

**Project title:** Monitoring metalaxyl-M sensitivity of Downy Mildew infections of Impatiens

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# AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

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## GROWER SUMMARY

### Headline

- Metalaxyl-M resistance in *Plasmopara obducens* has not been detected since 2014.
- Downy mildew infection on impatiens was mainly found in the wider environment.

### Background

Impatiens downy mildew (IDM), caused by *Plasmopara obducens*, is a foliar disease specific to impatiens. During early 2011, a metalaxyl-M resistant strain of *P. obducens* was introduced into commercial impatiens production resulting in widespread downy mildew infections which were difficult to control. To try and minimise the risk posed by the resistant strain, pro-active action was taken by the industry to restrict impatiens production using cutting raised plants. This action appeared to have been successful as no IDM infections caused by the resistant strain were detected during monitoring in 2012 (PO 011) or 2013 (PO 011a); in 2013 no downy mildew infections of impatiens were reported. However the risk of infection by the resistant strain still remains, particularly in areas where infection has occurred previously.

This small scale project aims to continue the monitoring work undertaken during 2012 and 2013 to provide growers with:

1. An early warning system for identifying the presence of metalaxyl-M resistance, in order to assist with decisions on suitable spray programmes.
2. Guidance as to the prevalence, persistence and geographical distribution of the metalaxyl-M resistance compared to metalaxyl-M sensitivity in the wider environment.

### Summary

Sporangia washed from downy mildew infected impatiens samples sent to Fera, were inoculated onto three replicate impatiens plants treated with a Subdue soil drench prior to inoculation. An additional three plants, drenched with an equivalent volume of water, were

inoculated as untreated controls. Inoculated plants were grown at 20°C until symptoms developed on the controls (8-10 days) at which point the metalaxyl-M sensitivity of the inoculated isolate was determined based on the pattern of infection; resistant isolates infected both treated and control plants whereas sensitive isolates only infected the control plants.

Over the duration of project PO 011b (2014-2018), nine impatiens downy mildew samples were screened for resistance to metalaxyl-M. Of the nine samples, three were sent by nurseries (two samples in 2014 were sent by the same nursery) and six were from the wider environment (private gardens). Three of the nine samples were shown to be metalaxyl-M resistant, two were sent by the same nursery in 2014 and one was from the wider environment. All three of the metalaxyl-M resistant isolates were detected in 2014; no metalaxyl-M resistance in *P. obducens* has been detected since 2014.

Samples from downy mildew infections on nurseries generally occurred during June and July whereas those from the wider environment occurred during late August and September. The difference in timing between infections found on nursery and the wider environment suggests that, over the period of project PO 011b, the infections was not likely to have passed from nursery to the wider environment or vice versa.

Over the period of this project the level of impatiens downy mildew found on commercially grown impatiens has been very low, which reflects the continued success of the decision by most UK growers to produce only seed-raised impatiens.

## **Financial Benefits**

In the UK, the annual retail value of the impatiens crop before 2008 was estimated to be £40m; however the onset of impatiens downy mildew has considerably reduced this value. The outbreak of downy mildew in 2011 demonstrated that the disease has potential to destroy whole site annual production as well as undermine consumer confidence in this commercially important product.

Prompt (up to 10 days after sample receipt) and widespread (sample originator and the wider network of growers) reporting of the metalaxyl-M resistance status of any infections would allow growers to ensure that spray programmes used will be effective in minimising losses that may result from any outbreaks.

## **Action Points**

- Where possible grow impatiens from seed not vegetative cuttings.

- Apply a protectant fungicide programme to seed raised crops during the production phase.
- Monitor crops carefully for signs of the disease, provide good levels of ventilation and don't water crops late at night.
- Dispose of infected plant material into sealed bags or bins.

## SCIENCE SECTION

### Introduction

Downy mildew of impatiens caused by *Plasmopara obducens* first arrived in the UK during 2003 and caused considerable economic damage to commercial crops and municipal plantings, especially in the South of England. Initially, emergency statutory action was taken by the Plant Health & Seeds Inspectorate (PHSI) and the downy mildew pathogen on impatiens was declared notifiable. This was revoked in 2005 on the proviso that the industry took on responsibility for management of the disease through implementation of an industry code of practice (Good Horticultural Practice (GHP)). Between 2004 and 2006, the disease was not reported in commercial crops but reappeared at low to moderate levels in 2007. In 2008, the disease was once again quite widespread and damaging, especially in municipal & other outdoor plantings. In 2011 early outbreaks originating from cutting raised product, but spreading to seed raised crops, proved difficult to control due to the emergence of metalaxyl-M resistance and resulted in devastating impacts on UK production.

