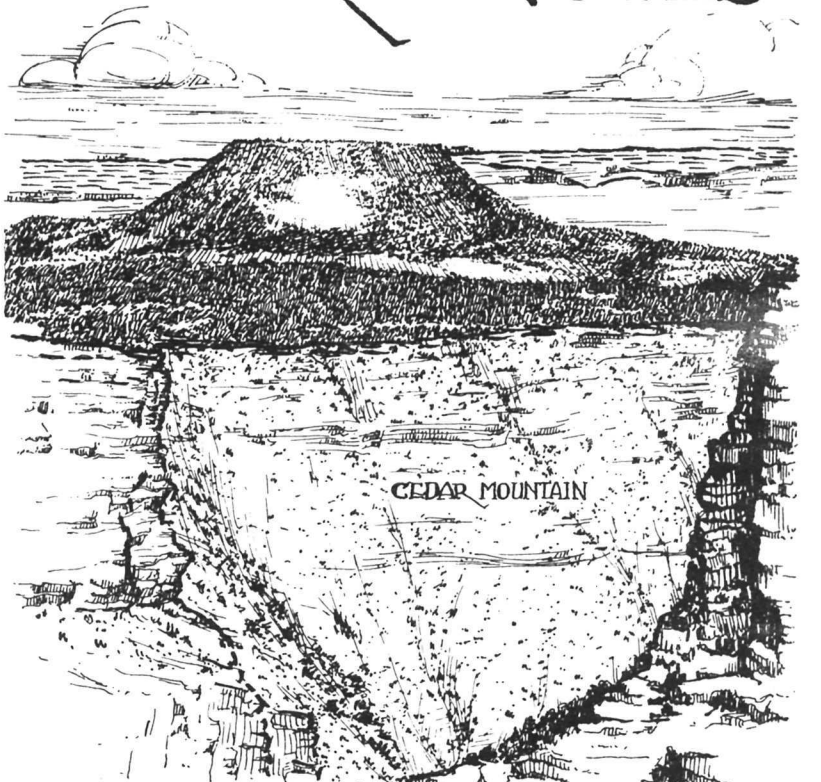
GRAND CANYON NATURE NOTES



VOLUME 9 / NUMBER 5
AUGUST 1934

GRAND CANYON NATURAL HISTORY ASSOCIATION

ADVISORY COUNCIL

Educational Development:
Dr. John C. Merriam, President Carnegie Institution.
Dr. Homer LeRoy Shantz, President University of Arizona.
Dr. Harold S. Colton, Director Museum of Northern Arizona.
Geology:
Dr. David White, U. S. Geological Survey.
Mr. Francois E. Matthes, U. S. Geological Survey.
Paleontology:
Dr. Charles E. Resser, U. S. National Museum.
Dr. Charles W. Gilmore, U. S. National Museum.
Mammalogy:
Dr. Vernon Bailey, U. S. Biological Survey.
Ornithology:
Mrs. Florence M. Bailey, American Ornithological Union.
Herpetology:
Mr. L. M. Klauber, San Diego Museum of Natural History.
Botany:
Dr. Forrest Shreve, Desert Laboratory, Carnegie Institution.
Entomology:
Dr. Frank Lutz, American Museum of Natural History.
Ethnology:
Dr. Clark Wissler, American Museum of Natural History.
Archaeology:
Dr. Harold S. Gladwin, Gila Pueblo.
Mr. Jesse L. Nusbaum, Director Laboratory of Anthropology.

BOARD OF DIRECTORS

Victor Patrosso, Mrs. E. J. Kirwan,
James V. Lloyd, Emery C. Kolb,
Frank C. Spencer, L. G. Carr,
M. R. Tillotson.

TREASURER

B. G. Carson, M.D.

EXECUTIVE SECRETARY

Edwin D. McKee, Park Naturalist

GRAND CANYON NATURE NOTES

Volume 9, Number 5.
August 1934

National Park Service,
Grand Canyon National Park.

Grand Canyon Natural
History Association
Grand Canyon, Arizona

This publication is issued monthly for the purpose of recording observations and of making known the results of research and scientific investigation in the Grand Canyon region in the fields of natural history, history and related subjects. It is published by the Natural History Association for the Grand Canyon National Park. Membership in this Association is $1.00 per year and includes a subscription to Nature Notes. Additional copies of Nature Notes may be obtained at 10¢ each by addressing the Grand Canyon Natural History Association, Grand Canyon, Arizona

M. R. Tillotson,
Superintendent.

Edwin D. McKee,
Park Naturalist

Table of Contents

Illustrations by Florence Satterwhite.

