Successional Use of Saguaro (Carnegiea gigantea1) Fruit by Coyote (Canis latrans2) and Desert Fire Ants (Solenopsis xyloni3)

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Successional use of saguaro (*Carnegiea gigantea*[1]) fruit by coyote (*Canis latrans*[2]) and desert fire ants (*Solenopsis xyloni*[3])

Aprovechamiento sucesional del fruto del saguaro (*Carnegiea gigantea*[1]) por el coyote (*Canis latrans*[2]) y las hormigas de fuego del desierto (*Solenopsis xyloni*[3])

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Abstract.
The successional use of saguaro (*Carnegiea gigantea*) fruit by the coyote (*Canis latrans* Say, 1823) and desert fire ant (*Solenopsis xyloni* McCook, 1879) removes large numbers of saguaro seeds from those produced each year, which probably results in a measurable reduction of the saguaro recruitment.

Key Words: Saguaro recruitment, coyote, desert fire ant, Sonoran Desert

Resumen.
El uso de la fruta del saguaro (*Carnegiea gigantea*) en sucesión por el coyote (*Canis latrans* Say, 1823), y la hormiga de fuego del desierto (*Solenopsis xyloni* McCook, 1879) reduce grandes cantidades de semillas de saguaro de la producción anual de semillas, lo que probablemente resulte en una disminución medible del reclutamiento de saguaro.

Palabras Clave: Reclutamiento de saguaro, coyote, hormiga de fuego del desierto, desierto de Sonora

[1]Caryophyllales: cactaceae
[2]Carnivora: Canidae
[3]Hymenoptera: Formicidae
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Four large coyote (*Canis latrans* Say, 1823) scats were located just northwest of the eastern unit of Saguaro National Park in Tucson, Arizona, during the last week of June 2021. The scats consisted predominantly of saguaro cactus (*Carnegiea gigantea*) seeds. Each scat was consolidated into a deposit of approximately 10 cm wide x 5 cm high (Figure 1).

Figure 1 Coyote (*Canis latrans* Say, 1823) scat that predominantly consists of saguaro (*Carnegiea gigantea*) seeds (28Jun21). This scat was dissected for analysis. Scale = 10 cm.

Figura 1 Hemento de coyote (*Canis latrans* Say, 1823) compuesto predominantemente por semillas de saguaro (*Carnegiea gigantea*) (28Jun21). Este excremento fue diseccionado para su análisis. La escala es de 10 cm.

The biotic community at the site is the Arizona Upland Subdivision of the Sonoran Desert, and the paloverde-cacti-mixed scrub plant series predominates (Brown 1982). The dominant plant species include yellow paloverde (*Parkinsonia microphylla*), saguaro, several species of cholla (*Cylindropuntia* spp.), prickly pear cacti *Opuntia engelmannii* and *O. phaeacantha*, and creosote bush (*Larrea tridentata*). Animals common in the area include the collared peccary (*Dicotyles tajacu* Cuvier, 1816), coyote, bobcat (*Lynx rufus* Schreber, 1777), desert cottontail (*Sylvilagus audubonii* Baird, 1858), white-throated wood rat (*Neotoma albigula* Hartley, 1894), Harris's antelope ground squirrel (*Ammospermophilus harrisii* Audubon & Bachman, 1854), desert spiny lizard (*Sceloporus magister* Hallowell, 1854), tiger whiptail (*Aspidoscelis tigris* Baird & Girard, 1852), desert kingsnake (*Lampropeltis getula* Linnaeus, 1766), western diamond-backed rattlesnake (*Crotalus atrox* Baird & Girard, 1853), and a wide variety of bird species. There is a bimodal precipitation regime, and the precipitation is

approximately evenly divided between the summer (July through September) and winter (December through March) seasons. The annual amount of precipitation is 32 cm per year (Western Region Climate Center 2025).

The scats were deposited at the tail end of the saguaro fruiting season, and only a small number of fruits remained on the plants at that time. All the scats were deposited in areas with only sparse vegetation. Three of the scats were broken apart to visually examine their contents. One (Figure 1) was sampled intact to analyze its content. Its dissection revealed seeds and fruit components of two plant species – saguaro and velvet mesquite (*Neltuma velutina*). There were approximately 32,888 saguaro seeds and 47 velvet mesquite seeds in the dissected scat. There are an average of approximately 3,500 seeds per saguaro fruit in this portion of the Sonoran Desert (W. D. Peachey, personal communication), thus, the content of saguaro seeds in the scat was the equivalent of approximately nine saguaro fruit. There was very little saguaro mesocarp (pulp matrix) evident in the scat as shown in Figure 1. This was typical for all the scats observed. There were no saguaro fruit exocarp elements evident in the three scats examined. Since it seems unlikely that the exocarp in the coyote digestive system would be totally absorbed, the animals do not appear to ingest this element of the fruits. The entire mesocarp separates easily from ripe, dehisced fruits that are scattered on the ground. Whether the coyotes somehow manipulate the fruit to separate the mesocarp, or chew the fruits, is not known. Most of the fourth scat was scavenged by a vertebrate before it could be examined for presence of exocarp elements.

