Hooray for Healthy Roots

A small GSteno in bloom, posed in front of a cardboard panel, March 2021.

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

Introduction

In March 2021, one GSteno (picture above) and one GStella (picture on the next page) produced flowers. Both specimens were offsets from larger specimens, rooted in a tray of rocks, and then potted up in a layered, rocky mix.

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.

Healthy Roots are a Good Thing

To be sure, GSteno and GStella are quite reluctant to flower in the hot and humid tropics, so I do not expect these specimens to be prolific in flower production. It's impossible to tell what finally pushed these two plants to flower. It could have been changes in the weather. It could have been time spent in the tray of rocks, acting as a rest period. But one thing that certainly helped was their healthy root systems. Healthy roots is the foundation upon which other things are built. In the next section we will look at the challenges in getting a *Haworthia limifolia* back on its feet.

A GStella with a bud in March 2021. This is the smaller of two specimens that were moved into individual pots in September 2019, as seen in the Roots in Rocks chapter.

Left: My second *Haworthia* specimen growing well in February 2020.
Right: A flower stalk appearing about 3 months later, in May 2020.

Keeping a HLimi (*Haworthia limifolia*[1]) Alive

I keep a few species of succulents that don't do too badly in the hot and humid tropical climate of Klang Valley, Malaysia. Most commodity succulent plants that I have bought over the years are no longer alive, but some species managed to survive the challenging tropical conditions and uneven care. One of them is *Haworthia limifolia*, which I will nickname HLimi for this discussion.

It's a small rosette species from South Africa that does not occupy a lot of space in one's collection. A healthy specimen of mature size is willing to flower in the tropics. I have one old specimen and one smaller specimen that is either an offset or a seedling of the larger plant. The larger specimen is more willing to produce flower stalks.

My HLimis do not get attacked by bugs, because it's much easier for the bugs to attack nearby *Echeveria* specimens. So this is a fairly maintenance-free succulent species for the (sheltered) tropical garden. However, there is one complication with this species: Even though it is being grown in a tropical climate without significant seasonal weather, occasionally HLimis will attempt some kind of dormancy action. In the process, a specimen may lose all its roots and on one occasion my smaller HLimi specimen (picture above) appeared to have trouble getting started again. This episode will be described in the next few pages – an example of the importance of roots and the fine line between success and failure when it comes to reviving a *Haworthia*.

1 It looks like they've actually made it *Haworthiopsis limifolia* in 2013. Oh great, a name change. The new name doesn't seem to be popular among collectors, though. I finally bumped into it on HLimi's Wikipedia page in 2021.

When HLimis are growing well, younger leaves near its growing point will have a lighter colour. Specimens of mature size may produce a flower stalk, as did this specimen in May 2020 (pictures below) – at first glance it would seem that this is a super-easy species to grow.

The specimen began to shrink after the flower stalk has dried up and was manually detached. Even though there was no change in the weather to push the HLimi into dormancy, it had expended a lot of its resources in producing the flower stalk, and dormancy-like behaviour may have been a natural follow-on event. By October 2020, the specimen has brownish shrunken leaves and the older lower leaves were drying up (see the pictures on the next page.) The plant wasn't quite dying though. It was more like "shrinking into itself."

Left: A week after the previous picture, the flower stalk has shot up. Behind it is a *Gasteria* that has turned into a rosette and has many offsets. It is probably unhappy in the cramped pot, so it is unlikely to flower. (May 2020)
Right: Eight days later, the first flower is about to open on the flower stalk. Its parent plant is the HLimi (see the blue arrow) behind the large GStella. (May 2020)

Left: The HLimi in mid-October 2020, ready for an inspection of its root system.
Right: The specimen out of its pot, showing the mostly dead root system.

Most of its roots fell off easily. This is a view of the underside of the specimen, after a bit of cleaning. The lowest leaves are drying up, while younger leaves are still alive, just shrunken. (October 2020)

A closeup view of the underside showing root nubs (arrows). The middle is mostly dead tissue and will probably not produce roots. (October 2020)

The HLimi specimen after potting up. As an experiment, I used a potting mix of mostly scoria, and some sphagnum moss was placed right under the plant. (October 2020)

The specimen looked worse in late January 2021.

