

Seed Sowing Experiments 2019



PCLav seedlings at 9 days old, growing under the clear cover of a disposable Bento container near a window. (April 2019)

The following piece is part of a collection of writings published on the Practical Small Cacti Malaysia site.

Stepping-Stone Experiments

The following sections discuss the progress of several batches of PMag and PCLav seeds sown in 2019 as stepping-stone experiments. I don't have the space to keep thousands of small cacti around, so these are limited experiments done in a semi-casual manner. They did not get perfect treatment; with the occasional neglect it's easier to expose the limitations of the cultivation methods being used.

All the seeds were from seed pods collected from my cactus specimens. My objective is to fine-tune cactus seed sowing and seedling cultivation practices on normal PMag and PCLav seeds first before trying to sow 'more valuable' cross-pollinated seeds. In these experiments in 2019, I thought jiffy peat was the best potting mix to use. As you will see later, there are problems with the long-term use of soilless potting mixtures in the hot tropical weather – even in an indoor setting.

Nicknames for Scientific Names

PMag = *Parodia magnifica*

PClav = *Parodia claviceps*

GBald = *Gymnocalycium baldianum*

MGeo = *Myrtillocactus geometrizans*

This naming scheme is purely for convenience. Just think of them as webchat nicknames. Other nicknames and additional notes can be found in the appendix to the third chapter.

A PClav Two-Pot Sowing (March 2019)

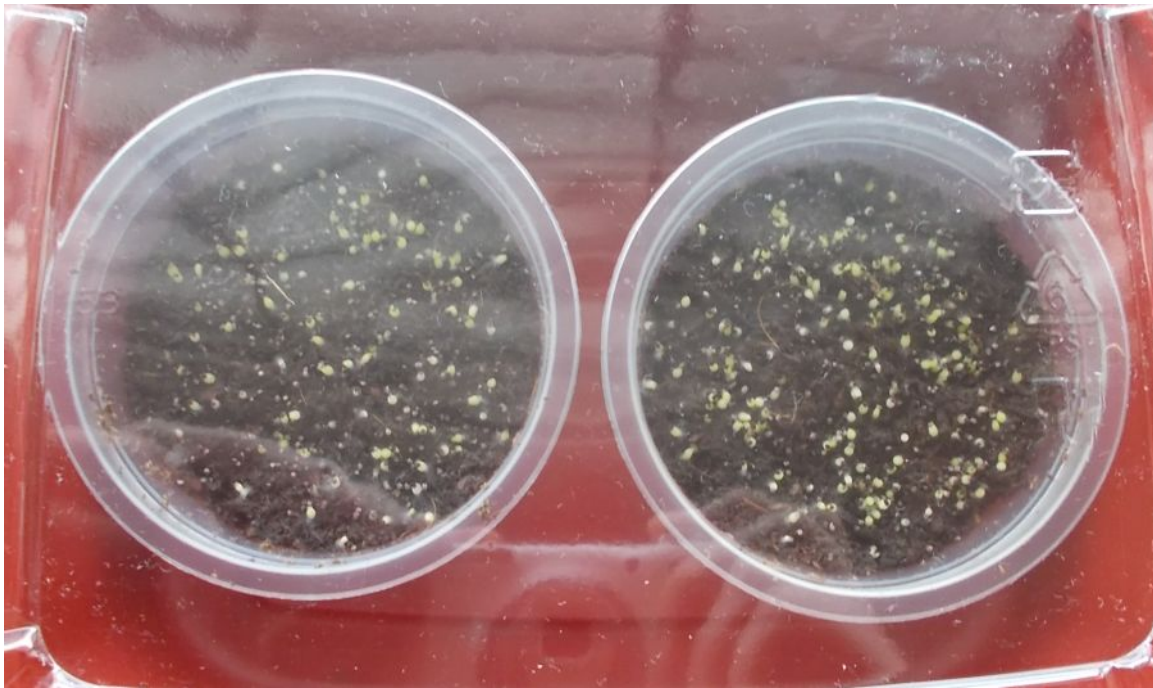


Ready for sowing. The PClav seeds were from the two pods seen on the first page of the Seeds and Volunteer Seedlings chapter. (2019-03-30)

