

Impatiens: Is There Life After Downy Mildew?

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To answer the question, yes. There is life for impatiens after impatiens downy mildew (IDM). Before we dive into why we think this, let's go into a little history. Impatiens downy mildew, caused by *Plasmopara obducens*, is an old disease that for mysterious, unknown reasons is new again. Some of the first collections of IDM in Europe and North America are housed in the US National Fungus Collection (BPI). For example, there is a specimen from 1877 in Germany of *P. obducens* on *Impatiens noli-tangere* and, on the US native *Impatiens pallida*, there are specimens from Decorah, Iowa in 1884; Ithaca, New York in 1891; and Auburn, Alabama in 1896 (Farr et al. 2014). In spite of the disease's long history on impatiens, the first instance on the bedding plant *Impatiens walleriana* was noted in 2003 in the UK in both greenhouse and nursery settings (Lane et al., 2005). This outbreak triggered regulatory actions in the UK because the pathogen had never been reported on wild impatiens there, even though there had been numerous European and Asian reports.

In 2004, shortly after the disease appeared in the UK, the first US reports of IDM on *I. walleriana* occurred in California (Koike et al, 2004), Tennessee (A. Windham, personal communication), and New York. These instances were relatively minor, manageable outbreaks that occurred during greenhouse production. No landscape outbreaks were observed. For several years, IDM was occasionally seen in greenhouses in the US, but cases were scattered over time and space, and IDM did not cause problems in the landscape. Then, in 2009, IDM appeared in plantings of impatiens in Saratoga Springs, NY and returned to the same landscape beds during 2010 and 2011. The pathogen appeared to be overwintering in some fashion. During fall 2011, the disease struck landscapes in southeastern New York and in 10 other states. As winter continued into 2012, the problem became conspicuous and dramatic in south Florida landscapes. Later in 2012, impatiens downy mildew was detected in greenhouses or landscapes in many additional states, causing widespread concern. By 2013, IDM had been observed in 38 states.

In spring 2013, the news media were captivated by the story, so that this previously obscure disease made the news in many publications, including the New York Times, Science News, the Washington Post, the Baltimore Sun, the Philadelphia Inquirer, the Cincinnati Enquirer, and the Chicago Tribune. The news coverage undoubtedly affected the consumer market for 2013. Ironically, IDM outbreaks were generally seen only late in the growing season in 2013, the year when gardeners were anticipating the disease. This was very different from the timing of disease in 2012, when IDM came as a spring surprise.

A national survey was conducted online in fall 2013 by Kristin Getter (Michigan State University), Nora Catlin (Cornell University Cooperative Extension of Suffolk County),

and Daniel Welch and Margery Daughtrey (Cornell University), which reached 122 growers, 138 grower/retailers, and 38 retailers in 36 states (Getter et al., unpublished). Of the New York growers and grower/retailers, 24 percent saw the disease in 2012, while only 5 percent saw the disease in 2013. Nationwide, 15 percent of growers and grower/retailers noted IDM in 2012 and only 7.3 percent saw it in 2013.

Several factors probably contributed to this reduction in disease reports in 2013 compared to the previous year, including weather differences, more effective use of fungicides during production, and growers' reluctance to grow impatiens due to fear of the disease or of a reduced market. Because of the widespread disease problem in 2012, 98 percent of New York retailers returning the survey sold less (or significantly less) impatiens in 2013 than in 2012. Nationally, 38 percent of the retailers surveyed sold less (or significantly less) impatiens in 2013 than in 2012.

Retailers who took the survey indicated that the three main reasons why consumers have been slow to switch to alternative bedding plants are because they are so happy with impatiens, the alternatives cost more, and the alternatives are often unfamiliar.

Because impatiens is one of the top bedding plants across the United States, the direct losses and the threat of the new downy mildew disease have significantly affected the bedding plant industry. This concern has led to the formation of a collaborative research team (Mary Hausbeck, Michigan State University; Lina Quesada, North Carolina State University; JoAnne Crouch, USDA ARS; Aaron Palmateer, University of Florida; and Margery Daughtrey, Cornell University) coordinated by Cristi Palmer of the IR-4 Project at Rutgers University. Over the last year, USDA ARS and USDA APHIS have directed funding toward understanding the biology, fungicide sensitivity, and genetics of *P. obducens*. Because downy mildews are obligate parasites, not able to be grown on agar media in the laboratory, many aspects of their biology are only sketchily understood. Studies on IDM will improve understanding of the role of oospores and the importance of other hosts (*I. balsamina* and *I. capensis*) and develop and refine avenues for environmental, cultural, and chemical control of IDM.

Biology

Plasmopara obducens has an atypically destructive effect on its host *I. walleriana*, but otherwise is a typical downy mildew. Symptoms of downy mildews typically include localized, discolored patches in leaves or, in systemic infections, stunted, chlorotic growth. Although roses, like impatiens, defoliate from downy mildew, the woody stems remain standing, and new growth can be generated when environmental conditions shift to being less disease-conducive. When *I. walleriana* are attacked by *P. obducens*, however, plants cease flowering, leaves drop, and stems collapse (Figure 1).