After about 3 months, it was clear that either the plant wanted more dormancy or the potting mix did not work. The specimen shrunk some more, and the leaves became more brown than green. Many more of its older leaves have dried up (picture above.)

According to Altman Plants, *Haworthia*s are dormant during the hottest summer months[2]. So a tropical urban climate may not be the best weather for growing these plants because urban heat waves may promote dormancy behaviour. Unfortunately, succulent growers tend not to put pictures of dormant *Haworthia* specimens on the Internet, so generally I have nothing to use for comparison.

My concern is that an unnaturally long period of dormancy (thanks to an urban microclimate in the tropics) might weaken a HLimi specimen so much that it may have trouble reviving itself. This specimen was looking worse and worse as the months went by. By contrast, my PMag and PClav specimens were able to go without roots for months and they would still look reasonably healthy. As such, I was very much interested in getting the HLimi specimen to start growing some roots again[3].

2 See: `https://altmanplants.com/zebra-plant-haworthia/`

3 Well, I also managed to kill the only *Tillandsia* (air plant) that I have ever purchased, so I get rather concerned when a succulent keeps shrinking and shrinking.

A second attempt at repotting the specimen, early February 2021.

Here is the specimen after a lot of the dry and dead lower leaves were removed. This may indicate that a HLimi cannot maintain this kind of dormancy for a very long time. The lower leaves were drying up steadily. Lose too many leaves and the plant will probably die.

There may be multiple causes for the failure of the HLimi to regrow its roots. The small amount of sphagnum moss dried up too quickly in the hot tropical weather. There was also too much dead plant matter – this left the root nubs high and dry. Apparently the plant did not have the resources to extend its root nubs very far out. (February 2021)

A closeup of the underside of the specimen after cleaning and removing a lot of dead plant matter. The arrows point to short lengths of roots or root nubs. (February 2021)

Seeing the picture of the specimen's underside, it looks like a small and shrunken *Haworthia* does not have the resources to extend its root nubs very far[4]. Healthy HLimi roots are fleshy and thick, so that takes resources that this specimen did not have. The potting mix dried up too fast. Dead leaves also formed a barrier between the root nubs and the potting mix.

Root nubs grow out from near the base of leaves that are still alive, while the lower and older parts of the stem have a lot of blackened, dead tissue and no roots. The solution is to repot the specimen in a potting mix that has more soil and less scoria, while also making sure that the root nubs are in contact with the potting mix.

Once the cultivation issues were corrected, the HLimi bounced back *really fast*. After about a week, the youngest leaves in the center started plumping up and showing signs of life (pictures on the next page.) It was fascinating to see the *Haworthia* revive itself in more or less three weeks flat. So the key to rejuvenation was the roots nubs – the roots had to find something nearby to grow in. In this case, spraying water at the leaves did not help at all; *Haworthia*s need to absorb water via its roots.

4 Or, the root nubs might extend only when it encounters something suitable to grow in.

Left: Six days after repotting. There were signs of recovery near the growing point in the center. (2021-02-10) **Right**: Nine days after repotting. Recovery is clearly evident now, and the specimen is un-shrinking itself. (2021-02-13)

Left: Sixteen days after repotting. The growing point in the center looks almost normal. (2021-02-20) **Right**: Twenty-two days after repotting. The lower leaves are still a bit brown, but the specimen has more or less recovered. The plant is smaller compared to its pre-shrinking size, due to many lost lower leaves. (2021-02-26)

While this shrinking episode and its resolution highlights the importance of healthy roots on HLimi specimens, there are also other issues to ponder. How does a dormant HLimi really behave? Why did this specimen kept losing its lower leaves, if it's supposed to be dormant? Did the tropical climate play a part? Would this kind of dormancy be riskier in the tropics compared to a similar specimen undergoing dormancy in a temperate climate?

