

**REEVALUATION OF THE BIOLOGICAL STATUS OF
JUNIPERUS DEPPEANA VAR. SPERRYI CORRELL**

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REEVALUATION OF THE BIOLOGICAL STATUS OF *JUNIPERUS DEPPEANA* VAR. *SPERRYI* CORRELL

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Adams, Robert P. (Department of Botany & Plant Pathology, Colorado State University, Fort Collins). Reevaluation of the biological status of *Juniperus deppeana* var. *sperryi* Correll. *Brittonia* **25**: 284-289. 1973.—Foliage and bark samples were collected from the tree that provided the type specimen for *Juniperus deppeana* var. *sperryi* Correll, as well as from trees from populations of *J. pinchotii* Sudw., *J. flaccida* Schl., and *J. deppeana* Steud. var. *deppeana*. These four taxa were compared using terpenoid and morphological characters. The terpenoid data suggest that *J. deppeana* var. *sperryi* is most closely related to *J. deppeana* var. *deppeana*; no evidence of relict or present hybridization with *J. flaccida* was detected. The morphological data showed *J. deppeana* var. *sperryi* to be intermediate in several characters between *J. deppeana* var. *deppeana* and *J. flaccida*. The probability of a hybrid origin for this taxon is discussed. Due to the scattered occurrence of trees referable to *J. deppeana* var. *sperryi*, it is proposed that this taxon be reduced in rank to ***J. deppeana* forma *sperryi***.

Juniperus deppeana Steud. var. *sperryi* Correll is an unusual juniper that occurs in the Davis and perhaps the Guadalupe Mountains in trans-Pecos Texas (Correll, 1966). It can be readily distinguished from *J. deppeana* var. *deppeana* by the bark that is furrowed and exfoliates in strips, as opposed to the checkered "alligator" bark of var. *deppeana*. In addition, var. *sperryi* has a peculiar drooping foliage that is somewhat like that of *J. flaccida* Schl. Fig. 1 shows the furrowed nature of the bark, and the drooping nature of the foliage. This is the same tree from which O. E. Sperry collected the type specimen.

On February 18, 1968, I visited the type locality with Mr. H. E. Sproul, owner of the Sproul Ranch. The trip took about half a day each way by horseback over some rather steep terrain. Since Mr. Sproul had accompanied Sperry on the original trip, he was very familiar with this particular tree. Mr. Sproul has known of this tree since childhood (approximately 40 years) and knows of only two other such trees in the Davis Mountains. There is no doubt that my collection (Adams 68-352, TEX) is from the same tree as the original collection. The purpose of our trip was to collect foliage for both morphological and chemical study as evidence bearing on the origin of this particular plant. Since the photographs of Sperry, published by Correll (1966), indicated a rather lax foliage and furrowed bark, it seemed likely that introgression from *J. flaccida*, which occurs 103 air miles SSE in the Chisos Mountains, might be responsible for the features concerned.

MATERIALS AND METHODS

Samples of fresh foliage were collected and sealed in plastic bags as described by Adams (1970). Portions of these samples were frozen within two days, and other portions were used for morphological examination and vouchers. The volatile terpenoids were removed by steam distillation as previously outlined (Adams, 1970). Separation and quantification was by gas/liquid chromatography and the use of an electronic digital integrator (for details, see Adams, 1970). Some of the compounds were identified by their infrared spectra (for discussion, see Adams, 1969). The similarity measure used was basically a matching coefficient as described by Sokal & Sneath (1963), which is described in detail by Adams & Turner (1970). The

