direct sunlight. When so herded together, the area occupied by them becomes yellow and it is impossible to see the rind of the fruit at all. The mites in this mass seem to be stuck to each other like numerous angle worms. They are a writhing, wriggling mass and crawl around without any apparent object or direction. Shortly after this congregating the dead bodies of the mites are observed. They occupy the same spot in the direct sunlight as they did before death. The dead bodies take on a more brownish color than when alive. This congregating habit is contrary to the normal habits of the species. Normally this species seek semi-sunshine or partial shadows and are not found in great abundance on the part of the fruit in direct sunlight. This abnormal habit of congregating has been observed many times since 1920.

It has also been observed that most of the adult mites change color from a lemon yellow to a darker or orange yellow. They also become somewhat sluggish in their movements.

An examination of the dead mites usually shows that certain fungal filaments protrude from their bodies. In most instances, also, there are fungus bodies on the inside of the dead mites. In fact, these bodies have been observed in mites which were still alive but which had changed color and become sluggish in their movements. The presence of these fungus bodies in the living mites indicate that the time is approaching when the species will disappear.

There is an enormous amount of data on file in the Bureau of Entomology which proves beyond the possibility of a doubt that the rust mites always become much more abundant following the use of copper sprays or compounds than they do on unsprayed trees and fruit. They are also abundant a considerable length of time after the beginning of the rainy season when scarcely any mites are present on trees not sprayed with copper sprays. The use of such fungicides evidently eliminates the fungus disease which in all probability under normal conditions would have attacked the rust mites. It seems, according to the circumstantial evidence already obtained, that it is reasonably certain that an entomogenous fungus attacks rust mites in Florida. In all probability this same disease attacks the species wherever the climatic conditions permit.

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PREVENTION OF WEAK LEGS IN EXPERIMENTAL CHICKENS

A DISCUSSION by J. S. Hughes appearing in SCIENCE, February 29, 1924, stated that young chicks often could not be successfully raised in confinement for experimental purposes. He attributes failure to the fact that rickets or "weak legs" develop, due, he thinks, to the absence of direct sunlight. His remedy is to expose the chickens for a few hours each day to sunlight which is not filtered through glass, or to include in their diet cod liver oil, which he has found will prevent the disease.

At present, April 1, 1924, we have in the laboratory 21 chickens which were hatched November 12, 1923. When three days old they were placed in small cages which had been previously sterilized. From that time on they were given no food, grit, water or litter that had not been sterilized. The room in which they were kept was not particularly sunny, and never at any time were they exposed to sunlight that was not filtered through glass windows. Their food consisted chiefly of buttermilk mash, which was always available. When about eight weeks old small amounts of bone meal were mixed with the mash, and raw potatoes were fed to them about twice a week from that time on, the outside of the potatoes being sterilized by immersing them in boiling water. A few carrots were similarly treated, but other than that no vegetables were given. A mixture of fine grains and an abundance of crushed oyster shell and grit composed the remainder of the diet, with the exception of a few dozen hard-boiled eggs, which were fed during the first three months.

None of this lot of chickens has shown any tendency towards the development of "weak legs," although at no time exposed to unfiltered sunlight or furnished cod liver oil. Only a small amount of hard-boiled egg was fed at any time, but the normal development of these chickens may have been to a large extent due to this ingredient in their diet.

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PERMANENT PHOTOGRAPHS

PROFESSOR PEIRCE'S letter in SCIENCE for April 4 (LIX, No. 1527, pp. 318–319) and Dr. Howard's letter for May 9 (LIX, No. 1532, pp. 422–423) have recalled to the writer's mind an experience, the results of which are of interest to any one making a collection of photographs in which the first requirement is permanency of the photographs collected.

