A ROCKHOUSE MICROHABITAT IN THE WEST CROSS TIMBERS OF NORTH CENTRAL TEXAS

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ABSTRACT

A rockhouse microhabitat located in the xeric savannah/woodland community of the West Cross Timbers of North Central Texas is discussed and an associated disjunct population of *Arisaema triphyllum* is reported.

RESUMEN

Se discute un microhábitat rocoso en la comunidad sabana/arbolado de West Cross Timbers en el centro-norte de Texas y se cita una población disyunta asociada de *Arisaema triphyllum*.

"Rockhouses" or rockhouse cliff formations are deep recesses in bedrock cliffs that can maintain microhabitats that are highly buffered from the extremes in temperature and moisture typical of the surrounding macroenvironment (Farrar 1998). As discussed by Walck et al. (1996), in comparison with the outside macroenvironment, rockhouse habitats tend to be more shaded, have higher temperatures during the winter, lower temperatures during the summer, and have lower rates of evaporation and higher relative humidities. Not only is there less evaporation, but water often enters via groundwater seepage, in some cases providing a relatively stable supply of moisture. In addition, condensation on the rock walls further increases humidity locally. The result is a rockhouse can provide microclimatic conditions very different (more moderated) from those typically found in a given geographic area.

There are numerous such rockhouse habitats in various areas of the eastern United States, particularly in sandstone strata. Several recent papers (Walck et al. 1996; Farrar 1998) have discussed these rockhouses and the interesting plant taxa now known to occur in them. According to Walck et al. (1996), 11 plant taxa are endemic or nearly endemic to sandstone rockhouses in the eastern U.S. Particularly interesting is the occurrence in rockhouses of a number of bryophytes and ferns with tropical affinities (Farrar 1998).

While relatively common in the eastern U.S., such rockhouse environments seem unlikely in the West Cross Timbers of North Central Texas—particularly

since hard surface rocks are unusual in most of the region. Such rocks, however, can be found in the area known as the Palo Pinto Country in the northwestern portion of the West Cross Timbers. This rather rugged region is underlain by the oldest rocks exposed in North Central Texas, deposited during the Pennsylvanian Period. These rocks vary, but are "largely made up of soft, impure shales alternating with harder, coarse, brown sandstone and conglomerates" (Hill 1901). In one area of western Parker County, where Pennsylvanian sandstones/conglomerates are exposed, deep recesses have formed that are worthy of the term rockhouse. Striking rock walls approximately 40 feet (12 meters) tall form narrow passageways and recesses. It has been known for a number of years that one unusual plant distributional record is associated with this environment. *Carya ovata* (Mill.) K. Koch, shag-bark hickory (Juglandaceae), is disjunct to this area by about 100 miles (275 kilometers) from its main region of occurrence in East Texas (e.g., *Lipscomb 2321*, 1977—BRIT). The site is also the westernmost locality in Texas for *Asplenium platyneuron* (L.) Britton, Sterns, & Poggenb., ebony spleenwort (Aspleniaceae) (Turner et al. 2003).

The moderated microclimate of this sheltered rockhouse microhabitat stands in rather sharp contrast to the macroclimate of the exposed upland West Cross Timbers macrohabitat/community. While yearly average precipitation in the area is approximately 29 inches (74 cm) (Griffiths & Orton 1968; Hatch et al. 1990), rainfall is unevenly distributed with summers typically being extremely hot and dry. As a result, the upland vegetation has a distinctly dry area aspect—a savannah/woodland with stunted *Quercus stellata* (post oak) and *Quercus marilandica* (blackjack oak), an understory of grasses (Diggs et al. 1999), and even such xerophytic, mainly western species as *Berberis trifoliolata* Moric. (agarito), *Echinocereus reichenbachii* (Terscheck ex Walp.) F. Haage (lace cactus), *Juniperus ashei* J. Buchholz (mountain-cedar), *Mimosa borealis* A. Gray (catclaw), *Opuntia leptocaulis* DC. (pencil cholla), *Zanthoxylum hirsutum* Buckley (prickly-ash), and *Ziziphus obtusifolia* (Hook. ex. Torr. & A. Gray.) A. Gray (lotebush).

