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Pseudomonas cattleyae and Erwinia: recurring problems

Growers always have to be on the lookout for bacterial infections when growing Phalaenopsis. A change in the market still often means the need for a new production strategy such as:

- growing under drier conditions to prevent pot worm problems.
- growing under wetter conditions to encourage more growth and multiple growth points.
- increasing shade and reducing the openings of ventilation windows to save on energy consumption.
- increasing the nitrogen component in fertilisers for faster growth.
- making use of new greenhouses with polycarbonate roof sheets.
- greenhouses without paths (or with paths that are difficult to access) that form a major barrier to scouting
- etc.

It is precisely after making one of these changes in production strategy that a new outbreak of bacterial diseases can occur more easily. To be economically sound, a nursery has to limit its annual losses to 2-3%, but an outbreak of a bacterial disease can easily increase this percentage to 5% or more!

Symptoms of disease

In Phalaenopsis production, Pseudomonas (also known as Acidovorax avenae subsp. cattleyae) and Erwinia are the most common bacterial diseases. *Pseudomonas cattleyae*, also known as ‘bacterial brown spot’ or ‘brown wet spot’ is characterised by black spots with a lighter and often yellow margin. The spots are small at first but often spread like oil slicks. At other times, they become encapsulated and do not increase in size; this, however, does not stop the disease from spreading. Erwinia, also known as ‘soft rot’, is characterised by leaves displaying glassy wet spots. The most common species affecting

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Phalaenopsis is *Erwinia carotovora*. One of its characteristics is a foul odour similar to rotting fish. A less common but more aggressive species is *Erwinia chrysanthemi*. Leaves of plants infected with this bacterium first become dull and yellowish; a few days later, a wet spot develops. Weak plants with few roots (typical of plants emerging from the winter) and plants that have just been repotted, moved or placed farther apart are more susceptible to bacterial diseases.

**Prevention**

In addition to using healthy parental material and taking hygienic precautions, applying the right production methods is very important. For bacteria, just like everything else in life, prevention is also the best cure! It is often still believed that taking measures after a bacterial disease sets in - such as applying chlorine dioxide - will be effective. However, applying the right production methods is the key to growing Phalaenopsis without any substantial problems. Uniformity is a key word in Phalaenopsis production. Prevent major climate fluctuations by taking these precautions:

- be sure to keep the air moving: ventilate and heat to provide sufficient air circulation around the plants.
- avoid temperatures exceeding 28°C; excessively high temperatures stimulate bacterial growth.
- make sure that the heating network has enough heating pipes running throughout the space; excessively high pipe temperatures can create an uneven climate. Depending on the number of heating pipes, limit the temperature of the lower network to 45-50°C.
- prevent a sharp fall in temperature caused by ventilating and opening the shade cloths too quickly.
- ensure that leaves dry off quickly after sprinkling.
- sprinkle only in the morning; during cloudy weather, supplementary lighting can promote drying.
- prevent sharply fluctuating RH levels; also prevent an excessively high (>75%) RH.
- be careful when considering the use of fertilisers with a high nitrogen content; providing extra nitrogen in the form of urea can increase growth rates but can also result in weak cell walls and thus a higher susceptibility to bacterial infiltration.
- always provide enough calcium for strong cell walls.
- provide clean irrigation water; bacteria are often found in the reservoir, silo and/or irrigation pipes, so have these checked occasionally.
- walk through the plants every week to scout for symptoms of disease.
- make sure that the upper and lower heating network are turned on simultaneously.

**Control**

When signs of a bacterial infection are identified, it is important to act quickly. Find out how it occurred: run down the foregoing list and make adjustments as needed! Taking the following measures is also important:

- remove diseased plants – even ones you just think might be diseased – every week. Put these plants immediately into a plastic bag so that you don't expose other plants in the greenhouse to them as you walk around.
- always do this before watering because water droplets can spread disease.
- a low concentration of a wetting agent in the irrigation water ensures that the leaves dry off faster.
- spraying agents containing peroxide (Reciclean) and agents such as Jet 5 and Horticlean immediately after sprinkling can prevent the spread of disease. Just remember that these products were not developed specifically for use on plants.
- as an added measure, the percentage of chlorine dioxide in the sprinkling water could be increased. Be sure, however, that this will not increase the Cl and Na percentages in the planting medium too much since this can reduce growth rates. (We devoted attention to this in the October 2008 issue of this newsletter).
- disinfect your hands when moving from one batch of plants to the next.
- consider following a logical sequence of activities: avoid doing things like setting out plants after scouting.
- disinfect materials such as benches, distribution forks, etc.