Another picture of the specimen sixteen days after repotting. I lifted the plant by its leaves and the pot didn’t fall off. In sixteen days, enough roots grew, pushing against the potting mix so that the pot is held in place. (February 2021)

Left: A new flower stalk appearing, 34 days after repotting. **Right**: Five days later, the flower stalk has grown a couple of inches. (March 2021)

Two HLimi specimens with flower stalks at the end of March 2021. More than half of flowers on the older specimen have opened.

Generic cultivation instructions for cacti and succulents are not always enough for the grower. Here, we have just seen how a small adjustment to encourage root regrowth can revive a HLimi, potentially saving the specimen from unfavourable dormancy-like behaviour.

Taking Better Care of GStellas

Two rooted GStella offsets moved into individual pots in September 2019.

These are two GStella specimens that were grown in a tray of scoria and pumice for 15 months. Then they were moved into individual pots in September 2019 – this was discussed in the Roots in Rocks chapter. They are excruciatingly slow growers – one has to be extremely patient. Surprisingly, one of these produced a flower in March 2021.

This is the parent GStella from which the two specimens originated, in September 2020. It was purchased in January 2002 as a small specimen.

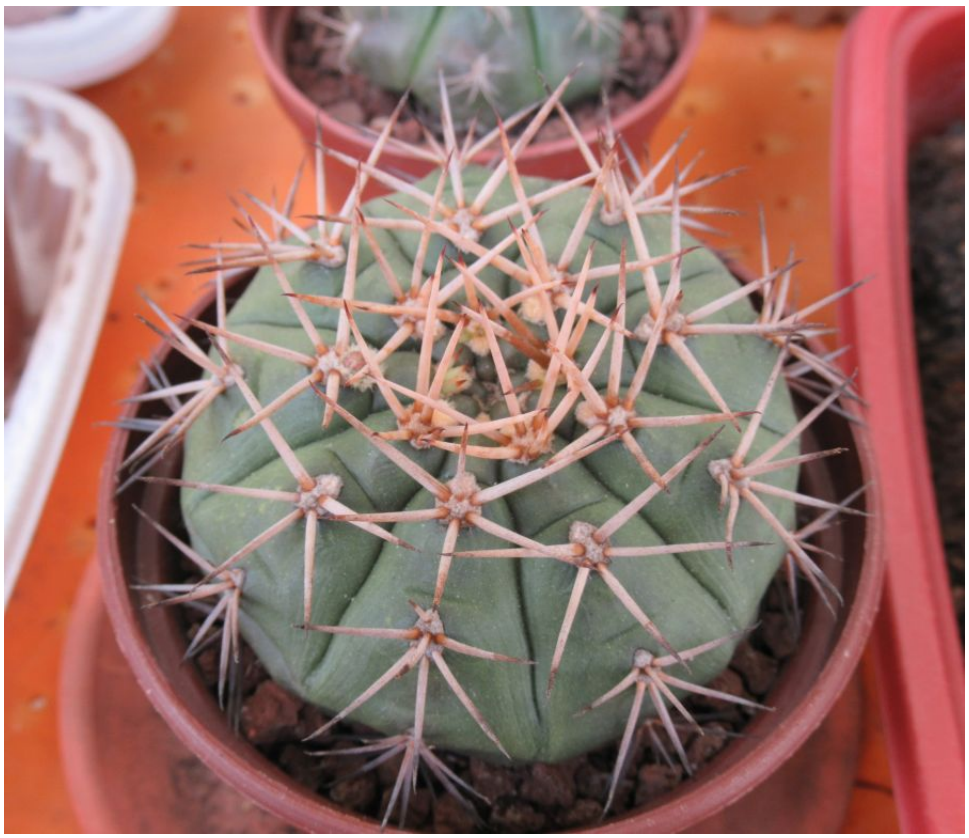
While it looks healthy enough, it appears to be acting like an old cactus that is intent on producing offsets. Many areoles look elongated, with the potential to produce flower buds, but the specimen is unable to do so. Perhaps for this species the tropical climate is not conducive to flowering.

