



Horticultural
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Final Report

PC 211 – Part 1

An investigation into pansy
mottle syndrome (PMS)

Final report 2005

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Protected Ornamentals: Pansy Mottle Syndrome

Season 2005

During the 2005 season a number of growers complained about various symptoms in pansy and viola crops, these varied from mild mottling of leaves to complete distortion of the growing points of the plants. The effects were severe enough to result in the plants being unsaleable. Collecting information on the severity was difficult because most growers accept the problem as one of the natural hazards of growing crops out of season and do not keep a record of losses. One grower, who raises his own plugs, estimated a loss of up to 10% at plug stage with a further 35% at sale time in one batch, Losses in subsequent batches were much less. In the viola trial at Warwick/HRI Steve Adams reported 46% distorted plants in one variety with other colours also showing problems. A grower in the United States reported 50% losses in one week's production.

The variation in the symptoms suggests that there may be more than one cause but the synchronicity of the onset of problems mitigates against this. It is more likely that symptoms vary as a result of varietal variation; some colours seem more susceptible as Steve Adams report shows; and also growth stage seems to have considerable effect. It is also the case that if the weather conditions allow a lowering of temperatures the symptoms are alleviated but do not grow out completely. Severely distorted plants rarely recover.



As colours vary in their response to the problem the practice of removing poor plants from the pack and replacing with good ones probably results in the removal of some colours from the mixture. This results in saleable plants but possibly disappointed customers. It is likely that the symptoms will not be a problem in the garden situation as plants obtained from growers and held outside for some weeks did not get any worse and in most cases improved slightly.



PMS in the past

The problem now described as pansy mottle syndrome has occurred sporadically for many years since pansy and viola became an important crop for Bedding Plant growers in the 1970's. Several investigations have been attempted to solve the problem, in the UK most recently in 1996 at Reading University with no positive result. The impact on the industry is difficult to calculate as no figures of losses have been collected and the incidence varies from slight to severe from year to year. In a bad year like 2005 losses in some production weeks on some holdings can be as high as 35% and much higher losses have been recorded in the United States. Intermittent, insoluble problems of this kind pose great difficulties especially for growers producing on contract. The financial costs to growers range from inconvenience to complete loss of a batch with the consequent loss of customer confidence.

It is suggested that the cause is associated with stress but growers disagree on the causes of the stress and the Reading project was unable to reproduce the symptoms in their trials. Bacterial and virus causes have been examined with negative results. The Reading trial looked at combinations of high temperatures and PGR's. Until the problem can be induced it is difficult to see how we can design preventive production systems and this requires a new look at the problem, collecting information from growers and propagators who have suffered this year while the information is fresh, and then designing trials to induce the symptoms. As well as showing the triggering mechanisms, this will give an opportunity to test methods for prevention and possible amelioration of symptoms when they are first seen.

The syndrome caused losses in 1995 and 1996 on a number of nurseries but no concerted effort was made to address the problem as it disappeared for the next few

years from growers notice and downy mildew was more of a concern at the time.

Suggested causes

The pansy problems in the mid 90's were followed up with virus tests by Dr Nicola Spence at HRI/Wellesbourne with negative results. At this time Nicola prepared a short report (one side of A4) on the problem in pansy. The description of 'mottled pansy syndrome' was described as causing thickened, crinkled, variegated and chlorotic leaves on pansies and violas. It appeared in relatively large numbers in the South of the USA in 1994 and again in 1997. A joint press release from four university advisors suggested the following:

- Symptoms tend to be worse under high light and high heat situations especially if the plants are water stressed during the seedling stage.
- There is no known cure.
- It does not appear to spread to unaffected plants.
- The disorder could be genetic and triggered by environmental conditions.

Nicola Spence's report went on to suggest that both she and Dr Nemeth of Ohio State University were independently attempting to isolate double stranded ribonucleic acid (ds RNA) from infected plants. Both research groups have now been successful in identifying dsRNA of a similar molecular weight, which is indicative of a virus infection.

In late 1996 HRI virology department looked for micoplasmas in distorted pansies, the results were negative.

In early 1998 Will Healy Technical Services Manager of Ball Horticultural Company in the USA reported that he had been following the problem for seven years. "It's like lightning; you never know where it is going to strike." His research showed that:

- It was not a disease.
- It is not an MLO (mychorrizal-like organism)
- It is not a virus.
- It appears to be boron or calcium deficiency, but symptoms can also show on plants with an excess of boron and calcium.
- It is not induced by PGR's. Although plants that have been treated with PGR's show more severe symptoms because of the stunting effect of the chemicals.
- It hits specific colours or varieties but rarely the whole crop.

