A Swampy Lifestyle for a Cactus

After 18 months in a pail, August 2022. The PMag is tilted to show young ferns. The part that grew while the plant in the pail is bluish green.

The following piece is part of a collection of writings published on the [Practical Small Cacti Malaysia site](#).

Introduction

PClavs and PMags are large *Parodia*s that have strong root systems. They can grow quite fast in rich soil under mild conditions – their thick roots are very robust. But if you are thinking about "cactus hydroponics", such plans will likely be stymied by a growth bottleneck caused by CAM respiration. A pail is a simple alternative; it's halfway between soil and hydroponics. I like to describe the conditions in the pail as "swampy". Surprisingly, it appears to work rather well.

Nicknames for Scientific Names

PMag = *Parodia magnifica*
PClav = *Parodia claviceps*
GBald = *Gymnocalycium baldianum*
MGeo = *Myrtillocactus geometrizans*

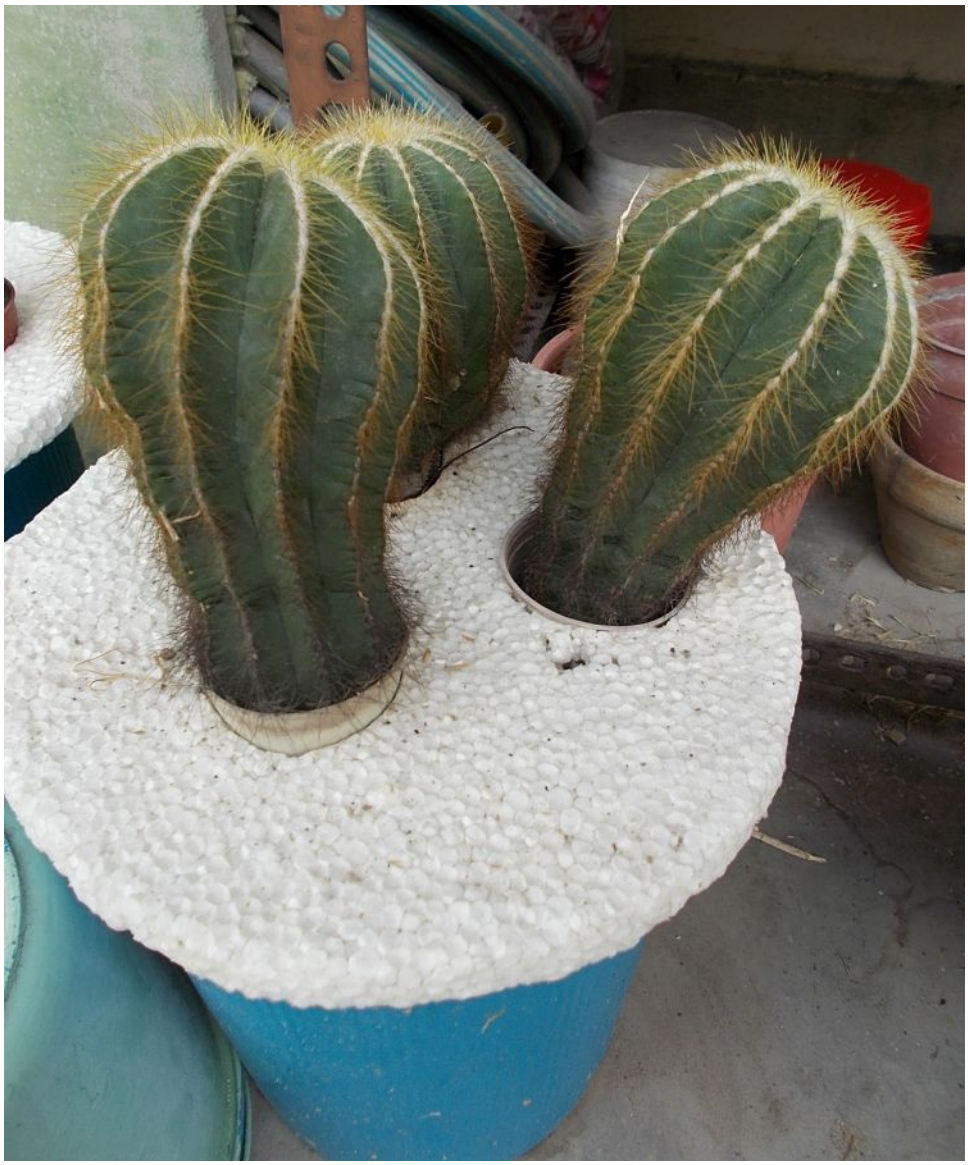
This naming scheme is purely for convenience. Just think of them as webchat nicknames. Other nicknames and additional notes can be found in the appendix to the third chapter.

