chains or clumps appear in the course of about an hour and crystallization is complete in two or three hours.

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YELLOW-SPOT DISEASE OF PINEAPPLES TRANSMITTED BY THRIPS TABACI LIND.

EXPERIMENTAL evidence has been obtained by the writer that an insect identified as *Thrips tabaci* Lindeman is a major vector operating in the field occurrence of a destructive disease of pineapple plants in the Hawaiian Islands, and furthermore, that this insect carries the virus to pineapple from certain weeds of which *Emilia flammea* Cassini now appears most important. Hitherto no means of transmission of this disease has been known. This preliminary note summarizes the evidence which will be published in detail in the near future.

The yellow-spot disease of pineapples is an infectious chlorosis with some distinctive and striking characteristics. In many respects it resembles diseases of both mosaic and ring-spot types, while in others it stands alone. Symptoms begin with a distinct "initial spot" with which thrips egg-punctures and feeding injury are generally associated. This spot, of about 5 to 20 mm diameter, is characteristically circular or rounded in outline, chlorotic and somewhat hypertrophied. Often it is concentrically banded dark and light. Extending down the leaf from this initial spot and developing on the younger leaves of the plant are chlorotic stripes and circular spots, sometimes strikingly zonate. Occasionally a coarse mosaic pattern develops in plants that have been long diseased. Pronounced dwarfing occurs as in many virus diseases. In this case the dwarfing is commonly unilateral, and leads to a marked curvature of the plant. Necrosis and rotting of affected parts follow, leading to death and decay of the plant within a few weeks. Microorganisms, apparently wholly secondary, are involved in this breakdown, although none have been detected in earlier stages.

Closely associated with yellow-spot in its field occurrence is a virus disease of *Emilia flammea* which likewise shows both ring-spot and mosaic characteristics. Thrips (*T. tabaci*) collected from this diseased weed in the field and allowed to feed upon healthy pineapple and Emilia seedlings have transmitted the virus, producing yellow-spot in pineapple and ring-spot mosaic in Emilia. Furthermore, thrips reared through several generations in the greenhouse on diseased Emilia plants have similarly proved infective.

For critical experimental testing, pedigreed non-viruliferous colonies of this thrips were established. These colonies were started from a single larva each, which was removed to an insect-free seedling of Emilia or of *Pisum sativum* L. at the moment of hatching and before feeding had begun. Thrips from such colonies, when tested on both Emilia and pineapple seedlings, have proved non-infective. When, however, these non-viruliferous thrips have been allowed to feed on diseased Emilia plants they have acquired the virus which they have later transmitted to both Emilia and pineapple, producing typical symptoms in a high percentage of plants.

Preliminary evidence indicates that certain plants in addition to Emilia may be sources of the yellow-spot virus, but it appears that this one plant, because of its abundance in pineapple fields and because of its suitability for the rapid reproduction of thrips during certain seasons, is now of major importance. The feeding of this insect upon pineapple plants appears to be quite incidental, and therefore it is probable that any natural transfer of the virus from pineapple to pineapple is relatively uncommon.

This is not the first well-established case of virus transfer by one of the Thysanoptera. Pittman[1] (see also the report by Dickson[2]) has already demonstrated a thrips (*Frankliniella insularis*) to be the vector of spotted wilt of tomatoes in Australia.

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FRACTURING AND MOVEMENT IN ROCKS WITHOUT APPARENT DISPLACEMENT[1]

A RATHER unusual kind of rock deformation has been found along one of the branches of Bluff Creek in the southeastern part of the Nortonville quadrangle about thirteen miles northeast of Hopkinsville, Kentucky. The rocks at this locality exhibit typical features of faulting but show no dislocation of the beds. They are abundantly grooved and slickensided, showing the effects of movement under compressive force, but bedding planes can be traced across the breaks with none or at the most not more than one or two inches of dislocation. All the features of faulting are the results of components of vertical movement. Careful examination has failed to reveal any trace of either oblique or horizontal movement parallel to the

[1] H. A. Pittman, "Spotted Wilt of Tomatoes," *Jour. Council Sci. and Industrial Res.* (Australia), 1(2): 74–77, 1927.

