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Some Coactions of Rabbits and Rodents with Cactus

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INTRODUCTION

The prickly pear (*Opuntia humifusa*) has received considerable publicity and study during the past few years due to its great increase on range and pasture land as a result of the drought conditions in the Great Plains region.

While making field studies of range conditions, the author observed the coactions and collected the data reported in this paper.

RELATED STUDIES

Taylor and Vorhies (10) reported extensive eating of cactus pads and stems by jack rabbits in Arizona.

The eating of the prickly pear fruit by animals has been reported from various sources. Phillips (4) observed in South Africa that cattle, goats, baboons, monkeys and birds eat the prickly pear fruits and disseminate the seed. Darnell-Smith (3) reported that the Emu, black magpie, rabbits and cattle ate the prickly pears. The rabbits appeared to have ground most of the seed during mastication but the others were credited with scattering the seed. Timmons and Wenger (9) reported the jack rabbits eating prickly pear cactus fruits in West Central Kansas and disseminating the seed in their fecal pellets. Clements and Shelford (1) reported the golden flicker and Indian road runner as including cactus fruits in their diets. Cook (2) reported rabbits and rodents as being among the chief disseminators of prickly pear seed in the Central Great Plains.

RABBIT COACTIONS

FOOD

Observations made of cactus infested pastures during the fall drought of 1939 showed much evidence of cactus internodes or pads being eaten by the blacktailed jack rabbits (*Lepus californicus melanotis*). This coaction was most pronounced since a lack of green food made the succulent prickly pear pads very desirable (10). This activity continued on through the winter, being particularly noticeable during the time when the snow covered the ground.

Very little feeding on cactus pads by rabbits was observed during the spring and summer of 1940 but the coaction became evident again when cold weather arrived, though to a much less degree than in 1939. The fall rains of 1940 made possible a considerable growth of green plant food which substituted for the cactus except when snow was upon the ground.

Prickly pear fruits were also consumed in large quantities by the rabbits during the falls of 1939 and 1940 (Fig. 1). Each year the eating of the pears began in early autumn and continued until freezing weather (8). Few clumps of cactus escaped having some of their fruits used by the rabbits for food. The seeds were consumed with the pulp of the

fruits, a few of them being broken up during mastication but most of them passing into the digestive tract of the rabbit uninjured.

DISSEMINATION OF SEEDS AND INTERNODES

The hard-coated seeds of the prickly pear cactus pass through the alimentary canal of the rabbit unharmed by the digestive processes. They are defecated in the fecal pellets (Fig. 2), these being eliminated while the rabbit feeds or soon after (7). In this manner, the seed is promiscuously scattered during the food taking activities of the rabbit.

The viability of the seed apparently is little affected by the digestive juices through which it passes. Timmons (8) conducted germination tests with prickly pear seed taken from cactus fruits and from rabbit pellets. The seed from the pellets germinated more quickly and to a greater per cent than the seed from the fruits in every test conducted.

In determining the extent to which cactus seed were disseminated by jack rabbits, a survey was made of several areas infested by cactus and the areas adjacent to them (Table I). Fecal pellets were gathered in each area. Ten samplings, each one foot square, were taken in each area, the samplings being 50 feet apart.

TABLE I. The data included in this table were obtained by collecting pellets from the various habitats. Ten stations, each 1 foot square, were sampled in each habitat, the stations being at intervals of 50 feet.

Name of Hab.	No. of pellets	Jack rabbit pellets	Cotton-tail pellets	No. cactus clumps per acre	No. pellets with seed	No. of seed	No. of pellets opened
Overgrazed Short grass	21	20	1	200	4.5	18	2
Revegetation area	27	22	5	60	4	7	2
Moderately grazed Short grass	19	18	1	125	2.5	2.5	1
Near cactus clump	130	105	25	155	16	24	16
Adjacent wheat field	17	17	0	0	2	5	1
Short grass no cactus	6	6	0	0	0	?	0
Little blue stem	27	21	6	5	1	?	0

The results of the survey showed the overgrazed, cactus infested areas to have the largest number of pellets containing cactus seed and the greatest number of seed per pellet. Revegetation areas which were grazed but contained less cactus clumps containing slightly less both of pellets and seed. Areas adjacent to cactus infested pasture land showed very few pellets containing cactus seed with the exception of wheat fields. The pellets collected from wheat fields were almost as great in number and contained nearly as many seeds of prickly pear as the short grass areas to which they were adjacent. The greatest concentration of fecal pellets and those containing seed was found to be near cactus clumps. The samples were taken within 2 feet of the cactus clumps where the pellets had been deposited as the rabbits ate the fruits.