A Bit About Past *Parodia* Hydroponics Experiments

Three PMags in a DWC pail. This was in August 2014, so these PMags did not get any fortified sprays – they got their nutrients from the hydroponic solution.

I have experimented with GBalds, PClavs and PMags in DWC (deep water culture) hydroponics in the past. Growth can be excellent (see the picture above), but there are complications. For GBalds, roots in DWC are flimsy and shed easily. One or two GBalds died due to wet lower stems rotting. PClavs and PMags did not rot, grew well and are very robust, but they tend to expend too much resources on growing roots, leading to suffocation. When you lift the cover, there is a kind of smell reminiscent of a dying, water-logged root ball. DWC is interesting, but it’s not a magical solution.

Not all species will be suitable for hydroponics. PClavs and PMags happen to be very robust.

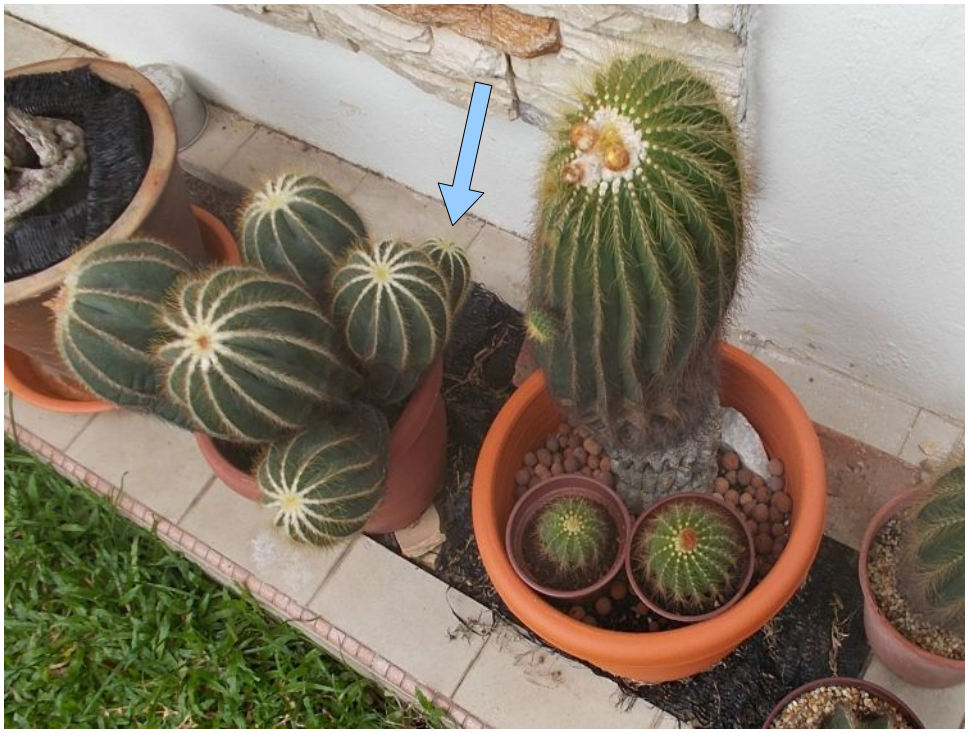


The three PMags 14 months later, October 2015. The one on the left has a slanted apex, which I now recognize as a sign of maturity (and willingness to flower). Back then, I was just annoyed at them bending over, so I rotated the pail 180 degrees.

