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NOTES

EFFECT OF HEAT ON SEED GERMINATION OF SOUTHWESTERN *YUCCA* SPECIES.—*Yucca* (Agavaceae) has twenty or more species distributed in a variety of environments throughout the southwestern United States, ranging from sea level to 2600 m and occupying various communities, including chaparral, grassland, desert scrub, and woodland.

Reproduction is broadly similar across the genus. The well known *Yucca*-moth pollination symbiosis is applicable to all species though the proportion of seeds consumed by the moth larvae is variable (J. Keeley, et al., 1984). Seed dispersal is however very different among species with a sharp division between dehiscent and indehiscent fruited species. The former group has capsular fruits and light seeds whereas the latter group has baccate fruits with heavy seeds (Table 1). Seed germination has been studied for some southwest species. Webber (Yuccas of the Southwest, USDA Agr. Monogr. No. 17, 1953) noted that of the few specimens examined, all had high viability and germinated readily without any special treatment and he also noted that seed germination was more rapid for capsular-fruited species. Arnott (UC Publ. Bot. 35:1-164, 1962) noted variable levels of viability, even within the same species, as did McCleary and Wagner (Amer. Midl. Nat. 90:503-508, 1973).

We investigated the effect of heat on seed germination in various species of *Yucca*. The experiments were designated to simulate various soil temperatures during wildfires. Since the *Yucca* species being considered represent communities with very different wildfire regimes it was hypothesized that these species would differ in (1) dependence upon heat for stimulating germination as noted for many species of fire prone environments and/or (2) ability to sustain high temperatures without loss of viability.

Four indehiscent baccate-fruited species (*Yucca baccata, Y. brevifolia, Y. schidigera, Y. torreyi*) and six dehiscent capsular-fruited species (*Y. angustissima, Y. elata, Y. glauca, Y. reverchoni, Y. thompsoniana, Y. whipplei*) were tested. Collectively these species range from California to Texas.

Yucca baccata ranges from southeastern California to southeast Texas (750-2200 m) in grassland and open woodlands. Seed collections were made from southern Utah and central and southern Arizona. *Yucca brevifolia* occupies open desert scrub from southeastern California to western Arizona and Utah (450-1800 m). Collections were made from several populations in the southern Mojave Desert. *Yucca schidigera* occurs along coastal southern California and east to Arizona (0-1800 m) in association with chaparral and other scrub vegetations. Collections were made from several coastal populations in southern California. *Yucca torreyi* is found in New Mexico and Texas (600-1500 m) commonly in open scrub. Collections were made in southeastern Texas.

Yucca angustissima occurs from northcentral Arizona to southern Utah (750-2300 m) in grassland and open scrub. Collections were made in southern Utah and northern Arizona. *Yucca elata* ranges from western Arizona to central Texas (450-1800 m) in desert grasslands and scrub. Collections were made from populations in southeastern Arizona and eastern New Mexico. *Yucca glauca* is widely distributed throughout the plains states (200-2200 m) in grasslands. Collections were made along the Texas-Oklahoma border. *Yucca reverchoni* and *Y. thompsoniana* are endemic to Texas (300-1300 m) in rocky open scrub and grassland. Collections were made from populations in southern and central Texas. *Yucca whipplei* is distributed in widely disjunct populations between southern California, Arizona, and central Baja California (0-2300 m) in chaparral. Collections were made from high elevation populations in southern California.

Seeds were collected in the summer of 1979 and germination experiments were done within 9 mo. Thirty seeds were placed on two layers of Whatman no. 1 filter paper in plastic petri dishes and wetted with deionized H_2O. Heat treatments were selected to represent a range of soil temperatures likely to occur at various soil depths during wildfires. Due to the largely unknown and likely heterogenous nature of seed distribution in the soil profile it is not possible to determine, even in an approximate manner, the temperatures particular species are likely to encounter during a wildfire. In general, species from desert scrub are likely to encounter fewer and less intense fires than ones from chaparral or woodlands. Heating treatments were applied on seeds in open glass petri dishes in a forced convection oven. Seeds were then transferred to the plastic petri dishes. All dishes were covered with plastic bags to reduce evaporation and maintained in the dark (as suggested by McCleary and Wagner 1973) at 5°2 C for 3 wk, followed by two weeks in the light at 23°2 C. After this five week period several species (e.g., *Y. schidigera*

TABLE 1.—*Seed germination of southwest* Yucca *species under various heat treatments. N = 3 or 6 dishes of 30 seeds each. Treatments (within the same species) with the same superscript are not significantly different at P<0.01, NS = P>0.05, LSD = Least Significant Difference at P<0.01. Seed weight is the mean of 100 seeds.*