[2] B. T. Dickson, "Spotted Wilt of Tomatoes," in "The Work of the Division of Economic Botany for the Year 1928–29," *Council Sci. and Industrial Res.* (Australia) *Pamphlet*, 14: 18–19, 1929.

[1] Published with the permission of the director of the Kentucky Geological Survey.

fracture surfaces. The area of deformation is located in a region where faulting is rather common so that the fracturing is not out of the ordinary. The unusual feature, however, is the absence now of any displacement along the lines of fracture.

The formations involved in the deformation are the Glen Dean limestone and Tar Springs sandstone of the Chester series of Mississippian age. The general dip of the rocks in the surrounding territory is about one degree in a northward direction. The Glen Dean limestone dips under about one fourth mile down stream from this locality. In the area of disturbance the rocks are folded into a small anticline, the trend of whose axis is at right angles to the general dip direction. The amount of elevation in the fold is small, approximately twenty feet, being sufficient to bring the Glen Dean limestone again to the surface in the bed of the creek. The fold is asymmetrical with the steeper dip, about three or four degrees, on the south and a lesser dip, about two degrees, on the north flank. The zone of deformation is parallel to the axis of the fold and is on the steeper, southern flank.

In the zone of deformation, which is about twenty feet in width, the Tar Springs sandstone has been fractured along a number of surfaces which have dips ranging from seventy degrees to vertical. Some are inclined toward the south and others toward the north, but the strike of all of them is essentially parallel to the axis of the fold. Some of the inclined breaks intersect and even at the points of intersection there is no offsetting of the breaks or of the beds. Some of the breaks are closely spaced, two to four inches apart, while others are several feet apart. Almost all of them exhibit effects of movement, the fracture surfaces being grooved and polished. The walls of many of the surfaces of movement are not now in contact, some of the breaks being open as much as an inch. How much movement there may have been along these lines of fracture it is impossible to say.

The following explanation is offered for the phenomenon. At the time of folding of the rocks the south flank of the anticline broke along this zone, the pressure being sufficient to cause enough movement to polish and groove the sandstone. With a decrease in the folding pressure the dislocated beds moved back to their original positions so that, while the effects of pressure and movement are clearly preserved, the beds show no dislocation or at the most only a very little. An alternate hypothesis is that the beds may have been in movement up and down along the fracture surfaces several times during the period of deformation. Due to the weight of overlying sediments and the inherent elasticity of the folded rocks, they tended to return to a more flattened attitude during such times as the deformative force was diminished. After deformation, the diminished compressive force allowed the beds to return to the relative positions they occupied before breaking. Although oscillatory movements along faults and partial returns to the original positions are known to have occurred, the writer knows of no other instance where the amount of recovery has so nearly equalled the amount of deformation.

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AN UNUSUAL RAINBOW

A REMARKABLY brilliant rainbow appeared to the northeast of Tucson, after a hard shower about 4 P. M. on February 13, 1931. This rainbow was out of the ordinary in that a repetition of the spectrum showing first, second, and third order colors in the same sequence occurred on the inside of the rainbow, as well as a fainter secondary reversed rainbow about 10 or 15 degrees outside of the primary arc. The brilliance of the rays of the sun in our southwest is no doubt responsible for the observance of this unusual phenomenon.

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SCIENTIFIC BOOKS

Thomas Say, Early American Naturalist. By HARRY B. WEISS and GRACE M. ZIEGLER. Foreword by L. O. Howard. Springfield, Illinois, Chas. C. Thomas. 260 pp.

SAY died in 1834, so that nearly a hundred years have been allowed to pass before the publication of a really satisfactory biography. Every zoologist and more particularly every entomologist and conchologist, has been familiar with the name of Say, with a more or less vague understanding that he was one of the founders of the science in America. The eccentric naturalist, in Fenimore Cooper's "Prairie," illustrates the once prevalent attitude toward the zoological explorer. The present book describes Say's life in the environment of his time and we may well marvel at his steadfast zeal, his ability in overcoming obstacles, the excellence and volume of his work. Aided by his friend and patron, William Maclure, he managed to accumulate a good library of zoological works, especially those in which American animals were described