- This leaves only stress as the cause.

All the reports leave us with stress as the cause, but do not define the particular stresses that are significant and would enable trial plants to be grown and the symptoms induced. Until we can do this regularly, trials of potential stress relieving agents will be difficult.

It is difficult for growers to control stress in the winter under low light and cold damp conditions with low water needs, equally it is difficult to control in the summer with high radiant energy.



Grower opinions

In discussions with growers many cause have been suggested: virus; genetic breakdown; too hot; too wet, too dry; cold night after high day temperatures; cold storage of plugs; PGR's; high salts; ammonium nitrogen. Suggested solutions: shade more; grow plugs outside avoid all the above possible causes.

Extent of PMS in 2005

The problem was widespread; 35 growers were contacted nation wide. Nine reported no problem this year though all had seen the syndrome in other years. Contrary to early reports the syndrome was not confined to the south and east of the country. It was interesting that growers only a mile apart in one case had different experiences; one reporting no difficulties this year the other quite a large, though unquantified, problem. It is difficult to be sure that growers are entirely frank in their responses either through embarrassment or a lack of information. Even so we have reports of symptoms from the North East, North West, East and West Midlands, East Anglia and all of the South of England.

The timing of the problem seems to be around the week 30-34 production though one grower, who produces plugs for home use, reported problems from earlier sowings. In this case it was suggested these were associated with a high salts level in one batch of compost. Few growers reported seeing signs at plug stage and most only saw a problem when the uneven growth became noticeable.

The varieties affected were right across the whole range of both pansy and viola. Two growers mentioned that viola Tiger Eyes always gave problems, one suggesting that he over sows this variety by 50% if he needs any plants at all!

Growers who admitted to having had problems used plug plants produced both in house and bought in supplies, including supplies brought in from abroad. If seed is the source of the problem then it must be in all strains of pansy and viola used at present. It does not appear to be transmissible between affected and good plants and it disappears as suddenly as it appeared.

In the viola trial at Warwick/HRI the seed for all five batches was the same, a few symptoms were present in batch one, very bad in the second lot and slight in batch three with none in the last two sowings. The percentages in batch two (sown week 33) as follows:

Sorbet antique shades	11
Sorbet Black Duet	5
Sorbet Sunny Royale	46
Sorbet Yellow Delight	24
Sorbet Orange Duet	23
Sorbet Marina Babyface	18

Butterfly Marina	20
Butterfly Purple Harlequin	6
Butterfly Rose/blotch	10
Butterfly White/blotch	7
Butterfly Yellow Gold	7
Butterfly Yellow/blotch	0

Steve Adam's reported that Sorbet Sunny Royale showed some mild distortion in batch one (sown week 31) The seed was the same for all batches. The same applies to the grower with the 35% losses, seed was split into three sowings with only one giving problems. If it is a seed borne problem it is always present waiting for the trigger. This is assumed to be stress, however we wish to interpret 'stress'.

Many growers produce plants as mixtures particularly in pansy; if the damaged plants are replaced by good ones this presumably removes all or part of certain colours from the mixture as some colours seem to be more susceptible. It is also the case that the severity varies and we must be aware that we may be close to 100% loss situation.

Light and Temperature Data

One or two growers were willing/able to supply computer data on temperatures and total light integral; these figures do not show any severe conditions during weeks 31 to 38. The daily light integrals (MJ/m²/d) never rose above 22, and were low during week 32 for two days (8.63 and 5.56). The temperature outside had a maximum of 23.4°C and night minimum of 8.8 (week 31) and 5.7 (week 37) ie nothing particularly unusual. Inside the glasshouse air temperatures reached 30°C during weeks 31, 32 and 33 but only for short periods, most of week 33 was relatively stable in temperature. Obviously air temperature records do not show plant temperatures but it is difficult to read from the figures any abnormal conditions.

Chemical use

It has proved difficult to associate the symptoms of PMS with any chemical applications as each grower has his own particular protocols for chemical use. Some growers apply products for disease control and PGRs to all batches whereas others only use sprays as required. It is also a problem that growers of bought in plugs have no information on any chemical treatments applied by the propagator. Information gathered from plug producers does not, however, indicate any association with the symptoms of

PMS.

