Data and Charts

GBalds in bloom, posed. February 2020. The flower at lower left is a bit pink because it's the sixth day the flower was open. Three GBalds have one small open flower each because it's the first day these flowers were open.

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

Introduction

Data and charts of cactus flowers in my collection are based on counting flowers during daily picture taking sessions. I also track or check the progress of flowers using archived digital pictures.

Picture coverage from 2016 or earlier is too sparse to be useful. From 2017 to 2018, data coverage gets progressively better, and should be fairly complete by late 2018. For 2019, data is more or less complete. From 2020, I use a spreadsheet to track flowers in more detail – this data can be useful for studying stuff like the longevity of cactus flowers.

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.

Notes on Data Collection

The spreadsheet data that I collect should have very few errors, but it is not final. There may be slight changes in the future when the tables get converted into a CSV file and error checking is done. Then it will be in better shape for a public data release (along with Python and/or R code.)

I don't keep track of each flower – that would take too much effort. I simply assume that older flowers dry up first. But usually, one does notice if a younger flower wilts before an older flower on the same stem. On the rare occasions this happened, it was when the GBald ex-graft was weak.

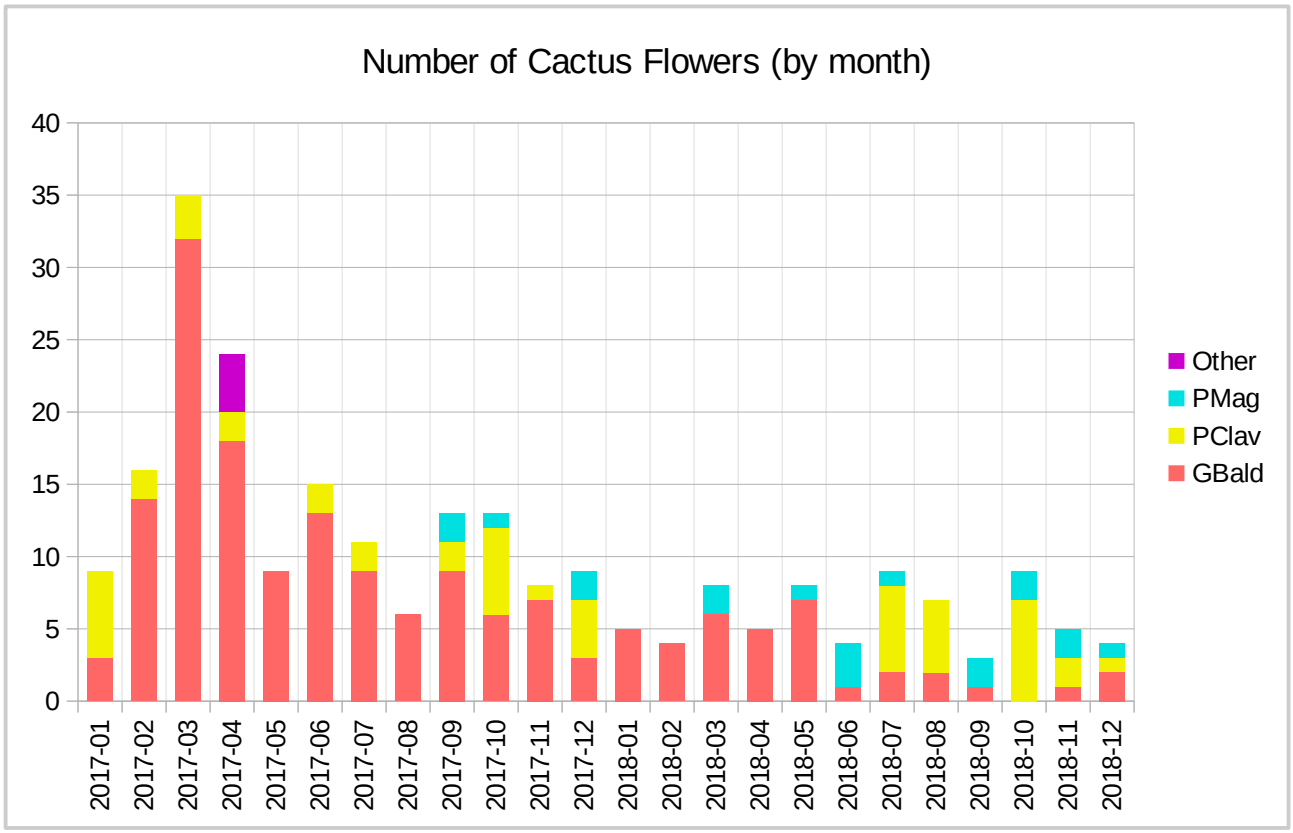
In general, flower counts means "operational flowers" rather than "open flowers". On days with extended wet and cloudy weather, GBald flowers tend not to open (but they are still 'operational', haha). Such days are rare. When a flower is open, it doesn't mean the flower is open the entire day. *Parodia* flowers open before noon, with PMag flowers opening a bit earlier than PClav flowers, while GBald flowers open sometime in the afternoon. Statistically, GBald flower opening times may look like a bell curve: small numbers may open around noon or after 4 pm. Also, flowers of different ages on the same GBald stem can open at different times. Most flowers close in the evening.

Sometimes a GBald flower bud is just barely mature and 'tries' to open in the late afternoon, but I will only count it if the petals are more than half open – it has to look more like a flower than a bud. Aging flowers with some petals wilting and stuck together are not counted as 'operational'.

2023-05-11	12	1		11	2	1		1	D1					
2023-05-12	15	3		12	6	2		4	D2,2D1					2D1
2023-05-13	15	2		13	1			1	X,2D2					2D2,D1
2023-05-14	10	1	1	8	2	1	1		2X,D1		D1			2D3,D2
2023-05-15	11	2	2	7	2	1	1		D2,D1		D2,D1			2D4,D3
2023-05-16	11	1	2	8	2			2	X,D2		D3,D2			2D5,D4
2023-05-17	12	4	1	7	4	3		1	D3,3D1		X,D3			2D6,D5,D1
2023-05-18	16	3	9	4	9		9		X,3D2		X,9D1			2X,D6,D2
2023-05-19	13		9	4	1			1	3X		9D2			X,D3
2023-05-20	13		9	4	0						9D3			D4
2023-05-21	5			5	1			1			9X			D5
2023-05-22	5			5	0									D6
2023-05-23	3			3	1			1						X

Screenshot of part of a spreadsheet table for May 2023. The red column section is the daily flower counts. The blue column section is the new flower counts. To the right is the per-specimen flower data. D1 is a flower on Day 1, while X is a dried flower, and so on. In the 2 weeks shown, the big PMag produced 8 flowers, the big PClav produced 11 flowers, and the 2014 GBald ex-graft produced 4 flowers. There were 16 flowers open on 2023-05-18 (there were another two GBalds with one flower each.) This table format has some redundancy, thus enabling some error checking later.

