5500	24-28	North slope	Limbs medium length, very stiff, slightly upturned. Resin glands at base of leaf.
17.	<i>C. bakeri</i>	Shasta Co., California	4000	20-24	Northeast slope	Limbs medium length very stiff slightly upturned. Resin glands at base of leaf.
18.	<i>C. macnabiana</i>	Amador Co., California	2000	30-34	Ridgetop and northeast slope	Limbs long, upturned, limber, and crooked. Trees of this source do not maintain central stems.
19.	<i>C. arizonica</i> var. <i>nevadensis</i>	Kern Co., California	5000	18-22	Northeast slope	Limbs medium length, stiff, slightly upturned. Very prolific cone producer. Foliage light green; no blue cast.
20.	<i>C. arizonica</i> var. <i>arizonica</i>	Graham Co., Arizona	4800	20-24	Northeast slope	There is more variation for color, form and limb angle at this source than other sources. About 75% of trees are forked. Limbs long, fairly stiff, slightly upturned.

Mexico boundary monument No. 66. There is a wagon road leading into the canyon. The stand extends up the creek for about 1.5 miles to an elevation of about 5,700 feet. Young trees are abundant in flats along the creek. Intermediates are kept cut by Mexicans for fence posts. The larger trees (40 inches in diameter and 100 feet tall) are straight, vigorous, and well pruned.

Arizona, Cochise County, Chiricahua National Monument, Bonita Canyon. The cypresses extend from below the monument boundary to above the road to Sugarloaf lookout, a distance of about 5 miles. There are many large beautiful specimens, but young trees are not plentiful.

Arizona, Greenlee County, Apache National Forest. Cypresses occur from just below the southern boundary of Apache National Forest on Highway 666 (north of Clifton) to about 6 miles north of the U.S. Forest Service boundary. There are thousands of trees in this area. The stand is about 2 miles wide at its widest point. The trees are smaller and are pruned less than those mentioned above.

Arizona, Cochise County, Dragoon Mountains, Cochise Stronghold. Cypresses occur from about 0.4 miles east of the east boundary of U.S. Forest Service land along Stronghold Canyon East up past the campground to near the top of the mountain. Cypresses also occur on the west side of the mountain in Stronghold Canyon West. The trees do not form a dense stand but are scattered along the creek.

Arizona, Cochise County, Chiricahua Mountains, South Fork of Cave Creek. Trees are scattered from Portal Ranger Station (USFS) to a campground at the end of the road on the South Fork of Cave Creek. Trees appeared vigorous, but cone production was very light (1964) and reproduction absent.

Arizona, Pima County, Santa Catalina Mountains, Mt. Lemmon Recreation Area, Bear Canyon. The road from Tucson to Mt. Lemmon passes through the upper portion of the cypresses. Trees are scattered except for two or three small stands. Most trees at this locality are tall and well pruned. The largest specimen observed was about 5.5 feet in diameter and 100 feet tall.

Arizona, Graham County, Galiuro Mountains, South Ash Creek. To reach the trees go north from Willcox toward Bonita to the Feeders Grain Company (Bonita Plant). Turn west at the grain company and stay on the main road to a U.S. Forest Service sign reading "South Ash Creek." Cypresses start about 1.1 miles

up the creek ($\frac{1}{4}$ mile up creek from U.S. Forest Service boundary). Trees of this source have a beautiful blue color and conical shape, but about 75 per cent of the individuals are forked. There is as much or more variation for some traits at this source than at any of the previously mentioned sources. It is interesting to note trees of this source have trunk bark like *Cupressus arizonica* var. *arizonica* and limb bark like *Cupressus arizonica* var. *glabra*. Cypress also occurs at the head of Rattlesnake Creek and at the head of Bass Canyon, both in the Galiuro Mountains and at the head of Pine Creek in the Winchester Mountains. The Winchester Mountains are southeast of the Galiuro Mountains in Cochise County. Cypress has also recently been found in the Rincon Mountains, Saquaro National Monument, but the exact location was not available.

Cupressus arizonica var. *glabra* (Smooth Arizona Cypress)

Arizona, Yavapai County, and Coconino County, Oak Creek and Sedona Area. Cypress trees occur from about 3 miles up Oak Creek north of Sedona to about 5 miles south of Sedona along Highway 89A. Cypresses also occur on Dry Beaver Creek.

Arizona, Gila County. Cypress trees occur along the road from Payson to Pine, along East Verde River, and at Natural Bridge. There are thousands of trees in this area.

Cupressus guadalupensis (Tecate Cypress)

California, San Diego County, Guatay Mountains. Trees occur on the northwest slope just above Guatay Forest Campground. There are only a few hundred cypresses at this source. Most trees do not have a dominant terminal leader. The tops are rounded as if mature but the trees are relatively young.

Cupressus arizonica var. *stephensonii* (Cuyamaca Cypress)

California, San Diego County, Cuyamaca Rancho State Park, Cuyamaca Peak. This area was swept by fire in 1950 and only a small stand of cypress remains. However, young trees are present along Kings Creek which heads on the peak. The small stand of cypresses is on the southwest slope of Cuyamaca Peak. Take the road on the east side of the peak to reach the lookout tower on Cuyamaca Peak. Then walk down to the stand. Trees in this stand are not more than 15 feet tall, have no central stem, and have wide spreading crowns. This is the only known grove of this species.

