Complications of Shrinking

This small rooted GBald offset was cut up to examine the insides. It was soft and discolouring, so I’m sure it won’t survive in the long term. Internal plant tissue is no longer wet and juicy; it is dryish and spongy, and there are large air pockets. This was one of the casualties of dormancy-like behaviour that started in 2017. (March 2018)

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

All About Shrinking GBalds

When you have grown GBalds for a good length of time, you will come to realize that *shrinking* is the dominant issue in long term GBald cultivation. It is possible to keep GBalds in a kind of growth phase for a long time and get a long and fat stem, but in a hot lowland tropical weather, it would be virtually impossible to keep such a scheme going indefinitely. So we must live with shrinking.

Shrinking is not a neat and tidy behaviour. Some specimens shrink their lower stems and keep going. Some specimens shrink, then grow weaker, and finally turn into a slowly dying husk. Both are to be expected, since GBalds have probably evolved to live for a few seasons only.

Sometimes specimens try shrinking but they do it badly, for example the small specimen in the above picture. It is useful for growers to know that there are complications when it comes to shrinking.

Nicknames for Scientific Names

PMag = *Parodia magnifica*	GBald = *Gymnocalycium baldianum*
PClav = *Parodia claviceps*	MGeo = *Myrtillocactus geometrizans*
GStella = *Gymnocalycium stellatum*	GSteno = *Gymnocalycium stenopleurum*

This naming scheme is purely for convenience. Just think of them as webchat nicknames.

Benefits of a Shrinking Lifestyle

Two GBalds being repotted, March 2017. For long can we keep them healthy?

When first discussing shrinking while introducing GBald as a winning species to grow in the tropics, I had highlighted its shrinking behaviour and compared it to the more regular behaviour of shrinking ribs in cacti. Shrinking was also favoured as a protection mechanism against the elements.

After many years of growing GBald and studying thousands of pictures, I realize that evolution is messy and often mechanisms are multifunctional. I can now see that the shrinking behaviour benefits GBalds in multiple ways.

Another GBald in March 2017. This bottom portion of specimen may look terrible, but the new roots look strong. These look like anchor roots. Note that the sides of the shrunken stem do not produce roots.

Shrinking its stem into the ground also provides protection from predators. Often people who explore for cacti in habitat will say that it is not easy to spot cacti that are half-buried in the ground in their habitat. Some species may have evolved taproots for the same reasons.

A GBald dying due to shrinking is also beneficial to the species. While shrinking, a GBald is usually able to produce a few offsets. These offsets will produce roots while still attached to the mother plant. When the lower stem weakens too much, the mother plant may fail to recover for the next season and it will dry up and die. It eventually becomes organic matter for the benefit of the next generation of GBalds. In time, a small clump may form in place of a single plant. As far as evolution is concerned, it works as a way of propagating or multiplying GBalds.

Weakening and dying has been mentioned in books and elsewhere as an issue with some cacti – especially *Gymnocalycium*s – with nary a solution in sight. Perhaps there is really no solution. But here we can at least gain some level of understanding of the issue. In these chapters, the issue has been laid out in detail with many pictures for illustration. Once we understand the lifestyle of GBalds, it’s not a disastrous thing at all. First, shrinking, weakening and dying are just normal evolutionary behaviours of GBalds. Second, there is no easy way of stopping shrinking behaviour. So grow GBalds as a population of specimens and you’ll do fine.

GBald End-of-Life Behaviour

A GBald specimen in July 2019, last seen in the chapter on Repotting.

In this section, we will take a look at the end-of-life behaviour of a GBald specimen. It was last repotted in July 2019 because it toppled over[1]. At that time, the specimen was sporting 3 flowers even though its root system was poor.

After studying many pictures of the progress of this specimen, I now realize that the weak root system is a clear sign of decline. There wasn't a lot of fine or fibrous roots, and there were only a few thick anchor roots. It may still be able to get some additional nutrition through foliar feeding, but the dilute sprays I use isn't enough and the specimen will use up its internal resources, shrinking the stem in the process.

1 See the chapter on Repotting for the pictures and discussion.

Left: The very last flower of the specimen, mid-June 2020.
Right: About two weeks later, at the end of June 2020, the specimen toppled out of its pot when nudged because it had no viable root system to speak of.