Any hydroponics setup will require some maintenance. Insects will eventually get inside the DWC pail and you may see squirming larvae in the solution after a few months. The nutrient solution then needs to be replaced, or you will need to add an insecticide. And so if you are thinking of going big with cacti in hydroponics, think about long-term maintenance needs too.

Growth is still slow compared to say, vegetables in hydroponics. I now think that these DWC cacti are still bottlenecked by CAM respiration. No amount of nutrient solution will make them grow much faster. As of 2023, I am reluctant to start doing DWC again because of the extra maintenance workload. But “wet” cultivation is still rather intriguing (and tempting), and so “cactus in a swamp” was born.

History of the PMag Before the Pail



The arrow shows the “pail PMag” when it was still an offset. (Aug 2018)

The swampy PMag in a pail started as an offset of the big PMag specimen. When the latter was repotted in December 2018, the offset was removed, because I was going to let all the other stems lean in one direction – it was easier than trying to constantly rotate the heavy pot plus plant to cancel out the leaning of a species that tends to lean.

Resting in an empty pot in early March 2019, just over 3 months after being detached.
I wasn’t keen on growing too many PMags, so it was expendable.

Left: At 6 months after potting up, October 2019. There is a lot of healthy new growth. The small cactus is a surplus *Echinopsis subdenudata* offset.
Right: The first bud is just visible 10 months later in August 2020. The PMag is wet after being sprayed with fortified water. Colour rendering is slightly different due to different point-and-click cameras used.

While PMag is a great species to grow, I generally prefer solitary stems, so I try not to keep too many PMags around. But since it wasn't very crowded with plants yet, I potted up the stem in early April 2019 in a mix of mostly coco peat. But it was more or less treated as a surplus specimen, kept as a spare.

In 6 months, the PMag expanded and grew a lot. New growth can be seen as the bluish green upper part of the stem (see the above left picture), with lighter spines and new, white wool. It received virtually zero care, apart from the usual fortified water. You should get good stem growth as long as a PMag is not pot bound, so it doesn't take a lot of effort to grow nice-looking PMags.

The first bud of the specimen was detected 16 months after potting up (see the above right picture). About 5 weeks later, the flower opened (see the next page). This PMag went from detached stem to flowering cactus in just over 20 months (Dec 2018 – Sep 2020). Not bad.

The PMag with its first flower in the midday sun, in early September 2020.

A year later, September 2021. The pail PMag is at far left (blue arrow). Two of the PMags (orange arrows) were from the blue plastic DWC pail seen earlier.

That was about as far as the PMag went. There were no more flowers and little or no new growth. It had been in the small pot for nearly 2 years at that point, so there probably isn't much more room for its roots to grow. It spent the next year slowly shrinking, bit by bit. Conveniently, neglecting the specimen was a simple way to study how a badly pot-bound PMag behaves.

Anyway, if I really need it to look like a nice and proper PMag, the specimen can always be revived by repotting it. That's what spares are for. It's a very robust *Parodia*.

Start of the Pail Experiment

By early 2022, it looked to be in obviously poor condition. Clearly, it was suffering. The lower stem was so wrinkled and shrunken that I finally got around to repot it (see pictures on the next page). It had produced one flower before, after all.

It looked like the PMag did a lot of shrinking. While PMags can have their lower stems lose the green chlorophyll and turn woody (or corky), most of the woody parts of this specimen are from its time as an offset of the big PMag. Note the PMag style of shrinking – lots and lots of wrinkles.

