

Viruslike Particles Associated with a Disease of *Chondrilla juncea*

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ABSTRACT

Viruslike particles were found on plants of *Chondrilla juncea* that had symptoms suggestive of infection by a virus. The particles morphologically resemble the rhabdoviruses with bullet-shaped particles in vitro and bacilliform ones in situ. The particles are much smaller than those of viruses of this type described earlier.

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Additional key words: skeleton weed disease.

Chondrilla juncea L., skeleton weed, is an important composite weed of wheat cultivation in south-east Australia. The plant has its origin in the Mediterranean and southern Russia. Recently a study of the plant has been undertaken in the Mediterranean to discover the diseases and arthropod pests that affect it there and to determine the suitability of these diseases and arthropods as biological control agents for introduction to Australia. During these studies symptoms of a viruslike disease were frequently observed on the *C. juncea* plants. The symptoms consisted of stunting and poor growth and a definite reduction in branching. The leaves were small in size, curled, malformed, and showed light yellow patches with irregular outlines. Sometimes several of these patches coalesce, covering a large area of the leaf surface. In advanced stages, dark-brown necroses developed within these patches. The flowers were normal but much reduced in number. Few viable seeds could be collected from a diseased plant. The distribution of the affected plants was irregular. Sometimes only a few plants were affected in a population whereas on other occasions entire *Chondrilla* populations showed the symptoms.

All attempts to transmit the agent mechanically were unsuccessful, but symptoms on affected plants suggested that the disease was caused by a virus. The leaves of five diseased plants were fragmented in the phosphotungstic acid (PTA) and examined by electron microscopy which revealed the presence of a few negatively stained bullet-shaped particles (Fig. 1). Such particles were absent from five healthy *Chondrilla* plants collected from a field in which the plants were free of the above disease symptoms.

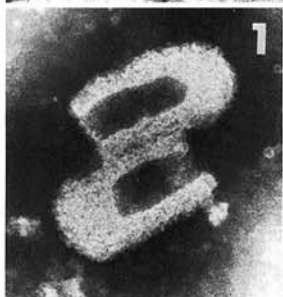
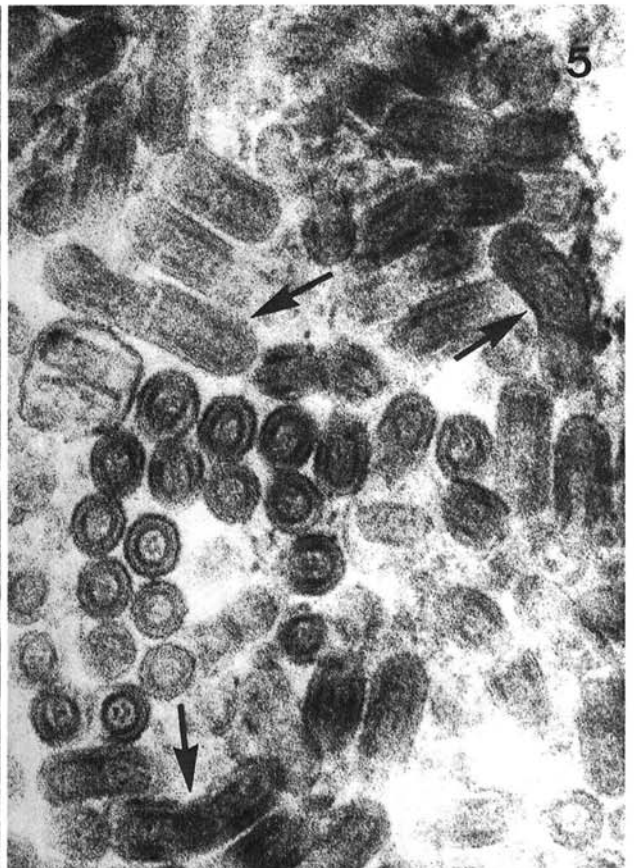
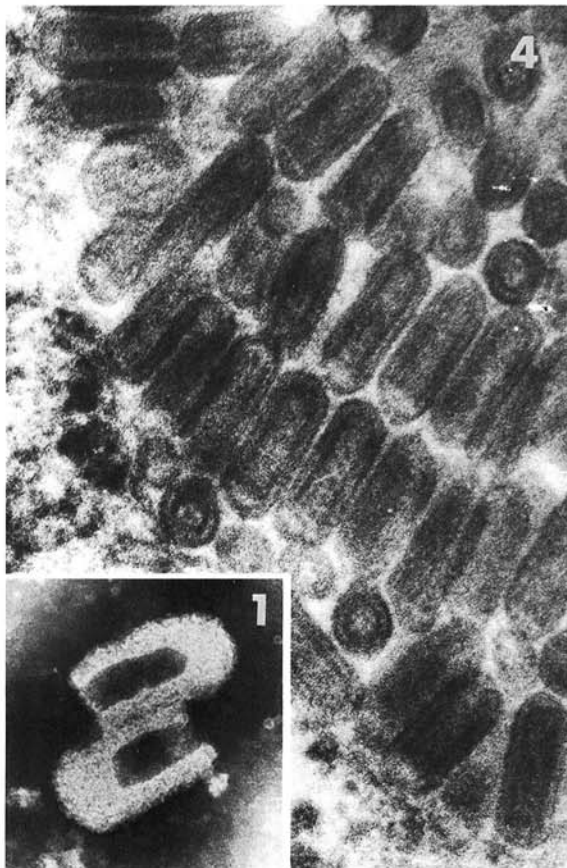
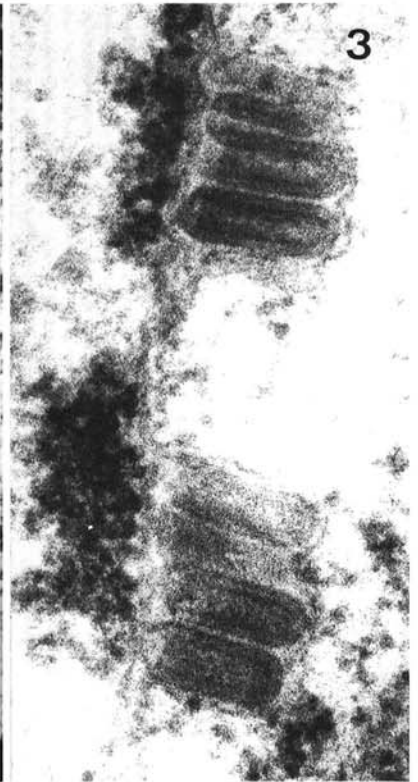
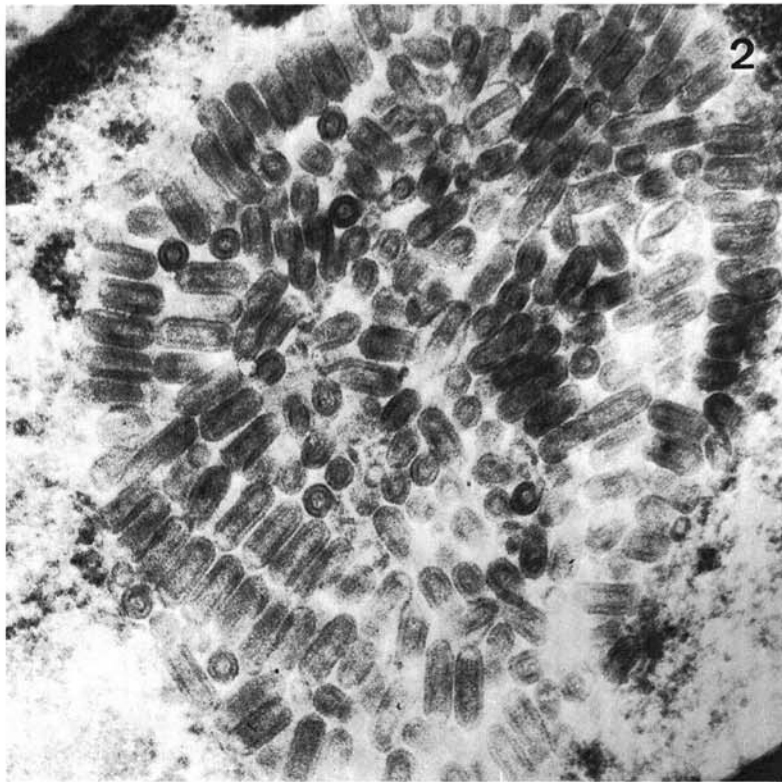
For detailed examination of the particles in situ, fragments from leaves showing symptoms were fixed by glutaraldehyde and osmium tetroxide and were embedded in Epon for thin sections. When sections were observed under the electron microscope, the cells of the affected tissue had a large number of bacilliform particles situated in nuclei at the periphery of the karyoplasm (Fig. 2) and others apparently situated between the two nuclear membranes (Fig. 3). These were particularly common in the companion cells of the phloem. No particles were observed in the cytoplasm.