Work in HDC funded projects (PC 230, PC 230a and PC 230b) has contributed to a greater understanding of the disease and hence provided guidance for minimising outbreaks (e.g. HDC briefing notes issued in 2011 and updated in 2012). It was clear from this work that spray programmes including metalaxyl-M were the most effective against the disease. With the discovery of resistance to this active ingredient late in 2011 however, growers now need to make educated decisions on suitable spray programmes. This project aimed to provide prompt identification of resistant isolates in 2012 and beyond to assist growers in making informed decisions on suitable action against outbreaks, helping to minimise spread where infections do arise.

### Materials and methods

#### *Testing Plasmopara obducens isolates for metalaxyl-M sensitivity*

On arrival at the laboratory, a sample was treated in one of two ways depending on its condition.

##### 1) Samples with high levels of fresh sporulation

Infected leaves were removed and sporangia washed from the leaf surface. The spore suspension was filtered through a double layer of lens tissue to remove any leaf or soil debris and the spore concentration adjusted to give  $10^4$  sporangia  $\text{mL}^{-1}$ . The spore suspension was then used to inoculate three replicate impatiens plants (6 week old) treated with a Subdue



soil drench containing metalaxyl-M (at 12.5 mL product/100L water @ 10% of pot volume) two days prior to inoculation. An additional three plants, drenched with an equivalent volume of water, were inoculated as untreated controls.

2) Samples with low level of fresh sporulation or low spore viability

Sporangia were washed from the leaf and filtered through a double layer of lens tissue. The sporangial suspension was then inoculated on to a single untreated impatiens plant in order to reinvigorated the disease to produce additional inoculum for testing.

Directly after inoculation all plants were incubated in the dark at 5°C for approximately 18hrs. Plants were kept in a propagator top to prevent drying out of inoculum and then transferred to a glasshouse, maintained at a constant 20°C, with 12hr day period and grown on for 8-10 days. During this period plants were watered from the bottom to ensure sporangia were not produced prematurely. Sporangial production was stimulated by wetting the upper surface of leaves and incubating overnight in a propagator top. The presence of disease was confirmed by assessing the underside of leaves for the white downy growth associated with a sporulating downy mildew infection. Sporulation on the control plants only indicated metalaxyl-M sensitivity, whereas sporulation on both control and metalaxyl-M treated plants indicated metalaxyl-M resistance.

Results were sent to the AHDB Horticulture research manager for appropriate dissemination.

## Results

During 2018, a single sample was received from a nursery during mid-July (**Table 1**). The infection was on home grown plants which were in late season pack product and still in the glasshouse.

No samples were received from the wider environment (garden locations).

Testing showed that the 2018 nursery isolate of *P. obducens* was sensitive to metalaxyl-M (**Table 1**). Summary results for the current and previous monitoring are shown in **Table 2**. Results show a declining incidence of disease and level of resistance since the outbreak in 2011.

**Table 1.** Metalaxyl-M sensitivity of *Plasmopara obducens* isolates collected in 2018.

Sample	Date	Site	Location	Metalaxyl-M sensitivity
1	16/07/2018	Nursery	-	Sensitive

**Table 2.** Metalaxyl-M sensitivity of *Plasmopara obducens* isolates collected between 2012 and 2018.

Year	Number of samples	Date received	Site	Metalaxyl-M sensitivity
2012	9	June to September	3 Nursery 6 Garden	Sensitive
2013	0	-	-	-
2014	5	July to September	1 Nursery (2 samples) 3 Garden	3 Resistant (2 nursery and 1 garden) 2 Sensitive
2015	2	August	2 Garden	Sensitive
2016	1	September	Garden	Sensitive
2017	0	-	-	-
2018	1	July	Nursery	Sensitive

## Discussion

During 2018, a single sample of impatiens downy mildew was screened for resistance to metalaxyl-M. The sample was from a commercial nursery and was shown to be sensitive to metalaxyl-M. Since the start of the monitoring (2012) this was only the fifth sample to be received from a nursery and was the first since 2014. The time when the disease appeared on the nursery (July) was consistent with previous nursery findings, where disease appeared during June and July.

The lack of samples from the wider environment during 2018, was consistent with the very dry summer.

## **Conclusions**

Over the period of this project the level of impatiens downy mildew found on nurseries has been very low, which reflects the continued success of the decision by most UK growers to produce only seed-raised impatiens.

Since the start of the monitoring, disease in the wider environment has generally appeared late-season once impatiens displays are beyond their best. This late season expression of the disease in the wider environment would not pose a risk to nursery production; however early season transport of infected impatiens material from continental Europe could still provide a threat to nursery production of impatiens.

## **Knowledge and Technology Transfer**