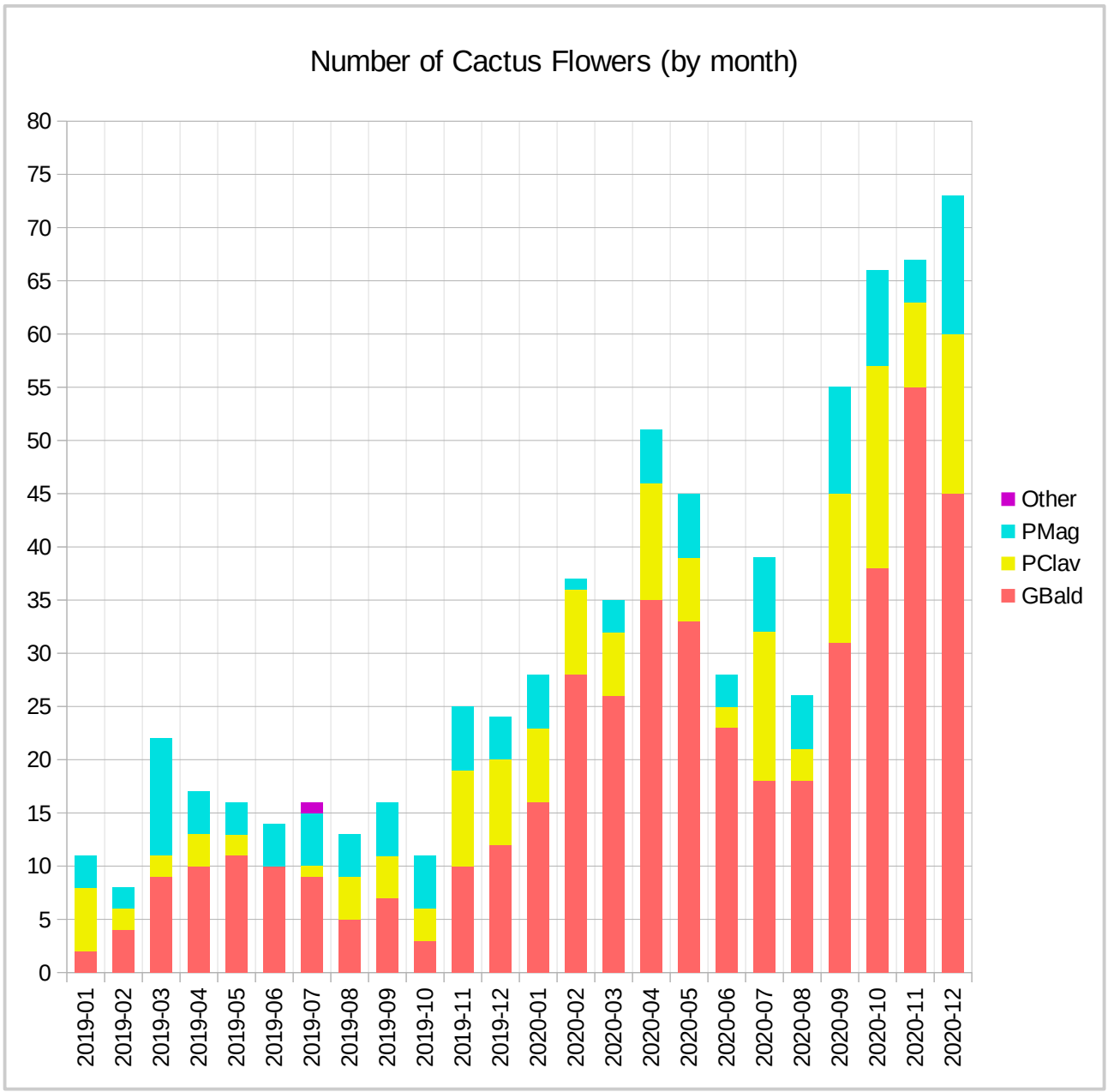
Cactus Flowers by Month



For ease of use, these charts uses flower colour for GBald (red) and PClav (yellow) while light blue is used for *blue*-stemmed PMags. The two species in the category of Other are GSteno (2017, 2019 and 2021) and GStella (2021 only). *Haworthia* and *Echeveria* flowers are not tracked.

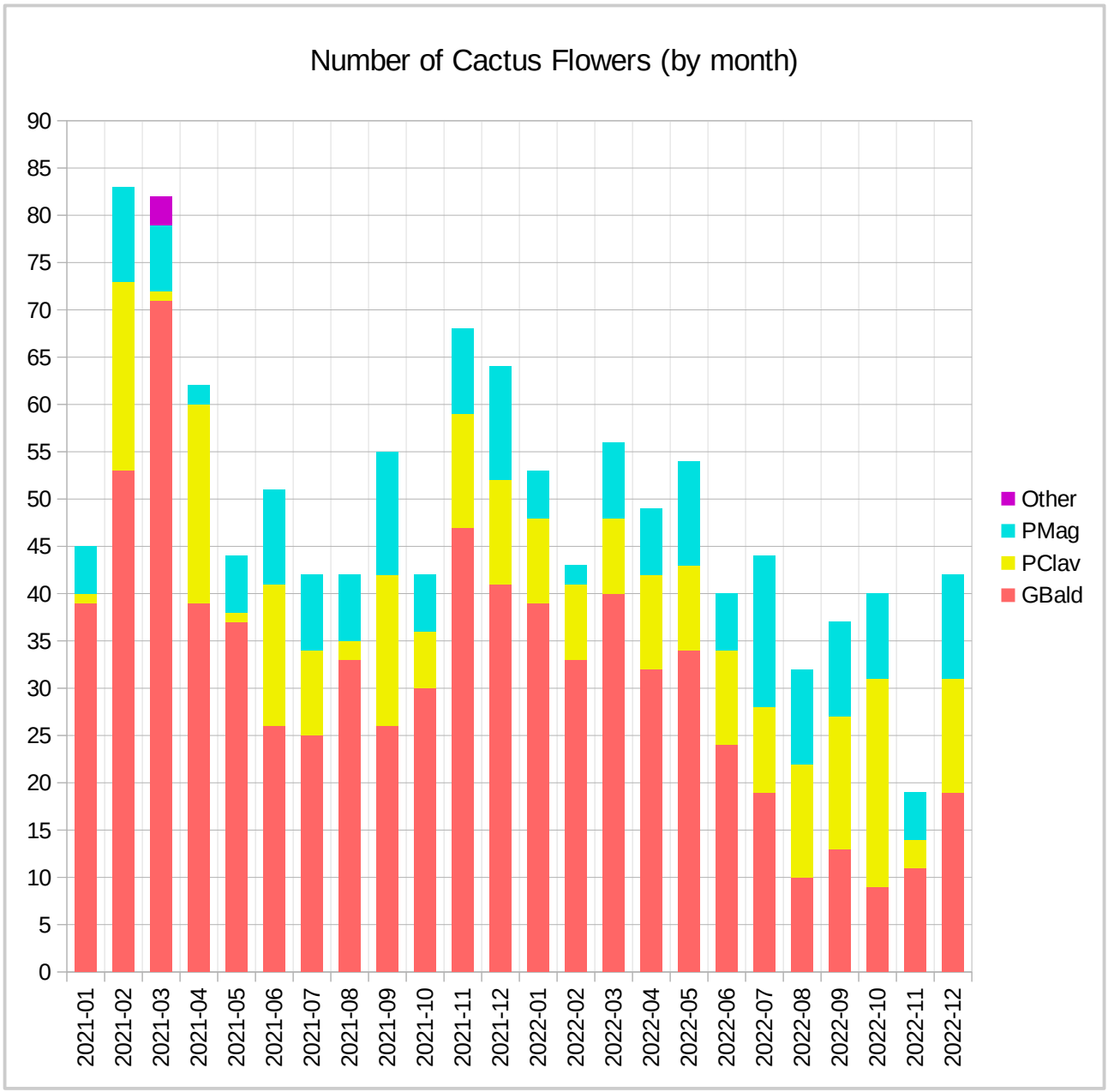
During this period, dormancy-like behaviour among GBald and GSteno specimens ranged from March 2017 (initial detection) to October 2017 (moved out of pots) to April 2018 (potting up of some specimens.) As you can see from the chart, some GBald flowers were still being produced almost every month. The lack of PMag flowers before September 2017 is due to PMag specimens being pot-bound. A similar issue affected PClav specimens from January 2018 to June 2018.

