NATURAL POPULATIONS OF *HESPERALOE* (AGAVACEAE) IN TEXAS

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Abstract: Starr provided a classically oriented systematic treatment of the genus *Hesperaloe* in which five species were recognized; only one of these, *H. parviflora* (including *H. engelmannii*) was said to be native to Texas (and closely adjacent Mexico). Unfortunately, he did not examine populations of this species complex in the field so as to assess morphoecogeographical patterns in the taxon. We have undertaken a field study of living populations of this complex in Texas and conclude that there are two, and possibly three, taxa of *Hesperaloe* native to Texas. Two of these, *H. parviflora* and *H. engelmannii,* have long been known to occur in Texas. The former is largely confined to the northern Chihuahuan Desert (mostly occurring with *Larrea tridentata, Agave lechugilla* and associated thorny shrubs) while the latter occurs mostly beneath oaks and associated shrubs and trees of the Edwards Plateau. A third, exceedingly rare, mostly Mexican species, *H. funifera,* has recently been suggested as being native to the state by Butterwick and Poole. According to Starr, *Hesperaloe funifera* is composed of two infraspecific taxa (*H. f.* subsp. *funifera* and *H. f.* subsp. *chiangii*), but these are treated as species in the present paper necessitating the following new name: **Hesperaloe chiangii** (Starr) B. L. Turner, comb. & stat. nov. Texas material belongs to *H. funifera.* A discussion of these several taxa is provided along with a map showing their distribution in Texas.

Keywords: Agavaceae, *Hesperaloe,* taxonomy.

Hesperaloe parviflora (Torr.) Coult. is a common horticultural succulent widely cultivated throughout the xeric and subxeric regions of the world. It was first collected by Charles Wright from gravelly hills near the mouth of the Pecos River (Val Verde County, Texas). It was originally positioned in the genus *Yucca* by Torrey (in 1859) but, as noted by Starr (1997), subsequently transferred to the genus *Aloe* by A. Gray (in 1867), where a new specific name, *A. yuccaefolia,* was provided due to an earlier *A. parviflora.* Engelmann (1871), finally positioned it in a newly erected genus *Hesperaloe* whereupon the original specific name was resurrected in accordance with priority rules of that day, which largely conform to those of the present.

Shortly after the discovery of *Hesperaloe parviflora,* Krauskopf described *H. engelmannii* from material which he personally collected along the western branch of the Nueces River in southwesternmost Edwards County, Texas (cf. Starr 1997).

Krauskopf took living material (presumably seeds) to Europe where they were grown and subsequently described in a horticultural circular. In his brief account of the taxon he did not make reference to any specimen that might serve as a type. As a consequence the name remains untypified, but a neotype from the type locality is provided in the present paper. Most subsequent workers have not recognized *H. engelmannii,* although Trelease, in 1892, accorded it varietal rank as *H. parviflora* var. *engelmannii.*

According to Starr (1997), Krauskopf reportedly distinguished *Hesperaloe engelmannii* from *H. parviflora* by its "longer anthers and a short, thick (not filiform) style." We have examined these floral characters in natural populations of the two taxa concerned and can vouch for their general utility in distinguishing between them (Figs. 1a, 1b). However, the taxa are more readily distinguished **in the field** by habit and vegetative features. *Hesperaloe engelmannii* is a

much larger plant (up to 2.5 m high) with longer leaves (mature well developed leaves mostly 1.0–1.3 m long, vs. 0.1–0.7 m); additionally, the leaves are darker green with a narrower more flattened blade at mid point. These features of vegetative morphology and habit are readily discernible in Figs. 1c, 2a and 3b.

Natural Populations of *Hesperaloe* in Texas

Hesperaloe parviflora

So far as known, *Hesperaloe parviflora,* as recognized here, is confined to the Devils River and lower Pecos River drainages of Val Verde Co., Texas and adjacent Mexico. As observed in its native habitat it is invariably a small, pallid-green succulent with relatively broad, markedly sulcate leaves, the margins of which are freely frizzed with recoiling fibers (Fig. 2c).

The taxon is quite rare, both regionally and locally. The largest populations to our knowledge occur on dry gravelly hills along the upper Devils River. In the spring of 2000, the first author observed about 30–50 individual plants or clumps over an area of several acres (*Turner 20-10* TEX). The taxon was not discerned elsewhere in the vicinity in spite of efforts to locate such along the few highways and roads in this area.