From July 2019 to June 2020, the GBald produced a small number of flowers. There was little or no new growth. Shrinking continued. Around this time, it tried to produce one or two small offsets (visible in the second picture on the next page.) However, the offsets barely grew, even with fortified water sprays. The upper 1 inch of the specimen that is green has also shrunken, with wrinkled ribs, so even that part may be spongy and without reserves.

In the chapter on Propagation Via Offsets, the cut lower stem of a GBald continued to shrink, until it turned into a mostly dry husk. Near the end, the last offset also stopped growing, as if all the stored reserves have been used up. Since this specimen is behaving in the same way, it is easy to conclude that it probably won't survive as a viable plant for much longer.

A week later, it was removed from its pot, then cut into three pieces (see pictures on next page.)

A week later, it was removed from its pot for study by cutting it up. (July 2020)

The GBald in 3 pieces. The top piece is somewhat spongy. (July 2020)

If you try to feel the weight of the specimen, it would not seem very solid (or wet and juicy.) It's one way of testing the condition of a GBald. Look at the specimen and feel its weight – then you can guess its density. If its weight feels a bit like sponge cake, then it is in very bad shape. The two lower pieces have no reserves and will not produce roots. The top piece still has a chance.

A week later, the bottom piece has dried up and has been cut into two (see the next page for a view of the other side.) The middle piece is drying up. The top piece has shrunken by a lot because it was somewhat spongy. The prospect of getting it to root is not very good. (July 2020)

The pieces were left to callus for a week, to see how they hold up. The bottom piece has dried up and is totally dead. The other two parts have shrunk by a lot. The middle part does not have any reserves left to do anything; it is now a slowly drying and dying husk. The upper part is in bad shape – since it shrank a lot, that means its tissue is quite spongy and it has little reserves left to revive itself.

So it goes like this: Young GBald tissue is wet and juicy, and holds a lot of resources that can be used for growth. When older parts of a stem shrink, it does so by moving resources out in the direction of the growing point or offsets. What is left behind is a cellulose-like matrix, so the tissue will turn spongy – no longer juicy, just moist. Substances are then added so that the spongy stem turns corky or woody. Presumably, reinforcing the drying and shrinking tissue enables the stem to shrink and pull the plant downwards. The shrunken part now has no resources and can no longer grow shoots or roots from its sides. It is only a pass-through between the healthy green parts and roots.

The middle piece was then cut into four pieces. Surprisingly, there was a thin layer of green under the brown skin. The tissue was spongy and barely moist. (July 2020)

Even though there was a bit of green in the middle piece, it was too weak to even produce a single root. The upper piece was then placed on some soil in a pot. Unfortunately, it also proved to be too weak – it rot from bottom up in a few days. In conclusion, the specimen was in *terminal decline* and it probably could not have been saved. For such specimens at their end-of-life, the only parts that can be saved are its *offsets*. Multiply your GBald collection by growing these offsets and you will be able to maintain a viable population of GBalds in your garden.

How can we do things differently so that this GBald specimen can be saved? The obvious answer is to take action *earlier*, when the healthy green portion of the specimen is stronger. In the future, I would cut off the healthy green portion earlier and then root it. For shrinking GBalds, if you wait too long, it is easy to see that the decline in health is not survivable. As of 2020, I have a good number of rooted GBald offsets, so I have no problem with losing specimens due to end-of-life. We must remind ourselves that *there is no such thing as a GBald that is too valuable to lose*.

Examples of dried-up dead GBalds. Healthy upper stems were cut, leaving these two shrinking bottom stems that eventually turned into dried husks. (July 2018)

The stems after being cut open. The insides were very slightly moist. They dry quickly into light, almost-woody pieces of dead cacti. (July 2018)

GBald Dormancy-Like Behaviour

The 2014 GBald on MGeo graft in August 2017. There are waxy and corky patches on the stem, while new growth is green and clean.

“Dormancy-like behaviour” is simply a convenient and descriptive label that I am going to use for this next part. It’s more of a long, confused mess that began around March 2017 and went on for the better part of a year.

Before we get into pictures and details, here is an summary: It started with waxy patches on the skin of some GBald specimens, then corky patches. This coincided with a mild scale insect attack. The scale infestation was not hard to stop, but many specimens continued with waxy and corky patches – like a bad allergic reaction, with various degrees of severity. The scale insects were long gone. Some did not have such skin problems, but displayed shrinking behaviour. Some tried shrinking, but did it badly. Even GStella specimens shrunk and turned yellowish, though not all at once. At some point, the waxy or corky skinning-over stopped. By this time, all GBald specimens had been removed from their pots. Strong specimens didn’t miss a beat and started producing new growth that looked completely normal, for example the grafted GBald in the picture above. Some weak specimens died. Eventually, survivors were repotted and things slowly became normal again. Weird!