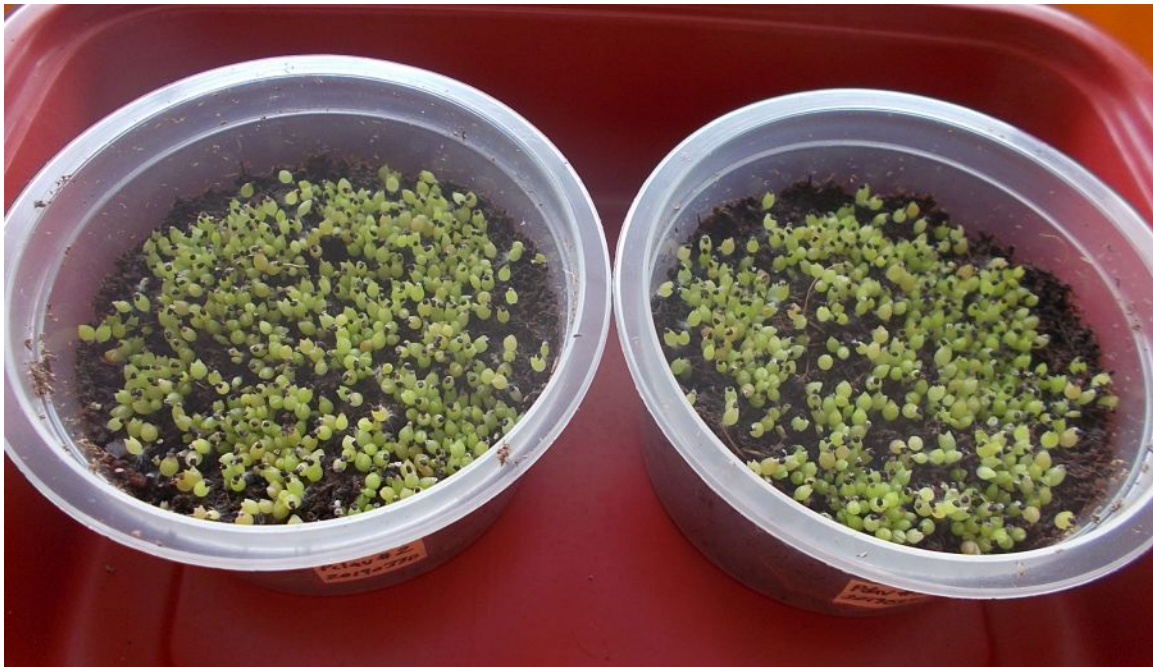
This two-pot sowing of PClav seeds was the ‘main experiment’, so to speak. The seeds were first stored in a container with silica gel for about 6 weeks. They were then packed in a small plastic bag and stored in the fridge. When the seeds were taken out for sowing, they had been in the fridge for about 5 months¹.

The potting mix was simply moist jiffy peat. One or two jiffy peat pellets were soaked, then excess water was squeezed out so that it is not too moist. The jiffy pellet net bags were removed and the peat was broken up. Jiffy peat has some fertilizer content, so algae contamination is a concern.

¹ This is how I store them anyway. Fresh PMag and PClav seeds germinate just fine.