The PMag just before removal from its pot. (February 2022)

Another view of the somewhat shrunken specimen. (February 2022)

Now, that’s a packed root ball. It’s no surprise that I had trouble getting the potting mix properly wet. Under the pot (arrow), there is a bit of mealybugs, but none are visible on the root ball. Mealybugs do not like PMag roots. (February 2022)

It’s a surplus PMag, so instead of trimming the roots and repotting it properly, I opted for more experimentation. Experimentation means more data. Here it is soaking in a pail of water so that the root ball is properly wet. It was soaked for about an hour. Then most of the water was poured out and the PMag was left in the pail. (Feb 2022)

Almost immediately, I got some useful pictures out of the exercise. Here is the root ball the next morning, with some new root tips after just 16 hours. (Feb 2022)

A closeup of the top surface of the root ball. In 16 hours, new root tips have appeared. I guess the root ball hasn’t been properly moist in a long time. (February 2022)

The quick growth of new root tips is not unexpected; cacti are expected to react quickly to take advantage of rain. It's easy to see these things when there is no pot to block your view.

Cultivating a PMag in a pail allows us to learn about how it behaves in usually-wet "swampy" conditions over many months. It would be useful if you are thinking about flood and drain schemes for pushing these cacti to grow fast. By allowing the root ball space to expand and grow some new roots, it can show how pots limit the growth of fast-growing cacti such as these *Parodia*s by constricting their root systems.

I also want to compare this experiment with past PMag DWC experiments. The wet root ball can be compared to PMag roots in water in a DWC pail. The roots in a wet root ball should be healthier than the sickly PMag roots in DWC. This PMag in a pail also does not get any special fertilization. We can compare its performance to the DWC PMags. These days I am not so keen on feeding my cacti with anything that is high in nitrogen, so with "swampy cacti" we avoid the use of A/B hydroponic mixtures. Cacti grow slowly so regular A/B solutions are overkill. Also, PMags in DWC arguably wasted much of the fertilizer growing roots to the point of suffocation.

So, it's an experiment to collect data and maybe gain some useful insight. It does not target optimal or peak performance like a lot of agricultural research papers focused on crops or mass production of horticultural plants. I look for simple things that work, that's all.

Left: After 2 days, the stem looks a bit better, with fewer wrinkles. (Feb 2022)
Right: New growth is just visible after 9 days in the pail. (Feb 2022)

Maintaining a PMag in a Pail

Left: After exactly one month, new growth at the apex of the PMag is obvious. It is no longer wrinkled and the top of the stem is becoming wider. (March 2022)
Right: About 1½ months later at the beginning of May 2022. The ribs of the older lower stem is now at maximum girth. Note the lines on the stem that used to be wrinkles. Low amounts of feeding has kept algae at bay. Instead, a carpet of fern gametophyte has grown on the top surface of the root ball.

The PMag is kept in generally wet conditions. Water is added by watering the root ball until there is a thin puddle of water in the pail. Fortified water is used when I am spraying the other specimens, otherwise it's tap water for the PMag. Normally, the puddle will dry up in a day or two. Small amounts of water has no problem evaporating in a tropical concrete jungle.

The pail protects the root ball from the wind, reducing evaporation so the root ball never really dried out completely. Even when water in a pail has dried up for a few days, there is enough moisture inside the root ball to keep the outer layer of the root ball barely moist. So, the conditions inside the pail is really kind of swampy – wet nearly all the time.

The root ball was also flushed with extra water a few times, for example when small insects were seen crawling about. The inside of the pail was kept reasonably clean, free of any obvious signs of algae or slime. With quite limited feeding, there was zero issues with salt deposits.

Left: After 4 months, with young ferns keeping the PMag company. (Jun 2022)
Right: After 6 months in the pail. Much of the ferns have been removed. (Aug 2022)

Much of the growth of new roots is near the base of the root ball, where it is wetter. Surprisingly, there is barely any sign of algae. The root ball was later wrapped in a piece of non-woven nappy liner because parts of it was falling apart. (August 2022)

The PMag with its root ball wrapped in nappy liner in December 2022. After about 4 months, there is a lot of algae on the liner. Perhaps the white liner makes the algae's green colour stand out better, but more likely the liner is wicking moisture and concentrating salts, leading to enhanced growth of algae.