In all my years of growing GBald, this kind of group behaviour has not happened before. Also, it was strange to see the GStella specimens shrink and turn yellow – they have never done this before. While all this was happening, my large *Parodia* specimens behaved normally and produced flowers normally and there were no skin problems or growth coming to a halt.

There is nobody on the Internet talking about GBald dormancy, so I do not have any point of reference to compare this with. All I know is their behaviour of shrinking into the ground, presumably during the dry season. If you check the climate of a Catamarca Province location, for example, La Higuera:

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https://en.climate-data.org/south-america/argentina/catamarca/la-higuera-416912/
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The charts indicate that winters are dry but mild, while rain mostly occur during the hot summers. Presumably GBalds shrink into the ground and become dormant during the dry winter season. However, the lowland tropics is hot and humid all year round and temperature lows never even approach 20°C. I have neglected my specimens in the past with no problems at all. So it was not *regular* dormancy. However, plant signalling is messy and things are often interlinked. One theory: stress mechanisms and dormancy behaviour such as shrinking could be all mixed up.

The crested GBald specimen with waxy patches on its skin, March 2017.

A small GBald with some waxy patches in March 2017. There are one or two patches with a brownish dot (orange arrow) which I presume were tiny scale insects. The blue arrow shows one of the locations where corky patches were starting to appear. For some reason, corky patchs are most severe between the ribs.

The problem started in March 2017 with the appearance of waxy patches on many GBald specimens. The waxy patches looked like waxy secretions of some sort. On most patches, no insect could be seen. Eventually, I detected a mild scale infestation on some specimens. The scale insects were mostly tiny; this scale attack was dealt with in mid-April.

As far as I can tell, the waxy patches appear to be associated with the scale insect attack, like some kind of defense mechanism against an insect threat. I have seen such waxy patches during other scale insect attacks, but not at this level of severity. I have no idea what prompted the extreme reaction to scale insects this time around.

Reaction to a chemical that was sprayed is unlikely; I have never seen such a response to a chemical compound on any other occasion. A microorganism? No data, so I have no idea. Soot from haze due to forest fires? Also unlikely, because there was sooty haze in other years and nothing weird happened. So I will stick to scale insects as the initiator. The cause of its severity is unknown.

A closeup of the grafted GBald showing waxy patches, March 2017. The waxy patches between the ribs will turn into corky patches.

Slowly, many specimens developed waxy patches, then corky patches. Corky patches usually start between the ribs. I got the impression that the GBalds were depositing waxy and corky stuff in reaction to something. Since it’s not actually damage, I don’t think it is scarring.

In mid-April 2017, the scale insects were dealt with. Unfortunately, the corking-over did not stop. As seen in the pictures in the following pages, you can see that there are different degrees of severity. Some specimens do not seem to be affected. Some do not have the skin issue but are trying to shrink. Strong specimens were still producing flowers. Some weaker specimens took a turn for the worse.

If this was a severe reaction to a scale insect attack, then it is possible that some kind of inter-plant signalling could have played a part in turning the situation into a group crisis. This would account for the GStella specimens shrinking along with the GBald specimens, even though I have never ever seen a scale insect on a GStella specimen.

Some GBalds at the end of June 2017.

The skin problem is getting worse, late July 2017. In this picture, the big and strong GBald specimens were more likely to survive. The most obvious visual difference is the skin of a big GBald (arrow) at the front left of the tray.

At the end of September 2017. The tall and fat GBald specimen is turning yellow-green. A small GStella specimen (arrow) has shrunk a bit and changed colour.

Some of the specimens, after removal from their pots at the end of October 2017. This was done because the tall and fat specimen collapsed due to rot. The top portion (arrow) of the specimen did not survive, though it took a few weeks to completely die. The GBalds were left to rest without soil, until their condition stabilized.

The big GSteno looked normal and seemed unaffected, while the big GStella (arrow) had shrunk and turned yellow-green. July 2017.

A smaller GStella specimen (arrow) has shrunk a lot and turned dark green, while the bigger one at right is just starting to shrink a little. (October 2017)

The grafted GBald in November 2017, out of its pot. It kept going and produced flowers almost every month. Note the corky patches – most are between the ribs and appeared to have been produced in one burst. Newer growth is clean and normal.

