

Short communication

Occurrence of barley yellow mosaic and barley mild mosaic bymoviruses in Greece

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Abstract

In March 1991, large chlorotic patches appeared in an autumn-sown barley crop growing near Thessaloniki, Greece. Leaves had characteristic mosaic symptoms and immunosorbent electron microscopy and enzyme-linked immunosorbent assay confirmed the presence of both soil-borne mosaic viruses of barley, barley mild mosaic and barley yellow mosaic bymoviruses. In the following year, similar symptoms appeared in a crop at Souroti, 30 km east of Thessaloniki but the disease has not been found in other areas of Macedonia. This report is the first record of these viruses from Greece and is the most southerly European record.

Abbreviations: BaMMV – barley mild mosaic virus; BaYMV – barley yellow mosaic virus; ELISA – enzyme-linked immunosorbent assay; ISEM – immunosorbent electron microscopy.

In March 1991, large chlorotic patches appeared in an autumn-sown barley (*Hordeum vulgare* L.) crop of an unknown cultivar at the University farm (20 km east of the University campus, Thessaloniki). All leaves of infected plants showed chlorotic streaks (1–5 mm in length) running along their veins with upward rolling of leaf margins (Figure 1). The streaks were most distinct on the young leaves and became necrotic, particularly towards the leaf tip. In the following year, similar symptoms appeared in a crop at Souroti, 30 km east of Thessaloniki. These symptoms, both in the crop and on individual leaves, closely resembled that of the soil-borne barley mosaic virus complex, caused by barley yellow mosaic (BaYMV) and/or barley mild mosaic (BaMMV) bymoviruses. In both fields, symptoms reappeared when barley was cultivated again.

Microscopic examination showed that roots of plants from the infected patches were abundantly colonised by *Polymyxa graminis* Ledingham, the vector of both BaYMV and BaMMV (Adams, 1990).

Leaf samples were sent to IACR-Rothamsted, where leaf dip preparations for the electron microscope revealed the presence of filamentous, slightly flexuous, virus particles. In 1991, three samples from different patches in the field were tested for the presence of BaMMV and BaYMV using both immunosorbent electron microscopy (ISEM) and enzyme-linked immunosorbent assay (ELISA) following the procedures detailed by Adams (1991) and antisera prepared to UK isolates of the viruses. The results (Figure 2 and Table 1) showed that both viruses were present in the crop. BaMMV was readily detected by both methods in samples B and C and BaYMV was found in samples A and C. Absorbance values and particle counts were lower for BaYMV than for BaMMV, probably reflecting the lower concentration and greater instability of this virus and the lower titre of the antibodies used. Characteristic symptoms were produced in barley seedlings sown in infested soil. Following mechanical inoculation of barley seedlings (cv. Thermi), symptoms appeared on those inoculated with



Figure 1. Mosaic virus symptoms on leaves of infected barley plants.

Table 1. Detection of barley mild mosaic virus (BaMMV) and barley yellow mosaic virus (BaYMV) by two methods in samples (A–C) of barley from Greece in 1991

Sample	ELISA ¹		ISEM ²	
	BaMMV	BaYMV	BaMMV	BaYMV
A	0.05	0.32	0	1
B	1.10	0.11	10–15	0
C	2.23	0.50	>20	1–3
BaMMV control ³	2.40	0.10	>20	0
BaYMV control ³	0.05	2.12	0	5–10

¹ Enzyme-linked immunosorbent assay. Absorbance values (mean of two replicate wells) after 17 h incubation with substrate.

² Immunosorbent electron microscopy. Numbers of virus particles trapped and decorated per field at $\times 40,000$.

³ Because there is no serological cross-reaction between these viruses, these serve as positive controls for the homologous virus and negative (healthy) for the heterologous one.

sap from the patch with BaYMV but not with that from plants with BaMMV.