It will take years and years to learn anything useful about the cultivation of this species in the tropics. Luckily, it is a very tough bug-free species. A note of caution: For maintenance-free species, you may unconsciously end up giving them less attention compared to other specimens.

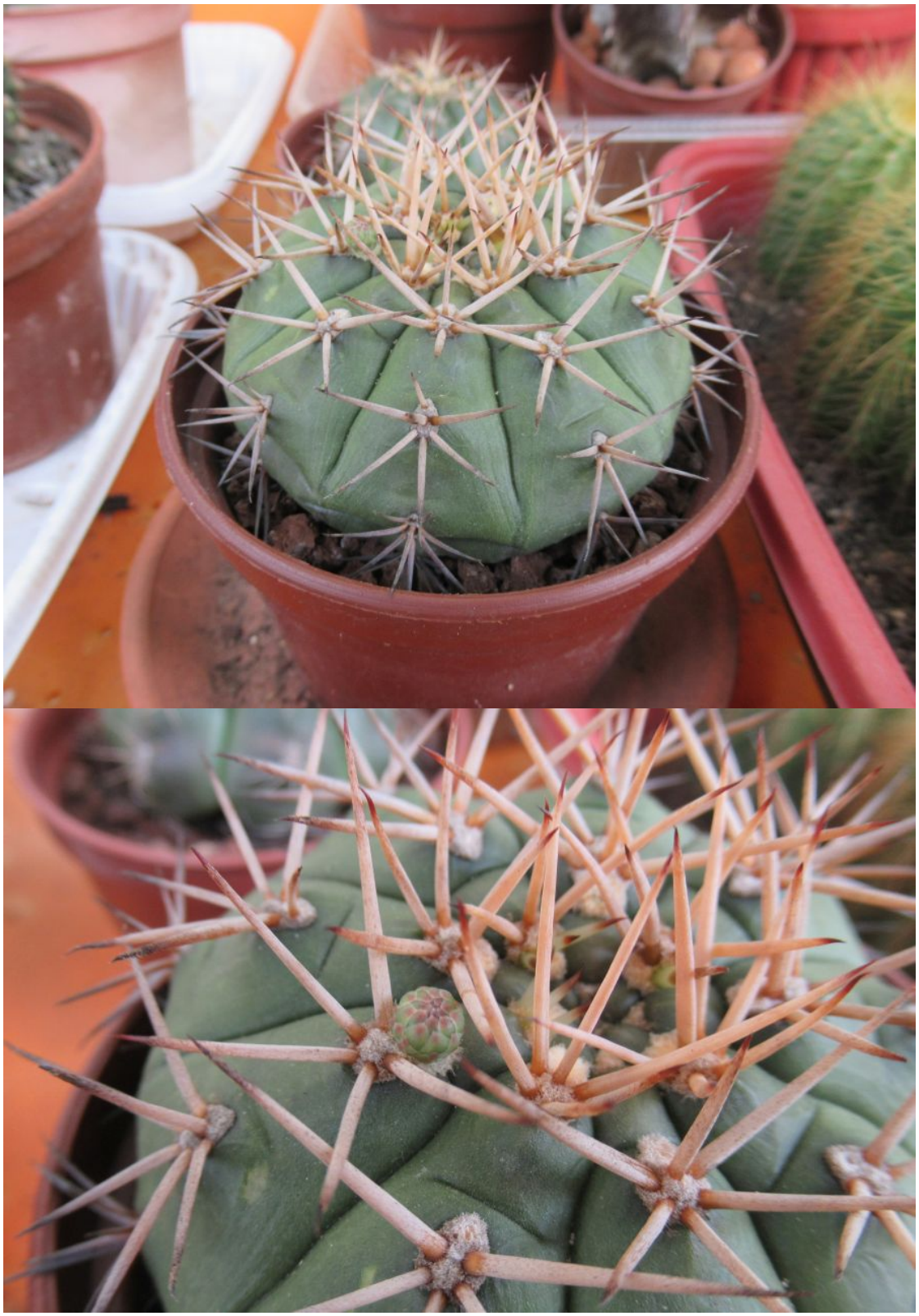
Here are the two specimens (blue arrows) one year later, barely larger. The dense thicket of spines around their growing points is evidence of growth. (September 2020)

The larger specimen had an areole that nearly produced a bud (blue arrow). But the bud (or offset or whatever it really was) never grew much larger. (October 2020)

Four months later, in February 2021. The ‘bud’ hasn’t budged.