Overall, however, the taxon is known from at least six populations in Val Verde County, as follows: south of Comstock, 23 Apr 1966, *Flyr 1005* (LL); 12 mi east of Langtry, 1 May 1955, *Turner 3789* (SRSC, TEX); 3.2 mi north of Devils River crossing along State Highway 163, 1 Apr 2000, *Turner 20-10* (SRSC, TEX); ca 6 mi east of Langtry, 7 May 2000, *Turner 20-366* (TEX); 10 mi northwest of Del Rio, 22 Apr 1951, *Warnock 9908A* (LL); 2 mi north of Devils River crossing [north of Comstock] along State Highway 163, 1 May 1949, *Warnock & Turner 758* (SRSC, TEX).

All of the above sites are seemingly situated in typical stands of Chihuahuan Desert vegetation, mostly dominated by *Larrea tridendata, Agave lechugilla* and associated thorny shrubs.

Finally, it should be noted that Mr. Jack Skiles, a long-time resident of Langtry, Texas (Val Verde Co.), called to our attention the population 6 mi east of Langtry along the Southern Pacific Railroad (cited above). In spite of his botanical interests and 50-plus years in the vicinity of this locale, both as a plant collector and cowboy (having served as a ranch foreman on several spreads in this region), he noted that over this period he observed only this single population, which was composed of only three plants when first observed. At the time of the senior author's rediscovery of this population, only a single plant was found (Fig. 1c).

Hesperaloe engelmannii

We have examined most of the sites given by Starr (1997) for collections of *Hesperaloe parviflora* outside of Val Verde Co., all of which appear to be populations of *H. engelmannii* Krauskopf (sensu the present authors). In addition, we have discovered several additional sites, albeit close to previously reported populational sites.

Starr (1997) cited and/or made reference to only six Texas collections of what we would call *Hesperaloe engelmannii*; these include one collection from along the Nueces River in Edwards Co. (whence the type locality), three collections from central Texas (as mapped in Mills and San Saba counties, although only one such collection was cited by Starr, that from Mills County), and two from north central Texas (Collins and Haskell counties). The last two he reckoned to be introduced cultivars, a view to which we also subscribe, giving their relative remoteness to yet other populations and their proximity to gardens and/or homesteads generally. Our survey for populations of *Hesperaloe engelmannii* in Texas follows: **Edwards Co.:** ca. 27 road miles SW of Rock Springs along highway 674 (ca. 2 mi SW of