Barley mosaic viruses affect only autumn-sown crops and are fairly new to Europe. Although BaYMV has been known for many years in Japan (Usugi, 1988) and China (Ruan and Jin, 1983), the first confirmed European report was from Germany in 1978 (Huth and Lesemann, 1978). Since then, infected barley has

been found in the United Kingdom (Hill and Evans, 1980), France (Lapierre, 1980), Belgium (Maroquin et al., 1982), The Netherlands (Langenberg and van der Waal, 1986), Italy (Rubies-Autonell et al., 1995) and Ukraine (Fantakhun et al., 1987). Two strains of BaYMV differing serologically were reported from Germany (Huth et al., 1984) and the UK (Adams et al., 1987), but these are now recognised as different viruses (Huth and Adams, 1990). BaMMV seems to be largely a European problem although it has subsequently been reported from Japan (Kashiwazaki et al., 1990), Korea (Kashiwazaki et al., 1993) and China (Chen et al., 1992). This report is the first record of these viruses from Greece and is easily the most southerly of the European records. Although crops in several areas of Macedonia have been examined, so far the disease has only been found in the Thessaloniki area. Four other viruses have previously been reported from barley in Greece: barley yellow dwarf luteovirus (BYDV), brome mosaic bromovirus, soil-borne wheat mosaic furovirus (SBWMV) and wheat streak mosaic rymovirus (Zois, 1972; Panayotou, 1982; 1992). Of these, only BYDV has barley as a major host, but SBWMV has the same fungus vector as BaMMV and BaYMV.

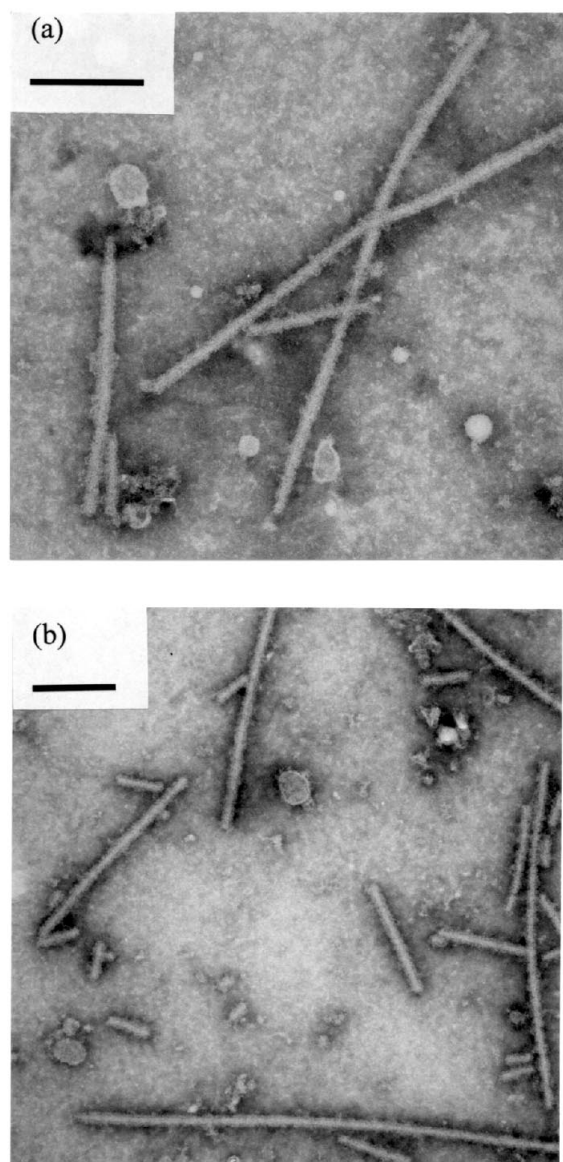


Figure 2. Particles of (a) barley yellow mosaic bymovirus and (b) barley mild mosaic bymovirus, trapped and decorated by immunosorbent electron microscopy from leaf samples from Greece in 1991. Bars represent 100 nm.

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