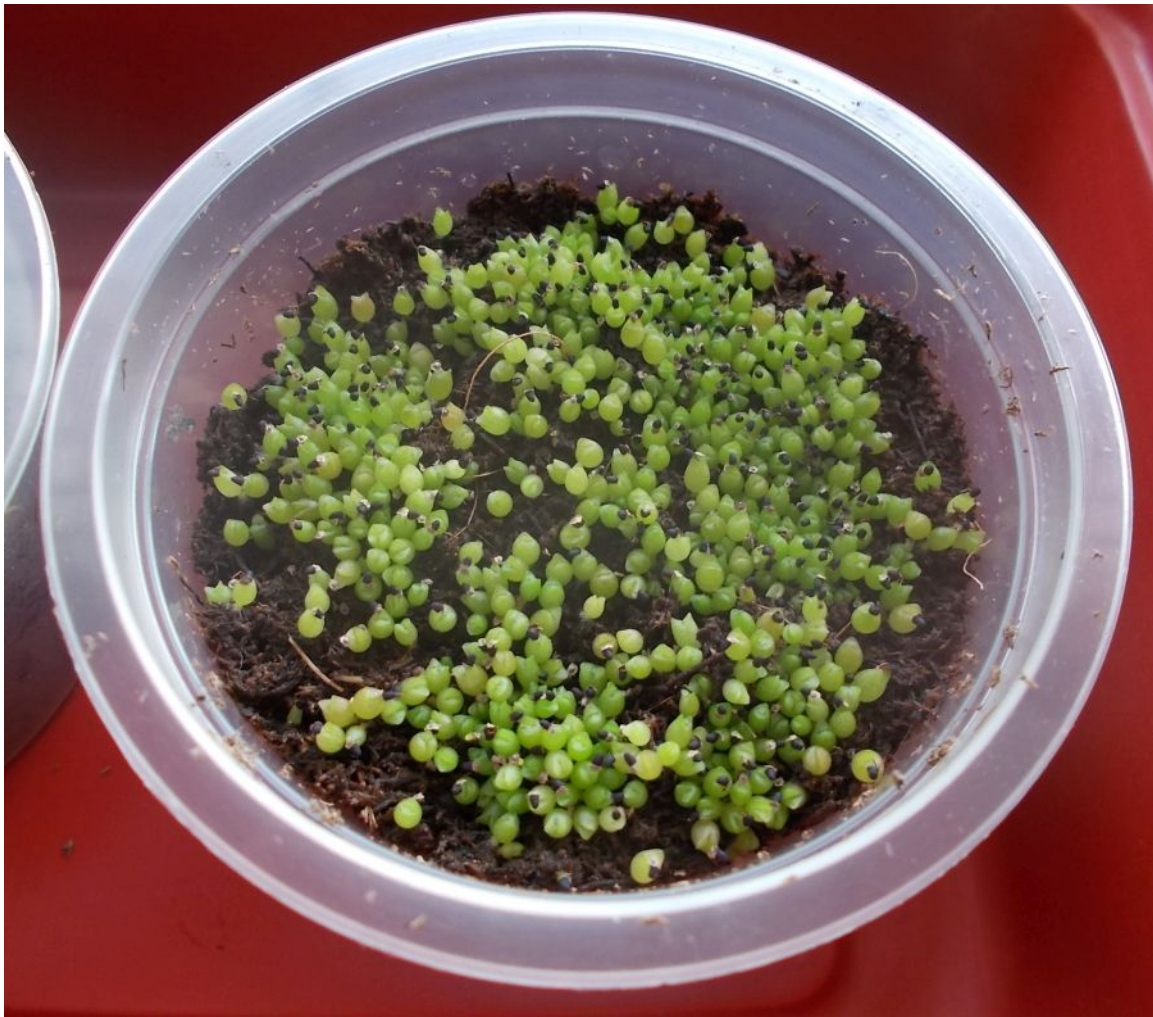


The two pots at +2 days. Plenty of seeds were germinating. (2019-04-01)



At +5 days. There are more than 200 seedlings in the two pots. (2019-04-04)

The 'pots' are disposable plastic containers with no drainage. Inner lip diameter is 66 mm. I did not expect to apply fertilizer for many months, so salt build-up should not be an issue. Also, if I water the jiffy peat with so much water until it needs draining, the peat will be very moist for many days and the PClav seedlings may suffer health issues. If you're unlucky, they may die en masse.