		Percent Germination						
			2 hours		5 minutes			
	Seed WT (mg)	Control (N=6)	80 C (N=3)	90 C (N=6)	90 C (N=3)	100 C (N=3)	110 C (N=6)	120 C (N=6)
Baccata Species								
Y. Baccata	93	84	9	0	97	49	0	0
Y. brevifolia	99	61^{a}	60^{a}	0^{b}	93	57^{a}	26	0^{b}
Y. schidigera	139	69^{a}	16^{b}	0^{b}	83	54^{a}	11^{b}	0^{b}
Y. torreyi	117	77	39^{a}	0^{b}	90	40^{a}	20	1^{b}
Capsular Species								
Y. angustissima	23	91^{a}	86^{ab}	6^{c}	93^{a}	77^{b}	7^{c}	1^{c}
Y. elata	17	94^{a}	93^{a}	32^{b}	90^{a}	83^{a}	28^{b}	0
Y. glauca	16	79	57^{a}	42^{ab}	41^{ab}	59^{a}	28^{b}	3
Y. reverchoni	8	67^{a}	66^{a}	34^{c}	47^{b}	59^{b}	34^{c}	3
Y. thompsoniana	7	86^{a}	87^{a}	49^{b}	89^{a}	82^{a}	33^{b}	7
Y. whipplei	16	63	34^{ab}	44^{a}	23^{b}	40^{a}	24^{b}	8
	P<0.01	NS	P<0.01	P<0.01	P<0.01	NS	NS	NS
LSD 0.01	7		49	26	29			

and *Y. angustissima*) showed substantial germination whereas for others (e.g., *Y. glauca*, *Y. reverchoni*, and *Y. thompsoniana*) few or no seeds had germinated. Therefore, this regime of 5 C for 3 wk/23 C for 2 wk was repeated two more times for all species.

Germination under control conditions was high and not significantly different between species (Table 1). All four of the baccate species had significantly higher germination after 5 min at 90 C. However, increasing temperature treatments produced a nearly linear drop in germination for all species. There was a distinct dichotomy between baccate and capsular species in their tolerance to extended heating. Two hours at 90 C did cause a significant reduction in germination of all species but it was completely fatal for all baccate species.

In general, germination response to heating is more similar among related species than among species sharing similar ecological habitats. Possibly this is a reflection of similarities in seed structure and size shared among species within each group. There is little evidence that fire has been an important selective influence on seed germination behavior. Indeed, *Y. whipplei*, which is a close component of the fire prone California chaparral, has seeds that are more sensitive to high temperatures than any other *Yucca* species. Thus the yuccas studied here appear to have non-refractory seeds and germination occurs when moisture and temperature conditions are adequate.—JON E. KEELEY AND ADRIENE MEYERS, *Dept. of Biology, Occidental College, Los Angeles, CA 90041.*

CARNIVOROUS BEHAVIOR BY A WHITE-TAILED ANTELOPE GROUND SQUIRREL, *AMMOSPERMOPHILUS LEUCURUS*.—Ground squirrels have been observed capturing, killing or consuming young rabbits (Johnson, J. Mamm., 3:187, 1922; Packard, J. Mamm., 39:154, 1958; Bridgwater and Penny, J. Mamm., 47:345-346, 1966), a small chicken (Bailey, J. Mamm., 4:129, 1923), lizards, young birds and mice (Bridgwater and Penny, J. Mamm., 47:345-346, 1966). Also, some individuals have been trapped using flesh as bait (Green, J. Mamm., 6:173-178, 1925), and some readily consume meat in captivity (Hawbecker, J. Mamm., 28:115-125, 1947; Bradley, J. Mamm., 49:14-21, 1968).

Chew and Butterworth (J. Mamm., 45:203-225, 1964) considered the white-tailed antelope ground squirrel to be a diurnal herbivore, but Bradley (J. Mamm., 49:14-21, 1968) and Bradley and Mauer (Southwestern Nat., 17:333-344, 1973) determined the animal to be omnivorous. Although mammalian remains have been found in the antelope ground squirrel diet, it is not known if the prey was killed or consumed as carrion.

This note describes predation by a white-tailed antelope ground squirrel on a pocket mouse (*Perognathus* spp.). On 3 April 1980, in northwestern Arizona, 5 km southeast of Littlefield, while using 7X35 binoculars, my attention was drawn to an adult antelope squirrel moving through a dense stand of red brome (*Bromus rubens*) under a creosote bush (*Larrea tridentata*). As I watched, the squirrel disappeared momentarily. This was followed by a high pitched squealing. The squirrel re-emerged holding a struggling adult pocket mouse in its mouth. The squirrel sat on its haunches, held the mouse with its forepaws and began eating the living prey. Feeding was initiated at the nasals. The mouse continued struggling until the squirrel had eaten about half of the skull. The entire skull and contents, except for the posterior halves of the auditory bulla, were consumed. The portions of skull not eaten were licked clean of tissue and blood. The skin of the mouse was peeled back over itself, and the muscles and organs of the thorax were eaten. At this point I approached the squirrel to identify its prey. The squirrel dropped the mouse and retreated. As I examined the remains, the squirrel circled me at a distance of 1 m, but returned to the mouse when I moved away.

