

**Project title:** Monitoring metalaxyl-M sensitivity in Impatiens Downy Mildew isolates from 2012 infections

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The results and conclusions in this report are based on an investigation conducted over a one-year period. The conditions under which the experiments were carried out and the results have been reported in detail and with accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results, especially if they are used as the basis for commercial product recommendations.

**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**

All nursery and garden isolates of Impatiens downy mildew collected during 2012 were sensitive to metalaxyl-M. No isolates were submitted for testing in 2013 which may reflect the success of the decision by the majority of UK growers to produce only seed raised material.

### **Background**

Early and widespread introduction of a metalaxyl-M resistant strain of the pathogen responsible for impatiens downy mildew infections in commercial production in 2011 meant that the disease proved difficult to control. It is hoped the pro-active decisions made by the industry regarding production of cutting raised plants will minimise infections in 2012 and beyond, however the risk of infection still remains. This small scale work aims to provide growers with:-

1. An early warning system for identifying metalaxyl-M resistance in any infections arising in 2012 and 2013, in order to assist with decisions on suitable spray programmes.
2. Guidance on the prevalence, persistence and geographical distribution of the metalaxyl-M resistant isolate compared to metalaxyl sensitive isolates in the wider environment.

### **Summary**

A total of 10 samples were received from eight different locations, with the first sample arriving on the 15<sup>th</sup> May 2012 and the last on the 27<sup>th</sup> September 2012. The samples were received from four nurseries (although one sample was too badly decomposed to recover) and four private gardens. All the infected plants were from seed raised material.

Each isolate was tested against three replicate 6 week old impatiens plants treated with a metalaxyl-M soil drench (as Subdue at 12.5 mL product/100L water @ 10% of pot volume) two days prior to plant inoculation and three untreated control plants.

All the isolates for which a test result was obtained (nine) were designated as metalaxyl-M sensitive. This designation was based on no disease was observation on any of the

metalaxyl-M treated plant, but disease symptoms on all the control plants, i.e. the disease had taken but was controlled by the application of metalaxyl-M.

The result of each test was immediately sent to the HDC research manager for dissemination as deemed appropriate.

No downy mildew on impatiens was reported in 2013, this was reflected in no samples arriving at the laboratory.

## **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 occurring in 2012 and beyond would allow growers to ensure that spray programmes used will be effective in minimising losses that may result from any outbreaks.

## **Action Points**

- In 2012, the application of metalaxyl-M would have been effective in a fungicide programme to control the development of Impatiens downy mildew.
- The lack of disease in 2013 may reflect the success of the decision by the majority of UK growers to produce only seed raised material.

## SCIENCE SECTION

### Introduction

Downy mildew of impatiens caused by *Plasmopara obducens* was first reported in the UK in June 2003 and caused considerable economic damage to commercial crops and municipal plantings, especially, though not exclusively, 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 the UK production.

Work in the 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 have to make educated guesses on suitable spray programmes. Provision of prompt identification of resistant isolates in 2012 and beyond would assist growers in making informed decisions on suitable action against outbreaks, helping to minimise spread where infections do arise.

### Materials and methods

#### *Collection of impatiens infected by downy mildew*

In 2012 and 2013 a call for samples was publicised to HDC levy payers through weekly news, HDC news and broadcast mail systems as well as via the HDC IDM briefing note update. In 2013 there was additional publicity through a short interview on Radio 4's Gardeners Question Time and a Radio 4 blog.

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

On arrival at the laboratory samples were treated in one of two ways depending on the 'freshness' of the sample. Where samples contained high levels of fresh sporulation infected leaves were removed and sporangia washed off using sterile distilled water (SDW). 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 mL<sup>-1</sup>. The spore suspension was then used to inoculate three replicate six week old impatiens plants treated with a soil drench of metalaxyl-M (as Subdue at 12.5 mL product/100L water @ 10% of pot volume) 2 days pre-inoculation, and three untreated control plants.

For samples that arrived with low levels of sporulation or where samples had undergone a long period in transit resulting in low spore viability, the washed and filtered sporangia were inoculated on to a single untreated impatiens plant in order to bulk up the spore concentration prior to inoculation of fungicide treated plants.

All inoculated plants were incubated for approximately 18hrs in the dark at 5°C in a propagator top to prevent drying out of inoculum. Plants were then transferred to a glasshouse and 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 prematurely produced. Sporangial production was initiated by wetting the upper surface of leaves and incubating overnight in a propagator top. The presence of disease was determined by assessing the underside of leaves for the white downy growth associated with a sporulating downy mildew infection. Isolates where sporulation only occurred on the three control plants were designated as metalaxyl-M sensitive, whereas isolates where sporulation occurred on both control and metalaxyl-M treated plants were designated as metalaxyl-M resistant.

The result of each test was immediately sent to the HDC research manager for further dissemination as deemed appropriate.

## **Results**

In 2012 a total of 10 samples were received from eight different locations (Table 1), with the first sample arriving on the 15<sup>th</sup> May and the last on the 27<sup>th</sup> September. The samples were received from four nurseries (although one sample was too badly decomposed to recover) and four private gardens, with three separate samples from one garden in Somerset. The location of the samples ranged from Somerset in the south west of England, West Sussex



in the south east of England and North Yorkshire in the north of England giving a good geographical distribution of isolates. All the infected plants were from seed raised material.

All the isolates for which a test result was obtained (nine) were designated as metalaxyl-M sensitive (Table 1). This designation was based on no disease observed on the metalaxyl-M treated plant, but disease present on the control plants. The presence of inoculum on the control plants indicated that the isolate was viable and the lack of disease on the treated plants that the isolate was sensitive to metalaxyl-M. The presence of disease on both the treated and untreated plants would have indicated a metalaxyl resistant isolate.

**Table 1.** Metalaxyl-M sensitivity of *Plasmopara obducens* isolates collected in 2012.

Sample location	Arrival date	Site type	Area	Metalaxyl-M sensitivity
1	15/05/2012	Nursery	Cambridge	-*
2	06/06/2012	Nursery	North Yorkshire	Sensitive
3	25/06/2012	Garden	West Midlands	Sensitive
4	17/07/2012	Nursery	West Sussex	Sensitive
5	23/07/2012	Garden	East Yorkshire	Sensitive
6 a				Sensitive
b	23/08/2012	Garden	Somerset	Sensitive
c				Sensitive
7	04/09/2012	Nursery	West Sussex	Sensitive
8	27/09/2012	Garden	York	Sensitive

\* no isolate could be recovered as the sample was too decomposed on arrival at the lab.

No samples were received in 2013.

## Discussion

The widespread metalaxyl-M resistance reported during 2011 was not detected during 2012, which may suggest that the metalaxyl-M resistant isolate has not been able to persist/establish itself. However, it is difficult to draw too much from the result presented here due to the relatively small sample size.

## Conclusions

The lack of detection of any metalaxyl-M resistant isolates in 2012 may suggest that the metalaxyl-M resistant strain of *Plasmopara obducens* detected in 2011 has not persisted in

the wider environment. However, to draw a more definite conclusion this type of survey work would need to be continued over the next few years.

The lack of disease in 2013 may reflect the success of the decision by the majority of UK growers to produce only seed raised material.

### **Knowledge and Technology Transfer**

Results of the work in 2012 were reported in technical notes produced by ADAS.

The monitoring work was discussed on the Radio 4 Gardener's Question Time programme broadcasted on Friday 10<sup>th</sup> May and repeated on Sunday 12<sup>th</sup> May 2013.