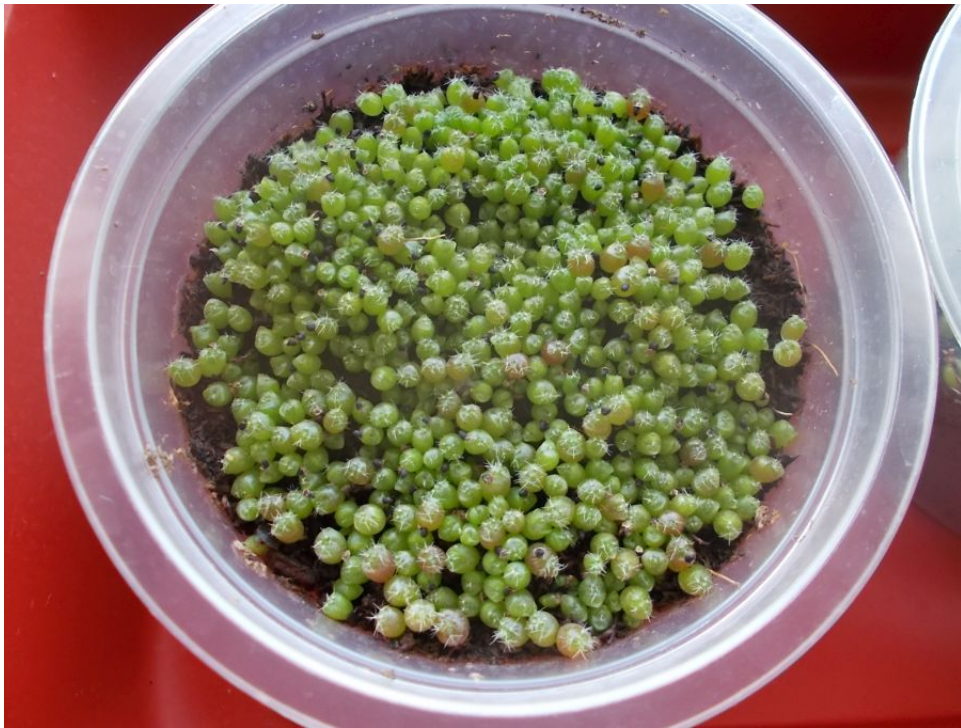
The right pot at +9 days. (2019-04-08)

In an effort to maintain milder conditions, the two pots were placed in a plastic container with a clear lid². The lid is never completely closed; there is always some space for air exchange so condensation never builds up. A covered container will reduce evaporation, so the moisture content of the jiffy peat mix would not change too quickly. The container and the pots are near a window, so they do experience changes in temperature and humidity.

I also thought the cover would reduce contamination: fungi, algae and bugs. In the event, some algae build-up was likely to have started due to an algae-contaminated sprayer. Fungus gnats were few and far in between for these two pots, so the cover probably helped. There was no damping-off due to fungi – I would credit this mostly to being able to maintain a moist and not overly-wet potting mix, but perhaps the cover helped a bit.

Germination was fast and germination rate was probably very good; I did not count the number of seeds sown. There was some crowding, and some seedlings were weak because their roots could not properly reach the potting mix. In general, the first weeks were rather trouble-free.

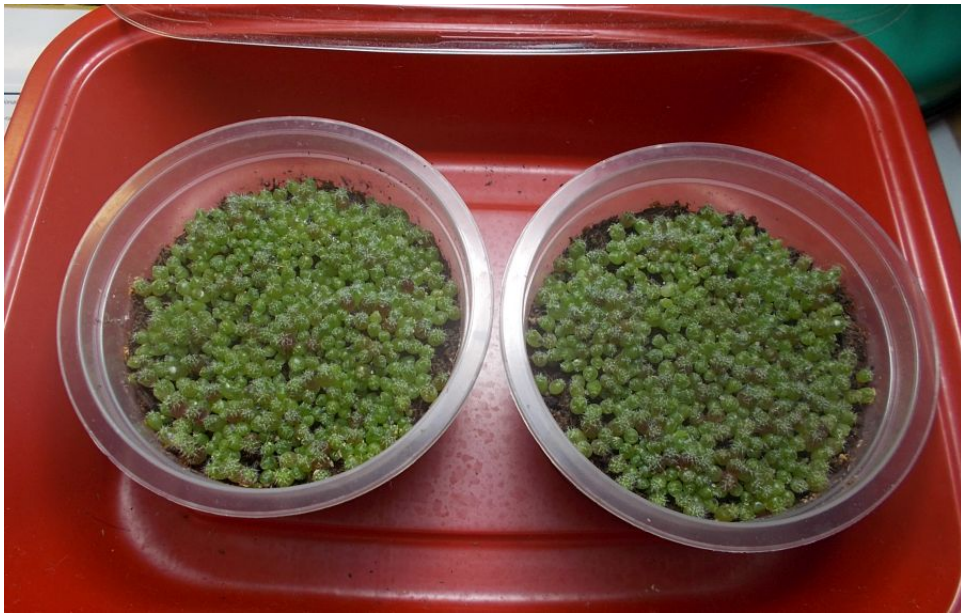
² These disposable containers are from Japanese-style takeaway meals, so I call them disposable Bento containers.