Per-species charts of flower totals by month are also available in a later section.



From 2019, continued recovery of GBald specimens led to more flowers. In 2020, as many as nine GBald specimens flowered for the first time. Out of these GBalds, six were grafted specimens. Two started contributing many flowers by April 2020, and all six were in bloom by September 2020, leading to a massive increase in GBald flowers towards the end of the year.

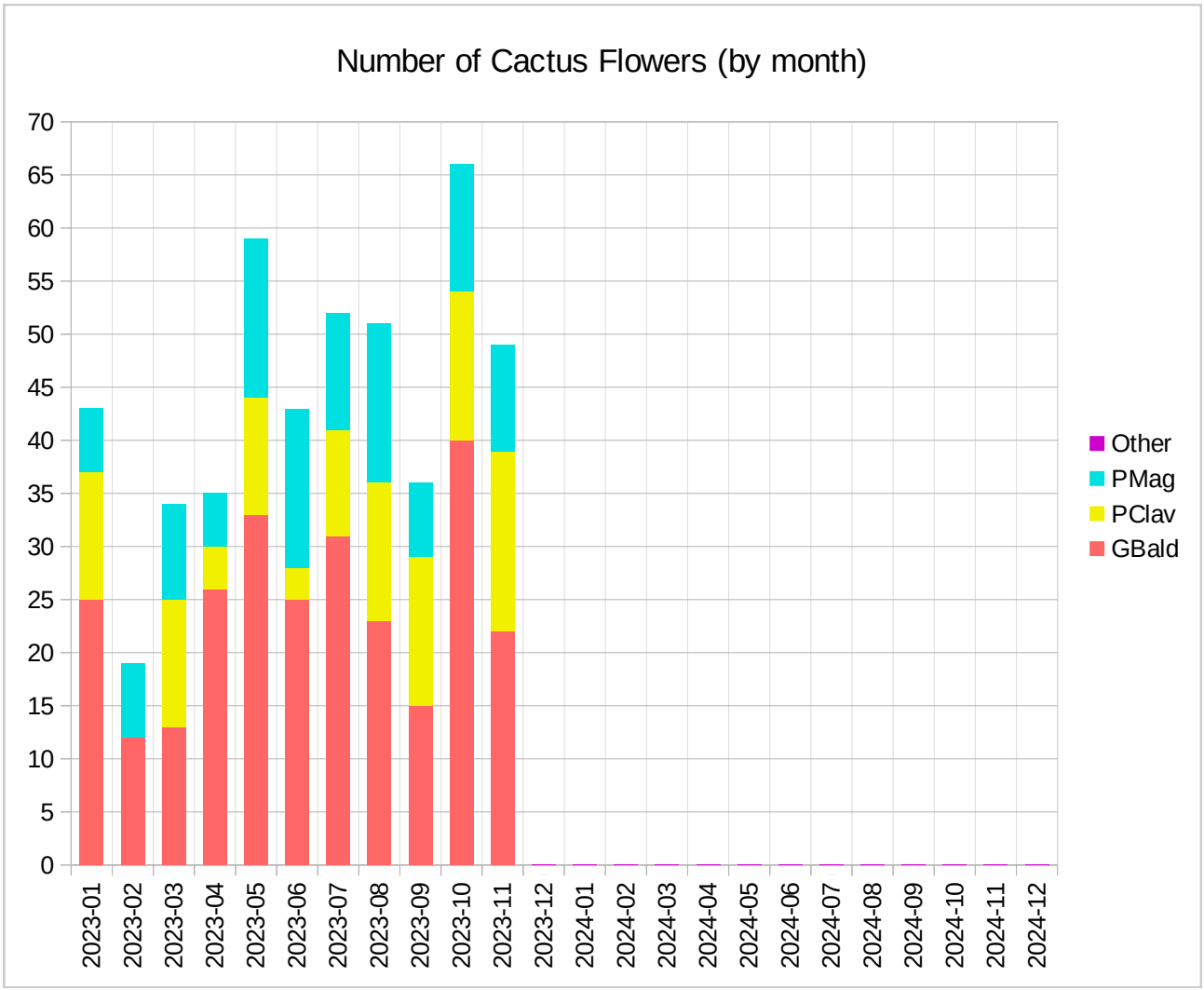
Subjectively, improved fortified water spraying consistency and better nutrition helped to produce more flowers among PMags, PClavs and GBalds. The effect can be clearly seen in the chart above as consistently longer blue and yellow bars after late 2019.