DOES MISTLETOE KILL the TREES at GRAND CANYON

By Donald Edward McHenry, Junior Naturalist.

WHEN THE EARLY DRUIDS venerated the mistletoe as a sacred or mystic plant, it was because this strange form of vegetation was found growing midway between heaven and earth, but, as they said, really belonged to neither. Little did they suspect that this interesting plant, far from being of the gods, was actually a brigand, exhausting the vitality of the very support which made possible its exalted position and gave it its semi-divine reputation.

Not in the same mystic sense, but none the less with considerable interest do the modern visitors to Grand Canyon National Park view the yellowish green clumps of mistletoe which dot some of our evergreen trees. Mistletoe is most conspicuous on the Utah Juniper (Juniperus utahensis). It has been identified as Phoradendron juniperinum. Much less conspicuous is the mistletoe, Razoumofskya cryptopoda on the Western Yellow Pine (Pinus ponderosa). On the Pinyon or Nut Pine, (Pinus edulis), only a few plants of mistletoe, Razoumofskya divaricata, are to be found. As one discovers these parasites and then finds a dead tree near by, he frequently wonders whether or not the tree has been killed by mistletoe. Such a conclusion seems especially probable if the dead tree has the characteristic scrubby growth known as "Witch's broom" on its branches - the adventitious growth induced by the hemiparasitic mistletoe.

The writer recently had occasion to carry on investigation in an attempt to answer the question of how much damage this mistletoe actually does. This investigation was undertaken along with the inspection of infected trees in the park made by Mr. John Miller, Entomologist of the Forest Service,

and Dr. F. P. Meinecke, Plant Pathologist of the Bureau of Plant Industry. A number of specimens were examined in various stages of infestation. In every case the early stages were first indicated by mild etiolation or yellowing of the leaves at the tips of the branches, usually uniformly over the entire tree. This became progressively more marked as the infection made greater inroads. The final stage was characterized by a uniform straw color of the leaves on the Western Yellow Pine while on the Junipers the branches were almost if not completely stripped bare of foliage.

Pinyon Pine on South Rim
McHenry Photo

Although at first one might easily conclude that a tree in the condition just described had been killed by the mistletoe, further investigation seems to indicate that this plant served only to begin a series of events resulting finally in the death of the tree. The mistletoe apparently serves to sap the vitality of the trees. One result of this seems to be the reduction of the resin flow. As suggested by Mr. Miller, a tree in full vigor is probably able to produce enough resin to ward off insect attack. When the flow of resin is great, the attacking insect must either retreat from it or become engulfed. Mr. Miller does not recall having ever seen any evergreens such as those represented in this park, successfully attacked by insects unless the vitality of the trees has been first reduced by some other agency.

A sapping action, however, can be directly attributed to the mistletoe on the evergreens. Following primary infestation, the attacking insects are able to bleed the plant of its resin until the flow has been sufficiently reduced to allow the entrance of the insect into the bark. Such insects then proceed to the cambium layer and, feeding upon it, actually bring about the death of the tree. It is thus probable that it is not the mistletoe but the secondary insect infestation which kills the tree. The insects involved include such forms as Long-horned beetles (Cerambycidae), Click Beetles (Elateridae), Metallic Woodborers (Buprestidae), and other related forms. Even such destructive primary forms of insect infestation as represented by the Black Hills pine beetle (Dendroctonus ponderosae or D. barberi) or Ips (Ips lecontei) are not able to make successful attacks until the vitality of the tree has been somewhat reduced, at least at the ends of some of the branches. In these latter cases, however, there is no evidence of mistletoe infection.

Another type of infection which causes yellowing of the ends of some individual branches of the Western Yellow Pines in the park gives no evidence of mistletoe attack. Upon close inspection Dr. Meinecke found that the etiolating needles first showed definite alternating transverse dark and light bandings which might at first suggest fungus attack. Careful examination with a hand lens, however, disclosed small red mites (Eriophus) in the axil of the infested leaves and these Dr. Meinecke thought might possibly account for the diseased appearance of the plant. This feature needs further investigation.