The pellet counts gave no information as to the actual numbers of rabbits in the various areas but did furnish a reliable indication of the areas most frequented by them (7).

There is little evidence to show that rabbits disseminate prickly pear cactus by scattering the internodes. When the prickly pear pads are eaten, they are normally attacked from the edge, the spines being carefully bitten off, and the pads gnawed cleanly as they are consumed. Rarely are whole plants destroyed in this food coaction. By this method of eating, there are few internodes detached from the plant to take root and grow elsewhere. Schaffner (6) accredits this method of dissemination to livestock.

RODENT COACTIONS

FOOD COACTIONS OF 13 LINED GROUND SQUIRREL (*Citellus tridecemlineatus pallidus*)

During the summer of 1939 large numbers of cactus seed were observed to have been eaten by ground squirrels and the hulls left in their temporary shelters beneath the cactus clumps. The seed had been opened by removing the seed covering from the side of each seed and removing the contents.

DISSEMINATION OF SEEDS AND INTERNODES

In the spring of 1940 several cactus seedlings were found sprouting from a store of prickly pear seed which had been buried about one inch under the soil in a cactus infested short grass area (Fig. 3). Some of the seedlings had been dug out and the unsprouted seed removed from the cache presumably by a ground squirrel. During the summer several other caches were discovered by finding the cactus seedlings sprouting from them. A close study of a 2 acre area of short grass containing about 150 clumps of prickly pear cactus per acre was conducted during the summer and fall of 1940. Thirteen caches of cactus seed were found from which 75 seedlings were observed sprouting. The first seedling emergence from a store of seed was noted on May 9 and the last cache found with seedlings was October 3. These seedling locations were marked for observation but none of them became established. A few days after emergence, they were bitten off, presumably by rabbits. One clump (Fig. 4), however, was found which apparently had grown from a seed cache during the previous year. While making observations of rabbit activity in eating cactus fruits in the early autumn of 1940, it was noted that rabbit pellets were being opened near cactus clumps. Investigation indicated that those pellets containing prickly pear seed were being broken apart and the seed removed by ground squirrels. No seed was left near the pellets opened. Though no ground squirrels were actually observed in this activity, cactus seed and portions of rabbit pellets were later found in temporary burrows of these spermophiles.

Apparently ground squirrels make little use of the cactus pads as food, no observations having been made of such an activity. Partially eaten prickly pear fruits have been found in their temporary shelters.

SHELTER

The 13 lined ground squirrel has repeatedly been observed using prickly pear clumps for shelter and protection. During the summer of 1939 many temporary holes were found which the ground squirrels had dug at the edge of the cactus clumps. Feeding chambers were also examined. The rodents constructed these by digging a hole just beneath the cactus internodes and parallel with the surface of the ground. Under the center of the prickly pear clumps, chambers about six to eight inches in diameter were hollowed out. When these chambers were examined, they usually contained a con-

siderable number of prickly pear seed hulls strewn about. No permanent nests were found in these shelters. When the ground squirrel came out of hibernation early in March, 1941, one of their first activities noted was the cleaning out of the temporary shelters under the cactus clumps.

FOOD COACTIONS OF WHITE-FOOTED MICE

(Peromyscus nebraskensis)

Early in the fall of 1940 cactus seed hulls were observed on the pads and the ground in the prickly pear clumps. The seeds had been opened by a different method than that employed by the ground squirrel. Each empty hull had a small hole gnawed in the rim, its contents having been removed through this opening. Clumps around which this activity was most apparent usually were found to contain white-footed mice, commonly one to a clump. The hulls became increasingly plentiful about the cactus clumps during the winter.

After cold weather had set in, rabbit pellets near cactus clumps were found to have been opened and the cactus seed which they contained eaten on the spot. The hulls had been opened in the manner mentioned above (Fig. 5).