Cupressus sargentii (Sargent Cypress)

California, Monterey County, Alder Mountains. To reach the cypresses go up California Highway No. 1 from San Luis Obispo toward Monterey to 1 mile north of Cape San Martin (just south of Willow Creek). Go inland 8 miles on steep winding road to U.S. Forest Service Alder Creek Camp, then take trail down creek about 1 mile to Cypress Creek. Cypress trees occur from the junction of Cypress and Alder Creeks to the top of the southwest facing slope. Trees of this location are tall, well pruned, and are growing on serpentine soil. Young trees are present in small thickets.

Cupressus macrocarpa (Monterey Cypress)

California, Monterey County, Point Lobos Reserve State Park; 6 miles south of Monterey on California Highway I. Most trees of this species are within 500 yards of the Pacific Ocean. Many of the trees appear mature. Sufficient numbers of young trees to replace the mature ones are conspicuously absent.

Cupressus goveniana (Gowen Cypress)

California, Monterey County, Point Lobos Reserve State Park. Six miles south of Monterey on California Highway I. The stand of Gowen cypress is within a few miles of the Monterey cypress. Inquire at Park Headquarters for exact location.

Cupressus goveniana (Santa Cruz Cypress)

California, Santa Cruz County, Santa Cruz Mountains, Eagle Rock. To reach the stand, drive from Bonnie Doon north toward the Lockheed Aircraft Plant. The cypresses occur on the southwest slope of Eagle Rock about 100 yards down slope from Eagle Rock fire lookout. The trees and surrounding land are privately owned. There are not more than 75 trees in the area, but those present are vigorous.

Cupressus goveniana var. *pygmaea* (Mendocino Cypress)

California, Mendocino County, Van Damme Beach State Park. There are many small stands of cypress in this area. One of the better stands for observing the pygmy type is in the park and is called the Pygmy Forest. There is another stand along the entrance road to the County Airport just south of the park. Observations in the area would lead one to believe that the pygmy trees are a result of the environment and not the genotype of the cypresses.

Cupressus bakeri (Siskiyou Cypress)

California, Siskiyou County, Goose Nest Mountains. To reach the stand of cypress, go east from Yreka toward Mt. Hebron about 20.6 miles to U.S. Forest Service Goose Nest Road No. 2, which extends up the northeast slope of Goose Nest Mountain. The cypress stand is at the end of the road (about 1 mile). The road is not maintained. This stand is very dense in places. These cypresses form a belt around the mountain on the northeast and northwest slopes at an elevation of about 5,500 feet.

Cupressus bakeri (Modoc Cypress)

California, Shasta County, Hat Creek District, Lassen National Forest, Burney Springs Campground and Cypress Campground. To reach the stands, go to Hat Creek Ranger Station on Highway 89. A road extends from the Ranger Station to Burney Springs (11 miles) and to Cypress Campground (13 miles). Scattered trees are also present 7.5 miles from the Ranger Station along the road to the above mentioned campgrounds.

Cupressus macnabiana (McNab Cypress)

California, Amador County, Red Hill south of River Pines. Cypresses occur on the northeast slope and the top of the hill, which forms the south boundary for the small town of River Pines. The trees of this source are short, wide crowned, and do not normally maintain a central stem.

Cupressus arizonica var. *nevadensis* (Piute Cypress)

California, Kern County, Sequoia National Forest, Greenhorn District, Piute Mountains, Bald Eagle Peak. To reach the stand, go about 3 miles toward Havilah from Bodfish to the summit of the grade. Turn left at the summit and go on road to Piute Mountain about 2.1 miles. Cypress extends along the road for more than a mile on the northeast slope. Trees of this species are the most prolific cone producers of all species observed.

GENERAL COMMENTS ON GEOGRAPHIC VARIATION

From the genetic standpoint, the most interesting aspect of *Cupressus* is the tremendous amount of variation in most morphological characteristics within a source or locality. Since the cypresses occur only in relatively small groves in a few protected habitats usually widely separated geographically from other