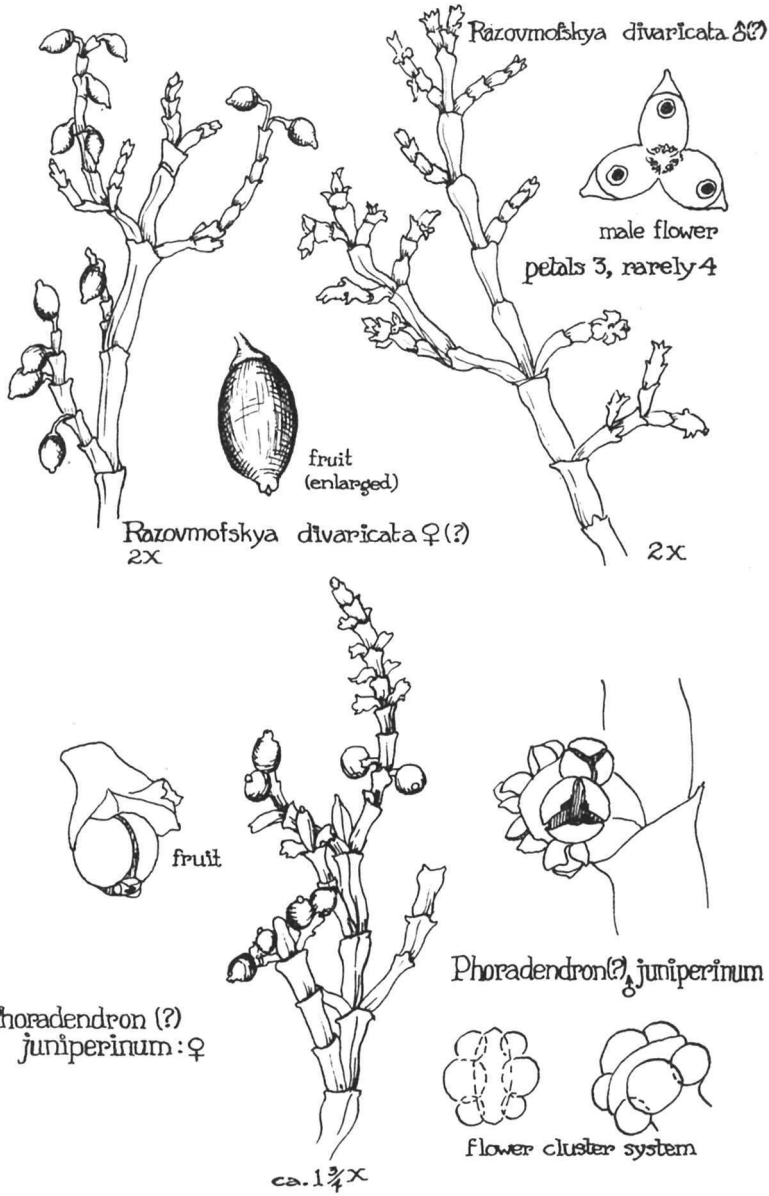
Infrequently Pinyon Pines will be found which are covered in varying degrees with Spanish Moss (Usnea florida). A few of these trees apparently are dying from the extremely heavy infestation of this peculiar lichen. Whether or not this plant will actually kill the tree or whether it acts in the same role as the mistletoe is a question which needs further study.

There are numerous trees which have suffered from primary agencies other than those suggested above. Some of them, especially the Western Yellow Pines, have been struck by

lightning which has naturally reduced their vitality. As in the case of the devitalized condition induced by mistletoe, the vitality of a tree struck by lightning is reduced to a point at which secondary insect infestation easily sets in and kills the tree.

Occasionally one is struck with the singular appearance of an evergreen in which the entire upper portion is dead while the part beneath is apparently in good health. Examination of such specimens often reveals evidence of attack by porcupine in which the tree has been "ringed". When a porcupine gnaws completely around the stem, cutting off the passage of the sap, it kills all portions above the wound.

There are doubtless other injuries to our trees which could also be discussed with interest, but the writer is only endeavoring to suggest here some causes of the more manifest types. This is in no way intended to be an exhaustive discussion of the subject; nor should the reader conclude that the problem is in any way serious in the park area. Fortunately the most destructive forms of infestation have been all but eradicated by a consistent program of effective control measures. It is believed that very few living Black Hills beetles are to be found in this forest at present. The writer holds the opinion that in the majority of cases where trees infected with mistletoe have been killed, their death is due not to this parasite alone but to the presence of secondary insect infestation, therefore, no effective measure for the control of the spread of mistletoe is being followed. As stated before, the major mistletoe attack is to be found on the juniper trees of the area. Although it has been suggested that in a few cases some of these trees have actually been killed by the mistletoe alone the writer is not acquainted with a well authenticated case of this nature. Further study may reveal that the mistletoe is more deadly *per se* than we realize.


Razovmofskya divaricata ♂(?)
male flower
petals 3, rarely 4
fruit
(enlarged)
Razovmofskya divaricata ♀(?)
2X
2X
fruit
Phoradendron (?)
juniperinum : ♀
ca. 1¾X
Phoradendron(?) juniperinum ♂
flower cluster system

REMNANTS of the AGE of DINOSAURS on SOUTH RIM of GRAND CANYON

By Edwin D. McKee, Park Naturalist.