A picture of the second GStella on the same day. There is a new ‘bud’ at the 9 o’clock position on the specimen. An interesting development. (February 2021)



Above: One week later. This bud broke out immediately. It’s unclear why this specimen behaved differently – both specimens always get the same treatment.
Below: A closeup of the bud. (March 2021)

One week later. This bud had no problems growing out. (March 2021)

And another week later, in mid-March 2021, a few days before the flower opened. Compared to pictures from September 2019 just after potting up, the specimen now looks somewhat flatter with some *wrinkles* near the base – an interesting change.

Left: Three days later. Like GBalds, the flower bud of this GStella grew significantly in the last few days prior to opening. **Right**: The next day. Here the flower bud is pictured a few hours before it finally opened. (March 2021)

It's unclear why the bud on one GStella stalled while another bud on the second specimen grew out immediately. Both specimen grew a little, leading to denser spines close to the growing point. Both got the same kind of care or treatment. Both have the same potting mix and they are located close to one another. One flower is nice, but there is too little data so far to form any conclusions. Since they grow so slowly, studying their behaviour is a task for very patient growers.

To this I would add the behaviour of their parent, the large and old GStella specimen. The old GStella specimen has areoles with bud-like protuberances. But these buds never broke out, even though the plant is a large and old one with (presumably) a lot of resources in that fat stem. In the tropics, I suppose we lack a certain *something* to push this species to flower regularly.

One interesting observation is that the two GStella specimens looked less fat compared to when they were growing in the tray of scoria with no drainage. After over a year in individual pots with a layered potting mix, the two specimens have *deflated* a bit, and some *wrinkles* can be seen near the base of the plants. So I may need to flood the pots to make them fatter. But a wrinkled specimen produced a flower – so it may not be a bad thing at all. GBald specimens in a layered mix are also not as fat as grafted GBalds or GBalds grown in rich soil – this may not be a bad thing either because the plants are still quite productive.

Nineteen years after buying a small GStella specimen, I finally got a flower from a rooted offset of that first specimen. Like the other flowering *Gymnocalycium* in my collection, this flower opens in the afternoon for a few hours. (March 2021)

A side view of the specimen the next day, posed in front of a cardboard panel. Note the slightly flattened aspect and the wrinkles near the base of the plant. This GStella may not be getting all the water it wants, but no matter, something prompted the bud to grow out into this flower. (March 2021)

Another view of the specimen, posed. The light pink bands on the petals became more and more prominent over the few days the flower was open. The flower often did not fully open due to rainy weather around this time. (March 2021)

The two younger GStella specimens grew out an extensive and healthy root system during their time in the scoria tray. By contrast, the old and large GStella suffered from years of poor and uneven care. I think healthy roots and healthy stems forms an important foundation. In the tropics we may not have the seasonal changes to reliably push many species of cacti into flowering mode, but with healthy plants we have prepared the foundation for such things to happen. The fact that these specimens grew up in one single microclimate may also have helped.