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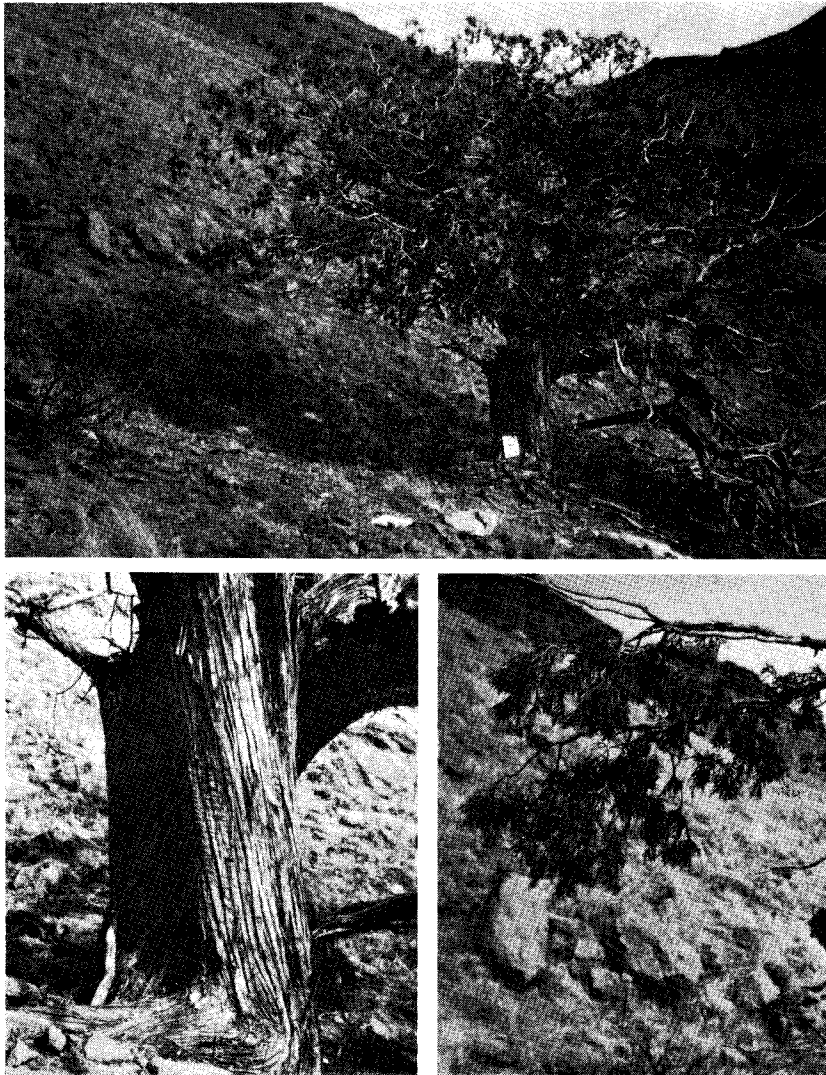


FIG. 1. Upper: General habit photo of *J. deppeana* var. *sperryi*; the white box at the base of the tree is about 1 ft high. Lower left: Close-up of trunk showing the furrowed bark. Lower right: Close-up of foliage showing the drooping nature.

character matches were weighted by use of F ratios (variance among taxa/variance within taxa). The single linkage clustering method was used to determine phenetic relationships (Sneath, 1957).

RESULTS AND DISCUSSION

Fig. 2 shows the gas/liquid chromatograms of *J. deppeana* var. *deppeana*, *J. deppeana* var. *sperryi*, *J. pinchotii* Sudw., and *J. flaccida* (for the identification of the major components, see Adams, 1972). The sample for *J. deppeana* var. *deppeana* came from tree 353, which was growing near the var. *sperryi* tree. The sample for *J. pinchotii* was taken from tree 354, which was also growing nearby. Both of these

TABLE I
SIMILARITY MEASURES BETWEEN 6 OTUS USING 67 TERPENOID CHARACTERS, F WEIGHTED.
SEE TEXT FOR EXPLANATION

	<i>sperryi</i> (352)	<i>deppeana</i> (popn.)	<i>deppeana</i> (353)	<i>pinchotii</i> (popn.)	<i>pinchotii</i> (354)	<i>flaccida</i> (popn.)
<i>sperryi</i> (352)	1.000	.673	.651	.433	.417	.288
<i>deppeana</i> (popn.)	.673	1.000	.678	.462	.483	.367
<i>deppeana</i> (353)	.651	.678	1.000	.526	.522	.240
<i>pinchotii</i> (popn.)	.433	.462	.526	1.000	.685	.149
<i>pinchotii</i> (354)	.417	.483	.522	.685	1.000	.182
<i>flaccida</i> (popn.)	.288	.367	.240	.149	.182	1.000

trees appear to be fairly representative of their respective taxa (for representative chromatograms of these species, see Adams, 1972). Careful examination of the gas chromatograms of these four taxa and other trees within these taxa failed to reveal any unusual compounds in the *sperryi* tree that could be ascribed to *J. pinchotii* or to *J. flaccida*. The peak running at the position of peak 2A had previously been found to contain mostly α -thujene in *J. pinchotii* versus only α -pinene in *J. deppeana* and *J. flaccida*. In order to determine if genes that code for α -thujene from *J. pinchotii* might be present in *J. deppeana* var. *sperryi*, an infrared spectrum was run on peak 2A of the *sperryi* tree. Examination of the spectrum revealed that this peak contained only α -pinene in the *sperryi* tree as in *J. deppeana* var. *deppeana* and in *J. flaccida*. Similarity measures were calculated using 6 OTUs: a group of 16 trees of *J. deppeana* var. *deppeana* from the Chisos, Davis, and Guadalupe Mountains; a group of 20 trees of *J. pinchotii* from the Davis and Guadalupe Mountains; a group of five trees of *J. flaccida* from the Chisos Mountains; an individual *J. pinchotii* tree, 354; an individual *J. deppeana* var. *deppeana* tree, 353; and an individual *J. deppeana* var. *sperryi* tree, 352. Table I shows the similarity matrix obtained. Examination of the var. *sperryi* (352) tree shows it to be most similar to the population sample (16 trees) of var. *deppeana* and then to the individual *deppeana* tree (353). On statistical grounds, if the plant concerned belonged to the species *deppeana*, one would expect it to cluster with a populational sample of the taxon, as opposed to a single individual (tree 353), even if this were collected in the immediate vicinity. There is no evidence of introgression from *J. flaccida* as shown by the fact that the similarity of *J. flaccida* to *J. deppeana* var. *sperryi* is less than the similarity of *J. flaccida* to the *J. deppeana* var. *deppeana* population. If var. *sperryi* had been a product of recent gene flow from *J. flaccida*, one would expect the taxon to be more similar to the latter than to var. *deppeana*, but this is not the case.