Ground squirrels do not require free water, however, some succulent food is necessary in the diet (Hudson, Univ. California Publ. Zool., 64:1-56, 1962). In arid areas, green vegetation is sparse or absent during parts of the year. Consumption of vertebrate flesh may therefore be seasonally important in the maintenance of water balance in desert communities.

I thank P. R. Krausman of the University of Arizona for reviewing this manuscript.—JOHN R. MORGART, *Division of Wildlife, Fisheries and Recreation Resources, School of Renewable Natural Resources, Univ. of Arizona, Tucson, AZ 85721.*

OBSERVATIONS OF COLLARED PECCARIES IN JUNIPER AND PONDEROSA PINE HABITATS.—Although the collared peccary (*Dicotyles tajacu*) is known to occupy a variety of habitats, it is apparently rare at elevations over 1829 m. However, on the San Carlos Apache Indian Reservation in east-central Arizona, peccaries are observed regularly at elevations of 1890 m or higher. Several recent observations from the Freezeout area (R25-26E, T2N; ele. 1920 m) were as follows: 13 adults and 2 young on 16 January 1982; 5 adults on 26 February 1982; 3 adults on 6 March 1982; 5 adults on 7 March 1982.

Vegetative cover of the Freezeout area consists primarily of alligator juniper (*Juniperus deppeana*). Arizona white oak (*Quercus arizonica*) and pinyon pine (*Pinus edulis*) occur infrequently. Ponderosa pine (*P. ponderosa*) is present in the canyons of Freezeout Creek and its tributaries. Blue grama (*Bouteloua gracilis*) appears to be the predominant herb.

Peccaries also have been sighted in the Park Creek drainage (R26E, T1S; ele. 1890 m), at B. S. Gap (R26E, T2N; ele. 2134 m), Dry Prong (R27E, T2N; ele. 2134 m), and Double Circle Tank (R23E, T1N; ele. 1890 m) throughout the year. Ponderosa pine is the dominant vegetation of these areas. Some Douglas-fir (*Pseudotsuga menziesii*) and Southwestern white pine (*P. flexilis*) occur in the B. S. Gap area on northerly aspects.

The above observations indicate that peccaries may inhabit these areas year-round, even though they are not well adapted for life in cold environments. However, winters in the area are relatively mild, and this probably enables peccaries to survive at these elevations.—SCOTT C. MENEELY, *USDI Bureau of Indian Affairs, Branch of Forestry, San Carlos, AZ 85550.*

AN ADDITION TO THE FISH FAUNA OF OKLAHOMA: *ERIMYZON SUCETTA* (CATOSTOMIDAE).—*Erimyzon sucetta* ranges from the southeastern Atlantic slope, to the Gulf slope, and throughout much of the Mississippi drainage (Lee et al., eds., Atlas of North American Freshwater Fishes, North Carolina State Mus. Nat. Hist., p. 399, 1980). Its range includes the Cossatot River basin (Little River drainage) in Arkansas, but it has not previously been reported from Oklahoma.

Erimyzon sucetta is similar to *E. oblongus*, a common species in eastern Oklahoma. Both species have cylindrical, elongate bodies, small heads and eyes, and moderately rounded snouts. *E. sucetta* differs from *E. oblongus* in having larger lateral line scales (35-39 vs 39-46) and more dorsal rays (11-13 vs 10-11). Adult *E. oblongus* have a bronze dorsal coloration grading into a yellowish venter. Dark-edged scales give *E. oblongus* an overall cross-hatched appearance. The lateral band is intensely black in young *E. oblongus*, but is reduced to a series of connected blotches in adults. Adults *E. sucetta* have olive-brown dorsal coloration changing to a white venter at the midline. Dark-eyed dorsolateral scales give a cross-hatched appearance above the midline but scales below the midline have little pigmentation. Young *E. sucetta*, like young *E. oblongus*, have an intense black lateral band, but the lateral band is either continuous or absent (often faint) in adults.

During the summers of 1981 and 1982, while we sampled the fish community and characterized the habitat at 156 locations throughout the Little River drainage in Oklahoma, we collected *E. oblongus* at 71 sites in LeFlore, Purhmataha, and McCurtain counties. Dorsal fin ray counts were (number of individuals in parentheses): 10(109), 11(55), and 12(1). Lateral line scale counts were 39-47, $\bar{x}$ = 42.35. These meristic counts are within the range reported for *E. oblongus* in Louisiana (Douglas, N. H. *Freshwater Fishes of Louisiana*, p. 194, 1974) and Missouri (Pflieger, W. L., *The Fishes of Missouri*, p. 199, 1975).