One of the scats (deposited during the evening of 30Jun21) was thoroughly harvested by a colony of desert fire ants (*Solenopsis xyloni* McCook, 1879) by the following evening (Figure 2). When observed at 0620 h of the second morning (02Jul21) the ants were removing the very few remaining saguaro seeds to a nest access, which was located 1.3 meters north of the scat, beneath the drip line of a creosote bush (Figure 3). Since the access had no excavated soil deposited at the entrance, and the opening was only 3 mm in average diameter, it was quite inconspicuous. Three additional entrances to the ant nest complex were within the 1.3 meter radius of the scat, but only the one furthest from the scat was actively in use at the time. All the entrances were of the same approximate size, and there was no excavated soil adjacent to any of the holes. Each of the entrances was probably a surface access along subterranean foraging trails that originated in the peripheral galleries of the nest complex (Trager 1991). Only minor dried mesocarp elements remained of the scat. Apparently the ants do not utilize the dried pulp elements. However, the situation is different for the fresh saguaro fruit pulp as discussed below. An 18 mm rainfall event that occurred during the night of 03Jul21 dispersed the remaining elements of the scat, so that the only indication of its presence was some minor yellow staining on a couple of small (approximately 5 mm) rocks.

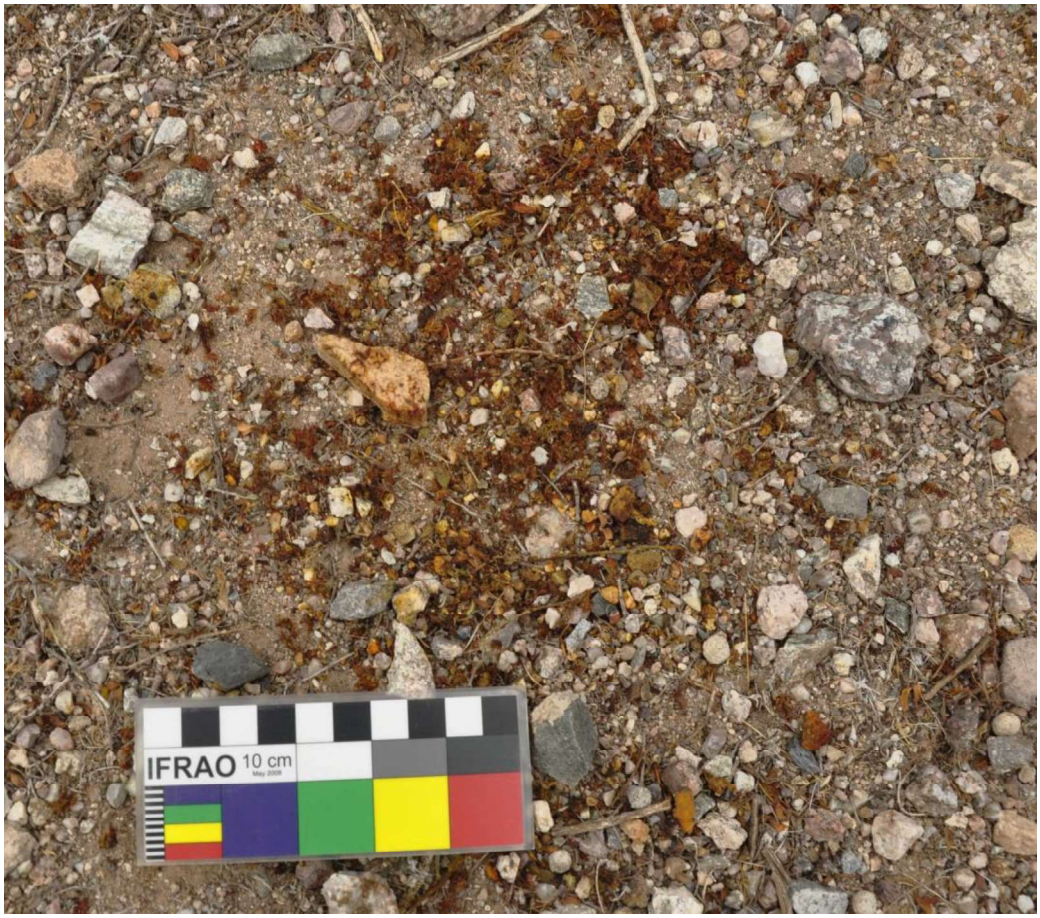

Figure 2. Coyote (*Canis latrans* Say, 1823) scat totally dissected by a nearby desert fire ant colony (*Solenopsis xyloni* McCook, 1879). The scat remains only consisted of dried elements of saguaro fruit mesocarp. Scale = 10 cm.
Figura 2. Heces de coyote (*Canis latrans* Say, 1823) totalmente diseccionadas por una colonia cercana de hormigas de fuego en el desierto (*Solenopsis xyloni* McCook, 1879). Los restos de excrementos consistían únicamente en elementos secos de mesocarpio del fruto del saguaro. La escala es de 10 cm.