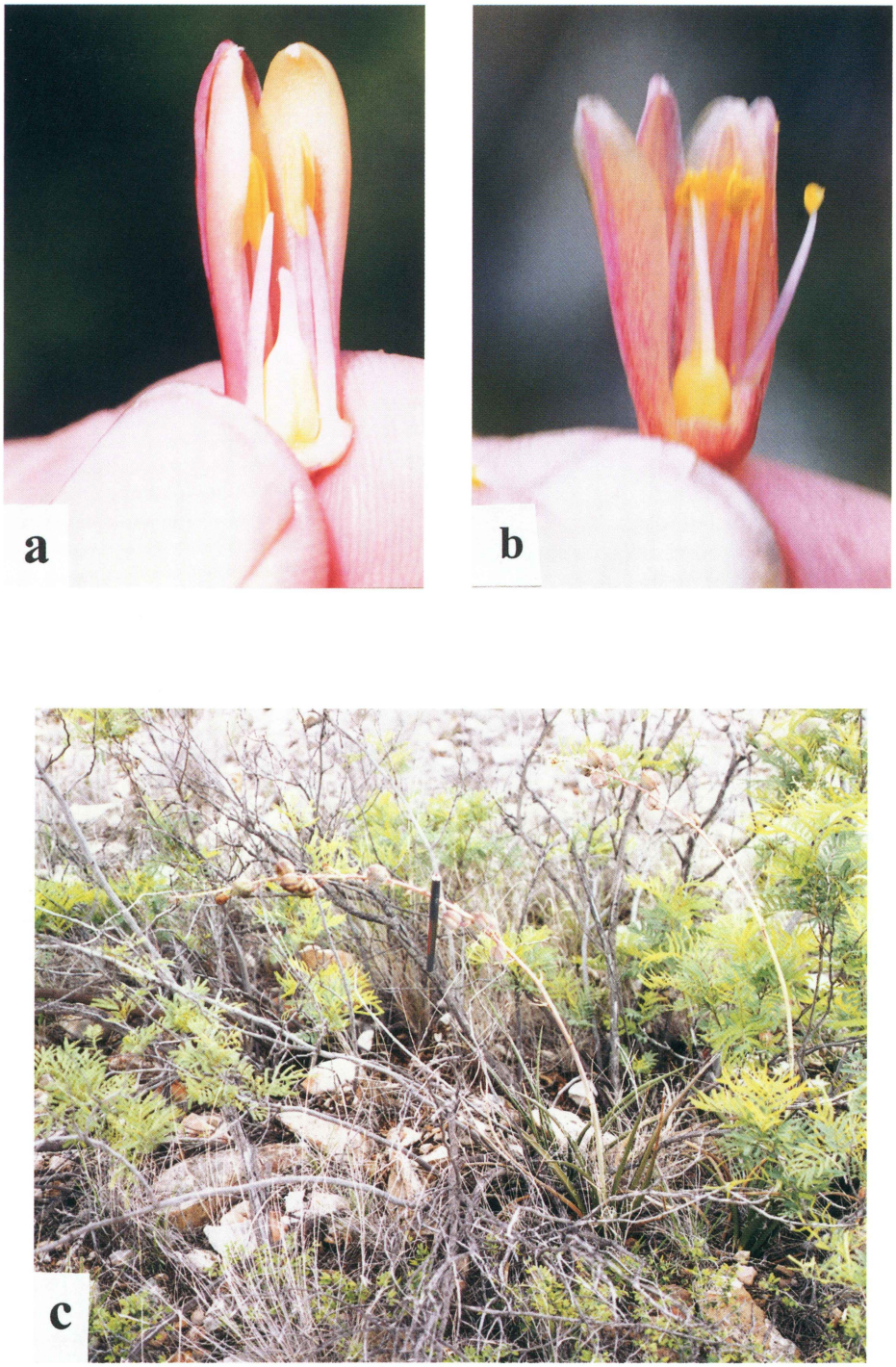

FIG. 1. a. Immature ovary and style of *Hesperaloe engelmannii*. b. Ovary and style of *H. parviflora*. c. *Hesperaloe parviflora*: showing habit, 6 miles east of Langtry, Val Verde County (*Turner 20-366*, TEX).