Figure 1. Late stage IDM infection on *Impatiens walleriana* where flowering has stopped and leaves have dropped.

The IDM pathogen has as its airborne inoculum true sporangia (Figure 2), which may either infect plants directly or in the presence of water develop zoospores within the sporangium. Zoospores multiply the infective potential of any sporangium landing on a plant, similar to how *Phytophthora infestans* causes epidemics of potato late blight with wet weather patterns. Think Irish Potato famine.



Figure 2. Sporulation is readily apparent on the undersides of infected *Impatiens walleriana* leaves.

In addition to sporangia, downy mildews may have a second spore structure called an oospore that allows them to overwinter (Figure 3). Large numbers of oospores have been observed in the stems of infected impatiens from the northeast to Florida (A. Palmateer, personal communication). Research is underway to discover how long these structures survive in an infested flower bed, and what is required for their formation and germination. With the impatiens downy mildew, oospores are only one of three potential means for a disease outbreak – transplants may also be infected via sporangia in the greenhouse, or plants may collect airborne sporangia from other infected impatiens in the neighborhood. In any year in which the industry were to offer solely downy mildew-free impatiens plants, both alternative hosts and oospores would be particularly important.

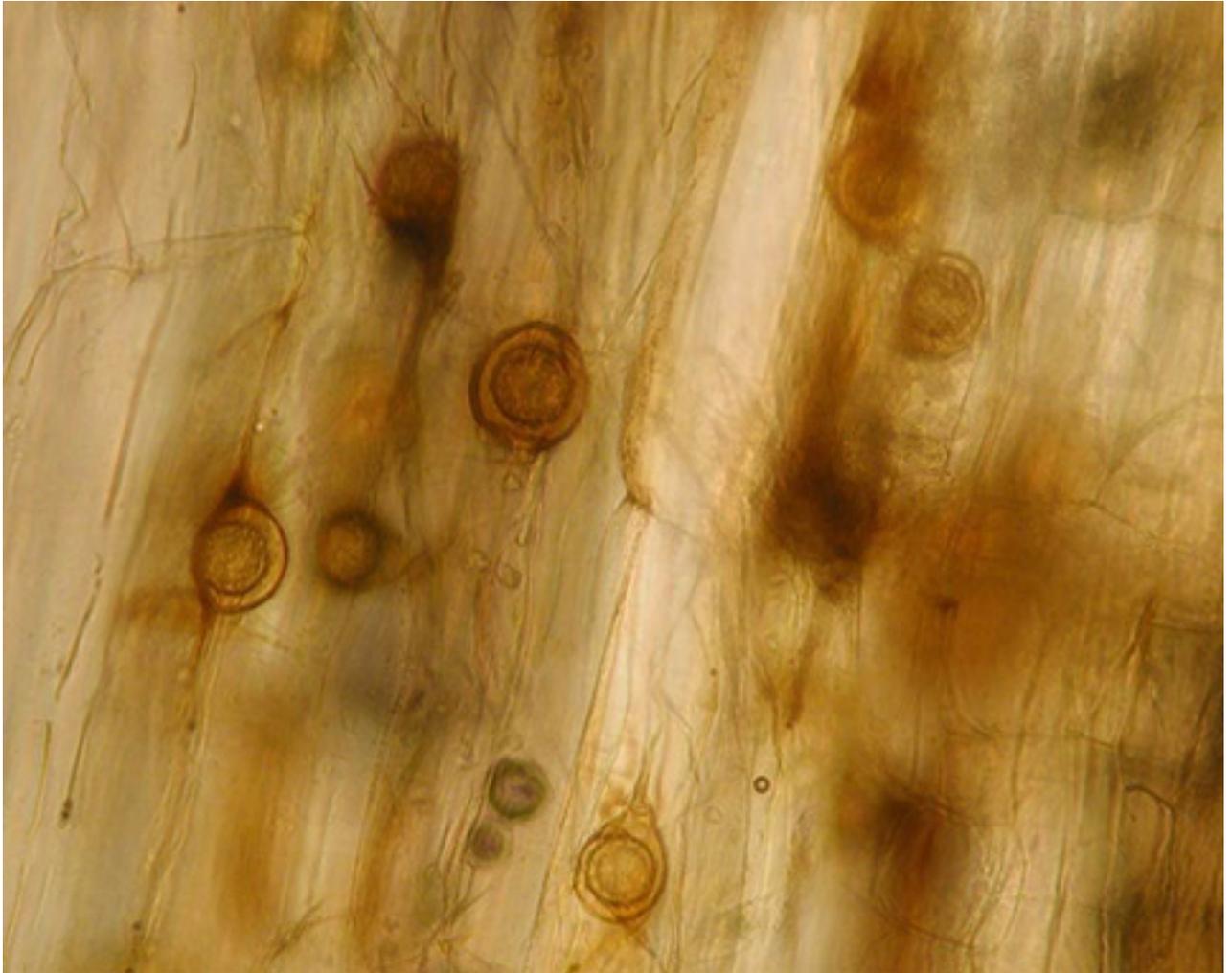


Figure 3. Oospores within *impatiens* stem tissues.