The left pot at about 2 months old, late May 2019. Although it's possible to transplant these seedlings into a bigger pot, I wanted to test the potting mix for a longer period of time. Crowding caused many seedlings to be lifted up.



A closeup of PClav seedlings in the right pot on the same day. (May 2019)



The two pots after about 3½ months, in mid-July 2019.



The right pot at about 3½ months on the same day. (July 2019)

Jiffy peat is a good potting mix for starting PClav seedlings, and they grew quickly during the first few months. I think growth speed is probably due to the fertilizer in the peat. The challenge is to keep the peat nicely moist for a long time, which is easier said than done in the tropics. Careful watering was done using a sprayer at first, but later I switched to a disposable plastic pipette.



A closeup of the left pot at about 3½ months on the same day. The crowding won't end well for a lot of these seedlings. (July 2019)

Precocious Germination of PMag Seeds

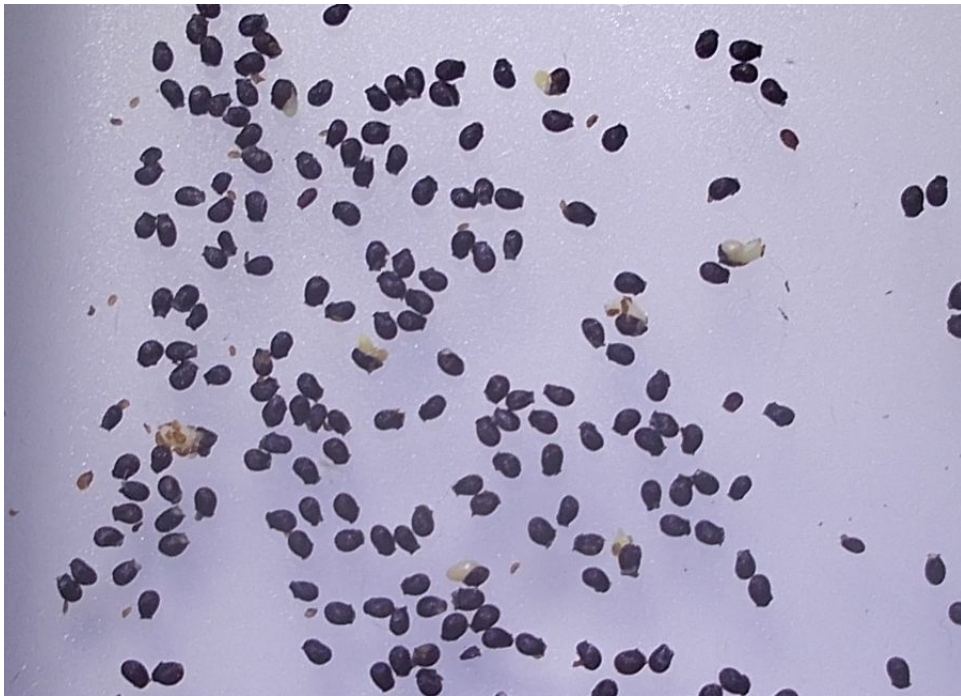


Harvesting a PMag seed pod in early February 2019.



The white bits are seeds that have germinated prematurely. (February 2019)

During wet or humid weather in the tropics, one may encounter seeds that are already germinating as the ripe seed pod detaches. During 2019, I have at times picked out such precocious seeds to be sown in a common pot.