Conclusions After One Year in a Pail

After one year, I have learned a fair bit about growing PMags the swampy way. Remember, such tricks work for robust cacti like PClav and PMag. Since I have done PClav DWC before, I think a swampy PClav will behave in a similar way. You can try other species at your own risk. If I get another flower out of this PMag, I'll declare the experiment a success.

I think the pail PMag doesn't grow much faster than a repotted PMag, so there is no clear advantage in using a pail. Both systems have new roots to promote growth, but in both systems we can't make them grow faster simply by force-feeding fertilizer – we are still hobbled by cactus physiology: slow growth. Cactus hydroponics has the same problem. There is no "big win" that can automatically make hydroponics a no-brainer to use on cacti.

To put it in another way, CAM respiration is the bottleneck. The PMag doesn't breathe all the time; stomata open only at night. The carbon dioxide that it can use is limited by the finite amount of resources the plant can use for the CAM respiration cycle each day. You are building a house, but you only get one pile of bricks each morning. Generally, we are stuck with this speed limiter.

The PMag in a pail (blue arrow), now much larger, posed with the two PMags that used to be in DWC (orange arrows) in late October 2022. This was taken about 13 months after the picture on page 7 which shows the same trio of PMags.

Even with the limitations of CAM respiration, PMags can grow pretty fast. Looking at the PMag in the pail, I think that natural max-speed growth requires *fresh, growing roots coupled with a fresh, growing stem*. This gets the plant hormone signals running properly in the cactus so that nutrients and resources get utilized efficiently. In this way, we are making good use of the plant's limited machinery for growth.

This experiment affirms the importance of repotting when it comes to growing PClav and PMag well. Repotting maximizes root growth and root health. The root tips will then signal the stem apex to grow. Remember also to apply the appropriate nutrients. Gymnos on the other hand can be very fickle – sometimes they just refuse to grow given ideal conditions. I am still trying to make sense of their behaviour. PClav and PMag are two species that happen to be somewhat predictable and reliable in how they behave in cultivation.

Of course, one can bypass the headaches of dealing with growing techniques. One way is to dope them with suitable hormones. Another way is to graft the specimen. Of the two, I lean towards grafting, but only for GBalds. I am likelier to use PClav or PMag as rootstock.

PMag in a Pail – Progress in 2023

The PMag in early May 2023. Growth is steady. In this picture, the root ball is nearly dry on the outside and algae is well under control.

In 2023, I initially maintained low levels of NPK feeding, electing to water the specimen with fortified water most of the time. This feeding strategy contained the growth of algae. Growth was steady, but perhaps slower than it would be if the PMag was in rich soil. The PMag also grew a lot of roots on the nappy liner (picture above and on the next page) to capture moisture.

From May 2023, I started feeding the PMag more aggressively. This quickly led to an algae bloom. It does not appear to harm the cactus, however.