IN 1858 Dr. J. S. Newberry, geologist on Lt. Ives' exploring expedition, recognized in the valley of the Little Colorado River where he crossed it about 40 miles below the present town of Winslow, a series of rocks which was definitely above and of later age than the highest which he had seen exposed in the walls of Grand Canyon. These rocks, 500 feet thick, were for the most part red sandstones and shales and he referred to them as the "Saliferous series" or "red sandstone series".

During the past sixty years many geologists working in the Grand Canyon region have noted the presence of Newberry's "Saliferous series" in various localities and have contributed to our knowledge of the history and extent of these rocks. Among a large accumulation of data, two things appear to have especial significance. First, since the remnants of these strata are found north, south, east and west of Grand Canyon and since they are known to have been formed during the Triassic period (first part of the "Age of Dinosaurs"), it is clearly evident that rocks of this age once covered the entire Grand Canyon area. Second, these remnants furnished evidence that a long period of erosion and wearing away of the region occurred just prior to the beginning of actual Grand Canyon cutting.

That rocks of the "Age of Dinosaurs" once covered the Grand Canyon Area, there appears to be very little doubt, but concerning the original thickness of this former covering mantle there is much room for speculation. Since to the east and north of Grand Canyon one encounters steps representing successively later and later periods of history, physiographers in general have been inclined to conclude that the total

thickness of these formations as found in meighboring areas, about 6,000 feet of rock, once covered the present topmost layer of Grand Canyon. But this is open to question.

South and west of Grand Canyon remnants of the "Age of Dinosaurs" contain only the "Saliferous series" of Newberry, now known as the Moencopic formation, and parts of the overlying Shinarump-Chinle formation. These then, with a combined thickness of probably not over 1,500 feet, are the only layers of rock which we can be sure covered the entire area in former times. It is probable, nevertheless, judging from the present proximity of the Vermilion cliffs, that the rocks of which they are composed (Jurassic age) once also covered Grand Canyon area, though obviously with much less thickness than they have in southern Utah since they become thinner toward the south and west. Overlying Cretaceous rocks may or may not have originally extended as far to the southwest as Grand Canyon. On the other hand, it seems almost certain that the still higher rocks of Tertiary age as found at Bryce Canyon, Utah, and Ganado, Arizona, did not, since they are far removed at present and they represent fresh water deposits which probably never has a very great areal extent. In brief, then, we can only say with assurance that the mantle of rock which formerly covered the Grand Canyon area was over 1,500 feet in thickness but probably considerably less than 6,000 feet.

South of Grand Canyon isolated remnants of the Moencopic formation are found in about nine scattered localities, the farthest southwest of which is in Sycamore Canyon. Both there and in Anderson mesa to the east the exposures are quite extensive laterally and in both cases are protected by lava caps. Since these and the other Moencopic remnants have considerable bearing on the history of the region, their extent and nature is here summarized:

PRINCIPAL OUTCROPS OF TRIASSIC ROCKS SOUTH OF GRAND CANYON.

Locality	Thickness	Overlying Beds	Recorder
Sycamore Canyon	300-400' Moencopie Cap of Shinarump	Basalt	Robinson (1)
Anderson Mesa N. Side.	400' Moenc. & Shin.	Basalt	Robinson (1)
Anderson Mesa S. Side.	550' Moenc. & Shin.	Basalt	Robinson (1)
Flagstaff	25'-150' Moencopie	Basalt	Robinson (1)
San Francisco Peaks	? 700' Moencopie Shin. & Chinle	Basalt	Gilbert (2)
Cedar Ranch N.E. of Kendrick	280' Moencopie 365' Shin. & Chinle	Basalt	Robinson (1)
Plateau between Diamond and Cataract Creeks	Outlier Moencopie	Erosion	Newberry (3)
Red Butte 14 mi. S.S.E. Grand Canyon.	600' Moencopie 210 Shinarump	Basalt	Ward (4)
Grand Canyon Rowe's Well.	50' Moencopie	Erosion	McKee
Grand Canyon west of Moran Point.	32' Moencopie	Erosion	McKee

Near Grand Canyon, outliers of rocks of the "Age of Dinosaurs" such as Red Butte to the south and Cedar Mesa to

the east have long been recognized for what they are. Remnants of such rocks occurring actually on the rim of Grand Canyon, however, have not heretofore been recorded but since the writer has recently discovered their presence there, he takes this opportunity of making known the details. Just west of the Hance trail and east of the steep hill formed by the Grandview monocline is one such exposure extending along the rim for perhaps half a mile. It includes the basal conglomerate member, 8 to 16 feet thick, and about the same thickness of red, thin-bedded, sandy shales above. These shales are also to be seen along the Bright Angel fault not far back from the canyon rim on the road to Havasu Canyon (about two miles S.W. of Rowe's Well) but there the underlying conglomerate and the Kaibab formation are not exposed.