In August, 1915, the writer moved from Palo Alto, Calif., to Ithaca, New York. Boxes of freight containing his books, instruments and miscellaneous collection of photographs were routed east by way of Galveston and New York City. At Galveston they were caught on the wharf by the hurricane of August

19 and were soaked in seawater. They were then carefully forwarded to Ithaca where they were stored in a freight shed until November when the writer arrived in Ithaca. On opening, they were found to have dried out, but all metal objects were crusted with rust, books were black with mould and the photographs were reduced to mouldy cards, on which the emulsion surface was changed to a chalky deposit that showed no traces of the former image; *except* a few *platinotypes,* which survived the whole exposure. These were soaked off of their card backs and, except for some slight moulding, were as perfect as when they were first made. It was a revelation as to what kind of a photograph was really permanent.

The platinotype is a gray or black and white print that was much in vogue thirty years ago. A metallic film is deposited directly on the paper of the print so there is nothing organic to change except the paper itself. The print is as permanent as the paper. It is more difficult to print and is more expensive than the present emulsion prints, but for a collection of portraits such as Professor Peirce and Dr. Howard describe, it makes prints every bit as permanent as engravings and etchings.

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SCIENTIFIC BOOKS

Investigations on the Red River made in connection with the Oklahoma-Texas Boundary Suit. By E. H. SELLARDS, B. C. THARP and R. T. HILL. 8vo., 174 pp., 9 plates, 7 maps in color. University of Texas Bulletin No. 2327. 1923.

THE state of Texas has signalized its victory in the famous Red River boundary dispute by issuing a bulletin of the scientific investigations on which the decision was won. In 1890 the Supreme Court of the United States interpreted the treaty of 1819 between the United States and Spain in such a manner as to fix the south bank of the river as the boundary line. The discovery of oil at Burkburnett in 1918 and in the river valley in 1919 rendered it necessary to determine what constituted the south bank, where the definite boundary should be drawn and whether this line had been affected by changes in the course of the river during the lapse of a century. Suit was accordingly brought by the state of Oklahoma, with the United States as intervener, against the state of Texas for the purpose of locating the exact boundary and settling the title to the valuable oil lands in the "Big Bend" of the river. The main contention of the plaintiff was to the effect that at the time of the treaty with Spain the river in this region flowed at or near the foot of the Texas bluff. On the other hand, the defendant maintained that neither the channel nor the bordering sand stretch lay adjacent to this bluff in the Big Bend area during the past hundred years. As a corollary, Oklahoma contended that the valley had been developed by a process described as "island building" and that all trees more than a hundred years old had originated on such islands, while Texas maintained that the development had followed the normal process of erosion and accretion and that the trees had begun growth on the proper floor of the valley.

The main body of the bulletin is divided into three sections, as follows: (1) geologic and soil studies on the alluvial lands of the Red River Valley, by E. H. Sellards; (2) ecologic investigations, by B. C. Tharp; (3) physiographic investigations, by R. T. Hill. In the first section, the most interesting and important studies had to do with the age of the river valley as indicated by the series of dunes and by the growth of trees. While the latter gave the most dramatic evidence, the former constituted a distinct contribution to the physiography and soils of a river system. With regard to the sand-dunes, it was found that their formation is determined by the source of the sand rather than by the direction of the controlling winds, and that they are built on the land as a rule and not on the sand-bed of the river. Dune development in the Big Bend area has not been a haphazard matter, but the dunes fall into four definite series, representing four different periods, probably corresponding to as many successive dry phases of the climatic cycle. The first or oldest series lies close to the Texas bluff, and the last or newest one parallels the sand-plain of the stream. The relative age of the several series is indicated by their position, vegetation and soil, all of which were found to be in entire agreement. The most novel evidence was obtained from the mechanical analysis of the top soil of the successive series, which gave 1 per cent. of finest material for the new dunes of series four, 5 per cent. for series three, 16 per cent. for two and 20 per cent. for series one, the oldest. This increased fineness of the top soil with age is explained by the progressive disintegration of soil particles, the addition of organic matter, and the accumulation of dust particles, and is in complete accord with the successional advance of the plant communities.

The age of the valley was further indicated by the thickness of the soils in relation to the age of trees growing in them and especially by the ring-counts of trees found on the alluvial fans. By determining the depth of soil above the river sand and the amount of fill above the main roots of the trees, it was possible to use the ring-count to approximate a period of four or five hundred years since the tributary began to accumulate a fan on the valley land. The study of the