Thanks to the six GBald-on-MGeo grafts, there has been many months where at least one flower was open for each day of the month. In a ‘lean’ 2021 month, for example July 2021, the minimum open flowers was 1, the maximum was 14, and the per-day average for the month is 7.7 flowers.

A silicon nanopowder fertilizer was used in fortified water sprays starting from October 2021. While some specimens apparently reacted positively to the stuff, I have not regularly used it because my *Haworthia* specimens reacted badly to either the silicon or maybe its acidic chelator.

Starting from April 2022, there is a steep decline in the number of GBald flowers due to specimens being pot-bound. Root growth was restricted, leading to stalled growth and no flowers. This is covered in detail in other chapters.

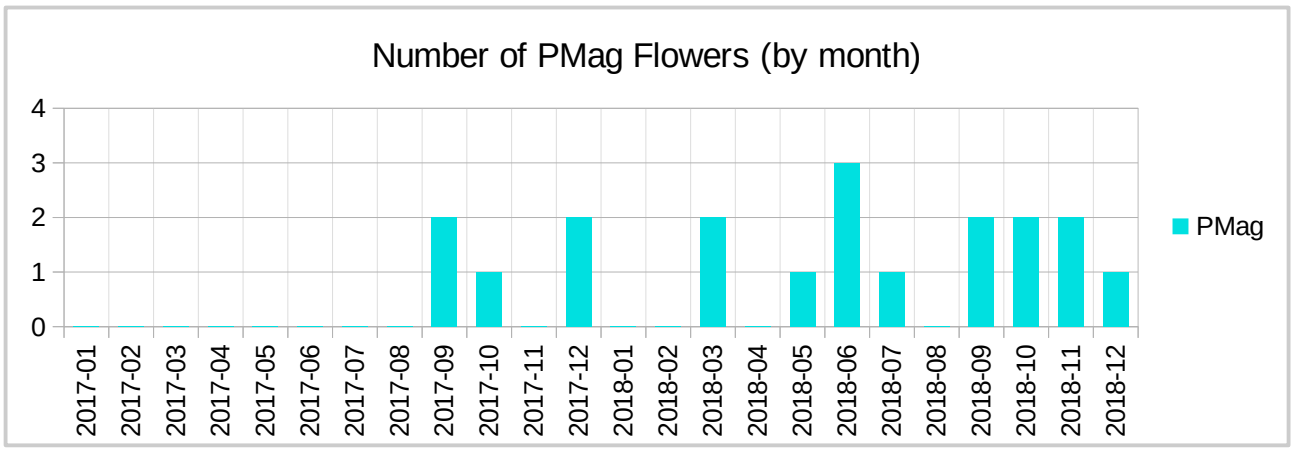


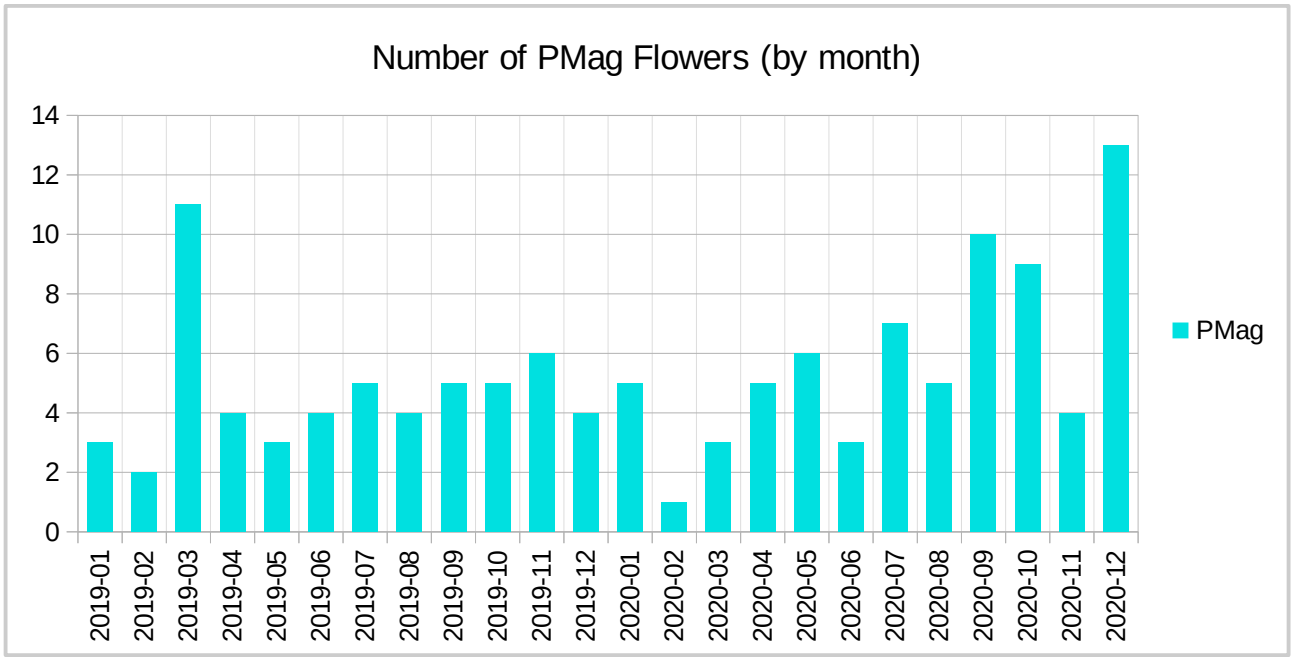
Once some GBalds were repotted and revived, there is an uptick of GBald flowers starting from December 2022. The number of GBald flowers went from about 10 per month to about 20 per month. In the first half of 2023, only two GBalds were able to produce large flushes of flowers. Some recovering GBalds cannot yet produce large flushes of flowers. Thus, there are large variations in the number of GBald flowers.

The PMags and PClavs are still going strong – the largest specimens have not displayed critical signs of being pot-bound because they are still responding to feeding. From the charts, one can see some improvement in the numbers of PMag flowers; this is due to more aggressive feeding and watering. But I'm still holding back on nitrogen fertilization because I want the PMags and PClavs to continue producing flower buds and not offsets.

Per-Species Cactus Flowers by Month

Here are the PMag-only flower numbers.