One importance of the discovery of the Moencopie formation on the rim of Grand Canyon is that it clearly shows that only a very small part of the Kaibab formation has been removed over much of this area by recent erosion. Beneath the Moencopie is found only a thin exposure of the so-called A-member or Harrisburg gypsiferous member of the Kaibab. It consists in this locality of two ledges of limestone each containing abundant casts of Permian pelecypods and gastropods, separated from each other by an irregularly-bedded crumbly, red sandstone. The red sandstone layer is seen at Yaki Point and on the Buggeln hill along the Desert View road where it has been mistaken for Moencopie sandstone because of its color. However, there is no need for confusion if one compares lithologic characters. The underlying limestone is the rock that covers a major portion of the plateau surface.

Along the rim of Grand Canyon west of Hance trail the contact between the Moencopie and Kaibab formations, representing a break between two great chapters of geological history, is plainly visible. The subangular pebbles at the base of the former, ranging in diameter up to 2-1/2 inches, completely cover the flat limestone surface of the latter and in places fill small depressions and channels cut into it. These pebbles are all of the most durable types of rock - jasper, chert, quartz, etc. - varying greatly in color but probably derived mostly from the Kaibab formation and transported only a short distance. A similar bed of conglomerate has been

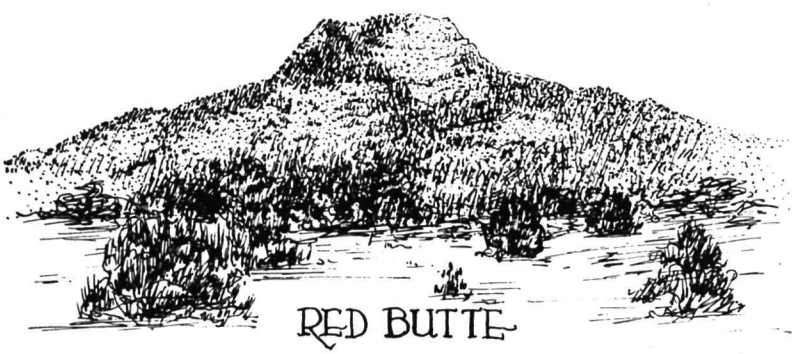
noted at the base of the Moencopie where the writer has examined it north of Cedar Mesa, along the Little Colorado Canyon, near Cedar Ridge Trading Post, in Sycamore Canyon and in the valley of the Little Colorado. Robinson (1) records a similar bed, 5 feet thick, at Anderson Mesa to the south, so it probably represents a fairly constant unit at the base of the Moencopie formation.

1. Robinson, H. H., The San Francisean Volcanic Field, Arizona, U.S. Geol. Survey Prof. Paper 76, p. 27, 1931.

2. Gilbert, G. K., U.S. Geog. Surveys W. 100th Mer., Vol. 3, 1875.

3. Newberry, J. S., Report upon the Colorado River of the West, explored 1857-58 by Lt. J. C. Ives, pt. 3, 1861.

4. Ward, L. F. Geology of the Little Colorado Valley, Am. Jour. Sci., 4th ser., vol. 12, 1901.



METEOROLOGICAL DATA.

Snow at Grand Canyon on June 6 is something worth noting. On that date the ground on both North and South Rims was white for a short while. Although snow storms are not uncommon here in May, there are very few records of their occurrence in June.

****

An effect of the great drought which has prevailed throughout the country is clearly visible in the present size of the Colorado River. At this date, July 13, the discharge in second-feet as recorded at the U. S. Geological Survey Gauging Station at Bright Angel Creek is only 2,310. For comparison with this, figures showing the discharge during four other years on July 13 and also at the lowest stage of each year have been selected at random from data available -

	July 13	Minimum for year
1934	2,310	--
1929	29,600	2,960
1927	43,000	2,870
1924	22,100	2,790
1923	40,200	5,770

BOTANICAL NOTE

A Prickly Pear Cactus, Opuntia sp., recently collected near Coconino Wash, demonstrated fully the adaptation of the root system of this species to the arid climate. Although the plant above the roots was comparatively small (five and one half inches high) and was composed of only two main and five secondary joints, its root system extended for the remarkable distance of five feet eleven inches. E. D. McKee.