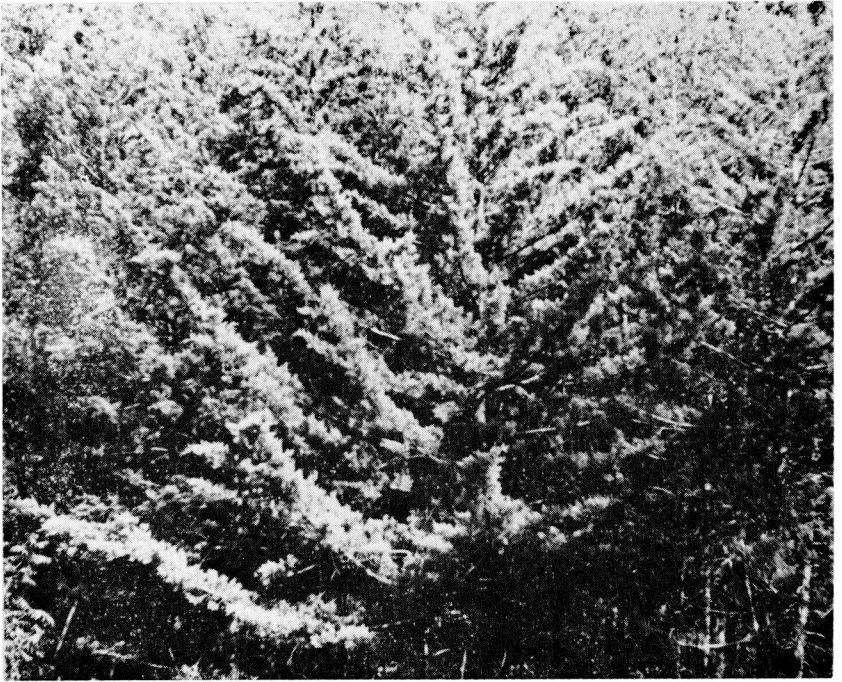


FIG. 2. Variation in branching, and foliage of *Cupressus arizonica*.
A. Dense Stand of *Cupressus arizonica*.

groves, one would expect *Cupressus* to be an old genus with little variation and little ability to evolve further. This, however, is not completely true because there is much variation between trees in groves and between groves. (Figure 2.) Wolf and Wagener⁵ stated that a considerable amount of the variation is because of differences in the environment and this is no doubt true for some of the differences that exist between groves, but this does not explain the large amount of variation between trees within a given grove. Part of the variation within groves may be caused by the extreme year-to-year environmental differences. Some genotypes could have a selective advantage in good years and other genotypes an advantage in poor years.

If one considers only *Cupressus arizonica*, the following points are noted:

1. The limbs form a 90° angle with the trunk in the southern part of the range. As one travels north the limb angle becomes

⁵ Op. Cit.



FIG. 2. Variation in branching, and foliage of *Cupressus arizonica*.
B. Unusual branching and foliage.



FIG. 2. Variation in branching, and foliage of *Cupressus arizonica*.
C. Unusual form and foliage.



FIG. 3. Variation in limb angle of *Cupressus arizonica* from south to north.
A. South.

increasingly acute to the extreme that lower limbs compete with the terminal. (Figure 3.)

2. Stiffness of the limbs tends to decrease from south to north.

3. In general, shape of the trees changes from a conical crown in the southern portion of the range to a more columnar shaped crown in the northernmost portion of the range.

4. Trees tend to be better pruned in the southern part of the range than in the northern part, but this may be partially the result of stand density. There are thickets of trees in the southern part of the range, but in the northern part, even in pure stands of cypresses, the trees do not tend to form thickets. (Figure 4.)

5. Bark on the trunk tends to be ridged and fibrous in the southern part of the range and becomes increasingly smooth and scaly in the northern portion. In the middle of the range, trees have limbs with scaly red-brown bark and trunks with ridged fibrous bark. (Figure 5.)

6. Trees in the northern portion of the range have pitch glands at the base of the leaves, under the surface of ovulate cones, and



FIG. 3. Variation in limb angle of *Cupressus arizonica* from south to north.
B. Intermediate.



FIG. 3. Variation in limb angle of *Cupressus arizonica* from south to north.
C. North.



FIG. 4. Dense, well-pruned stand of young *Cupressus arizonica*.

under the bark surface on the limbs, whereas the trees in the southern portion of the range are relatively free of active pitch glands.

7. As noted previously, there is much variation both within and between stands. However, there is more variation in color, tree form, bark, limb angle, limb stiffness, and pruning within a stand in the northern part of the range than in the southern portion.

It would seem from the standpoint of Christmas tree production that trees from the southern portion of the range would be best since in general the trees have a flat limb angle, conical form, relatively stiff limbs, and fibrous bark.

The species collected in California are too diverse both from the genetic and environmental standpoints to attempt to describe geographic trends in morphological characteristics without specific data. The species of *Cupressus* in California are not as promising for Christmas tree production as *Cupressus arizonica* because several of them do not maintain a central system and some are apparently highly susceptible to *Phomopsis blight*.



FIG. 5. Ridged, fibrous bark of large *Cupressus arizonica* in Chihuahua, Mexico.

However, if they survive and grow well in the South some may become valuable as horticultural plants.

COMMENTS ON STUDYING CYPRESSES

If one is endeavoring to study the species of *Cupressus* in the Southwestern United States during the summer, it is probably advisable to complete the work before the middle of July. Some individual trees at some sources do not have cones persistent for several years and the only cones on these trees tend to open in July. Also, the rainy season in Arizona normally begins before the middle of July thus hampering travel to the isolated groves.

The majority of the groves are located on public land and in many cases a permit to collect specimens is required. Federal agencies such as U.S. Forest Service, National Parks, and National Monuments will normally give collecting permits the same day applied for, but state agencies usually have an office at the state capital where the permits must be processed thus requiring, in some cases, a waiting period of several weeks.