Table II shows several morphological characters that separate *J. deppeana* and *J. flaccida*. The bark exfoliation pattern of var. *sperryi* is very similar to that of *J. flaccida*, as is the foliage laxness, although the foliage does not seem quite as drooping and lax as in typical *J. flaccida*. When one examines the ratio of the whip-leaf gland/whip-leaf sheath length, var. *sperryi* is surprisingly intermediate. The leaf margins are serrate in all three taxa, but under a magnification of about 20 \times , the leaf margins of *J. flaccida* appear almost without teeth. It is only under higher magnification that these small teeth are visible. The margins of *J. deppeana*

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FIG. 2. Gas/liquid chromatograms of the terpenoids of four taxa of *Juniperus*. Note the similarity between *J. deppeana* var. *sperryi* and *J. deppeana*. See text for discussion.

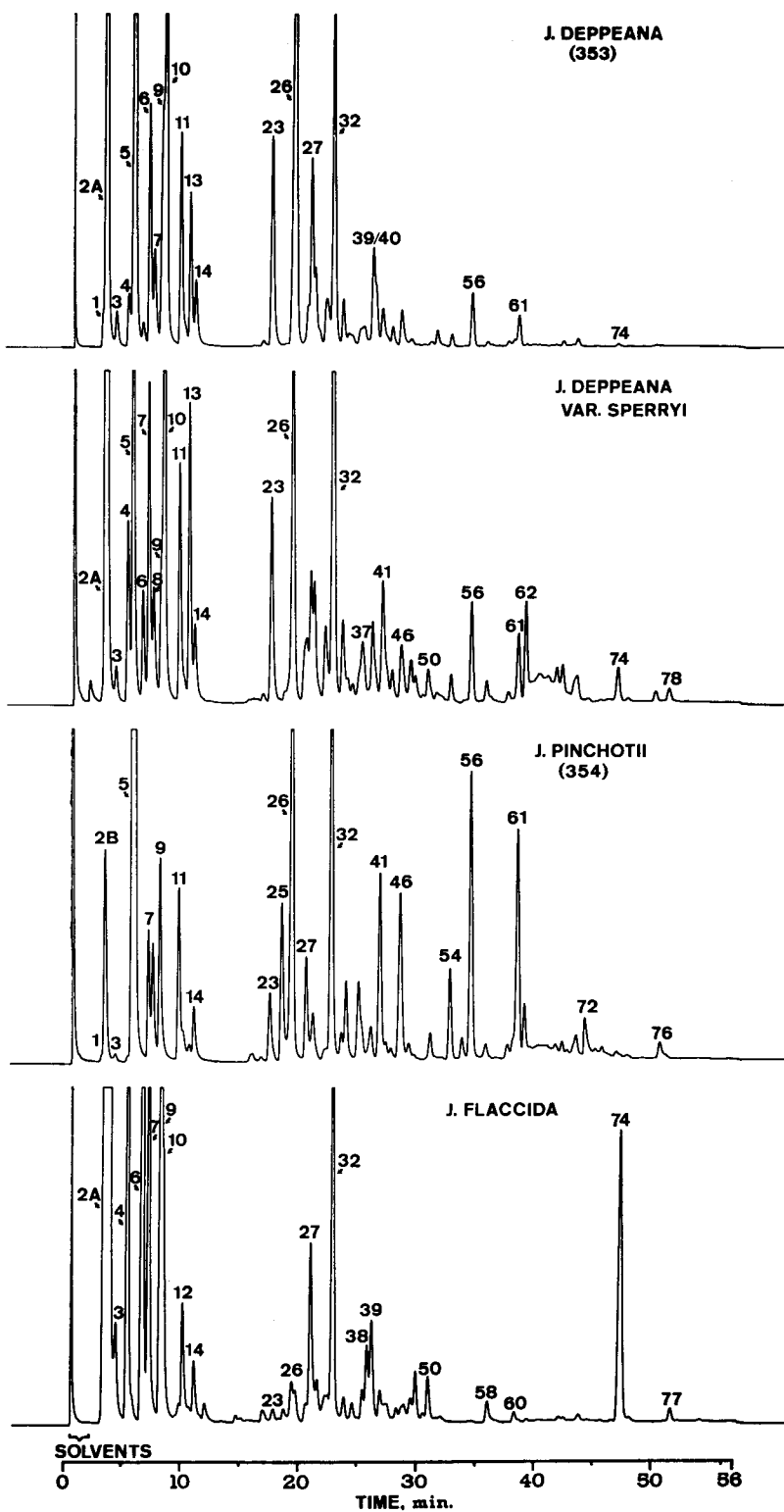


TABLE II
MORPHOLOGICAL CHARACTERS THAT SEPARATE *J. deppeana* VAR. *deppeana*,
J. deppeana VAR. *sperryi*, AND *J. flaccida*

	<i>J. deppeana</i>		
	<i>var. deppeana</i>	<i>var. sperryi</i>	<i>J. flaccida</i>
Bark exfoliation pattern	squarish blocks	furrowed strips	furrowed strips
Foliage laxness	mostly erect	mostly drooping	drooping
Ratio of whip-leaf gland/ sheath length	0.47	0.745	0.95
Leaf margins (at 20× mag.)	obviously serrate	mostly serrate	slightly serrate
Number of seeds/cone	3.14	5.2	8.35
Female cone diameter (mm)	9.32	10.85	11.09

var. sperryi might be slightly less serrate than in *J. deppeana* var. *deppeana*, but quantitative measures were not made. The number of seeds per cone in *var. sperryi* is also somewhat intermediate (5.2 seeds/cone) between these two taxa. Although cone diameter is correlated with the number of seeds, the cone is also intermediate in size.

From the analysis of the morphological data, one might conclude that *var. sperryi* arose through hybridization of *J. flaccida* × *J. deppeana*. The terpenoid data, however, fail to lend support to such an origin. The literature contains numerous reports of hybridization being detected in the morphological but not the chemical characters, and vice versa (Baetcke & Alston, 1968; Brehm & Ownbey, 1965; Crawford, 1972; Forde, 1964; Habeck & Weaver, 1969; Mirov, 1956; Zavarin & Critchfield, 1969).