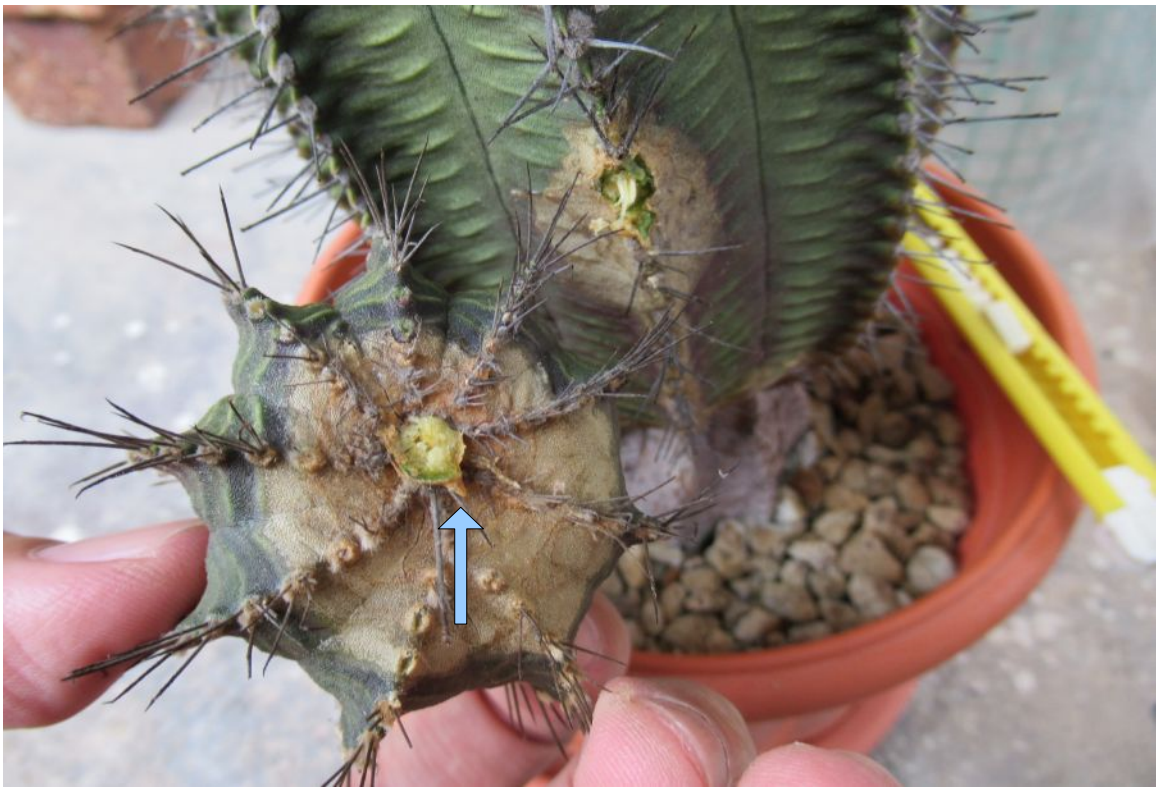
Interesting Behaviours of GSteno Offsets

The large GSteno specimen in late September 2020.

After several months of regular fortified water sprays, the large GSteno specimen has grown a bit. New growth near the growing points sports a darker shade of green. Areoles on newer growth are also very wooly. Unfortunately, it does not want to flower.

Given the poor shape of the lower, woody part of the specimen, one option would be to cut the specimen in half and let the upper half grow a healthier root system. A less drastic option is to remove the two healthy-looking offsets, and see if anything changes on the main stem. So, in late September 2020, the two offsets were removed (see pictures on the following pages.)

The big offset detached. The stem colour is a nice dark green and the areoles are very wooly. (September 2020)



The connection of big offset to the main stem is quite thick. Jutting out a bit from the side of the cut area is a root nub (blue arrow). (September 2020)

The small offset detached. (September 2020)

The corky or woody surfaces seen here may be normal for this species, because GSteno stems have tough skin and I don't believe spider mites can easily damage them. This small offset has short pieces of roots (blue arrow) attached to its underside. (September 2020)

Four days later. The two GSteno offsets before planting. Short roots on the small offset can be more easily seen in this picture. (September 2020)

The two GSteno offsets were planted in the scoria tray which still holds two rooted GStella offsets. Having ran out of red scoria, I used (recently purchased) black scoria. Some sphagnum moss was added as a medium to retain water.