Substrates

A range of different growing media were used, some proprietary 'pansy' mixes, some home produced and some produced to the growers own recipe. In one case a problem of too much fertiliser was suspected which showed up on a conductivity test, no further analysis was undertaken.

Water

With the range of growers affected and because of the cases of growers close to one another using the same water supply, but not sharing PMS, water supply has been discounted as a potential source of the problem.

Growing conditions

All growers have their own protocols for pansy/viola production, for example one producer who grows his own plugs was very specific; germinate at 18°C, compost kept saturated for the first 4 days then dry right down. Once cotyledons are spread drop the temperature to 15°C, preferably lower, but this is not possible in August. Keep the seedlings dry with no use of PGR's and no chemicals until after transplanting.

Another grower who produces his own plugs, reports the use of low level Boron sprays as a preventive measure for PMS and distortion in petunia!

A large grower who uses bought in plugs is very concerned about high temperatures and keeps the plugs outside in summer conditions before transplanting and shades after transplanting.

None of these producers reported any problems. Three quite different approaches although one and three particularly aim to reduce stress as they interpret it. This is not to suggest that growers who have problems don't care about the conditions. Steve Adams at Warwick/HRI particularly worried about the growing conditions and took advice from successful producers of the crop.

Research in progress

The work by Paul Nemeth and Nicola Spence in the mid nineties has been followed up by Dr John Hammond at the Floral & Nursery Plants Research Unit at the US

National Arboretum Beltsville Maryland. His ongoing research has produced evidence of an ilarvirus, as yet unnamed, in most of the plants showing symptoms that he has examined. He is at present examining seed lots from various sources to see if it is carried in the seed. It would be possible to design a laboratory test for seed if this turns out to be a problem, but it does not explain the apparently intermittent nature of the symptoms and for the seed producers to clean up an unknown virus would be a mammoth task. In the mean time if we are to continue to produce what is, by some way, our largest single bedding plant crop we need to establish growing protocols that minimise 'stress'.

Potential damage to the industry

The 'farm gate' value of the pansy crop must be in excess of £50 million (as usual figures are difficult to come by) and that is a low estimate. The losses from PMS cannot be ascertained accurately as growers do not keep the figures but in a bad year, as 2005, one fortnight's production was badly affected with other weeks affected to a lesser degree. This must add up to a considerable sum. At present there are no alternative crops with anything like the potential of pansies and violas. The summer climatic conditions are unlikely to become less stressful in the coming years.

Possible remedial action

One of the problems growers have in production using bought in plugs is the lack of information on the conditions the plants have been grown in and any sprays that have been used. This is not to suggest that PMS is induced at an early stage, but it is the case that techniques exist that can help vegetable transplants overcome transplanting shock. Low level pre-stressing is known to help the plant cope when a larger stress comes. Also fertilizer use may be significant in preventing problems. Some growers have expressed the view that high levels of ammonium nitrogen can be a factor in causing PMS.

Pansy/viola have been an important crop for many years, and there is a lot of effort from breeders and suppliers to come up with more new varieties every year with particular interest in the early autumn crop which is when PMS is most likely to appear. Therefore it may be that we should be looking for alternative products for the periods when PMS is a potential problem. This is a question for the whole industry to consider.

Suggestions for further action

It is important that we do not ignore this problem now that it is no longer with us. We have done this in the past and it has come back to damage our industry again and it is certain to crop up if conditions are in its favour.

The work by John Hammond at Beltsville must be monitored and discussions between Dr Nigel Paul at Lancaster University and Dr Rick Mumford at CSL followed up with a view to funding work in the UK to establish a test for viral problems in pansy/viola seed. Obviously if there are viral problems this is a matter for the seed industry to sort out, but we have lived with this situation for a number of years producing good, saleable crops of pansy/viola from the seed we have now and we must accept that the problem arises because of something growers do.

We need a clearer understanding of 'stress' in summer raised plugs. This can be achieved through a project mimicking the production protocols of plug growers who have had problems. Once we can induce the syndrome we should have a good understanding of the causes and can advise producers of the conditions to avoid.

An industry wide effort to develop alternative crops for the times when PMS is a problem as part of the long term development of the garden plant market. This is essential apart from PMS. No crop goes on for ever, customers become bored with the same thing again and again.