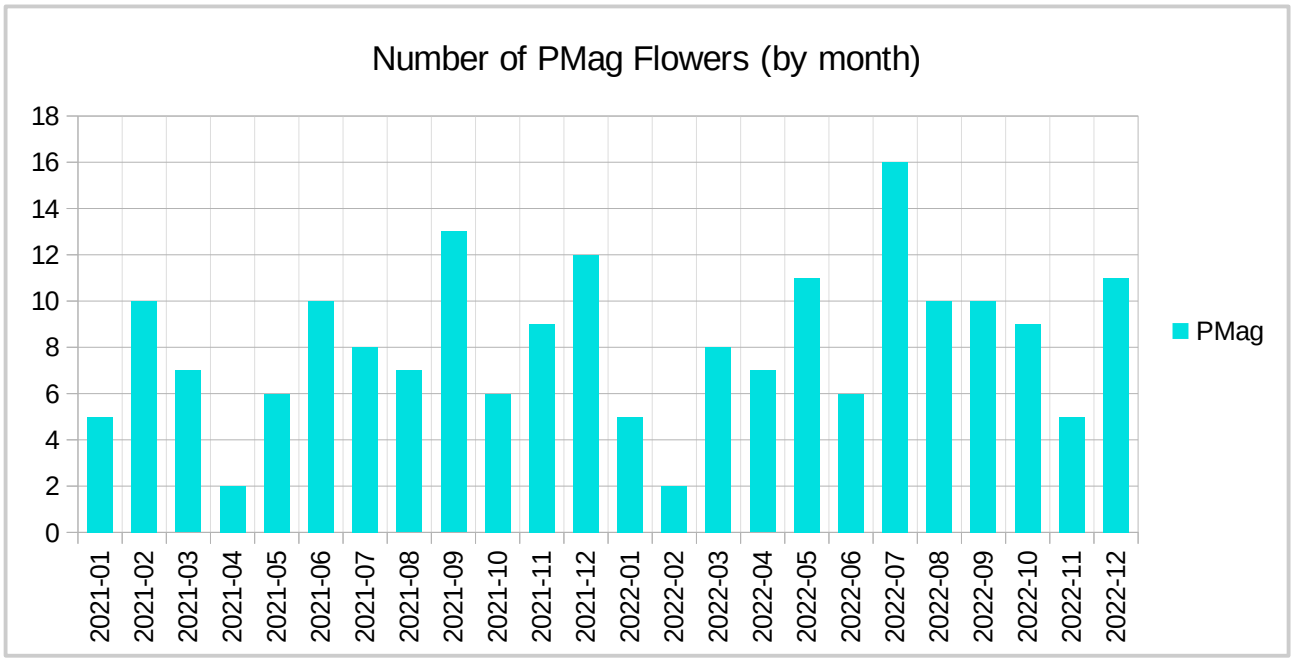


In 2020, five PMag specimens produced one or more flowers. Out of the five, only two were consistent in producing flowers.

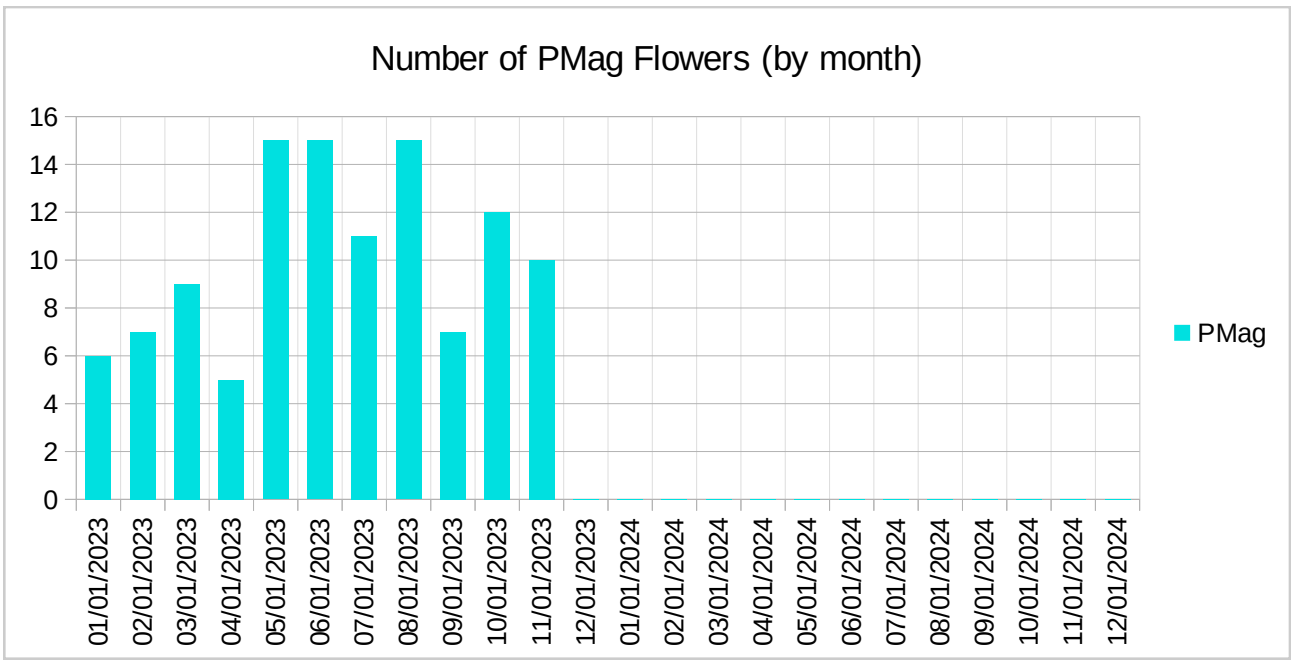
I suspect the flowering potential of my PMag specimens is seriously hampered by being pot-bound to various degrees due to the strong root system of this species. PMags fill up their pots really fast; one may have to repot every year to get a growth rate closer to optimal. PMags are less spectacular as flowering specimens, as one stem can only produce at most two simultaneous flowers. Usually a stem produces only one flower at a time. Also, if there are many seed pods, there will be fewer flowers. We should remember that cactus plants have limited resources to expend.