Figure 3. Inconspicuous nest site access (yellow arrow) of *Solenopsis xyloni* (McCook, 1879) beneath a creosote bush (*Larrea tridentata*) 1.3 meters north of the scat location. Scale = 10 cm.
Figura 3. Acceso discreto al sitio de anidación (flecha amarilla) de *Solenopsis xyloni* (McCook, 1879) debajo del arbusto de creosota (*Larrea tridentata*) a 1.3 metros al norte de la ubicación de los excrementos. La escala es de 10 cm.

The presence and spread of the scat remains (saguaro fruit mesocarp elements) is indicative of a thorough, piecemeal disassembly by the ants (Figure 2). Whereas consumption by vertebrates would have resulted in the removal of the entire scat or, at least, consolidated aggregations or individual saguaro seeds would have remained. There were no remains of mesquite (or other) fruits or seeds evident at the site, and the scat was apparently composed entirely of saguaro fruit mesocarp and seeds. While mesquite seeds are too large for the individual minor workers of *S. xyloni* to transport, cooperative efforts by several ants or assistance from major workers could probably accomplish this task. However, the nest entrance was too small to accommodate mesquite seeds, and it is unlikely that majors could masticate the larger, thicker test of a mesquite seed. I did offer several seeds of night-blooming cereus (*Peniocereus greggii* var. *transmontanus*) to the ants. These seeds are considerably larger than the saguaro seeds but much smaller than the mesquite seeds. The ants

repeatedly examined the *Peniocereus* seeds, but they could barely grasp them due to their larger size and soon abandoned their efforts to harvest them.

I placed a 3 cm “ball” of fresh saguaro fruit mesocarp approximately 20 cm from the entrance to the *S. xyloni* nest early on the morning of 04Jul21. The ants located the offering within a minute and quickly assembled a large number of minor workers to process the food source. They worked almost exclusively on the pulp until it was gone and then proceeded to remove the seeds to the nest until nothing remained. An inspection of the ant nesting area on the morning of 07Jul21 (at 0645 h) revealed no activity of ants on the surface, and all the nest entrances had been closed. The conditions were mostly sunny, very humid with a minimal intermittent breeze, and rather hot (32°C). Figure 4 shows a *S. xyloni* major worker sampled from the colony with one of the transported saguaro seeds. The major workers of some *Solenopsis* spp., such as *S. geminata* Fabricius, 1804, have the morphology for, and are commonly tasked with, processing the seeds in the nest (Trager 1991). *Solenopsis xyloni* is known to have significant impacts on native seed banks and stored grain. They also predate newly hatched birds and attack agriculture plants by girdling (Mackay and Mackay 2002). It is a serious stinging ant, but it is not as aggressive as its relative, the invasive red imported fire ant (*X. invicta* Buren, 1972).

In this instance, the harvesting of saguaro seeds by *S. xyloni* is a secondary utilization subsequent to the initial endozoochorous event by coyotes. A high percentage of viable saguaro seeds is known to pass through the coyote digestive system. A total of 97% was recorded by Steenbergh and Lowe (1977). Sequestering, and the probable crushing of the seeds in the ant nest, along with their relatively deep subsurface placement, almost certainly precludes successful seed germination and establishment of the plants. While the dissemination of saguaro seeds by coyotes can be an effective mechanism of dispersal for the plants, the secondary utilization of coyote scats by other animals may have deleterious consequences for the reproductive success of saguaros. Additionally, the tendency for coyotes to mark their routes with their scats, often including areas of open terrain, can place saguaro seeds in situations where there are no proximal suitable nurse plants for successful establishment.