To know if you are making progress in your control measures, it would be a good idea to keep records. Normally, losses will continue longer (and thus be higher) among batches that
have spent more time under improper greenhouse conditions; batches that have spent less time under improper greenhouse conditions because these conditions were corrected should generate few if any losses. When this happens, you should be seeing light at the end of the tunnel. But don’t rest until the last diseased plant has been removed!

Prevention is better than cure: having healthy plants growing in a healthy climate with sufficient air circulation is the best way to achieve successful results in Phalaenopsis production and avoid problems with bacteria.

**Whitewash off, whitewash on!**

When should whitewash be applied to the roof? And when should it be removed again? It’s the same question you face every year. Obviously, the first factor to be considered is the type of greenhouse, the type of shading system and the number of shade cloths. Since no nursery is the same, the following information should be seen as a general guideline.

First of all, we want to point out that it is important to act in time, particularly as winter turns to spring. As the graph below shows, the number of hours of light per day is increasing at that time instead of decreasing as it does in the autumn as we head into winter. The line representing spring rises more sharply meaning that the light level starting at the shortest day of the year increases faster than it drops during the autumn when it heads towards the shortest day of the year! In the autumn, the usual time for removing whitewash from sections housing plants in the spike induction and flowering phases is around the first week in September (week 36). The average light sum at that time is around 1100 to 1150 Joule/m²/day. In the spring, this occurs around the first week in April (week 14), so this is when the first coat of whitewash should be applied to the roof!

During the vegetative phase of production, we should remove the whitewash from the roof around the first week in October (week 40 to 41). If we then want to apply the whitewash when the light level is the same (approx. 700 Joule/m²/day), we should not wait any longer than week 9 or 10 (the last week in February/first week in March).

In theory, and according to production processes, the date for removing whitewash in the autumn could possibly be moved up another 1 or 2 weeks. After all, light levels are diminishing and the plants are now strong and vital enough to tolerate more light. Be sure, however, not to allow excessively high light levels or fluctuations in light since this can increase the risk of premature spiking in Phalaenopsis.

As winter ends (February/March), the plants are then used to lower light levels and will be more susceptible to damage from excessive light. This is also the period when we see many more – and more quickly increasing - peaks. So be alert to this and take action immediately. We see many cases of sun scald every year.
New labels

Since the beginning of this year, there have been new labels on the transplant containers used for Floriclon® Phalaenopsis. These labels provide more information than before. The opposite page shows the information given on this label along with arrows indicating the correct information for that particular variety.

We have classified our Floriclon® Phalaenopsis into three main groups: Multiflora® Standard Grandiflora®

The plants in the Multiflora® line are characterised by a short spike so that the total height of the plant from the underside of an 11/12 cm. pot to the top of the inflorescence measures 45-55 cm. For the Standard line, this measurement is 60-70 cm, and the plants in the Grandiflora® line begin at 70 cm. Usually, a taller plant height will also mean larger flowers but this is not always the case.

The first column in the horizontal bar running across the label displays looks like a bar graph with three levels. In the example given here, the middle one is in colour to indicate that this variety is classed as Standard. Another way to recognise this is that the variety code (31978) begins with a '3'.

The second column in the bar indicates flower colour (in this case, orange). The printed colour comes as close as possible to the actual colour of the flower.