Two out of four PMags in bloom, each with two flowers open on one stem. This isn't a common occurrence. (November 2019)

The big PMag about 2 weeks later. The resulting seed pods (arrow) will stall the growth of new flower buds for a while. (November 2019)

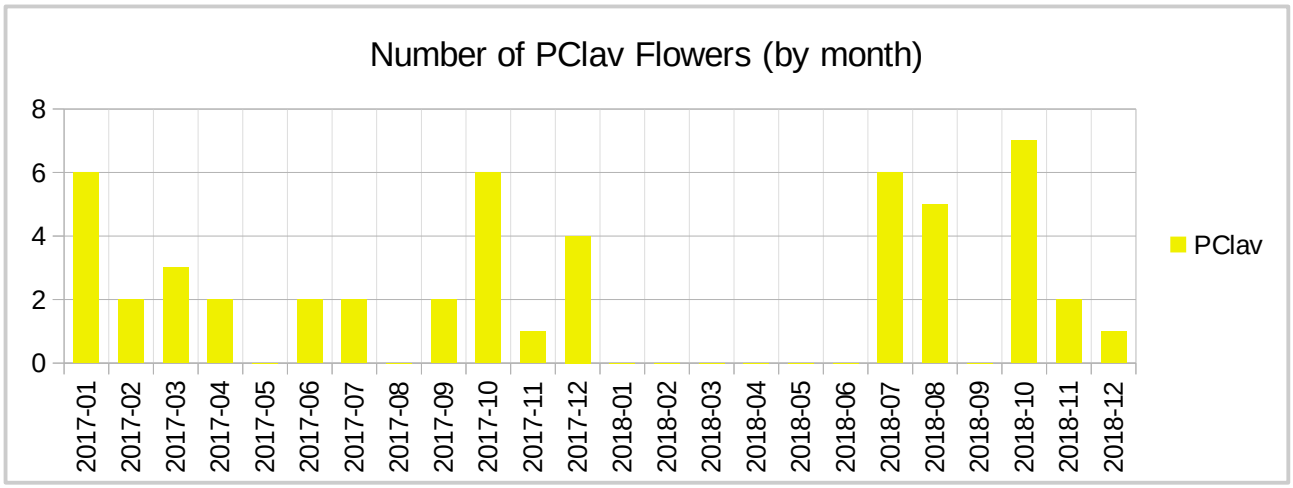


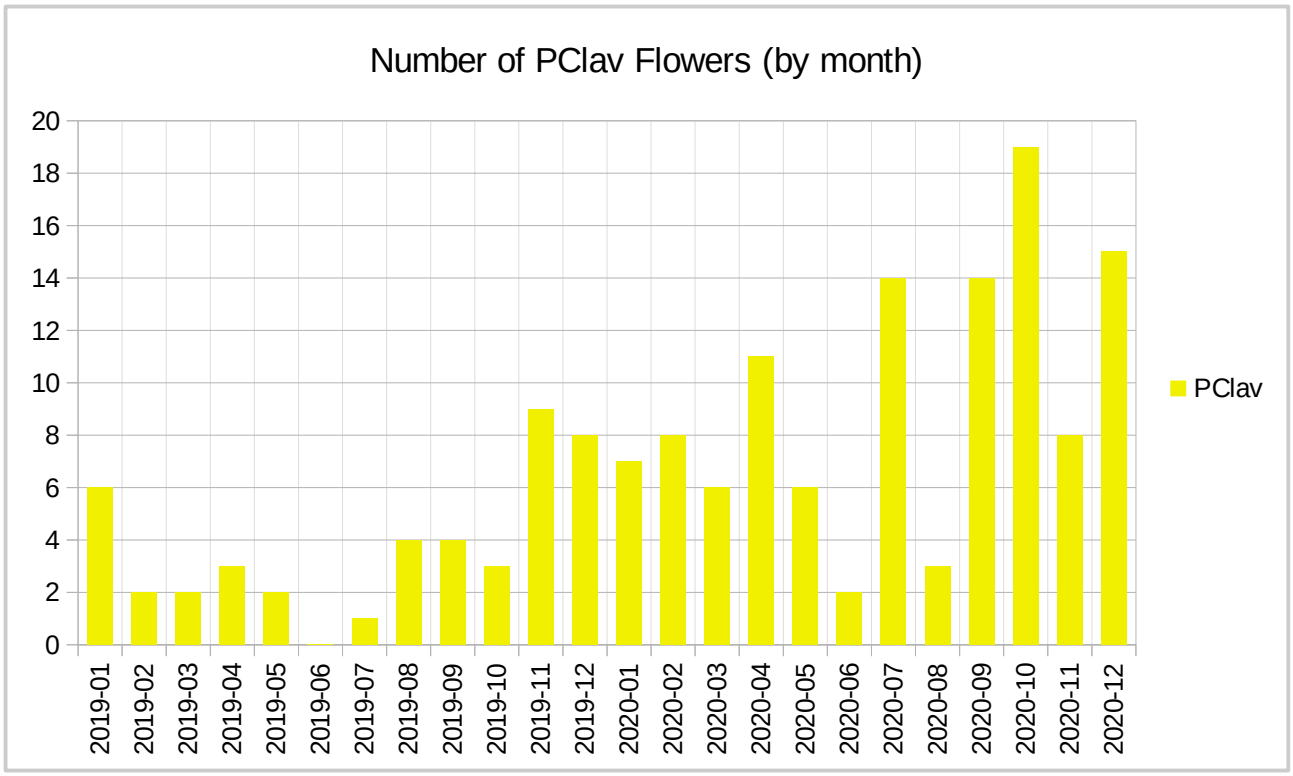
In 2021 and 2022, the two largest PMags reliably plodded along, providing some flowers each month. The specimens most likely can produce many more flowers if given new, larger pots to live in. I'm thinking of repotting a couple of PMag specimens every 6 months as a test, but the prospect of repotting every 6 months is not very appealing, so I haven't taken any action yet.



Two PMags were repotted in March 2023 and they've begun to flower again. This, plus the aforementioned more aggressive feeding and watering, is expected to help PMags to a better flower total for 2023. Small adjustments have successfully led to improved PMag performance.

Here are the PClav-only flower numbers.