A closeup of the seeds on a tray. A precocious few are germinating. (February 2019)



The precocious seeds were picked out and germinated on wet tissue paper. (Feb 2019)

I don't think this form of precocious germination means that PMag seeds are defective in any way; this is probably a minor issue only for growers in the tropics, and it is due to humid conditions. As of 2020 and later, I don't pick out precocious seeds because I have plenty of seeds collected and stored.



At +2 days. The seeds are germinating normally. (February 2019)



The next day, at +3 days. PMag seeds are not dormant when the seed pod detaches, so some end up germinating when conditions are humid. (February 2019)



At +6 days, in mid-February 2019.



The seedlings were transplanted on the same day into a disposable container with a potting mix of jiffy peat. (February 2019)

Parodia Seedlings in a Common Pot



The precocious PMag seedlings at 3 weeks old, in early March 2019.



A month later. Two more batches of precocious seeds have been added, making it a common pot of sorts. At upper right are *Haworthia limifolia* seedlings. (April 2019)

Most of the precocious seedlings were PMags, because my PMag specimens tend to produce a lot of seed pods. In 2019, my records show a total of 43 PMag pods and only 7 PClav pods. There wasn't any GBald seed pods until July 2020. This common pot was maintained somewhat casually, because keeping every seedling alive was not hugely important. The jiffy peat potting mix was fine for a few months. Then problems will start to appear and escalate.



Late May 2019. The oldest seedlings are now 3½ months old.



A month later. The oldest seedlings are 4½ months old. (June 2019)



A top view of the pot. The oldest seedlings are now 5 months old. Here, the potting mix is dryish, but at the edges, some of the peat is already bone-dry. (July 2019)

The problem with using jiffy peat in the tropics – even if the pot is indoors under a lid – is that hot and dry weather will tend to dry out the peat. There will be a few days when the evaporation rate is very high. Pots dry out very fast on such days. This pot was carefully watered so that the peat wasn't too moist for the cactus seedlings, but that wasn't enough to maintain moist conditions everywhere in the potting mix. Adding more water to moisten everything then caused an algae bloom, because algae love very moist conditions and they may have arrived via a sprayer.



Removing the top layer of jiffy peat in an attempt to control algae. (September 2019)



Late October 2019. The oldest seedlings are now 8½ months old.

Since the jiffy peat contains some fertilizer, algae tend to spread very fast if the conditions are moist enough. Algae also binds the top layer of peat together, hampering the downward movement of water. The peat inside the pot will then dry up, and you will have trouble getting it wet again. Adding more water helps the algae by giving them a very moist environment on the surface. When algae gets the upper hand, some of the seedlings will start to die. And oh, fungus gnats like to eat algae.



The oldest seedlings are now 1 year old. The arrow points to a thick patch of algae. There are tiny bits of algae everywhere on the peat surface. A piece of cinnamon can be seen on the lower right – it didn't repel the fungus gnats. (February 2020)



About 7 months later, just before transplanting. The common pot is on the left while the *H. limifolia* pot is on the right. I had given up on removing algae by this time. The larger seedlings are somewhat tough and many survived. There was even a fern gametophyte (arrow) in the common pot! (September 2020)

Hyperhydricity Issue with PClav Seedlings



An earlier experiment, mid-March 2019. The pot on the left has germinating PClav seeds, while the pot on the right has germinating PMag seeds.

Here are two pots started about two weeks before the two-pot PClav sowing. As an early experiment, it was somewhat haphazard. In the picture above, you can see that the jiffy peat potting mix is not well broken up, and looks sort of wet.

In this section I will highlight an issue that cropped up with the PClav seedlings. Some PClav seedlings suffered from *hyperhydricity* and more than half died. I'm pretty sure it wasn't fungi or damping off – you can see the pictures in the following pages and judge for yourself. The problem did not appear among the PMag seedlings.

Hyperhydricity is a physiological malformation often encountered in plant tissue culture³. Generally, hyperhydric plant tissue has a translucent or glassy appearance. In the past, hyperhydricity was known as *vitrification*. In tissue culture, hyperhydricity is commonly seen in liquid-grown plant cultures.