This large GBald also kept going and produced flowers. The pattern looks the same: a burst of corky patches, much of it between the ribs, then new growth is green. Smaller and weaker GBalds in the background were doing much worse. (January 2018)

Also by January 2018, some specimens clearly did not look like they will survive. These have poor spines – perhaps they had spent some time indoors. Squeeze one, and it would feel like dryish skin and the insides was mostly air.

Three weeks later, two of the three were cut up for study. They are shown here just before they were cut up. The last one was cut up in March 2018, as seen on the front page of this chapter. (January 2018)

The larger specimen. The plant tissue inside had a barely moist spongy texture. There was one big hole in the middle. Also note the smaller holes – they were aligned with the centre of the ribs. (January 2018)

The condition of the smaller specimen was worse. The specimen's skin was quite soft, with a red hue. The plant tissue looked really spongy. (January 2018)

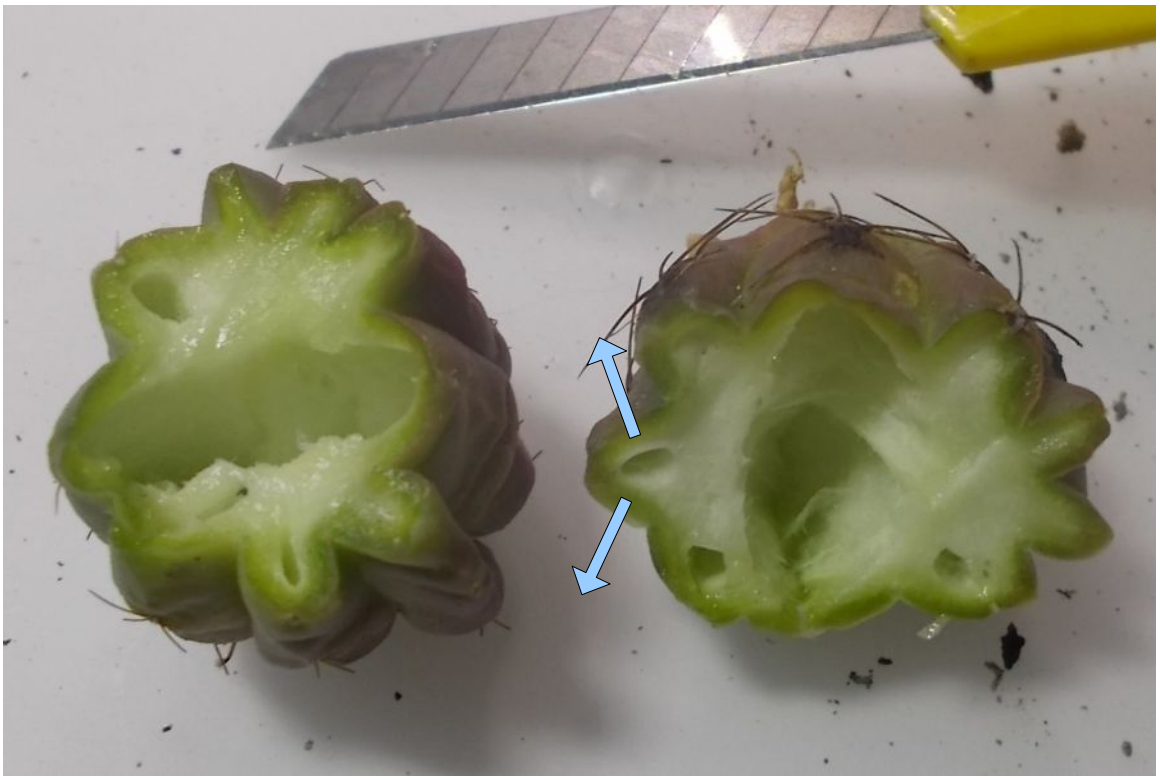
It appeared that the small specimens tried to shrink, but could not produce the corky stuff to reinforce drying tissue. Without the corky stuff, GBalds may not be able to shrink properly, and they may turn into spongy specimens that inevitably go into decline and die.

