

BIOLOGY

A Suspected Virus Disease of the Citrus Red Mite *Panonychus citri* (McG.)

A DISEASED condition of the citrus red mite, *Panonychus citri* (McG.), was first observed in material collected near Oxnard, California, in 1958. Experimental proof that the disease was transmissible was obtained by two methods: first, by transferring healthy mites to lemons bearing a diseased culture, and secondly, by spraying an aqueous suspension, prepared from ground-up diseased mites, on to healthy mite colonies. In each case the healthy mites developed infection¹. Many diseased mites

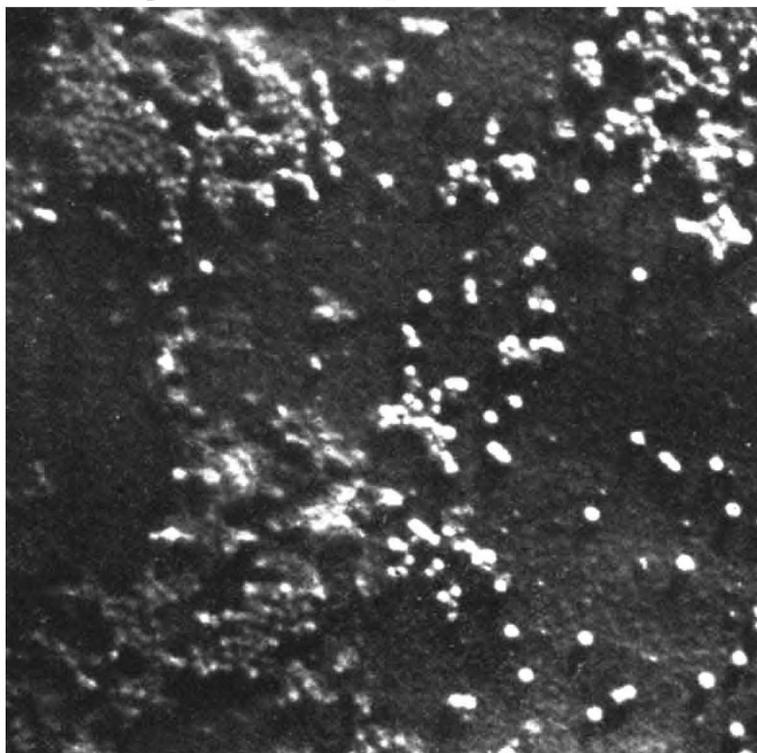


Fig. 1. Virus-like particles from an aqueous suspension of diseased mites. ($\times 60,000$)



Fig. 2. Similar particles to those in Fig. 1, but negatively stained with phosphotungstic acid, adjusted to pH 7. The particles have a six-sided contour which suggests they may be icosahedra. The particles showing a darker centre are partially empty. ($\times 160,000$)

become paralysed with the legs stiffened ventrally. Diarrhoea sometimes occurs and mites may be found dead with the anal end fixed to the feeding surface by faecal material.

Since no disease agent visible by optical methods could be detected, an intensive study with the electron microscope was made on the assumption that a virus might be concerned.

At first, ultra-thin sections of diseased and healthy mites were examined without any conclusive results. The next attempt was to try to isolate a virus; aqueous suspensions of diseased mites were made and clarified by differential centrifugation, the final spins being made at 36,000 r.p.m. (110,000*g*) on a 'Spinco' centrifuge. From three separate suspensions of material which had proved infective, a characteristic, virus-like particle was observed. The results obtained from a similar suspension of healthy mites, treated in the same way, were quite different. Whereas in the case of the infective fluid, virus-like particles were present in large numbers in every grid square, suggesting at a rough calculation 5 million particles/ml., it took several hours of hard searching to find three or four similar particles in the control fluid. This may suggest the presence of a small quantity of latent virus infection in the healthy mites. In a second control suspension no virus particles could be observed.

Fig. 1 is an electron micrograph of the particles, shadowed with palladium gold; the particle is very small and measures about 35 millimicrons in diameter. The magnification is $\times 60,000$. Fig. 2 shows similar particles stained with phosphotungstic acid at a magnification of $\times 160,000$. Note the six-sided contour² and that four of the particles appear to be empty or partly empty³.

This is the first record, so far as we are aware, of a virus disease in the Arachnida, and it suggests that viruses exist in other classes of organisms in which none has yet been discovered. That this disease might prove useful in the control of a serious citrus pest has already been indicated¹. Whether it can be induced to attack other species of red spider (spider mites) in the United States or in Britain remains to be proved.

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¹ Munger, F., Gilmore, J. E., and Davis, W. S., *Calif. Citrograph.*, **44** (6), 190, 216 (1959).

² Williams, R. C., and Smith, K. M., *Evolution. Biophys. Acta*, **28**, 464 (1958).

³ Smith, K. M., *Parasitology*, **48**, 459 (1958).