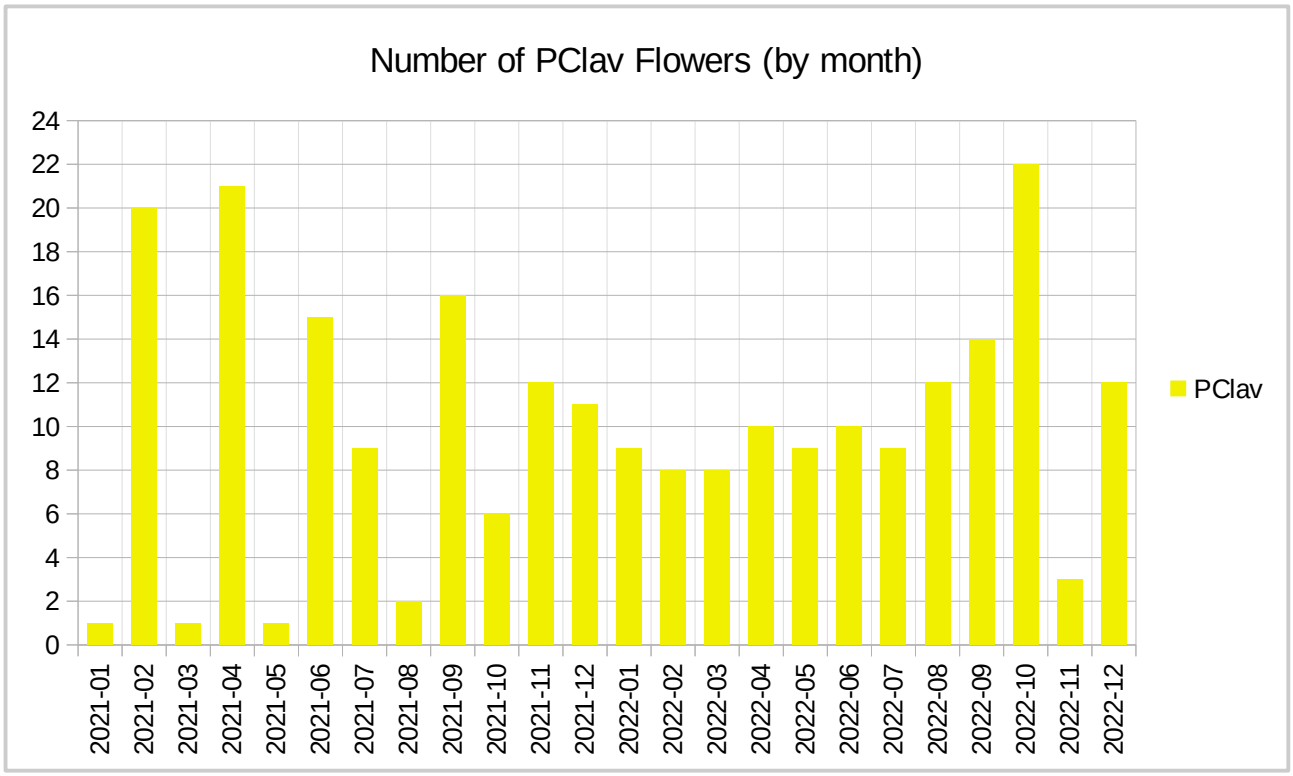


In 2020, four PClav specimens produced one or more flowers. Out of the four, only one – the largest specimen – was consistent in producing flowers.

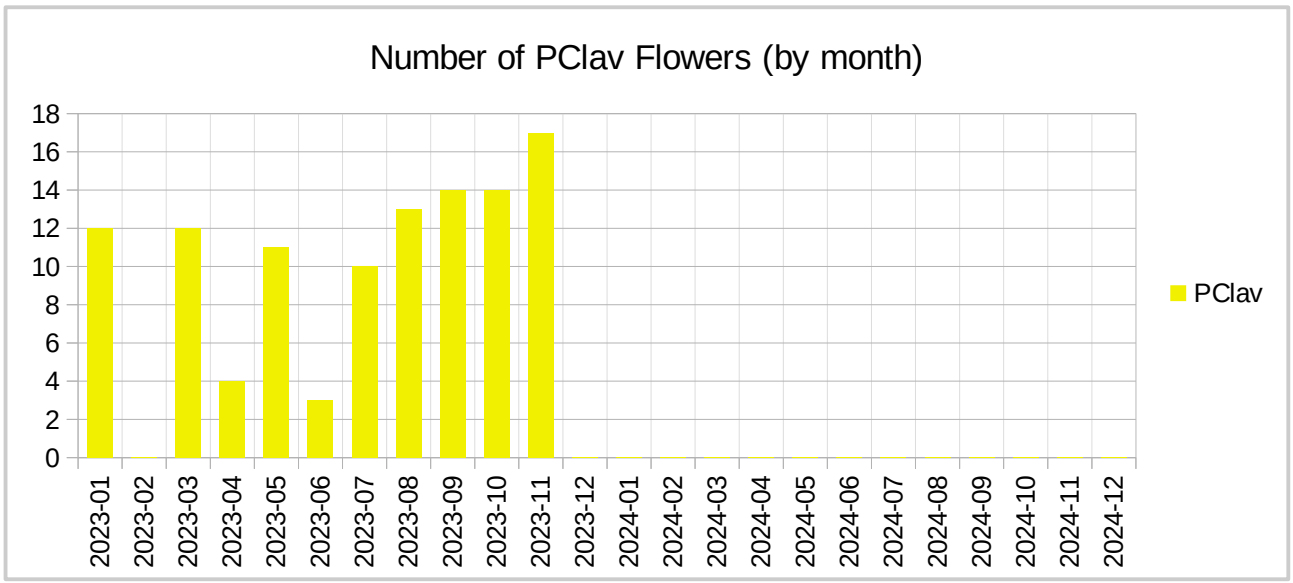
The second largest specimen is still grappling with having to maintain a number of offsets, so there are less resources to put into flower production. Two others are on the small side; flower forcing was attempted and a total of 9 flowers were produced in October and November 2020 from the two specimens. Seed pods on PClav will also slow down the growth of flower buds.

This is the third day these 7 PClav flowers are open – just barely. (October 2020)

About 10 days later, in November 2020. Three largest seed pods (centre and left) are viable; manual pollination was done on those flowers. In the centre, new flower buds can barely be seen – their growth has stalled due to the seed pods.