Erimyzon sucetta was collected from four locations in McCurtain Co.: OSMZ 11384, 1 adult, Little River tributary, R25E T7S Sec. 17, 5 July 1982; OSMZ 11385, 6 adults, Crooked Creek, R26E T6S Sec. 15/16, 11 July 1982; OSMZ 11386, 1 adult, Little River tributary, R26E T7S Sec. 8, 11 July 1982; and OSMZ 11387, 4 adults, Ponka Bok Creek, R27E T7S Sec. 6, 11 July 1982.

Meristic counts for *E. sucetta* from these sites are within the range reported by Pflieger for the species in Missouri and by Douglas in Louisiana. Dorsal fin ray counts (number of individuals in parentheses) were: 11(1) and 12(11), and lateral line scale counts were 35-39, $\bar{x}$ = 36.92.

We reexamined all material cataloged as *E. oblongus* in the Oklahoma State University Museum of Zoology (OSMZ), and the University of Oklahoma Stovall Museum of Science and History (OUSM). We found no misidentifications in the OSMZ but, three collections from OUSM contained *E. sucetta*: OUSM 39969, 4 adults, Broken Bow City Lake, R24E T6S SEc. 2, 17 July 1963; OUSM 39827, 1 adult, Horsehead Creek, R22E T5S SEc. 13, McCurtain Co., OK, 8 Aug. 1963; OUSM 40687, 1 adult, slough south of Eagletown, McCurtain Co., OK, 7 June 1982.

Habitat of *E. sucetta* was typically low altitude streams ($\bar{x}$ altitude = 102.8 m, $\bar{x}$ stream order = 1.75, $\bar{x}$ distance of each site from the headwaters = 3.6 km) characterized by small substrate (predominantly gravel), moderate depths (5-20 cm), emergent vascular plants, and detrital leaf litter.

In Oklahoma, this species occurred only in lowland tributaries of the Little River (downstream from Highway 3 and 7) and was commonly associated with *Lepomis cyanellus*, *L. macrochirus*, *L. punctatus*, *Ictalurus natalis*, *Gambusia affinis*, and *Notemigonus crysoleucas*. These species are typical of many lowland tributaries of the Little River drainage. *E. sucetta* and *E. oblongus* were sympatric in two of the four sites were *E. sucetta* was collected.

In contrast to the restricted distribution of *E. sucetta*, *E. oblongus* was collected throughout the Little River drainage from a wide range of habitat types. Collection sites varied considerably in altitude (92.2-329.0 m, $\bar{x}$ = 181.1 m), stream gradient (21.7-1.0 m/km, $\bar{x}$ = 6.4 m/km), stream order (1-6, $\bar{x}$ = 2.5), and distance from headwaters (0.3-264.5 km, $\bar{x}$ = 11.7 km) and were characterized by medium substrate (predominately rubble), moderate depths (5-20 cm), emergent vascular plants, and detrital leaf litter.

Erimyzon oblongus is widely distributed and reaches its greatest abundance in the upper to mid-reaches of the Little River drainage (upstream from Highway 3 and 7). It is commonly collected with a ubiquitous species group represented by *Lepomis cyanellus*, *L. megalotis*, *Etheostoma radiosum*, *Esox americanus*, *Campostoma anomalum*, *Notropis boops*, and *Ictalurus natalis*.—D. ALLEN RUTHERFORD and A. A. ECHELLE, *Dept. of Zoology, Oklahoma State Univ., Stillwater, OK 74078* and O. E. MAUGHAN, *Oklahoma Cooperative Fishery Research Unit, Oklahoma State Univ., Stillwater, OK 74078.*

FIRST RECORD OF *PIPISTRELLUS SUBFLAVUS* (CHIROPTERA: VESPERTILIONIDAE) ON PADRE ISLAND, TEXAS.—On 19 August 1982 an eastern pipistrelle (*Pipistrellus subflavus*) was collected at Mile and Half Plant, 2.4 km S of the north entrance to Padre Island National Seashore, Kleberg County, Texas. The bat, which was a non-lactating female, was found hanging under the roof of a gas separation plant building by a naturalist (Richard Harris) at Padre Island National Seashore.

This locality represents a new county record as well as the first record of this species on the Texas Gulf Coast barrier island system. To my knowledge, there are no other published reports of bats inhabiting the barrier island system of the Texas Coast. The eastern pipistrelle is a common cave bat in eastern and central Texas (Blair, Texas J. Sci., 4:95-98, 1952; Schmidly et al., Texas J. Sci., 28:127-14, 1977) but apparently is rare in south Texas where it has been recorded from only Bee and Cameron counties (Davis, J. Mamm., 40:521-531, 1959).