Grower Summary

PC 286

Bedding Plants: Investigating the cause and prevention of “Pansy Mottle Syndrome”.

Final Report 2010

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The results and conclusions in this report may be based on an investigation conducted over one year. Therefore, care must be taken with the interpretation of the results.

Use of pesticides

Only officially approved pesticides may be used in the UK. Approvals are normally granted only in relation to individual products and for specified uses. It is an offence to use non-approved products or to use approved products in a manner that does not comply with the statutory conditions of use, except where the crop or situation is the subject of an off-label extension of use.

Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

Further information

If you would like a copy of the full report, please email the HDC office (hdc@hdc.ahdb.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

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Headline

- Pansy mottle syndrome (PaMS) is an intermittent condition which appears to be the result of a physiological response to stress.
- Comprehensive systematic testing of a wide range of agronomic factors has failed to pinpoint any single factor or combination of factors that may be consistently linked to the condition.

Background and expected deliverables

Symptoms consistent with what is now called ‘pansy mottle syndrome’ were observed on a range of bedding species as far back as the 1960’s. The symptoms have been reported on *Antirrihinum*, marigold, pansy, *Petunia*, stocks, sweet pea and *Verbena*.

The term (PaMS) was coined in recent years to describe a particular set of symptoms seen primarily, though still not exclusively, in pansy plants (similar symptoms have also been recorded in *Petunia* for example). The symptoms include leaf distortion, mottling and bleaching of the leaves, stunting, and in severe cases apical blindness (as shown below).

(courtesy of Will Healy- Ball Colegrave)

Figure 1 GS. Examples of PaMS symptoms

The condition, which previously was only seen intermittently by UK growers now appears to be becoming more prevalent. Early work carried out in 1990 (PC 27) and 1993 (PC 27a)

suggested that the problem may be linked to a bacteria, and a later review carried out in 2005 by Stuart Coutts and Neil Bragg (PC 211) supported this view. A comprehensive literature review of the current state of knowledge in the UK was subsequently carried out by Nigel Paul at Lancaster University in 2007 (PC 211). The aim of the current HDC funded project (PC 286) was to examine the various possibilities arising from the review to establish potential causes or contributory factors causing or triggering PaMS in pansy production.

Summary of the project and main conclusions

Approximately 140 UK bedding plant producers were surveyed to gather their experiences and information on PaMS. A response rate of 40% was achieved and the information was used as a basis to plan experiments to evaluate some of the potential 'trigger' factors that might be implicated in the disorder.

Based on data collated from the survey a number of initial experiments were undertaken (Year 1) using some of the PaMS affected plants received from growers and propagators.

Seed collected from severely distorted PaMS affected plants was sown alongside a similar variety of commercial seed but there were no significant differences in numbers of PaMS affected plants resulting from the two sources of seed indicating that PaMS is not carried genetically through seed. Lack of symptom expression in other trials in year 1 prevented identification of other agronomic factors that may be directly linked to the incidence of PaMS.

During the spring and summer of 2009 (Year 2) larger trials were undertaken at STC. Propagation trials focused on growing pansy and *Viola* varieties in different module sizes under a range of different, and overlapping, growing regimes examining light, irrigation and plant growth regulator applications. PaMS symptoms were successfully reproduced particularly with certain specific varieties in the studies. However, these studies failed to identify any of the above factors as specifically triggering PaMS and symptoms were observed in all treatments.

Subsequently, a much larger, fully replicated glasshouse trial was carried out using several varieties of pansy and *Viola* (three of each, using cultivars reported to have been potentially susceptible by growers). Plants were propagated by two commercial propagators (and also by STC Ltd). The plants were potted-on into 6-packs to allow the crop to be monitored for a longer period. The plants were arranged on $20m^2$ benches and all combinations of the

following factors were applied to the plants in an attempt to identify the key variables which could influence the incidence of PaMS:

Module tray size	308	576	
Light level	Low (shaded)	Ambient	High (Lit)
Plant growth regulator regime	None	One application	
Irrigation regime	Standard	Low	

On close inspection during transplanting it was observed that a small to moderate percentage of the seedlings propagated at STC were already showing early PaMS symptoms (6% of the total number of plants for Pansy A and *Viola* A), whereas a much lower percentage (1% and 3.5%) of those propagated commercially were affected at this stage. Irrespective of this early appearance of PaMS symptoms the full range of treatments continued to be applied, the crops being assessed and monitored regularly for PaMS symptoms.