Several years ago, another disjunction was discovered by one of us (O'Kennon). A large population of *Arisaema triphyllum* (L.) Schott, jack-in-the-pulpit (Araceae), was found in the mesic microhabitat between rock walls (Figs. 1 and 2) in the same extensive rockhouse as *Carya ovata* (voucher: *O'Kennon 16024*—BRIT). Interestingly, even though we estimate the population at approximately 2,000 above ground stems (the number of genetically distinct individuals is unknown), it had not been reported previously in the literature, possibly due to confusion with the related widespread species, *Arisaema dracontium* (L.) Schott, (green-dragon). The locality information was provided to Turner et al. (2003) for inclusion in the *Atlas of the Vascular Plants of Texas*. The large numbers of individual stems present and their occurrence through a rather extensive area of the rockhouse argues against any type of recent human interven-

FIG. 1. Rockhouse habitat in Parker Co., Texas with large number of individuals of *Arisaema triphyllum* in the foreground (photo by R.J. O'Kennon).

tion (e.g., transplantation). Observation of the population over two growing seasons revealed that relatively few plants produce inflorescences (roughly one in 100 during the first week of April), even fewer produce fruits (during one season only three individuals were observed with mature fruits), and most reproduction is probably by vegetation means. At the site, digging indicated that rhizomes/underground stolons could be traced between different stems signifying vegetative expansion of the population. Additionally, several transplanted plants produced offsets (traceable to the original plant) the following spring approximately 40–50 cm from the parent plants. It thus seems clear that the plants are reproducing vegetatively, and that the number of genetically different individuals probably can be determined only by molecular analyses. The apparent lack of extensive sexual reproduction is interesting in light of Kral's (1966) observation that other relict species in East Texas were also apparently reproducing predominantly via vegetative means. The disjunction between the western Parker County site and the nearest known East Texas location (Henderson County) is approximately 140 miles (225 kilometers). The occurrence of this species in the West Cross Timbers is quite unexpected given its preference for low or moist woods. However, the special microclimate (particularly reduced evapotranspiration and persistent substrate moisture) apparently has allowed the long term survival of this mesic species in an otherwise rather inhospitable macroenvironment.

The taxonomy of *Arisaema triphyllum* is controversial. Detailed study of these extremely variable plants led Huttleston (1949, 1981, 1984) to conclude that the variation seen in the species was best represented by recognizing a single species with four subspecies; he indicated that "...plants of the four subspecies are very distinctive and readily identified, at least in living condition. Since many of the key characteristics...are obscured or lost during drying, it is not always possible to identify herbarium specimens to subspecies." At the other taxonomic extreme, because "much overlap occurs in expression of the characteristics supposedly defining infraspecific taxa," because numerous intermediate forms exist, and because the ranges of the subspecies overlap, Thompson (2000) recently recognized a single variable species without infraspecific taxa. Thus, depending upon one's treatment of the variation present, the disjunct Parker County population would be either *Arisaema triphyllum* (no subspecies recognized) or *A. triphyllum* subsp. *triphyllum*. In a forthcoming flora of East Texas, we are treating the taxon as *A. triphyllum* subsp. *triphyllum*.

As discussed by Kral (1966), MacRoberts and MacRoberts (1997), and others, Texas has numerous plant occurrences which represent relicts of past climatic conditions. Further, from the study of Texas bogs (e.g., Potzger & Tharp 1954; Bryant 1977; Holloway & Bryant 1984; Bryant & Holloway 1985) and from knowledge of modern day plant distributions (e.g., Turner et al. 2003), it is clear