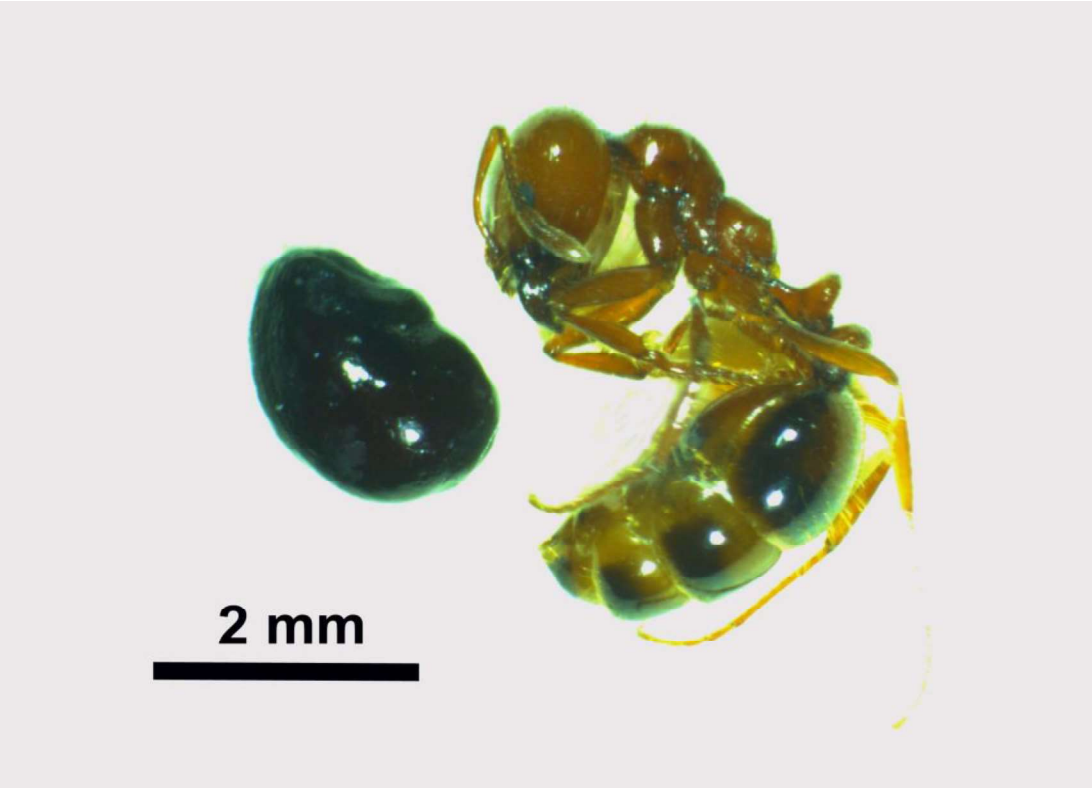

Figure 4. Major worker of *Solenopsis xyloni* (McCook, 1879) and a saguaro (*Carnegiea gigantea*) seed sampled on 28Jun21.
Figura 4. Obrera mayor de *Solenopsis xyloni* (McCook, 1879) y una semilla de saguaro (*Carnegiea gigantea*) muestreada el 28Jun21.

Other ant species that have been recorded harvesting saguaro seeds include *Lasius* sp. (Fabricius, 1804), *Leptothorax* sp. (Mayr, 1855), *Pogonomyrmex barbatus* (Steenbergh and Lowe 1969, 1977), *Messor pergandei* (Mayr, 1886), *Pseudomyrmex gracilis* Fabricius, 1804 (as *Pseudomyrmex mexicanus*) and *Solenopsis* sp. (De Sosa-Fernandez 1997). Saguaro seeds and mesocarp were offered to a colony of *Novomessor cockerelli* (André, 1893). The ants examined the isolated, free seeds, but they did not pick up or harvest them. They readily consumed the mesocarp outside of the nest and moved a couple pieces of this matrix, including seeds, into their nest. While the seeds moved into the nest are unlikely to be consumed by the ants, they have nonetheless been removed from propagation.

Four small (approximately 3mm) coprophilous histerid beetles comprising two species, *Xerosaprinus martini* Fall 1917 and *X. fimbriatus* LeConte 1851 (Coleoptera: Histeridae), emerged from the coyote scat during the dissection process.

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References Cited

Brown, David Earl. "Biotic communities of the American southwest-United States and Mexico." (1982).

de Sosa-Fernandez, Vinicio. *Dispersal and recruitment ecology of columnar cacti in the Sonoran Desert*. University of Miami, 1997.

MacKay, William P., and Emma Mackay. *The ants of New Mexico (Hymenoptera: Formicidae)*. Lewiston, NY: Edwin Mellen Press, 2002.

Steenbergh, Warren F., and Charles H. Lowe. "Critical factors during the first years of life of the saguaro (Cereus giganteus) at Saguaro National Monument, Arizona." *Ecology* 50, no. 5 (1969): 825-834.

Steenbergh, Warren F., and Charles H. Lowe. *Ecology of the Saguaro: II, Reproduction, Germination, Establishment, Growth, and Survival of the Young Plant: Warren F. Steenbergh & Charles H. Lowe*. No. 8. Department of the Interior, National Park Service, 1977.

Trager, James C. "A revision of the fire ants, *Solenopsis geminata* group (Hymenoptera: Formicidae: Myrmicinae)." *Journal of the New York entomological Society* (1991): 141-198.

Western Region Climate Center. "Sabino Canyon, Arizona (027355)". Internet site: https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?az7355, 2025.