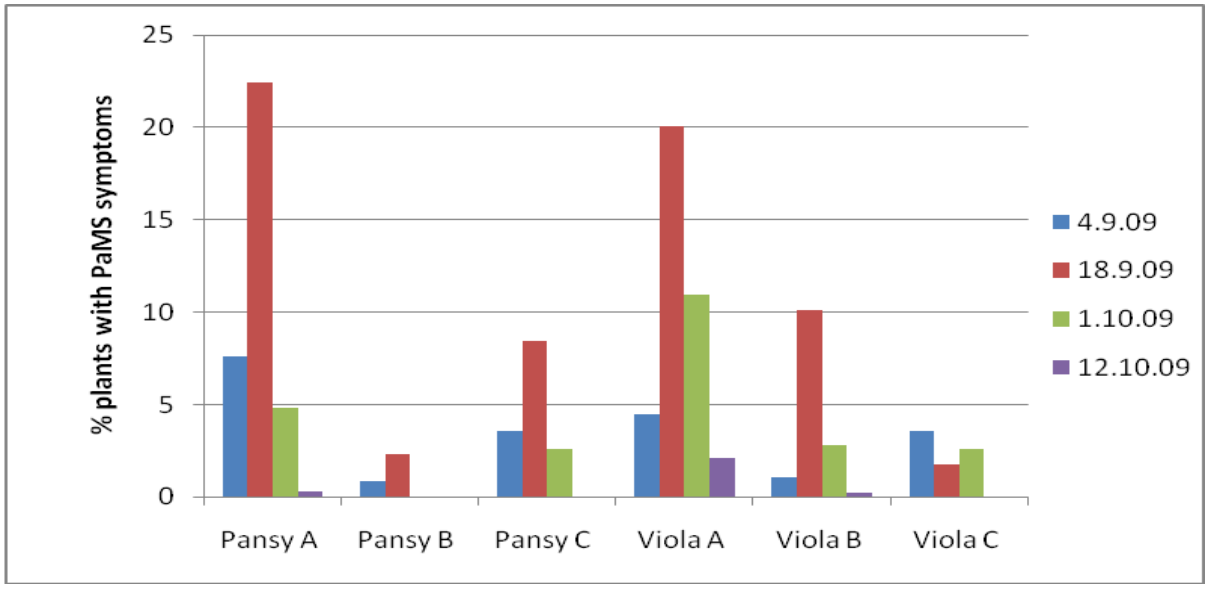

Figure 2 GS. Chart showing the percentage of plants with PaMS symptoms at each assessment date in the glasshouse trial

* 1st assessment on 4.9.09 was made a few days after transplanting from module trays.

The chart shows that the percentage of affected plants increased sharply at the second assessment date, particularly in Pansy A and *Viola* A, and this was in part due to the fact that the first and second pairs of true leaves had emerged and distortion was observed in these leaves rather than the cotyledons (indicating this was probably a continuation of symptom expression from an earlier cause rather than new symptom development). In nearly all cases the number of affected plants dropped off in later assessments. This was largely due to plants growing-away from the symptoms and producing new healthy foliage. In the vast majority of cases the PaMS symptoms were transient or temporary and most plants grew away from the symptoms over time (but this is not always the case under commercial conditions).

There was no observable pattern to the development of symptoms in the plants that could consistently be attributed to a particular set or combination of imposed factors.