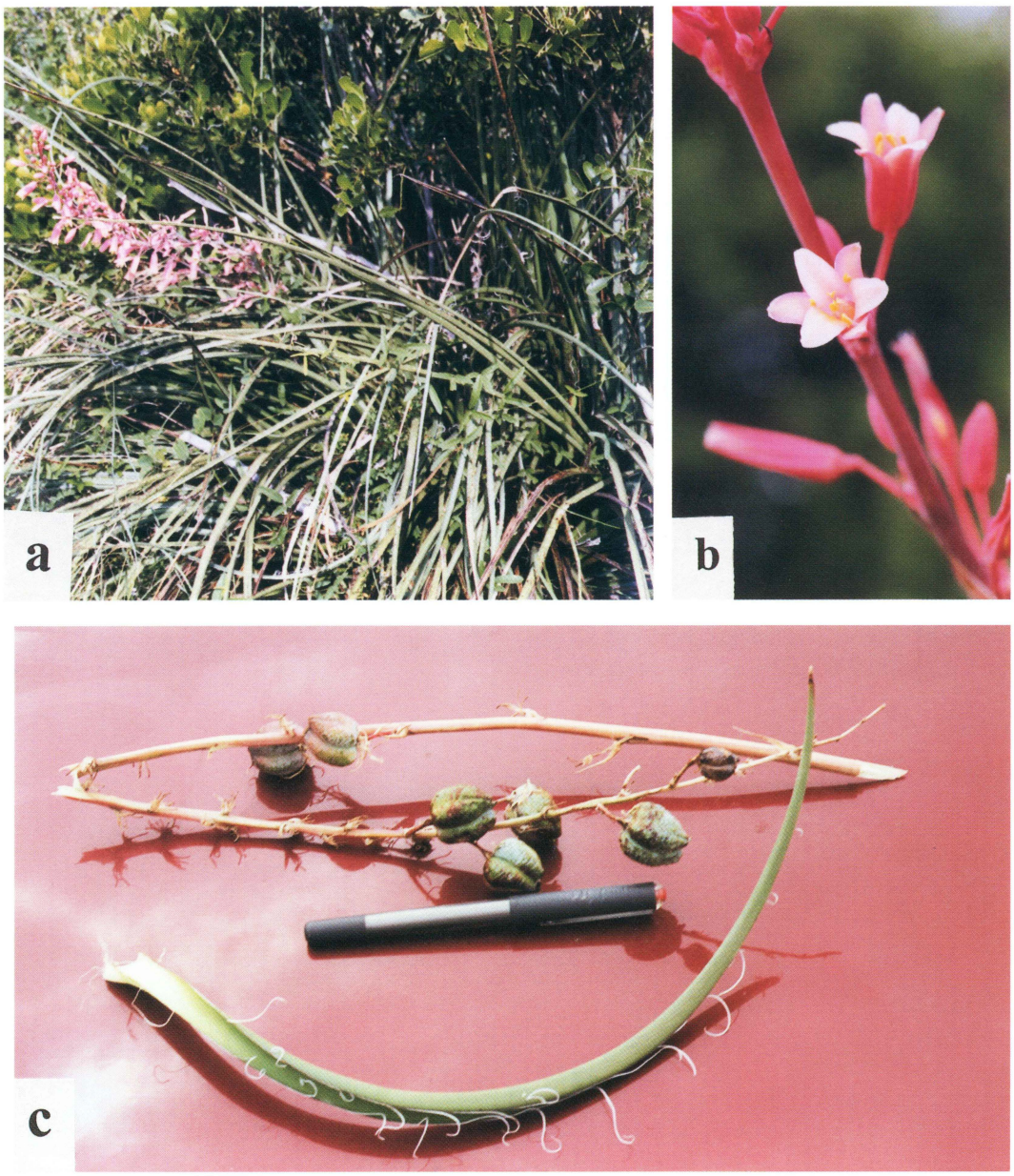

FIG. 2. *Hesperaloe engelmannii.* a. Habit, Edwards County (*Turner 99-367*). b. Flowers, Mills County (*Turner s. n.*). c. *H. parviflora,* fruiting racemes and longest leaf from plant shown in Fig. 1c.

One Mile Canyon), 28 May 1999, *B. L. Turner 99–69* (TEX).

A number of vigorous flowering populations (ca. six), beginning at the above site, were observed southward along Highway 674, these disappearing near the entrance to Kickapoo State Park (ca. 4.4 mi N of the Edwards/Kinney county lines). Some or most of these populations were revisited in early May of 2000 and relatively few flowering specimens could be detected, although about six (mostly non-flowering)

populations were discerned after diligent searches at likely sites. The first population located during this second visit was 21.7 road miles south of the intersection of Highway 674 with Highway 377. This population consisted of five plants (or clones), all very depauperate and severely browsed, presumably by wild game (probably deer or javelinas). Indeed, had the senior author not discovered the existence of these populations during his first visit to the region, he would almost certainly not have noted the plants concerned since they were so badly damaged, both by inflorescence browsing and, presumably, rooting of the basal rosettes and consumption of rhizomes by javelinas. From this site to near the Kinney County line (ca 15 miles) only about five more, mostly small populations were located. The largest, ca 0.5 miles N of Government Draw, consisted of ca. six plants, only a few of which were in good flower (Fig. 2a).

MILLS COUNTY POPULATIONS. As noted in the above introduction, Starr (1997) reportedly examined only two collections of *Hesperaloe engelmanii* from Mills Co., but cited only one (*Smith & Gentry 4322*, ARIZ). The senior author visited this locale (1.5 mi W of Center City) on 16 Apr 2000. This population was difficult to discern from the highway since most of the plants occurred beneath a dense stand of several species of small oaks and other mesic shrubs and vines (e.g., *Viburnum rufidulum*, *Smilax bona-nox*). The general habitat of this population is pictured in Fig. 3c. No vouchers were made at this site, but some 15–30 widely spaced plants and/or clones were observed along the approximately 100 meters pictured, most of which were growing beneath oaks or along their periphery (as shown in Fig. 3a). All of the plants concerned grew in red sandy soils between the forest edge and a barbed wire fence. A brief sortie (ca. 20 mi) along dirt roads in the immediate vicinity of this locale revealed no additional populations, although likely sites were examined carefully.

SAN SABA COUNTY POPULATIONS. The only collection of *Hesperaloe engelmannii* known from San Saba County prior to the present study has been that of *Correll & I. M. Johnston 17343* (LL!, this specimen presumably mapped, but not cited, by Starr [1997]). The senior author attempted to locate plants at the site concerned on 23 Mar 2000, but was unable to do so. But he did chance upon a newly-discerned population in fruit 10.4 mi south of downtown San Saba along Highway 16. (*Turner 20-1*, TEX). Since this was the only population he noted along the road to San Saba it was assumed that the initial collectors had erred in the mileage given.