The particles were hemispherical at each end and composed of an outer membrane and inner components which could be distinguished into two parts, an outer striated structure and an inner electron dense, probably hollow body, representing the axial canal (Fig. 4). That the central part was hollow was confirmed by the penetration of PTA into the axial canal of the bullet-shaped fragments from the flat end.

The size of the particles within sections of *C. juncea* leaves showing symptoms was determined by direct measurement from the microscope display. The mean length and diameter including the outer layer was 142 and 58 m μ , respectively. The majority of particles observed were within the range 135 m μ and 156 m μ in length. However, a small number of particles were found to be just less than double the above length. These longer particles appeared to consist of two shorter particles placed together lengthwise with opposed ends flattened against each other (Fig. 5).

The viruslike particles found in *Chondrilla* resemble morphologically the rhabdoviruses with bullet-shaped virions in vitro and bacilliform ones in situ. Virions of this type have been described for sowthistle yellow vein virus (5), for mottled dwarf virus of egg-plant (4), for potato yellow dwarf virus (3), for lettuce necrotic yellows virus (6), and for yellow striate mosaic of wheat (1) and of barley (2). The bacilliform particles described herein are much smaller than those of the viruses mentioned above [Table 1 in (4)].

Fig. 1-5. 1) Bullet-shaped particles ($\times 126,000$) negatively stained with phosphotungstic acid and observed after leafdipping of *Chondrilla juncea* plants showing symptoms suggestive of infection by a virus. Sections through the companion cell of a leaf from a field grown *Chondrilla* plant showing symptoms. 2) A large number of bacilliform particles can be seen in the perinuclear area ($\times 70,000$). 3) A row of particles lodged apparently between the two nuclear membranes ($\times 135,000$). 4) Typical bacilliform particles showing striated inner component and hemispherical ends ($\times 135,000$). 5) Double-length particles apparently resulting from the lengthwise conjunction of two particles (indicated by arrows) ($\times 135,000$).



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