When it was clear that new growth was behaving normally, specimens were propped up so that they could be sprayed regularly. (February 2018)

Some smaller specimens. The discoloured GBald (arrow) would be cut up in March. Left and below that, the smallest specimen on this tray survived, producing its first flower in June 2020. The other GBalds were growing again. Although the two GStella look green in this picture, later they would still turn yellowish. So all of my GStella specimens were affected, but not at the same time. (February 2018)

The GBald-on-MGeo graft just before the MGeo stock was cut shorter, at the end of February 2018. New growth was decidedly normal, but the lower stem of the GBald had turn yellowish. The lowest part of the MGeo stock *had also shrunk* a bit, and looked somewhat corky too.

It turns out GBald plant signals can successfully direct an MGeo to shrink and turn corky. This specimen will be discussed further in the chapter on Grafting Part 1.



Another view of the small spongy offset from the front page. This was the third of the trio of spongy offsets. When spongy drying tissue tries to shrink, the walls of the ribs are better anchors, so tearing occurs, creating holes. The arrows show the directions of shrinking that caused the formation of the small hole. (March 2018)

The condition of the cut pieces the next day. Spongy and moist tissue dries rather fast. (March 2018)

Five days after the specimen was cut. I don’t believe this condition is survivable, because there is about zero resources for the specimen to revive itself or produce roots or an offset or two. (March 2018)

After about six months out of their pots, most specimens were potted up in mineral mixes low in soil content. Badly discoloured specimens were still left with bare roots, such as the second specimen in the lower left tray. Generally, if a GBald failed to produce new growth at this point, then it may be incapable of reviving itself – don't expect it to survive. (April 2018)

All GStella specimens were affected, at different times. (April 2018)

Some yellowed and shrunken GStellas and three poor GBalds were placed in a tray of scoria, June 2018. The GStellas eventually recovered. Unfortunately all three GBalds failed to recover.

By July 2018, two of the three GBalds were dead. The GBald on the left lasted a month or two longer. The colour of the GStella in the middle (arrow) has improved and it also looked less sickly. It appears GStellas can recover by turning into healthy and plump green stems again. GBalds on the other hand cannot revive their shrunken and yellowed stems, so they must rely on new growth.

The two dead GBalds were cut up for study. The top portion of a GBald should have a healthy green colour. If that part has turned a sickly yellow or brown or reddish green, then it's not looking good for the plant. (July 2018)

After reviewing my picture archives for this chapter, it turned out there were quite a number of casualties, more than I remembered. Some were just-rooted offsets that got confused. Others were weak specimens that no longer have the internal resources or reserves to revive themselves. But the healthier specimens survived, and the strong ones breezed through just fine.

In the picture above, I suspect these two weaker GBalds have succumbed to fungi or bacteria. Almost the entire stems consist of spongy tissue. They were too weak to fight off disease. This may be *exactly* what Nature intended: cull the weaker plants and let the stronger survivors reproduce.

Perhaps the tropical climate made it worse than it would have been if they were growing in their natural habitat. Well, I haven't yet seen a research paper on the lifecycle of GBalds, so there's nothing to use for comparison. This was simply what happened to practically all GBald and GStella plants in my collection around 2017–2018.

One important lesson from this massed dormancy-like behaviour is to make sure that you have a few *healthy* GBald specimens. This crisis is *survivable*. Remember, we need to cultivate GBalds as a population – no individual plant is irreplaceable. If your collection runs smack into dormancy-like behaviour like mine did, then the healthy specimens are the ones that you will need to keep your GBalds from getting wiped out. So keep an eye on the health of your GBald specimens and add to their numbers now and then by propagating them via detached offsets.

Recovery of GStella Specimens

The big GStella potted up, June 2018. Growth is slow. Note the light brown patches.

To recap: Dormancy-like behaviour among GBalds led to similar behaviour among GStella specimens. GStella specimens have very tough skins, and I don't recall ever picking one scale insect off one of these specimens, so this behaviour is puzzling.

There is a bit of similarity in the dormancy-like behaviours of the two species. The GStella specimens shrunk, turning into a sickly yellowish-green colour in the process. On the largest specimen (above picture), there is a hint of deposition of brownish or corky stuff between ribs. More obvious are the patches of brownish or corky stuff below some areoles. But once they begin to recover, new growth is completely normal-looking.

Looking much better in September 2018 with a bit of new growth.

Shrinking in GStellas appears to be reversible. A few months after potting up, the big GStella specimen looks almost normal. The normal green colour of the specimen has returned, and it looks less flattened. Older growth still bears some marks. The brownish patches are still there, but less prominent thanks to new growth. There is a yellow patch under one areole – this may be heat stress related.

Six months after potting up, in December 2018.