The present authors revisited the above-mentioned site on 22 Apr 2000 and were delighted to find the plants concerned in full flower (Fig. 3b). Thereafter, we were able to locate three additional populations of *H. engelmannii* from along Highway 16, as follows:

Locality	No of plants and/or clones noted
1.5 mi S of San Saba	2
4.0 mi S of San Saba	10–15
5.1 mi S of San Saba	11–12
10.4 mi S of San Saba	11–12

All of the above populations occur along the eastern side of the highway in sandy or silty calcareous soils, with individuals mostly on top of roadcuts and outside of fences. Attempts to locate other populations in the immediate vicinity along county roads proved futile, even when likely habitats were explored. The roads traversed, some 20–40 miles, were mostly across large ranches heavily stocked with goats and sheep, none of the roadsides fenced. It is likely that domestic livestock, over the years, destroyed most of the natural populations of *Hesperaloe engelmannii* in this region, if such ever existed.

Hesperaloe funifera

Hesperaloe funifera (K.) Trel. was mapped by Starr (1997) as occurring in Texas, but no specimens were cited, nor did he include Texas in its natural distribution. Presumably, he took the uncited specimen to be introduced, as noted below. Butterwick and Poole (1980) noted the occurrence of a single collection of *Hesperaloe funifera* in Val Verde Co., as follows: In rocky limestone soil at the entrance to the Finnegan Ranch (29 ° 56′N, 100° 58′W), ca. 65 km NW of Del Rio, 2 Aug 1979, *Deal s.n.* (TEX-LL). This specimen, or duplicates thereof, is perhaps the basis for Starr's mapped symbol of the plant in Texas. Presumably Deal thought the plants concerned to be introduced in the region, which they well might be.

Additional information relating to the occurrence of *Hesperaloe funifera* in Texas may be found in Smith and Butterwick (1975), this not mentioned in their 1980 publication: "In the general area of... quadrat transects which were run east of the Finegan [sic] Ranch, scattered individuals of *Hesperaloe funifera* were found growing on the upper slopes (their fig. 7). This species has never been recorded or collected before in Texas, although it occurs in northern Mexico."

When queried about the above reports rendered by Poole and Butterwick, especially as regards its possible introduction to the area, Poole responded (by email): "As I recall, the ranch owner, Mr. Finnegan, did tell us that he had transplanted the *H. funifera* from the native site to near the ranch gate. I talked to Linda Hedges today about the native locations of *H. funifera* at Devils River State Natural Area [populations of which Poole had called to my attention in previous conversations]. Linda has a map that shows at least two locations (the one that Mary and I saw, and one seen by David Riskind)."

The latter communication suggests that there was a very localized natural stand of *H. funifera* on Finnagans Ranch from which the owner transplanted plants to his ranch entrance, The senior author, however, feels that its naturalness to the area is moot; initial transplants of the species might have been made by early owners of the ranch concerned, which subsequently became well established by clonal offshoots.

The senior author has reviewed the taxonomic status of *Hesperaloe funifera* as recognized by Starr (1997) in his revision of the genus. Starr recognized two subspecies under the fabric of *H. funifera*: subsp. *funifera* and subsp. *chiangii.* Of these I would elevate to specific rank his *Hesperaloe funifera* subsp. *chiangii,* as follows: **Hesperaloe chiangii** (G. D. Starr) B. L. Turner, stat. nov. Based upon *Hesperaloe funifera* subsp. *chiangii* G. D. Starr, Madroño 44: 289. 1997.

As noted by Starr (1997, p. 282), the late Engard, who was deeply involved in a revisionary study of *Hesperaloe* at the time of his death, intended to describe this taxon as a species. Starr, however, thought the plants concerned better treated as a subspecies of *H. funifera.* I disagree with this assessment. *Hesperaloe chiangii* is a geographically isolated, well marked cohort of *H. funifera* (cf. distribution maps, Starr 1997), showing little sign of morphological intergradation with the latter, to judge from my examination of Mexican materials (LL, TEX) and by the key provided by Starr to distinguish between the two. Indeed, the morphological differences between *H. funifera* and *H. chiangii,* in my opinion, are as marked as those that separate *H. parviflora* and *H. engelmannii.* Such was apparently the opinion of Engard, as noted in the above.