It seems likely that during fluctuations of species' ranges during the Pleistocene *J. flaccida* would be found in the Davis Mountains. These few trees of *var. sperryi* might be relics of past hybridization, as the morphological data suggest. On the other hand, *J. deppeana* is known to be highly variable both morphologically and chemically (Adams, 1969). It is interesting to note that Martínez (1963) created a subsection, *Juniperus* subsect. *Deppeanae*, with two species: *J. deppeana* and *J. patoniana*. From my field experience, *J. patoniana* differs from *J. deppeana* mostly in having furrowed rather than checkered bark. In fact, Martínez (1963) even mentions that *J. patoniana* forma *obscura* has the lower bark checkered and the upper part furrowed! I have collected specimens from a tree of *J. deppeana* south of Saltillo, Coahuila, Mexico, that appeared to be "good" *deppeana*, except that the bark was furrowed. The terpenoids of that tree were very much like *J. deppeana* in general. This would lend support to the idea that *var. sperryi* represents an unusual combination of only a few genes from within the highly variable *deppeana* genome.

CONCLUSION

Examination of the terpenes of *J. deppeana* var. *sperryi* has revealed that the terpenoid pattern is very similar to that of other *J. deppeana* var. *deppeana* trees; there is no evidence of introgression from *J. flaccida*. Nevertheless, the morphology appears in several characters to be somewhat intermediate between *J. deppeana* var. *deppeana* and *J. flaccida*. Until *J. deppeana* is better understood throughout its range, it is difficult to state conclusively that the few trees of *J. deppeana* var. *sperryi* (three or four known) are the result of relict hybridization or just the chance occurrence of unusual gene combinations from within the gene pool of *J. deppeana*.

Since *J. deppeana* var. *sperryi* appears to be limited to a few, widely scattered trees,

it seems more reasonable to accord the status *forma* to the plants concerned than that of *varietas* (Kapadia, 1963). I therefore propose that the var. *sperryi* Correll be recognized as **J. deppeana** forma **sperryi** (Correll) Adams, comb. nov.—based upon *Juniperus deppeana* var. *sperryi* Correll, *Wrightia* **3**:188–189. 1966.

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