The scoria tray just after the two GSteno offsets were planted. (September 2020)

A month later, in late October 2020. The healthy green colour of the two GSteno offsets have faded somewhat. No cause for alarm... yet.

Closeups of the big GSteno in early December, just over 2 months after the offsets were detached. (December 2020)

After about 2 months, there is no change in the big GSteno. While there may still be slow and steady growth, and the upper parts of the stem looks healthy, the specimen does not look like it will move into another gear. So, the first option (removing the offsets) was – unsurprisingly – a total bust.

If you study the closeup pictures shown above, you should be able to detect four ‘stuck’ buds. Let’s face it, these are not offsets – there is no hint of a stem-like structure, areoles or young spines. But these frozen[5] buds are neither growing nor aborting.

The next step, to be undertaken later in 2021, is to cut the specimen into two and, using the upper stem, grow a healthy specimen with a new root system. The lower stem can be used to produce offsets, if it can survive without shrinking like GBalds.

GSteno resides in the *Gymnocalycium mihanovichii* species group. Healthy *G. mihanovichii*, including highly-coloured Moon Cactus specimens, do occasionally flower in a tropical country like Malaysia. The problem with the big GSteno is bud growth. To learn more about how to push these cacti to flower, we must start with a foundation of healthy specimens. One important step is to learn how to grow out and maintain strong GSteno root systems in a tropical climate. The behaviour of this big GSteno’s two offsets in 2021 – as we will see in the following pages – also hints at the importance of healthy root systems, without which, the plants won’t do much of anything.

5 Or dormant. But it’s living in a tropical climate with no clear seasons, so I’d rather call it stuck or frozen.

The two GSteno offsets at the end of December 2020, wet after spraying.

They look worse a month later, in late January 2021. It’s not looking good.

Moving Out the Small GSteno Offset

Since the two offsets were not doing well in the scoria tray, the small GSteno offset was moved out in early February 2021. The smaller specimen is more likely to be stressed because of the quick-drying conditions in the scoria tray. When removed, it did not appear to have grown any long roots.

The small GSteno offset with sphagnum moss stuck to the bottom. (Feb 2021)

Potting up using scoria plus black soil, so that it gets more moisture. (Feb 2021)

Sand and scoria was added as a mulch, so that the soil-and-scoria potting mix can hold moisture for a longer period of time in the small pot. (Feb 2021)

Just *six days* later, the small GSteno offset has turned green, a remarkable turnaround. There were short roots in the sphagnum moss and I guess the roots like the new potting mix better than pure scoria. The scoria tray was probably a rather stressful place for a small cactus to live in and it could not thrive in there. (Feb 2021)

Moving the Big GSteno Offset Too

Since moving out the small GSteno offset worked so well, I moved out the bigger one immediately. (February 2021)

Closeup showing its roots and broken roots left in the scoria. (February 2021)

Amazed at the recovery of the small GSteno offset, I moved the larger specimen out on the same day. The latter had grown more roots than the smaller offset, but it wasn't enough to keep the plant looking green and healthy. GSteno roots proved to be a lot more flimsy compared to GStella roots. The latter is able to grow out a root system that is extensive with lots of long and tough roots in the scoria tray. GStellas look positively happy in the scoria tray, round and green without a single wrinkle to be seen on the stem. For GStenos, there are no positives at all.

In fact, GStenos may well possess a weaker root system than even GBalds. Remember, it is possible to keep a lot of small rooted GBald offsets in a tray of scoria and maintain them in a reasonably healthy state[6]. Those GBalds grew root systems that is structurally different from GStella root systems. I think GStella root systems are stronger or more robust, but GBald root systems grown in scoria is not too shabby either.

Given the deterioration of the two GSteno offsets, it would probably not be possible to keep them in the scoria tray forever. Three species of *Gymnocalycium* all behave differently growing in the scoria tray in the tropics.

