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DISPERSAL OF SEEDS AS NEST MATERIAL BY THE CACTUS WREN

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ABSTRACT—Cactus wren (*Campylorhynchus brunneicapillus*) nests from the southern Chihuahuan Desert contained viable seeds of grasses, forbs, and shrubs. The most common plants used as construction material in these nests were *Muhlenbergia porteri, Boerhavia spicata*, and the alien grass *Eragrostis lehmanniana.* We suggest that birds are potentially important dispersers of certain types of plants in semiarid rangelands through the use of plants with seeds as nesting material. Implications of this process for rangeland plant dynamics need to be further explored.

RESUMEN—Nidos del reyezuelo (Troglodytidae: *Campylorhynchus brunneicapillus*) en el sur del Desierto Chihuahuense contuvieron semillas viables de zacates, hierbas y arbustos. Las plantas más frecuentemente usadas como material para construir estos nidos fueron *Muhlenbergia porteri, Boerhavia spicata* y el zacate exótico, *Eragrostis lehmanniana.* Sugerimos que son importantes los pájaros en la dispersión de algunos tipos de plantas en los matorrales semiáridos por el uso de las plantas con semillas como material para construir los nidos. Es necesario estudiar más las implicaciones de este proceso para las dinámicas de las plantas de matorrales.

Nests of birds often contain viable seeds among the plant materials used in their construction (Matheny, 1931; Chippendall, 1946; Snow, 1976; Dean et al., 1990). For at least one species of plant in the Karoo, South Africa (*Galium tomentosum* Thunb., Rubiaceae; Dean and Milton, 1994) and one species of plant in Trinidad (*Nepsera aquatica* Naud., Melastomaceae; Snow, 1976), dispersal of seeds as nest material appears to be a primary dispersal method, but for many other species of plants, dispersal of seeds as nest material may be of lesser significance (Dean et al., 1990).

We were interested in the generality of seed dispersal as nest material by birds in semiarid ecosystems, such as the Chihuahuan Desert in the United States, and whether some seeds, together with parent plant material, consistently are included in nests of birds that inhabit such ecosystems. The significance of dispersal of seeds as nest material is that birds have the potential to move large quantities of viable seeds and to store them in shaded, dry sites where they are relatively safe from seed predators and fungi. Secondly, by gathering nest material away from the nest site, birds may be effective dispersers of seeds of non fleshy-fruited alien plants that have structures suitable for birds' nest material. Of particular interest are materials used by small passerine birds that construct relatively large globular nests in shrubs and small trees in semiarid grassland and shrubland. Such nests often contain an abundance of finely branched and hooked plant stems, and usually include seeds attached to plant material.

The cactus wren (*Campylorhynchus brunneicapillus*) in the southwestern United States constructs such nests, typically building their nests in cacti. We therefore described the plant material used by the cactus wren for nest construction in terms of species composition and the presence of seeds, and conducted some preliminary surveys on selectivity of the birds' use of nesting material and viability of seeds recovered from the nests.

MATERIALS AND METHODS—During the period 31 October to 3 November 1994, we collected samples of material (about 30 g of dry matter—a fist-sized sample that did not destroy the nest) from nests of the cactus wren. Nests were found on the roadside and in shrubland at Columbus, New Mexico (2 nests), west of Hachita, New Mexico (2 nests), and scattered in semiarid shrubland about 5 km southeast of Portal, Arizona (8 nests). Nests were located in *Opuntia imbricata* (3 nests), *Prosopis glandulosa* (4 nests), *Yucca elata* (3 nests), and *Acacia greggi* (2 nests). We also sampled the plant assemblage for presence/absence of plant species within a 20 m radius of each nest, as an index of the selectivity of birds for nesting material. From each nest sample, we took about 20 g of nest material (sufficient to cover our germination trays) and spread this over damp perlite. Additionally, we separated out identifiable seeds and planted samples of each species on perlite in order to test viability of at least these known species. Seedtrays were kept moist for four weeks and all seedlings in each nest sub-sample and seedlings emerging from identified seeds were counted in the third and fourth weeks. Seedlings from nest sub-samples were not identified as we had no reference collection of seedlings, but were classified as monocotyledons or dicotyledons.

RESULTS—We identified 34 species of plants incorporated into nests (Table 1). These included 10 monocots and 12 dicots. There were also five unidentified grasses, one unidentified sedge, and six unidentified forbs. The most frequent species, *Muhlenbergia porteri*, was present in 9 of 12 nest samples and in 10 of the surrounding areas (Table 1). Lehmann's lovegrass *Eragrostis lehmanniana*, an alien grass of African origin, occurred in four nests and in two of the surrounds.

Of the 34 plant species identified in nests and/or surrounding habitat, only 13 species occurred in both, whereas 10 species recorded from nests did not occur in surrounding habitat (Table 1). This indicates that material from these 10 plant species had been collected from further than 20 m from the nest. Eighteen plant species recorded in surrounding habitat did not occur in nests (Table 1). These discrepancies between relative availability and use of plant material suggest that birds are selective in their use of nesting material.

