

Incidence and Disease Control of Zucchini Yellow Mosaic Potyvirus



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Submission: October 23, 2019; **Published:** November 08, 2019

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Abstract

Zucchini Yellow Mosaic Potyvirus (ZYMV) was first identified in northern Italy. It likes other species of the family Potyviridae. ZYMV has been recorded in many countries since 1981. The efficient intercontinental spread of the virus can be explained by international trading of infected seeds. Since Coat Protein (CP) analysis has become a primary method for taxonomic assignment of potyviruses the aims were to characterize this genomic region of ZYMV originating from virus-infected cucurbitaceous seedlings. Virus infection in cucurbits is typically associated with mosaic symptoms on leaves and lumpy, distorted fruit. The range of symptoms produced by each virus can overlap and plants are commonly infected by more than one virus at once. The viruses are spread by many species of aphids moving through or within a crop. Control options include destroying old cucurbit crops as soon as harvesting is completed destroying weeds and volunteer cucurbits, within and around crops as these harbors the viruses and/or the aphids separating new crops from maturing crops as these will have high levels of virus infection avoiding overlapping crops of cucurbits

Keywords: ZYMV; Cucurbits; Seedlings; Aphids; Squash; Pumpkin

Introduction



Figure 1: ZYMV on Squash Fruits.

Zucchini Yellow Mosaic Potyvirus (ZYMV) like other species of the family Potyviridae Lisa & Lecoq [1] is transmitted by aphids in a non-persistent manner. The virus was first reported in Italy in 1973 Lisa et al. [2] but ZYMV causes devastating epidemics in commercial cucurbits worldwide and several biologically distinct strains have been described Lisa & Lecoq [1], Greber et al. [3], Wang et al. [4] and Tóbiás & Palkovics [5]. ZYMV has been recorded in Australia since 1981 Greber et al, [3] but no molecular analysis of sequence variability has been done. Zucchini Yellow Mosaic Potyvirus (ZYMV) was first identified in northern Italy (Figure 1). Soon after, it was identified in areas throughout the

world where cucurbits are cultivated, including Mediterranean countries, Japan, Germany, Central Europe, China, Chile, Australia, Mexico, Mauritius, Canada and the USA Desbiez & Lecoq [6] and Prieto et al, [7]. This relatively new, but aggressive virus (member of the potyvirus group) has spread rapidly throughout the world, suggesting an efficient transmission from plant to plant by several aphid species in a nonpersistent manner Lisa & Lecoq [1] and long distance distribution via infected seeds Davis & Mizuki [8]; Schrinjwerkers et al, [9], Fletcher et al, [10]. The efficient intercontinental spread of the virus can be explained by international trading of infected seeds. However, the rate of disease transmission via seed is low and difficult to prove Provvidenti & Robinson [11] Gleason & Provvidenti [12]; Robinson et al, [13]. There is some evidence for seed transmission in the case of zucchini Davis & Mizuki [8] Schrinjwerkers et al, [9] buttercup squash Fletcher et al, [10] and hulled oilseed pumpkin Burgmans & Fletcher [14] and Tóbiás & Kovács [15]. This work focused on studying the seedborne virus transmission on hulled oilseed pumpkin, (Figure 2) the effect of storage time on the rate of virus transmission via infected seeds, and characterization of the virus isolates transmitted by seeds. Since Coat Protein (CP) analysis has become a primary method for taxonomic assignment of potyviruses the aims were to characterize this genomic region of ZYMV originating from virus-infected cucurbitaceous seedlings Choi et al, [16]. Virus infection in cucur-

bits is typically associated with mosaic symptoms on leaves and lumpy, distorted fruit. The range of symptoms produced by each virus can overlap and plants are commonly infected by more than one virus at once.



Figure 2: ZYMV on Pumpkin Fruits.



Figure 3: ZYMV on Squash Leaf.

The role of aphids in spreading the viruses

The viruses are spread by many species of aphids moving through or within a crop. The aphids pick up the virus after feeding on infected leaves for only a few seconds and remain capable of spreading the virus for up to several hours after feeding. Winged aphids may be carried several kilometers by wind. In this way, small numbers of aphids can successfully spread the viruses to large numbers of plants. As a result, devastating crop losses can occur without significant numbers of aphids being observed. Most commonly, virus is spread by aphid species which do not settle and establish a colony within a crop but move from plant to plant, briefly tasting as they search for suitable host plants Sammons & Schrijnwerkers et al, [9,17].

Disease Control

All viruses can be managed using the same methods. As the greatest yield losses occur when plants are infected early in life, control measures are aimed at delaying and minimising the levels of virus within crops. No single measure provides complete con-

trol and integrating multiple measures will provide better control. Control options include: destroying old cucurbit crops as soon as harvesting is completed destroying weeds and volunteer cucurbits within and around crops as these harbor the viruses and/or the aphids separating new crops from maturing crops as these will have high levels of virus infection avoiding overlapping crops of cucurbits, particularly zucchini arranging sequential plantings so that younger plantings are upwind of older crops separating crops, for example by using blocks of non-susceptible crops using resistant or tolerant varieties (Figure 3). These are available for all three viruses in pumpkin and zucchini using super-reflective plastic mulches, as these deter aphids from landing on leaves and can delay disease development in zucchini and other cucurbit species which do not rapidly cover the mulched area combining super-reflective mulches with weekly applications of stylet oil, applied to cover leaf surfaces thoroughly. Regular insecticide applications generally have little effect on the spread of these viruses, as it usually occurs with very short feeding times. Some insecticides actually increase virus spread as the chemicals agitate the aphids causing more frequent movement and feeding. Virus diseases are a worldwide problem of cucurbits and a major limiting factor for cucurbit production approximately 35 viruses infecting cucurbits worldwide Provvidenti [18].

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