Morphological Comparisons Among Texas Populations

Hesperaloe funifera is readily distinguished from both *H. engelmannii* and *H. parvifolia* by its broad leaves and white te-

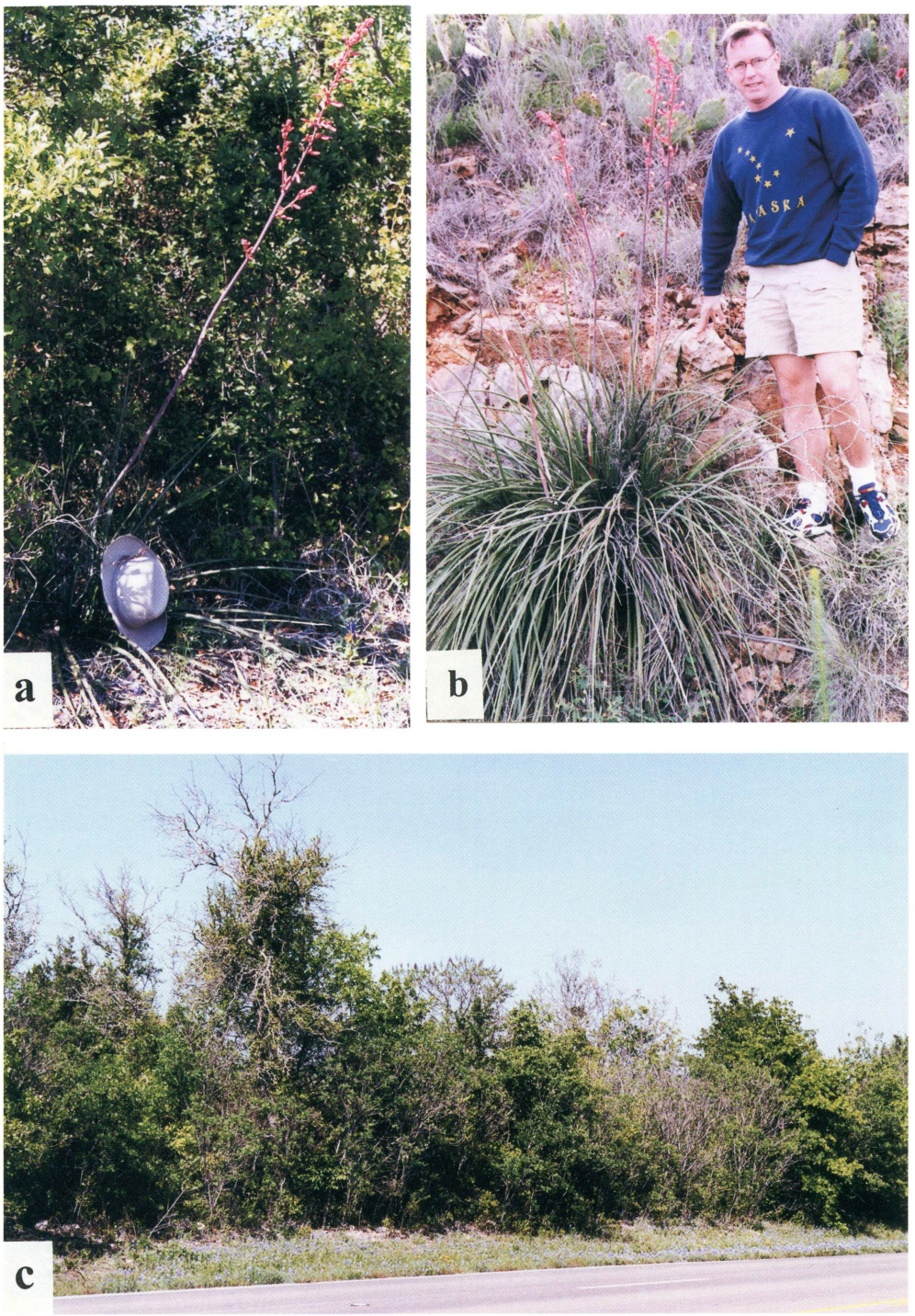

FIG. 3. a. *Hesperaloe engelmannii,* Mills County, one of the 15–30 plants found growing beneath the trees at the site shown in Fig. 3c. b. Individual of *H. engelmannii* from San Saba County, along with junior author. c. Roadside habitat of 15–30 plants of *H. engelmannii,* one of these shown in 3a.