During the 2012 growing season, a trial was run on a number of different *impatiens* species to test for susceptibility to *P. obducens*. Plants were held in a shade house with overhead irrigation twice daily to encourage downy mildew spread and development. Seven *impatiens* species developed sporulation of *P. obducens* on the foliage: *I. flanaganae*, *I. capensis*, *I. hochstetteri*, *I. auricoma*, *I. arguta*, *I. balsamina* and *I. walleriana*. Most of these showed leaf spotting; only *I. walleriana* was killed. *I. auricoma* showed stem dieback as well as leaf spotting. *Impatiens balsamina* developed yellow patches in the leaves, but no conspicuous systemic effects: plants continued to grow and flower (Figure 4). With the native jewelweed host *I. capensis*, tiny purplish leaf spots appeared on foliage in late summer. *Impatiens* with no visible symptoms included *Impatiens* ‘Blue Angel’, *I. balfourii*, *I. namchabarwensis*, *I. glandulifera*, *I. tricolor*, *I. nianiamensis* ‘Congo Cockatoo’, *I. ‘Sichuan Gold’*, *I. morsei* ‘Velvetia’, *I. repens*, *I. omeiana*, and *I. hawkeri*. The New Guinea *impatiens*, *I. hawkeri*, is the only one of these that is a well-established bedding plant, or suited to such use. Plant breeding to develop a less susceptible *impatiens* bedding plant with traits closer to *I. walleriana* will not be easy, but resistant germplasm is at least available in the genus. A new interspecific hybrid

impatiens to be exhibited by Ball Horticultural Co. at Spring Trials (the Bounce series) will offer a New Guinea impatiens look but a spreading habit (Beytes, C., 2014).



Figure 4. Impatiens downy mildew causes patches of discoloration in garden balsam (*I. balsamina*).

Management

As we approach the future knowing what we know now about IDM on *Impatiens walleriana*, it seems unlikely that this bedding plant species will return to its trouble-free status, even though its immense popularity will continue to keep it in the trade. The more the industry learns about the disease, the more it can reduce the potential for introducing inoculum on plants coming out of spring production, and this will have a huge benefit. Although 38 states saw some IDM in 2013, landscape outbreaks generally occurred after midsummer in 2013. This was likely due partly to less conducive spring weather conditions in 2013, partly to the fact that growers and retailers in areas especially hard hit by IDM in 2012 did not grow or sell impatiens, and partly to the widespread educational efforts by the trade press funneling information from breeding companies and university researchers to growers.

One component of this information was instruction on how to choose protective fungicides effective against downy mildew and how to rotate them to preserve their effectiveness by selecting products with different mode of actions. In spite of these warnings, some *P. obducens* in south Florida was found to be insensitive to mefenoxam (in Subdue MAXX) in both production and landscape settings during 2013 (A. Palmateer and C. Warfield, personal communications). Other parts of the country should take note: other effective active ingredients should be used in alternation or as tank mixes to avoid developing Subdue MAXX-insensitive downy mildew populations. Studies continue to identify active ingredients and programs that will provide long-term protection for impatiens; hopefully fungicide registrants will be able to assist the bedding plant industry with label language that will allow sustainable protection of impatiens for at least the first few months after plants leave the greenhouse.

When it comes to managing the disease in your own greenhouse, there are things you can do to minimize your risk. If you live in an area where IDM has been a big problem in the past, assume that this may be the case again. In such areas, do not count on sales to landscapers, who are not going to risk planting impatiens if they have had a serious problem with IDM in 2012 or 2013. Adjust the number of flats you grow accordingly. If you have a retail business, educate your customers on the risk of IDM and on the positive attributes of alternatives. Consider seeding your own impatiens, or at least not purchasing plugs from areas where the disease could be moving into the greenhouse from the landscape. Sources where all the plants are grown from seed are less risky than sources where impatiens are also grown from cuttings. Vegetative propagation must be carried out with great care to avoid shipping diseases such as downy mildew or powdery mildew along with the cuttings: clean stock production practices are essential. Use fungicides to protect your impatiens from downy mildew, especially once spring temperatures have allowed outdoor plantings in your area. Use materials that are effective against downy mildew, and rotate among mode-of-action groups (by checking FRAC Codes) to maintain the effectiveness of systemic fungicides. Scout for the disease, especially on incoming plant material.

Is there a life after IDM? Yes, impatiens are still valued as a flowering plant for shady areas, IDM is currently manageable during production, scientists are investigating the role of oospores and sporangia in disease development and overwintering and studying new disease management strategies, and breeders are developing new impatiens cultivars.

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