Why did these PClav seedlings suffer from hyperhydricity? The likely answer is the initial wet conditions of the potting mix. This is why I later squeezed excess water from jiffy peat so that they feel moist instead of wet. Wet conditions *plus* a covering lid is bad news for cactus seedlings.

³ Paraphrased from Wikipedia: <https://en.wikipedia.org/wiki/Hyperhydricity>



The PClav pot at the end of March 2019.



The PClav pot in late May 2019. Some seedlings are not growing at all.



A bit over two weeks later, June 2019. Many of the hyperhydric seedlings are losing their green colour and some are starting to die off. Note the healthy PMag seedlings in the other pot at the upper right.

Looking at the pictures, it is apparent that the problem didn't start in June 2019. It probably started quite early on. In the May 2019 picture, you can see that some seedlings are simply not growing and they look slightly discoloured. So the seeds germinated, then something went wrong and the seedlings went into a slow decline. But a few PClav seedlings are growing normally – a strong case against fungi as the cause of the dying off.

Always remember that these pots are placed in disposable bento containers with its clear lid loosely in place. The clear lid is usually taken off before pictures are taken.



A month later. Generally, hyperhydric seedlings do not recover. (July 2019)



Late October 2019. Most of the hyperhydric PClav seedlings are dead and have been removed, but a few are still barely hanging on.

This problem with PClav seedlings is not due to fungi or damping-off. The slow decline of the damaged seedlings was spread out over a period of at least *five months*. Their translucent or glassy look did not change as they shrunk and died. There were no signs of browning or rotting due to fungi. In October 2019, a few damaged seedlings were still barely hanging on. So I suspect that we are really looking at hyperhydricity caused by cultivation conditions.

Some useful open-access scientific papers can be found on the topic of hyperhydricity. I found the following open-access paper very informative:

Rojas-Martínez *et al.*, **The hyperhydricity syndrome: Waterlogging of plant tissues as a major cause**. URL:
https://www.researchgate.net/publication/241869171_The_hyperhydricity_syndrome_water_logging_of_plant_tissues_as_a_major_cause
In **Propagation of Ornamental Plants** 10(4):169-175, December 2010.

Two of the authors have also written a more accessible open-access article:

Rojas-Martínez & de Klerk, **Drowning from Within - Hyperhydricity in plant tissue culture**. URL:
https://www.researchgate.net/publication/254835625_Hyperhydricity_in_plant_tissue_culture_Drowning_from_within
In **Prophyta Annual 2010**, January 2010.

Plainly speaking, in hyperhydricity a plant is water-logged due to overly-wet or humid conditions. When the places where a plant has air spaces are water-logged, it can no longer conduct air exchange properly. In other words, the plant tissue is drowning. Other mechanisms may play a part and eventually this leads to the death of the plant.

In the case of my pot of PClav seedlings, the primary cause could be as simple as accidentally putting on the clear container lid a little too tightly for a few days while the potting mix was wet. PMag seedlings may be more resistant to hyperhydricity. Very humid conditions plus poor ventilation are probably dangerous to small cactus seedlings, and newly-germinated seedlings may be more at risk of hyperhydricity than seedlings that have grown some spines. Once damaged, the PClav seedlings never recovered. So if you ever want to try the baggie method of germinating cactus seeds, make sure you use a moist potting mix. Never use a wet potting mix. Cactus seeds do not need wet conditions to germinate – moist conditions will do fine.

This incident raises the interesting possibility that not all incidents of cactus seedling damping-off are due to fungi or microorganisms. Some may simply have been hyperhydricity brought about by incorrect cultivation conditions. If you have had problems with damping-off in the past, it may be a good idea to regularly take pictures to document the progress of your cactus seedlings. Looking at the pictures of these PClav seedlings, I am convinced that a fair number of damping-off incidents are really cases of hyperhydricity.

Back to the PClav Two-Pot Sowing



The two pots of crowded PClav seedlings at nearly 7 months old. (October 2019)

As the PClav seedlings grew bigger in the two pots, there is crowding. Since the peat surface was now more or less fully covered by the seedlings, algae growth was almost non-existent. There were one or two fungus gnats, which I controlled using a pyrethroid-based household insecticide solution. The biggest problem though, was the jiffy peat potting mix.