Another closeup. This shows the underside of the GSteno. A few roots can be seen on the right side, while there appears to be a bit of wispy spider mite webbing on the left side. The sphagnum moss was drying up too fast in the tropical weather to effectively hold moisture. (February 2021)

6 Those very nice root systems is described in the Roots in Rocks chapter.

The big GSteno offset in its new pot, wet after spraying. The arrow points to a flower bud on an areole. **Inset**: Closeup of the bud. (Feb 2021)

Interestingly, the big GSteno offset was sporting a small flower bud at the time it was transplanted. I noticed the flower bud only while preparing the above picture for this chapter. Since its parent has so many frozen buds, it is possible that the hot tropical weather had already pushed this GSteno offset to produce a bud or two. But given its worsening condition, the GSteno was unlikely to actually flower while in the scoria tray.

The two rooted GSteno offsets three days later. The contrast in stem colour is clear. The bud on the big GSteno offset can just be seen near the 12 o'clock position. (February 2021)

In this closeup crop, the arrow points to the flower bud. (February 2021)

From Detached Offset to Flowers in Six Months

Four days later, I finally noticed the buds – not one, but *two* buds. (February 2021)

Top view of the big GSteno offset. This fella is in a hurry. (February 2021)

Another four days later. The buds are growing rapidly. (February 2021)

A week later. The two GSteno offsets at the end of February 2021.

The small GSteno offset turned green quickly after potting up, while the big GSteno offset is taking its time to do the same. Instead, it is rapidly growing out two flower buds. Perhaps the big specimen had dormant flower buds at hand, ready to erupt when conditions are suitable.

The first flower opened three days later. Here is the big GSteno offset posed in front of a cardboard panel. The plastic pot is an old crumbling one, because I totally did not expect this plant to burst into flowers. (March 2021)

While this was not the first GSteno flower from plants in my collection, it was a very interesting event. So it is possible to get flowers from a GSteno offset in just *six months* – it was detached from its large GSteno parent in late September 2020.

Both rooted offsets are posed in this picture taken the next day. (March 2021)

Two days later, the second flower is about to open. (March 2021)

Due to rainy weather, the flowers didn't open fully on some days. Here is the GSteno specimen two days later. (March 2021)

There are probably many factors that led to the two flowers. The offsets were detached as healthy stems. The bigger one may already have dormant buds. Their stay in the scoria tray may have been beneficial – perhaps it was an adequate substitute for dormancy in their natural habitat. And it appears that a winter season is not an absolute requirement – good news for GSteno growers in the tropics. Perhaps it is really possible to formulate a reliable recipe for forcing GStenos in the tropics.

I think the flowers would never have been possible without a good root system. With slow-growing cacti such as GSteno and GStella, our problem is that we hardly ever get to check on their root systems. Often a specimen will end up staying in one pot for many years, and so we end up monitoring the stem and never the roots. It's something of a hidden mystery: make a batch of potting mix, pot up your cactus in the mix, then cross your fingers and hope that the root system will prosper.

We have to do better than simply follow standard recipes in order to get our cacti to grow the best possible root systems. More knowledge is needed. For growers in the tropics, healthy cacti with strong root systems is a critically important foundation, without which we cannot hope to get these plants to produce beautiful flowers[7].

7 At least for *Gymnocalycium* specimens, since these days I would prefer to buy them for such experiments. And GBald is of course, a crazy species – we cannot always apply lessons from GBald to other *Gymno*s.

The big GSteno offset posed, the next day. Note the specimen's stem colour – it is now a much healthier shade of green. (March 2021)

No amount of fortified water sprays could improve the poor colour of these two GSteno offsets while they were in the scoria tray, but by the time the second flower opened on the big GSteno offset, both specimens were now sporting healthy-looking green stems. All it took was a change of container and potting mix, plus of course, functioning root systems.

In the end, the flower display by the big GSteno offset lasted 12 days: the first flower lasted six days while the second flower lasted nine days. Rainy weather during that period may have helped to extend the longevity of the flowers. No pollination was attempted, but both flowers managed to set seed pods, which turned into a nice shade of pink when ripe. GSteno pods have a wet pulp, and the juice has a slight aroma of watermelon (yes, really.) ♦

Version Information

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Colophon

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