The third column in the bar indicates the markings (if there are any) on the petals. In this example, the flower is striped with reddish-brown lines so it is classified among the striped and/or spotted flowers. This can also be seen by looking at

Water

This year, the need for having a sufficient supply of good irrigation water at all times was again abundantly clear. As early in the season as late April / early May, there was such an acute shortage of rain that many growers were staring at almost empty reservoirs. Because this was followed by a brief period of sufficient rain, the problem appeared solved. But rainfall during the summer was not nearly adequate. Growers in some regions were lucky to get a certain amount of rain, but growers in other areas had hardly any rain at all.

This situation emphasises the need for having extremely large reservoirs for growing orchids — regardless of whether they are Cymbidium, Miltonia, Phalaenopsis or Dendrobium. Reverse osmosis is the solution. The irrigation water should have an initial EC of 0.1 (no more than 0.2). Mains water usually has an EC of 0.7 and can be even higher than this in some areas. In such cases, there is no leeway for the application of nutrients when the maximum EC may not exceed 1.0. Unfortunately, we have observed many growing facilities using mains water or, even worse, water from drainage ditches. Although the plants can survive this for the short term, problems will occur later. The most common result is losses, and the costs involved are high. Other consequences are retarded flowering or a reduction in the quality of spikes or plants. Surprisingly, the reaction of those involved is still the same: ‘It couldn’t be as serious as all that, could it?’ Well, yes, it could — and it is. If you are at sea in a lifeboat, you don’t drink any seawater even if you’re dying of thirst. You don’t put diesel fuel in a car that burns petrol just because diesel fuel is cheaper. And these are just two examples of things people know not to do.

Orchids simply react very badly to mains water or water from a drainage ditch. If professional growers give such slight consideration to this fact, how can they expect to produce a good yield of excellent products? Having an unlimited supply of good irrigation water is a basic requirement for growing any kind of orchid.

The table below provides basic guidelines; as we indicated previously in this article, your own circumstances will ultimately determine the dates and implementation.

<table>
<thead>
<tr>
<th>Whitewashing guidelines</th>
<th>vegetative phase</th>
<th>cooling/flowering phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>week 8-9</td>
<td>1st application</td>
<td></td>
</tr>
<tr>
<td>week 14</td>
<td>2nd coating</td>
<td>1st application</td>
</tr>
<tr>
<td>week 18-19</td>
<td>possible 3rd time</td>
<td>possible 2nd coating</td>
</tr>
<tr>
<td>week 36</td>
<td></td>
<td>remove</td>
</tr>
<tr>
<td>week 40-41</td>
<td></td>
<td>remove</td>
</tr>
</tbody>
</table>

Points of departure:

<table>
<thead>
<tr>
<th>pH</th>
<th>5-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC</td>
<td>&lt; 0.2</td>
</tr>
<tr>
<td>HCO₃</td>
<td>&lt; 0.3</td>
</tr>
<tr>
<td>Cl</td>
<td>&lt; 50 mg/l</td>
</tr>
<tr>
<td>Fe</td>
<td>&lt; 2 mg/l</td>
</tr>
<tr>
<td>Hardness</td>
<td>&lt; 3 German degrees</td>
</tr>
</tbody>
</table>
the second digit in the variety code: a ‘1’. This means that plants in group 31 will always be Standard size with stripes or spots. A variety code beginning with 21 will always be a Multiflora® with stripes or spots, and 41 will be a Grandiflora® with stripes or spots.

If a flower has no markings, this column will be left blank. So, if the flower is entirely white, yellow or pink and has a lip of the same colour, the 5-digit code will begin with 33 for a pink, 34 for a white or 35 for a yellow Standard size. For a Multiflora®, these codes will begin with 23, 24 and 25 respectively and for a Grandiflora® 43, 44 and 45 respectively. (The attentive reader will now know what a 32, 22 and 42 represent!).

In the example here, the fourth column displays a red semicircle. This means that this variety has a red lip. But it could also be yellow or purple as indicated by the colour of the semicircle. If the flower colour is entirely white without stripes or spots but has a red lip, it will be classified as a member of the Red Lip Group with a second digit of ‘2’. This means that 32 (and thus 22 and 42) represents a flower with a lip colour unlike its flower colour but a flower that is neither striped nor spotted.

The last three or four digits in this variety code (976) stand for the Floriclone® number. We now have more than 1600, and the very latest test numbers already begin with 2000.