A selection of plants showing symptoms were used to carry out additional investigations such as virus testing and maintaining plants for later seed collection. No virus was detected in any of the affected plants. No differences in tissue or growing media nutrient levels were observed. No systemic downy mildew was detected when the affected plants were tested by molecular analysis using polymerase chain reaction (PCR).

A gas chromatography mass spectroscopy test (GCMS) did show a very slight peak for a chemical product that was detected in the distorted plants, which was not present in the unaffected plants. This was identified as belonging to the natural plant hormone methyl-salicylate (MS). This product can be released by 'stressed' plants and is involved in 'turning-on' the natural plant host defences. A small-scale laboratory study to investigate whether this product could induce PaMS symptoms was subsequently undertaken.

Seed was germinated in sealed containers containing beakers of MS at five different concentrations (0, 50, 200, 500 and 1000ppm). It was found that the higher concentrations impacted severely on germination. Seedlings treated with lower concentrations of MS did not show any PaMS symptoms. This suggests that MS is not responsible for the development of PaMS symptoms, but instead, that its presence merely reflects that affected plants were showing 'stress' although the tests done were not extensive.

Seed collected from affected *Viola* plants was sown alongside another variety of *Viola* to determine whether the symptoms may be carried genetically. No evidence was found to support this hypothesis.

Findings from these trials suggest that there may be another, so far unconsidered, factor or factors causing the development of PaMS. An important observation in these studies was the very early incidence of PaMS in young plants prior to the start of the trial. The difference in the initial level of PaMS noted (dependent upon the site of propagation) could indicate that a particular factor or a range of factors influenced by the different propagation regimes may be implicated in the development of PaMS symptoms. However, it could also simply be a reflection of the different quality control procedures employed by businesses leading to slightly different sub-standard seedling rejection rates within trays of commercial plants prior to dispatch.

Financial benefits

Plant losses due to PaMS (at the propagation stage and finished plant stage) are difficult to quantify due to the variable and intermittent nature of the problem. Published Defra statistics (2002) indicate that around 9.5 million pansies are produced annually with a wholesale value of almost £2.1 million. (These figures undoubtedly underestimate the pansy crop currently grown in the UK). Official production figures for other crop groups which also suffer from similar symptoms (*Petunias* for example) do not exist. The main period when the symptoms are noted is late summer and early autumn, so only a percentage of the pansy and *Viola* crop is affected. Losses may be around 1% on average, equating to around £20,000 based on the Defra figures, but this figure doesn't take into account the costs incurred to 'make up' affected plug trays or finished packs of plants as a result of odd affected plants (to avoid product rejection) and the other plant species affected by this disorder.

Clearly, in years when PaMS symptoms are more severe on specific nurseries or if there is a continuing increase in the frequency and severity of symptoms this will have more of a financial implication for growers. It is hoped that the data and information collected during this study will improve awareness within the industry and help growers implement strategies to reduce the risk and incidence of PaMS.

Action points for growers

- If propagating plants ensure that good quality seed is used.

- The symptoms do not appear to be viral in nature (confirming the findings from HDC project PC 211) and therefore measures to minimise the spread of virus can be ruled out as important requirements for the control of the problem.

- No single factor has been conclusively linked to the incidence of PaMS but it is advised that plants are propagated and grown on under conditions where plant stress is minimised to avoid symptom development. This would include the use of good quality growing media, uniform and appropriate irrigation, using irrigation water of suitable quality, provision of shade as required, ensuring adequate levels of air movement over the crop and avoidance of intensive spray programmes, especially over very young plants.

- If plant stress levels cannot be minimised on the nursery during the propagation phase then consider buying in young plants at certain times of the year when the symptoms are an issue.

- If certain varieties or flower colours are more prone to the problem try substituting them for others, or take extra care with the production of these.

- The project indicated that the plants may eventually grow away from the symptoms, but regular inspections of growing crops (both seedlings and finished plants) will help to ascertain the level of incidence and the need to rogue-out plants to help facilitate better crop management later on.