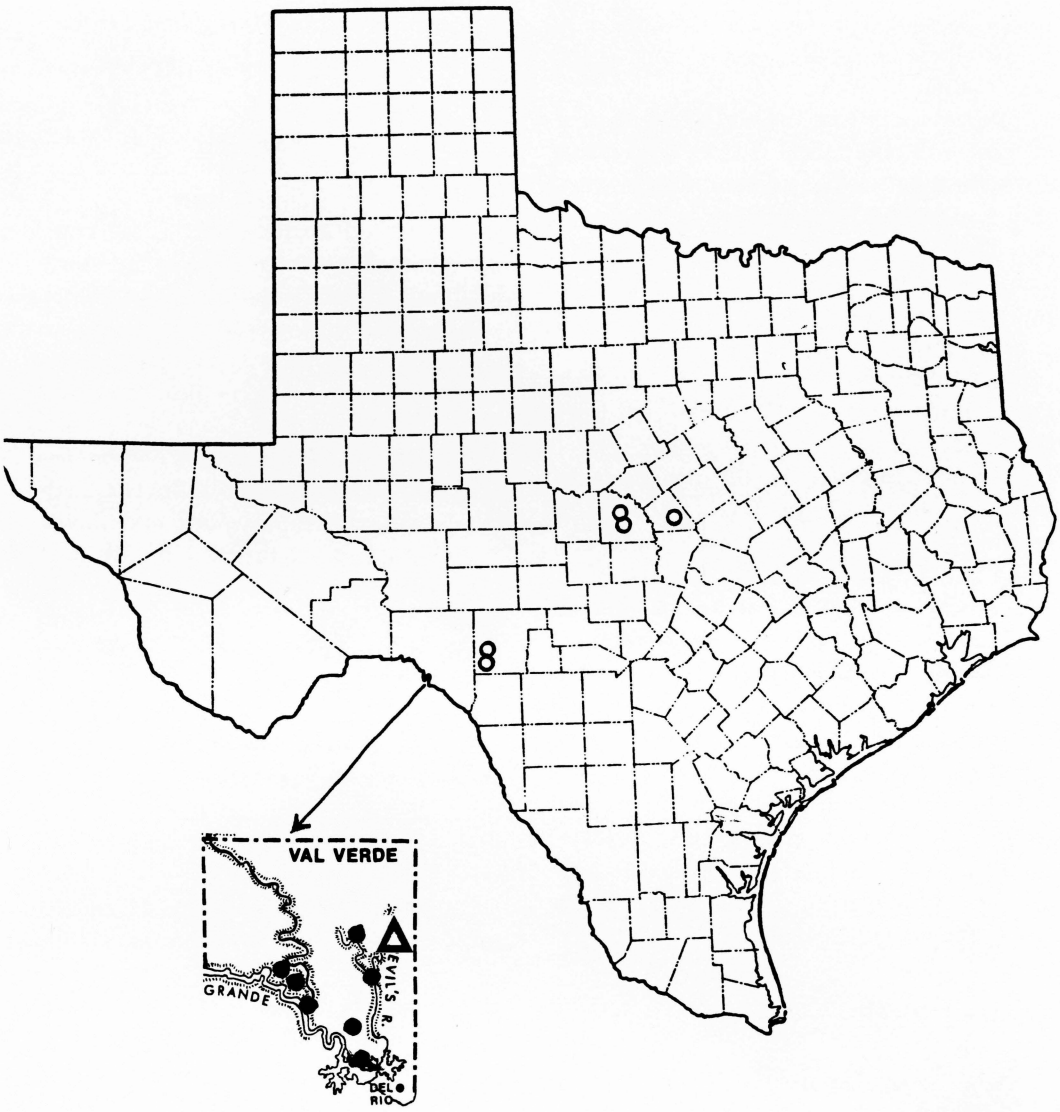

FIG. 4. Distribution of known natural populations of *Hesperaloe* in Texas: *H. parviflora* (solid circles) and *H. engelmannii* (open circles). A single doubtful natural population of *H. funifera* from Val Verde County indicated by triangle (this discussed at more length in text).

pals, as was noted by Starr (1997). This taxon is not considered further here.

As noted in the above introduction, however, Krauskopf distinguished *Hesperaloe parvifolia* from *H. engelmannii* by its floral characters, the latter having a short, thick (not filiform) style and longer anthers. We can, in general, verify these two observations. Fig. 1a shows the usual style in *H. engelmannii* as it occurs in natural populations. While variable in mature flowers, the styles are mostly 1–2(3) times as long as the ovary proper, and more thickened at the base. In contrast, plants of *H. parviflora* from natural populations are 3–5 times as long as the ovary proper, clearly more nearly filiform, their apices often extending for 1–3 mm beyond the tepals (as illustrated by Powell, 1988). Additionally the flowers of *H. engelmannii* tend to have inner tepals with white, flaring

apices, as shown in Fig. 2b, while those of *H. parviflora* are only weakly flaring and only marginally white, if at all.

Pellmyr and Augenstein (1997), in connection with pollination studies, have neatly documented the considerable floral variability in a natural population of *Hesperaloe parviflora* at Dolan Falls, Val Verde County, Texas. Unfortunately, the workers did not publish data relating to anther size or style length, but their drawings of the flowers concerned show the styles to be elongate and slender, and sometimes exserted from the tepals.