Each Floriclone® number that makes it through the testing phase will be given a name and be protected by growers’ rights. In this example, the name chosen was ‘Marie-Therese’.

The new label gives you and your employees various ways to identify the colour, flower marking and group classification of a certain variety. Although this can be seen from the code number, not everyone will recognise its meaning immediately, so this is why we have added the symbols. What’s more, each colour can have so many variations that before we had this label, it was hard to know the exact shade of pink or yellow displayed by a certain variety. Having the actual colour printed on the label provides more accuracy.

Cymbidium: production prognosis

Now that we are farther along in the season, it’s somewhat easier to make a prognosis. At the beginning of this year, it was thought that earliness would be forfeited due to high energy costs. Not everyone is/was willing to go ahead and pay a substantial amount for heating. The mid and late varieties that produced high yields last season should also start producing less during the coming season, supposedly as a result of that earlier high production rate.

The year 2009, however, has been a great year as far as light is concerned. From March through September, there was an average of 20% more sunlight than usual available per month, with April standing out as having more than 70% more hours of sun (see the graph on the next page). This meant that the early varieties came into bloom earlier and produced greater masses of flowers at certain nurseries and that supply through early October was even higher than last year. Varieties produced for Christmas sales are also expected to exceed those of last year. There are actually no reasons to suggest that a delay and/or decrease in production will occur. At most, there has been only one grower who will be faced with a lower yield and/or a delay in production because he was forced to use poor alternatives due to a shortage of water.
It was initially thought that mid and late varieties would be producing smaller yields because of their substantially higher production last year, but it is now clear that production in the coming season will remain the same.

In conclusion, we can still expect an increase in production again throughout the entire season. If you are growing varieties that will start producing huge masses of flowers, remove some of the young flower spike buds yourself. As a result, the quality of the remaining spikes will be better, the plants will recover faster and better, and you can realise a good yield again next year.

One thing we know for sure, however, is that once everyone produces a good yield, prices will drop.

Cymbidium: Crop production advice

Extremely early
The early Cymbidium varieties will have finished flowering by the end of October. As soon as this happens, the temperature in this greenhouse section can be reduced in early November to 11-12°C at night and 13-14°C during the day in order to maintain an average 24-hour temperature of 12-13°C until early/mid February. Do not add any nutrients to the irrigation water; provide plain water only. If necessary, use plain water to thoroughly flush the planting medium. Remove spike remnants and old or broken leaves to keep the plants tidy. Spread the plants farther apart if needed; get rid of old plants in varieties you no longer want, and replace them here with plants that will bloom for the first time during the upcoming season. Admit light during the day, however, insofar as this is still available. Check the EC and pH levels of the drainage water. As long as the EC of the drainage water is high, it is important to provide enough plain water. If the pH is low, apply 3 grams of Dolokal per litre of planting medium. (For a 10-litre pot, this would be 30 grams which is about 1 tablespoon.) After application, flush with plenty of water. Keep this greenhouse section well ventilated. Starting in early/mid February, the temperature in the greenhouse can be increased. Over one week, the temperature can be gradually raised to 22-24°C during the day and 16-18°C at night to attain an average 24-hour temperature of 20°C. Using a transparent film during the day ensures that the average temperature at plant level is higher than it would be without it. The same effect is obtained under greenhouses with double glazing or polycarbonate roof sheets. In a greenhouse kept at an average 24-hour temperature of 20°C, the average temperature at plant level can be 1 to 2°C lower. This will delay blooming. At the same time that the temperature is increased, nutrients can also be added to the irrigation water: an initial EC of 0.5 up to 0.75 by mid-March.