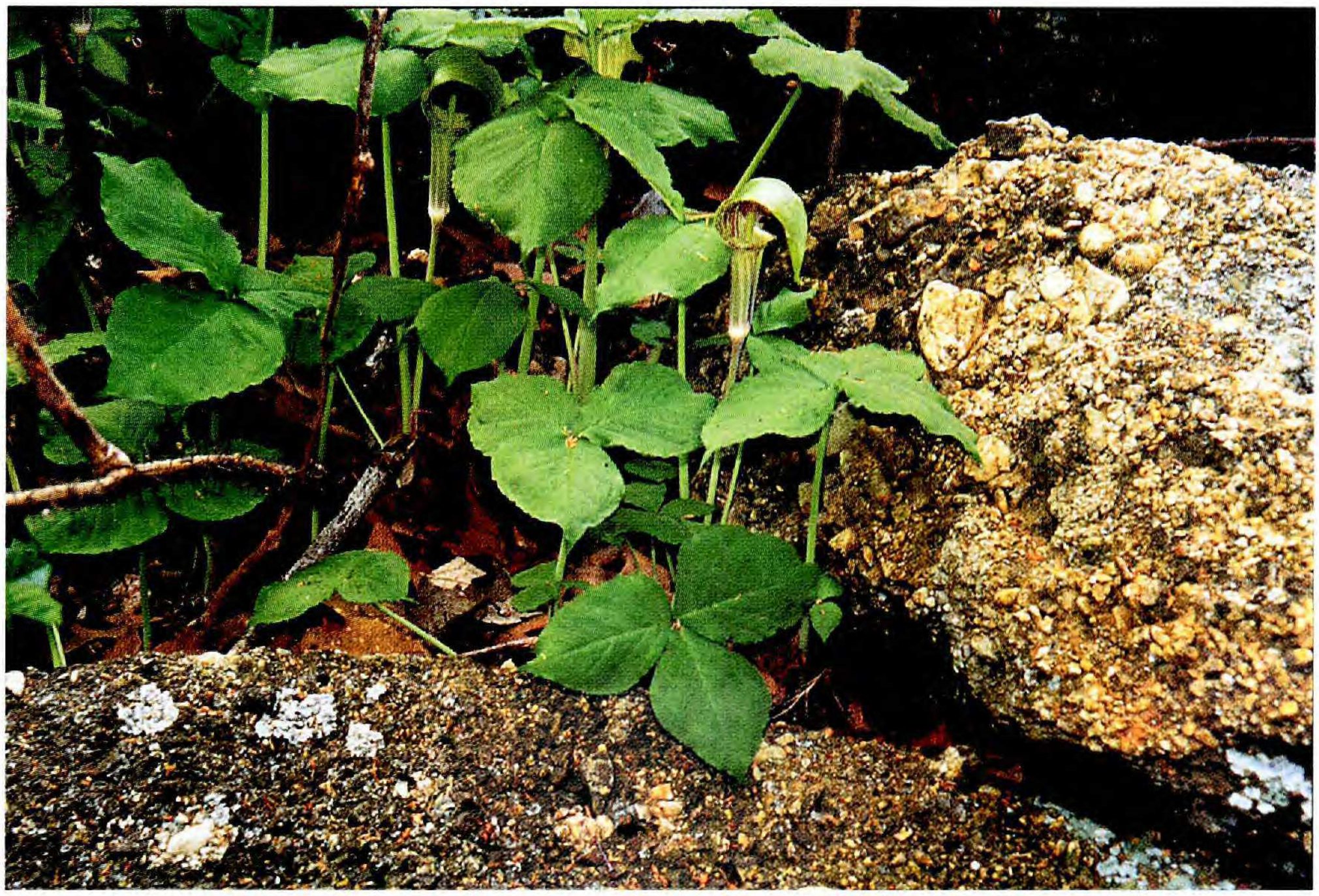

FIG. 2. Closeup of *Arisaema triphyllum* (photo by R.J. O'Kennon).

that Texas vegetation was profoundly influenced by the climatic change associated with glaciation, even though actual glaciers were hundreds of miles to the north of Texas. The Parker County occurrence of *Arisaema triphyllum* thus probably represents an "Ice Age holdover" (MacRoberts & MacRoberts 1997) from a colder and wetter period of the Pleistocene when vegetational areas were shifted considerably to the south and west. It is known, for example, that at 15,000 years before present, the mean annual air temperature of Texas was 5° C less than at present, conditions were moister, and there was a more widespread forest mosaic over most of Texas (Bryant 1977; Stahle & Cleaveland 1995). Other modern day reflections of such past conditions can be seen in the many species and genera typical of East Texas showing up in isolated disjunct pockets on the Edwards Plateau (e.g. *Hamamelis virginiana* L., witch-hazel) as well as many other interesting disjunct species and communities (Palmer 1920; Diggs 2002).

While rare in Texas, rockhouses do provide an interesting window into biogeographic history. As noted by Farrar (1998), the disjunct occurrences of plant species in rockhouses "document, as clearly as do fossils, a record of changing climate and vegetation." When this phenomenon is taken together with the study of bogs, and an understanding of other current day plant distributions, the impact of glacial history on the vegetation of Texas becomes increasingly understandable.

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