From the nest sub-samples a total of 375

TABLE 1—Plant species found in samples of material from 12 nests of the cactus wren in the southern Chihuahuan Desert, New Mexico, and Arizona.

	Frequency	
Species	In nests	In surrounds
Monocotyledons		
Aristida longiseta	3	2
Aristida ternipes	0	1
Aristida sp.	1	0
Bothriochloa saccharioides	0	3
Bouteloua aristidoides	0	1
Bouteloua barbata	0	2
Bouteloua curtipendula	0	2
Bouteloua eriopoda	1	0
Chloris virgata	1	1
Digitaria californica	0	1
Eragrostis lehmanniana	4	2
Erioneuron pulchellum	2	5
Muhlenbergia porteri	9	10
Panicum obtusum	1	1
Poa sp.	0	1
Setaria leucopila	3	4
Sporobolus cryptandrus	0	3
Sporobolus flexuosus	0	1
Sporobolus sp.	0	3
Typha sp.	1	0
Unidentified grass	5	7
Unidentified sedge	1	0
Dicotyledons		
Acacia greggii	1	0
Asclepias sp.	0	2
Astragalus sp.	0	2
Atriplex canescens	0	1
Baileya multiradiata	1	1
Boerhaavia spicata	5	1
Ceratoides lanata	1	0
Chilopsis linearis	0	1
Cirsium ochrocentrum	1	1
Descurainia pinnata	2	0
Eriogonum annuum	0	1
Eriogonum sp.	2	2
Gutierrezia sarothrae	0	5
Haplopappus gracilis	1	1
Larrea tridentata	2	0
Machaeranthera tanacetifolia	0	1
Plantago patagonica	1	0
Prosopis glandulosa	1	0
Salsola kali	0	3
Tidestroemia lanuginosa	1	1
Unidentified forb	6	9

TABLE 2—The total number of seedlings germinating over four weeks from each 20 g sample of nesting material from nests of the cactus wren.

Nest No.	Monocotyledons	Dicotyledons
1	37	1
2	6	1
3	0	1
4	2	0
5	15	0
6	158	1
7	4	0
8	36	0
9	16	0
10	35	0
11	44	0
12	22	13
Total seedlings	375	17

monocotyledons and 17 dicotyledons emerged (Table 2). The nests contained *inter alia*, viable seeds of the grasses *Muhlenbergia porter* and *Erioneuron pulchellum*, and the forbs *Descurainia pinnata* and *Haplopappus gracilis*.

DISCUSSION—The data support our hypothesis that viable seeds may be dispersed in nests of cactus wrens. For nest material, the wren selects fine branched plant structures, often with seeds attached. Similarly, small passerine birds nesting in semiarid Karoo shrubland in South Africa, use flexible, finely branched, hooked, or woolly stems for constructing the framework of their nests, and "wind-dispersed" soft, cottony or silky seeds as lining material. Plant parts used in both construction and lining of nests in southern Africa frequently included viable seeds held in indehiscent fruits (Dean et al., 1990). The difference between relative frequency of use as nesting material and occurrence in surrounding areas observed here (Table 1) suggests that cactus wrens are selective in their use of plant nesting material.

The cactus wren is potentially important as a disperser of small dry seeds. Nest material may be carried from distances up to 65 m (Anderson and Anderson, 1957). Nests of the cactus wren are fairly long-lived (Bailey, 1922; Woods, 1948; Anderson and Anderson, 1973). Seeds in nests may therefore be stored for extended periods. Furthermore, cactus wrens build, in addition to nests used for breeding, nests in which they roost at all times of the year (Anderson and Anderson, 1973), so the birds collect nest material when many grasses and forbs have seeds. These roost nests may be in the same plant as the nest used for breeding, or may be in other plants in the vicinity. The total amount of nest material containing viable seeds carried by a pair of cactus wrens in a year may be much greater than the amount used to build a single nest. Cactus wrens have been recorded at a density of $35/km^2$ (Parker, 1986) and with a nest density up to 172 $nests/km^2$ (37 nests/53 acres; Bailey, 1922).

The cactus wren is known to nest in cacti and thorny bushes scattered in grassy flats (Bailey, 1922; Woods, 1948; Anderson and Anderson, 1973; Parker, 1986). Thorns frequently protect the herbaceous understory from grazing, thereby facilitating seed set (Janzen, 1986). Dispersal in cactus wren nests may thus enhance the spread of such palatable introduced species as Lehmann's love-grass that regenerate by seed (Cox and Ruyle, 1986; Cox et al., 1989). The grasses *Aristida* sp., *Bouteloua* sp., and *Muhlenbergia porteri* were all common in nests collected in Arizona in the 1920s (Bailey, 1922). At that time the African alien grass *Heteropogon contortus* was also recorded in nests. Lehmann's love-grass, however, was not introduced as a forage grass until 1932 (Cox and Ruyle, 1986; Anable et al., 1992).

These findings support our contention that transport of seeds to birds' nests is a common mechanism for seed dispersal in arid and semiarid regions. Further studies of nest longevity, viability, longevity, and predation risk of seeds stored in nests, and relative efficiency of this form of dispersal are needed.

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