As already noted in the introduction, however, the two taxa are readily distinguished in natural populations by habit and vegetative features: *Hesperaloe engelmannii* is a much larger plant (up to 2.5 m high measured to the top of its inflorescence) with longer, relatively narrower, somewhat flatter, darker green leaves, the margins of which show little tendency to form markedly arcuate frilly fibers. In contrast, *H. parviflora* is a much shorter plant in natural populations, with pale-green, sulcate, broader leaves, the margins tending to produce a striking array of frilly, broadly arcuate, fibers (Fig. 2c).

Taxonomic Considerations

Starr (1997), as already noted, provided a rather detailed revisionary study of *Hesperaloe.* In this he recognized a single species as native to Texas, *H. parviflora* (including *H. engelmannii*). However, he noted that what the present authors accept as *H. engelmannii* was perhaps a good biological taxon with the statement that

> [Krauskopf's plants] were collected along the western branch of the Nueces River while the plants Wright collected came from near the Nueces River and Devils River. These localities are close enough that neither specific nor subspecific rank should be maintained for those plants [*H. engelmannii*] until more research can be done.

We hope that our fieldwork has helped establish the biological reality of these two population systems, but of course it need not resolve the nomenclature.

If treated as a species, as we consider the taxon, the correct name of the non-Chihuahuan Desert populations is *Hesperaloe engelmannii.* If treated as an infraspecific taxon of *H. parviflora,* its correct name is *H. parviflora* var. *engelmannii* (Krauskopf) Trel.

We maintain *Hesperaloe engelmannii* as a species because it is allopatric with its closest cohort, *H. parviflora,* and shows little evidence of intergradation with it. Both taxa show considerable variation over their ranges, even within a single population, as neatly documented by Pellmyr and Augenstein (1988) for a single population of *H. parviflora* from Val Verde County, Texas and through pictorial representation of *H. engelmannii* in the present study. Indeed, floral characters appear to be more plastic than vegetative characters, at least as observed in the field.

In short, we propose that *H. engelmannii* be accepted as a valid species, as follows:

HESPERALOE ENGELMANNII Krauskopf, Notice to Botanists (circular). 1878. = *Hesperaloe parviflora* var. *engelmannii* (Krauskopf) Trel, Ann. Rep. Missouri Bot. Gard. 13: 33. 1902. TYPE: TEXAS. **Edwards Co.**: ca. 25 road miles SW of Rock Springs along Highway 674, ca. 1 mile south of Two Mile Canyon in rocky limestone soils along the western branch of the Nueces River, 23 May 1999, *B. L. Turner 99-367* (NEOTYPE TEX).

As noted by Starr in the protologue of *H. engelmannii,* no specimens were cited. Krauskopf's description was apparently drawn from cultivated plants, no pressed plants recorded which might serve as types. Krauskopf drew his description from material taken into cultivation from Edwards

Co., from along the western branch of the Nueces River. Starr (1997, p. 288) apparently intended to provide a neotype for *H. engelmannii,* but neglected to do so in the publication concerned. To rectify this omission we have selected the collection from the type locality to serve as a suitable neotype.

The known distribution of *Hesperaloe parviflora* and *H. engelmannii* in Texas is depicted in Fig. 4. Both species are rare in Texas, but it is not unlikely that additional populations might be found, judging from our success in finding at least three new populations in San Saba County. Because of *H. parviflora*'s spectacular, red or coral-colored inflorescence, it is not likely to have been missed by several generations of botanists traveling the roads of Texas. Indeed, I happened upon the populations along the western branch of the Nueces River by chance, this over a 50 year period of intensive road travel in western Texas.

HORTICULTURAL CONSIDERATIONS. Since both *H. parviflora* and *H. engelmannii* were taken into cultivation during the late 19th century, both in Europe and North America, horticulturists have had occasion to hybridize the two taxa, out of which, no doubt, numerous cultivars have arisen. Even so, casual examination of the numerous cultivars grown in Texas suggest that the majority of such plants can be classified as "like or approaching" *H. parviflora,* or else "like or approaching" *H. engelmannii,* although occasional plants combine traits of both, as might be expected after 100 plus years of cultivation.

ACKNOWLEDGMENTS

We would like to thank Jack Skiles for providing information on the distribution of *H. parvifolia* in the area of Langtry, Texas. Two anonymous reviewers provided helpful suggestions which much improved the completed manuscript.

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