It seems that jiffy peat used in this way for growing cactus seedlings in the tropics is only good for six months or so. Keeping all of the potting mix nicely moist appears to be almost impossible. The urban tropics have heat waves that will mess up your peat-based potting mixes, even indoors.

Heavier waterings inevitably leads to algae growth, because of the fertilizer content of the peat. And algae growth will attract fungus gnats, even if you have mosquito netting on your windows⁴. The baggie method is one option, but I have zero experience with it. Alternatively, one can build a small terrarium with artificial lighting – this will give your seedlings a closed, protected environment and you'd still be able to take them out for inspections.

I think for growers in the tropics who want to grow cactus seedlings, jiffy peat is a clean potting mix that you can use as long as you don't keep your seedlings in there for too long. Just remember: never use wet jiffy peat, think about how to keep the peat evenly moist, and transplant when parts of the potting mix start to dry out.

When watering small pots of seedlings, I now use disposable plastic pipettes and boiled water. It's important to use clean containers or tools to water your seedlings, if you don't want to introduce algae into your pots.

⁴ Fungus gnats can breed in your drain plumbing. Look for those tiny flies in your bathroom.



The left pot in mid-September 2019. There is more variation in the sizes of the seedlings now, because some seedlings are out-competing other seedlings.



The right pot in mid-September 2019. The arrow points to a dried, dead seedling.



The left pot in February 2020. The cinnamon pieces were intended as a fungus gnat repellent – I don't know if it worked. There are some Captan fungicide stains because I initially thought there was a fungi problem. Instead, seedlings were probably dying because of competition and stress due to the drying potting mix.

Since I wasn't planning to transplant about two hundred PClav seedlings outdoors, I left them to grow in the pots. As crowding worsened, some seedlings out-competed others. The stronger seedlings grew taller while many weaker seedlings shrunk and died out. Much of the jiffy peat potting mix has dried out by now and cannot absorb water properly – this added to stress on the seedlings. This is what happens when you leave seedlings cramped in a pot for too long.

I do not believe there was any fungi issue, although at that time I applied a spray of Captan fungicide once or twice. When I finally transplanted these PClav seedlings in early March 2021, it looked as though the primary killer was root competition among the seedlings. The surviving seedlings had stronger root systems, while the roots of dead seedlings have been crowded out.

The progress of the seedlings after transplanting is the subject of another experiment and will be presented in a future chapter. Due to the hot tropical weather, the jiffy peat and the roots of the seedlings were all glued together in large lumps. Getting the lumps properly wet was a problem, and teasing out all the roots was more or less impossible. So I decided to take drastic action – just the stems of the PClav seedlings were transplanted, without roots. They were almost 2 years old at that point, so I expect quite a few to survive the treatment. We'll see.



A closeup of the right pot in mid-October 2020. The seedlings are now a bit more than 1½ years old. The arrow points to one of the many dead seedlings.

For new seed starts in 2021, I used a commercial soil mix instead⁵, plus coarse sand as a mulch. Since I aim to keep seedlings in their pot for as long as possible, I avoided using jiffy peat. Another objective is to avoid the fertilizer content in jiffy peat pellets. I want to use a minimum of NPK fertilization to avoid overly plump and green seedlings. As a bonus, hardier seedlings with less nitrogen content may be less attractive to bugs. This means that growth speed is not a priority for me.

The challenges in caring for cactus seedlings in the hot and humid tropics are not insurmountable. Thanks to these experiments, I know a lot more about what works and what does not work. Once we have fine-tuned the details of a suitable cultivation scheme, I'd say that it's not really hard to grow these cacti from seed indoors in the tropics. ♦

5 Baba Vegemix. It's a synthetic mix that is usually quite clean. Check the soil and remove any large bits before use.

Version Information

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Colophon

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All pictures used to produce the images in the document were taken by the author unless otherwise stated. Images are not meant to be of art print quality. The pictures were taken by unsteady hands without a tripod, then they are cut or resized and finally resampled to about 150 DPI and a JPEG quality of 80 for screen reading and also to keep file sizes manageable.