Early – Christmas
This greenhouse section is now in bloom or almost there. Be sure to continue keeping a good eye on the RH here. This can exceed the recommended level, particularly on days with high outdoor humidity when temperatures are not that cold. Maintain a temperature of 14-16°C at night and 17-18°C during the day and provide adequate ventilation. Ensure sufficient air movement and keep the RH low enough. Check the drainage water weekly for EC, pH and drainage percentages. Please note that we are not talking here about combined samples (combining the samples from 6 measuring points and then measuring). No, it would be better to measure a sample for each variety because the readings taken for each of these varieties can display substantial differences. As soon as the EC of the drainage water exceeds the level in the nutrient solution and there is still 20% or more water exiting from the pots, the EC of the nutrient solution will have to be reduced. If the pH of the drainage water is less than 5, it would also be better to reduce the EC of the nutrient solution to 0.25 or 0 EC. If this is 0.25, limit the ingredients in the nutrient water to calcium nitrate alone. The calcium ions will reduce the intake of potassium ions so that the pH is not reduced further; meanwhile, the nitrate ions
being absorbed will increase the pH somewhat. As a result, the roots will function better for a longer time. After 1 January, as soon as flowering has finished, it would be advisable to apply the same measures as listed for the plants in the extremely early greenhouse section. The cold treatment can be given until early April. It remains important to measure the quantities of drainage water every week. Precipitation and wind will extract a lot of heat from the greenhouse. On the other hand, a sunny day can also have a major impact on water intake. It's always surprising to find that you have to give more or less water than you had expected. If you don’t measure, you won’t know this, and you won’t know whether or not you are making mistakes.

**Mid-season**

In the greenhouse section holding mid-season flowering plants, it is important to measure drainage quantities and the EC and pH. It is particularly during this elongation phase that many varieties can still require nutrients – up to 0.7 EC. The quantity of water provided is also important; providing too little water during this phase will lead to bud drop that will not become apparent until January or February. As long as the EC of the drainage water is lower than the nutrient solution, you can continue to add nutrients, even if this solution already has an EC of 0.7. You need not be concerned about an EC of 0.4 in the drainage water. If you measure regularly, you will see that the EC of the drainage water starts to increase at a certain time. As soon as you see this happening, you should be ready to take action. If the drainage percentage exceeds 20-25%, you will have to start reducing the EC in the nutrient solution to achieve a value of 0.5; if the drainage percentage is less than 20-25%, the first thing to do is increase the quantity of water given. If the EC of the drainage water is the same or higher than an EC of 0.5 in the nutrient solution, reduce the EC in the nutrient solution to 0.25 or 0 (plain water). In a greenhouse section housing late mid-season varieties, you can still spray for red spider mites at this time. If you know that you are growing susceptible varieties, or if there are certain locations in a greenhouse section where this problem recurs (and if few if any of the spikes have been tied up), you still have a chance to take this measure. This applies somewhat more to the varieties that bloom in March/April than the ones schedule to bloom for Valentine's Day.

**Late**

At this time, the late and extremely late-flowering varieties are still being kept warm. The longer they are kept warm, the longer they will be delayed. Average 24-hour temperatures higher than 20°C (17°C at night - 23°C or higher during the day) will ensure that spikes do not elongate and that the shoots that started being initiated in July will continue to grow properly. Here again, check drainage water for EC, pH and drainage percentage (preferably for individual varieties). Be sure to provide enough water; not doing so will reduce the number of flowers on the spike or even the number of spikes. As long as the temperature in this section is still high, scout regularly for red spider mites and spray as necessary. Some growers will start lowering the temperature before Christmas while others will wait until mid-January. This should be distributed over at least 7-10 days. A shorter period will result in shorter stems below the individual flowers; a longer ‘drop period’ (3 weeks, for example) will result in longer stems. Doing so, however, will reduce the length of delay. The temperature to be maintained has to depend on the outdoor temperature; if this is very low, the greenhouse temperature can be dropped to 10°C, but if outdoor temperatures are higher than the maximum, the temperature in the greenhouse should not be reduced but kept the same. Be sure, however, to provide plenty of ventilation and introduce a minimum pipe temperature of 40°C for 1-2 hours in the morning so that you can still stimulate a certain level of crop activity. The minimum transpiration per week should be 2 litres/m²/week (or about 0.3 litres/m²/day). This is easily 7 times less than the average amount of what Cymbidium transpires in a greenhouse during a summer day when one variety will transpire up to 4 litres/m²/day and another will transpire just a little more than 1 litre/m²/week – in the same greenhouse! This is how great the differences can be! This minimum level of transpiration is needed to keep plant activity at a minimum to adequate rate.