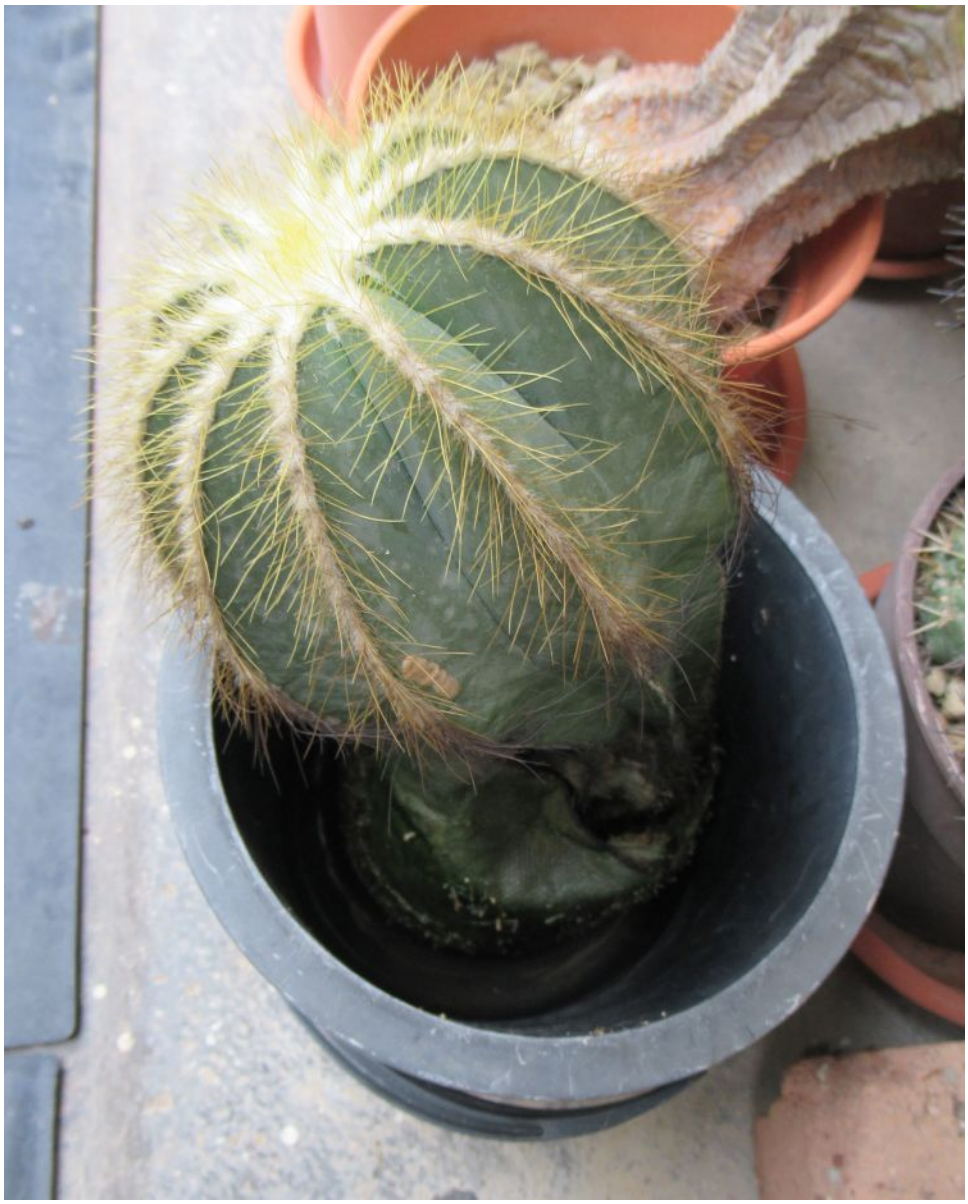
Left: Looking down inside the pail, late June 2023. It had just been watered; there is a bit of standing water in the pail. The nappy liner looks mostly green due to the algae bloom.

A closer view of the nearly-dry root ball in early May 2023.

The underside of the nearly-dry root ball in early May 2023.

By August 2023, the nappy liner had a thick layer of algae in places. The PMag appears to be doing well in spite of all the algae.

The root ball in August 2023. The root system and the nappy liner is still wet. A lot more roots have grown over the nappy liner. Nothing is turning black and falling off.



The PMag in late September 2023. Note the woolly apex of the PMag, plus bits of wool shed between the ribs.

In Klang Valley, Malaysia, the weather throughout most of 2023 was often wet and cool, making it a continuation of the wet year of 2022. El Niño is supposed to be dry and hot in these parts[1], but I haven't seen its effects yet. Due to the often wet weather, feeding has been spotty but this PMag is doing well. By late 2023, the apex of the PMag has become quite woolly. Usually this means that the cactus is willing to flower – but this PMag hasn't done so. I think the lack of a good bit of hot weather is holding the PMag back.

While it's a fun experiment, I don't think having a dozen cactus in pails is a fantastic idea. But such experiments can help us understand better the behaviour of some cacti. ♦

1 In the US, NOAA had announced the arrival of El Niño in June 2023.

Version Information

This is the December 2023 Edition of this document.

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Colophon

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