To verify the assumption that this was an activity of white-footed mice, some specimens were captured and their incisors fitted into the openings of the hulls. The rather long lower incisors fitted admirably into the gnawed holes and could have easily removed the contents of the seed. By the spring of 1941, a large per cent of the prickly pear seed in cactus clumps in West Central Kansas had been used for food by these small rodents and about 10 per cent of the rabbit pellets containing seed, which were in cactus infested areas, had been opened and the seed from them eaten.

Observations made on a tour of Western Kansas in April, 1941, showed this activity to be general in cactus infested areas in the west half of the state. The fruit of prickly pear cactus was also observed to be eaten by the white-footed mice.

A survey was made of the mouse population living in the cactus clumps in several areas of short grass. One-tenth acre plots were sampled. From ten to twenty white-footed mice per acre were found to inhabit these areas. No other species of rodent was found living in the cactus clumps examined.

SHELTER

White-footed mice apparently find the cactus clumps well suited to their needs for places of habitation. The globular nests of these small rodents were found concealed under the cactus pads. They were constructed primarily of finely stripped leaves of the short grass and were about the size of a regulation baseball. This location protects the mice from most of their predators.

Observations indicate that male white-footed mice do not build as large nests as the females.

No evidence has been found which would indicate that white-footed mice are agents of dissemination for the prickly pear cactus.

DISCUSSION

The ecological significance of the coactions reported seems worthy of mention.

The dissemination of prickly pear seed by jackrabbits as a result of eating the fruits of the plants, and the planting of the seed by ground squirrels in

satisfying their food storing habit are the principal means by which seed of the prickly pear cactus may be scattered in this part of Kansas. The using of the seed for food by the rodents acts as a check on the increase of cactus by growth from seed. The removal of cactus seed from fecal pellets of rabbits further reduces the chances of increasing cactus from seedling production.

Although the ground squirrels may occasionally fail to remove the cactus seeds from their shallow store rooms, thus permitting seedlings to grow and form new clumps, it is obvious that they dig up and consume many more seeds than they leave. The ground squirrel and the white-footed mouse species deserve a place along side other forms of animal life in furnishing a biological control for *Opuntia humifusa*, the prickly pear cactus.

CONCLUSIONS

Black tailed jack rabbits were observed to have eaten quantities of prickly pear cactus pads during the fall and winter of 1939 and 1940. Prickly pear fruits were also consumed in considerable amounts during the fall months of these years. Most of the seeds eaten with the fruits passed through the digestive tracts of the rabbits unharmed.

These were defecated in the fecal pellets of the rabbits and were scattered at random while the rabbits were feeding.

Pellets containing cactus seeds were most numerous in overgrazed short grass areas infested with cactus. Wheat fields adjoining these areas had nearly as many pellets containing seed deposited upon them as were found on the areas.

The greatest concentration of pellets in which seed was embedded was found close to cactus clumps.

The 13 lined ground squirrels were observed to feed on the cactus seed and to bury the seed in the ground in caches. Seedlings of prickly pear were found emerging from these buried stores. Ground squirrels also remove cactus seeds from rabbit pellets. They use the cactus clumps for shelter and protection.

White-footed mice were found to eat large quantities of cactus seed during the fall and winter as evidenced by the hulls of the seed strewn about in cactus clumps near by.

In the vicinity of cactus clumps they broke open about 10 per cent of the rabbit pellets containing cactus seed, and ate the seed.

The white-footed mice were observed to build their nests in the cactus clumps, preferring overgrazed short-grass areas which were infested with prickly pear cactus. The nests were constructed of the leaves of the short grass.

No observations have been made to indicate that white-footed mice disseminate cactus seed.

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EXPLANATION OF FIGURES

Fig.

1. A cactus clump, Sept. 12, 1940, showing fruits eaten by jack rabbits. Many of the fecal pellets in the foreground contained cactus seed. The pellets in the right foreground have been torn apart, presumably by ground squirrels and the seed removed.
2. Fecal pellets of the black tailed pack rabbit showing cactus seed embedded in them. They were collected near the cactus clump shown in Fig. 1.
3. Prickly pear cactus seedlings which have germinated from seeds buried by a ground squirrel. The cache has been partly opened by some rodent. May 9, 1940.
4. A group of young prickly pear seedlings apparently growing, from a cache of seed buried by a ground squirrel. Two emerged in the spring of 1940, the other six having emerged in 1939.
5. Prickly pear cactus seed opened and eaten by white-footed mice. The seed was removed from jack rabbit pellets by the rodents.