In addition, spraying to control red spider mites should be carried out at least once, if only for prevention. Scout carefully, especially among susceptible varieties and in places in the greenhouse where plants were infested with these pests during the previous season. As soon as low temperatures are being maintained, red spider mites will become rare. If you have not identified this pest and have not sprayed for it, another outbreak will not occur until April/May when outdoor conditions will cause a rise in temperatures and a low RH. This time, however, the pests will do a lot more damage and be a lot more difficult to control. This greenhouse section should be whitewashed for the first time around mid-late February.

Cymb. Bremo 'Monica'
Cymbidium during the summer

This may appear a weird heading for a Newsletter you’re reading in November, but controlling certain situations often means looking ahead. Last summer, for the first time in three years, we had nice warm weather in August, including a few days topping 30°C. Fortunately, it cooled off enough during the evenings/nights. But it could have turned out differently. So, especially for growers producing extremely early varieties (or those considering this option) it is important to be able to take enough precautions to ensure that these varieties can be kept cool later. First to be considered is a combination of exterior shading system and roof sprayers. There should always be enough light in the greenhouse, even during cloudy summer days. In addition, a greenhouse without whitewash will always receive twice as much light in the mornings and evenings. Roof sprayers can achieve additional cooling during the day, and this option is appealing with regard to costs. An exterior shading system with a misting system is another good alternative and is very effective. Having roof sprayers as well gives you a more complete set of options but you won’t be using all these systems at once. Using a misting system in a whitewashed greenhouse kept temperatures at the end of the day in August last year at around 27-28°C while temperatures outside were substantially higher than 30°C. Using roof sprayers on a whitewashed greenhouse is still a difficult combination. If the whitewash gets wet, its opacity is reduced. This is counterproductive to cooling the greenhouse because it admits more light and thus warms up the greenhouse. What’s more, the windows have to be kept more closed to prevent water from coming inside. In general, this combination is only effective with sufficient wind that will result in more evaporation. It will not be as effective with less wind. Finally, one can consider air-conditioning. We indicated certain options in this regard in our Newsletter of October 2006. After lengthy consideration, certain grower decided to go ahead and invest in this solution on a limited scale. Although two years went by without having to use it, he finally used it this summer. He has two greenhouse sections at his nursery: one with air-conditioning, the other without. Both were whitewashed, ventilation, etc. was the same for each. The section with air-conditioning had accommodated the extremely early varieties, while the other section contained the Christmas varieties. In both sections, it was also still possible to use humidification but this was not mist. In the section with air-conditioning, it was possible to maintain an average daytime temperature of 3°C lower than the other section. On one of the hottest days, the high temperature for the day outside was 35°C and the air-conditioning kept the temperature in the greenhouse at 28°C or less at the hottest time of day. Meanwhile, the temperature in the section without air-conditioning was just below the outdoor temperature. If a misting system had been available, the maximum temperature here could have been lower – maybe around 30°C or a bit less. The great advantage of air-conditioning, however, is that you can also lower the temperature by 3°C at night – something that cannot be achieved by misting. We hope to be making even more use of this result in the future. It seems as if the flowering of the spikes will be more uniform – the same as we are seeing with Phalaenopsis. If there is little difference between day and night temperatures during spike elongation, flowering will be more uniform.

In conclusion, we would like to make you aware of a new type of shade cloth: the XLS Harmony Revolux from Ludvig Svensson. Using this kind of shade cloth should provide somewhat cooler temperatures during hot conditions and admit more diffuse into the greenhouse. Diffuse light keeps leaf temperatures lower and also reaches down underneath the foliage. We actually saw this happen under commercial conditions and it looked interesting and very promising. Certainly in combination with the other cooling options we mentioned, this should make it possible to beat the summer heat without a loss of quality among the early-flowering Cymbidium varieties. We’ll be cranking up the discussion about this now so that you can think about it, discuss it and maybe even decide on investing in one of these options.