Thanks to better nutrition and a new soil mix, the big GStella specimen is turning into a round ball. Growth is slow, but strong. The blemishes due to dormancy-like behaviour is not very noticeable. This specimen also has elongated areoles and it readily produces offsets near its base, so it is a mature plant. Unfortunately, it does not want to flower in a tropical climate that is evenly hot and humid. As such, this is a candidate for future flower forcing experiments.

The four smaller GStella specimens in January 2019, all recovered.

The four smaller GStella specimens recovered very well. If you look at the picture of these specimens in June 2018 a few pages back, they looked quite awful back then. After half a year, practically no evidence of dormancy-like behaviour is visible.

In general, my GStella specimens are very green and rather fat. Most pictures of *Gymnocalycium stellatum* on the Internet do not look this green or this fat. Those are often brownish-green or reddish-green. The nice green colour on my specimens may be due to nutrition from fortified water sprays. Note that it’s not an unhealthy kind of “green and fat”, because I am still using minimal amounts of NPK in the water sprays.

This species is as close to maintainence-free as it gets. Just spray fortified water to provide nutrition and to discourage spider mites. It’s slow growing, so you can leave it in a pot for years.

Recovery of GBald Specimens

New growth on the three larger GBalds is normal, April 2018

This section follows the progress of four GBald specimens as they recovered from dormancy-like behaviour. The three larger GBalds in the above picture are the largest of young GBalds in my collection, so they are juicy and healthy. The three were among the first to be potted up because they displayed strong new growth. The other GBald is a just-rooted offset.

In the following two pages, you can see just how fast young GBalds can grow. The brownish corky stuff does not disappear, but new growth eventually dominates. For these specimens, I used a lot of scoria and eventually the specimens became stuck tightly in the pots. They seem to be shrinking their lower stem while growing their upper stems. I'm not sure if the resulting "body shapes" of the GBalds are more like specimens in habitat versus specimens with yellowed, half-shrunk stems. But by the end of 2018, these four look pretty healthy to me.

Older GBalds did not recover this quickly, nor did they speedily produce new growth. They may have a lot of spongy tissue and as such, they are less healthy compared to younger specimens. Old specimens with very spongy tissue may also be nearing their end of life.

The quartet of GBalds at the end of June 2018.

Two months later, in late August 2018. Healthy new growth is dark green in colour, and the skin may have a slight waxy sheen. Sprayed water beads very nicely on healthy new growth of young GBald specimens.

The three larger specimens in February 2019.

One of the three specimens finally produced two flowers in November 2019.

Some GBalds posed, June 2020. The quartet that we have been following are the four GBald specimens nearest to the camera. All three of the larger GBald specimens have produced flowers. The smallest GBald (at left) is still in its 2-inch pot. It is now about the same diameter as its pot and has just produced its first flower.

GBalds are not capable of turning their shrunken stems back into fat and juicy green stems – they need to produce new growth instead. New growth initially depends on the stored resources or reserves in the stem, if we assume that the root system needs some time to recover or regrow. Since young GBalds have juicy tissue compared to older specimens that may have spongy tissue, young specimens will tend to recover more quickly and display strong growth earlier.

Thus, our ability to maintain a collection of GBald specimens depends a lot on shrinking behaviour. A GBald stem that fails to shrink properly will probably be disastrous to the plant. For the four specimens shown, scoria in the pots tends to interlock, giving the stems something to push against. The lower stems of these specimens appear to be shrinking well and this may have a positive impact on the health and longevity of the plants. Progress on understanding and dealing with shrinking behaviour will be reported in future chapters.

Assessing the Health of GBalds

Gently squeezing one of the three of the larger GBald specimens from the previous page, now labeled. It is stuck very tightly in its pot. (September 2020)

The quickest way to determine the health of a GBald specimen is to hold its stem and squeeze it gently. Spongy stems will sink a bit under the pressure of your fingers, while a young and juicy stem is very firm to touch. Your brain will process all the information – from the fingers, hands, eyes, etc. – so you can deduce whether it is very juicy or it is not quite juicy.

For old specimens, it is easy to see them shrinking. Once the upper stem starts shrinking, flower buds may abort and stop being produced. Then growth will grind to a halt. Check the upper stem. If it feels light compared to young specimens, then it is nearing its end-of-life. Save and propagate any offsets. Spongy upper stems probably cannot be saved. ♦

Version Information

This is the December 2020 Edition of this document.

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Colophon

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