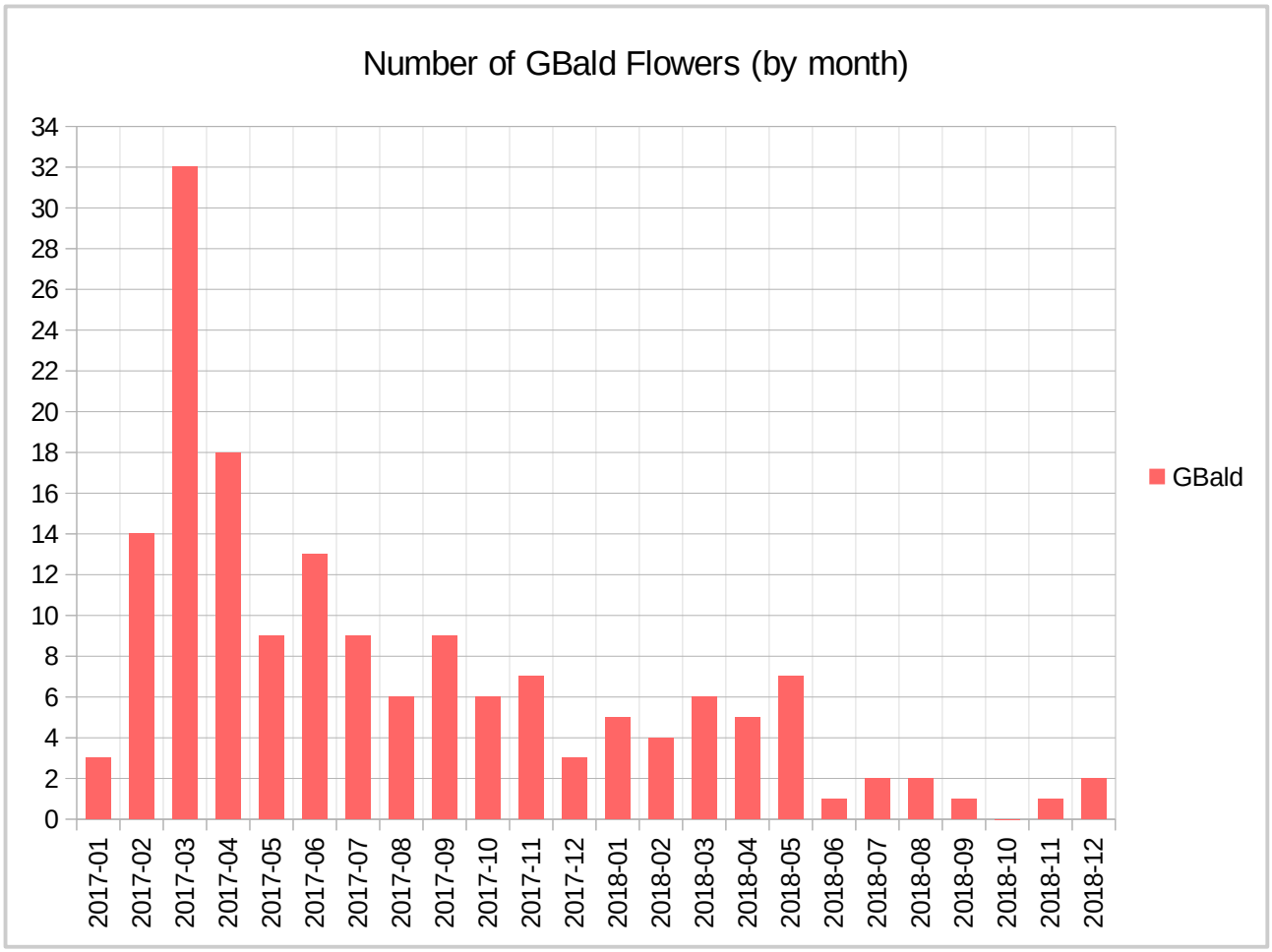


In 2021, all but three PClav flowers were contributed by the big PClav specimen. The big specimen now appears to be operating on a two-month cadence. In the second half of 2021, the cadence of flower flushes is less extreme but the pace of flower production is still very good. In 2022, flowering was generally more regular. The dip in November 2022 is more of a statistical or data binning effect due to the timings of flower flushes.

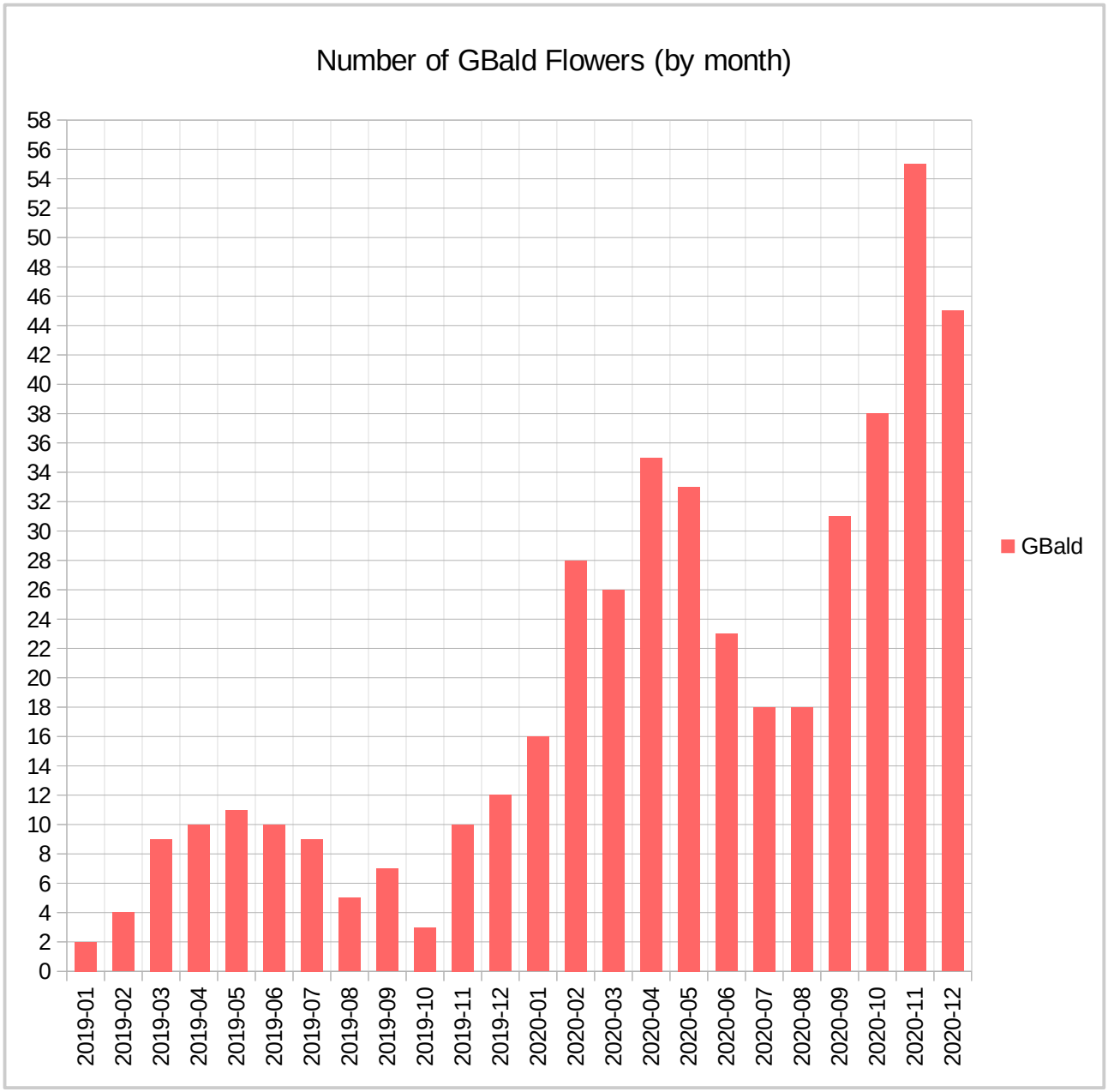


In 2023, PClav flowers is again dominated by flushes of flowers from the big PClav. Well, I think I have to grow more PClavs then.

Here are the GBald-only flower numbers.

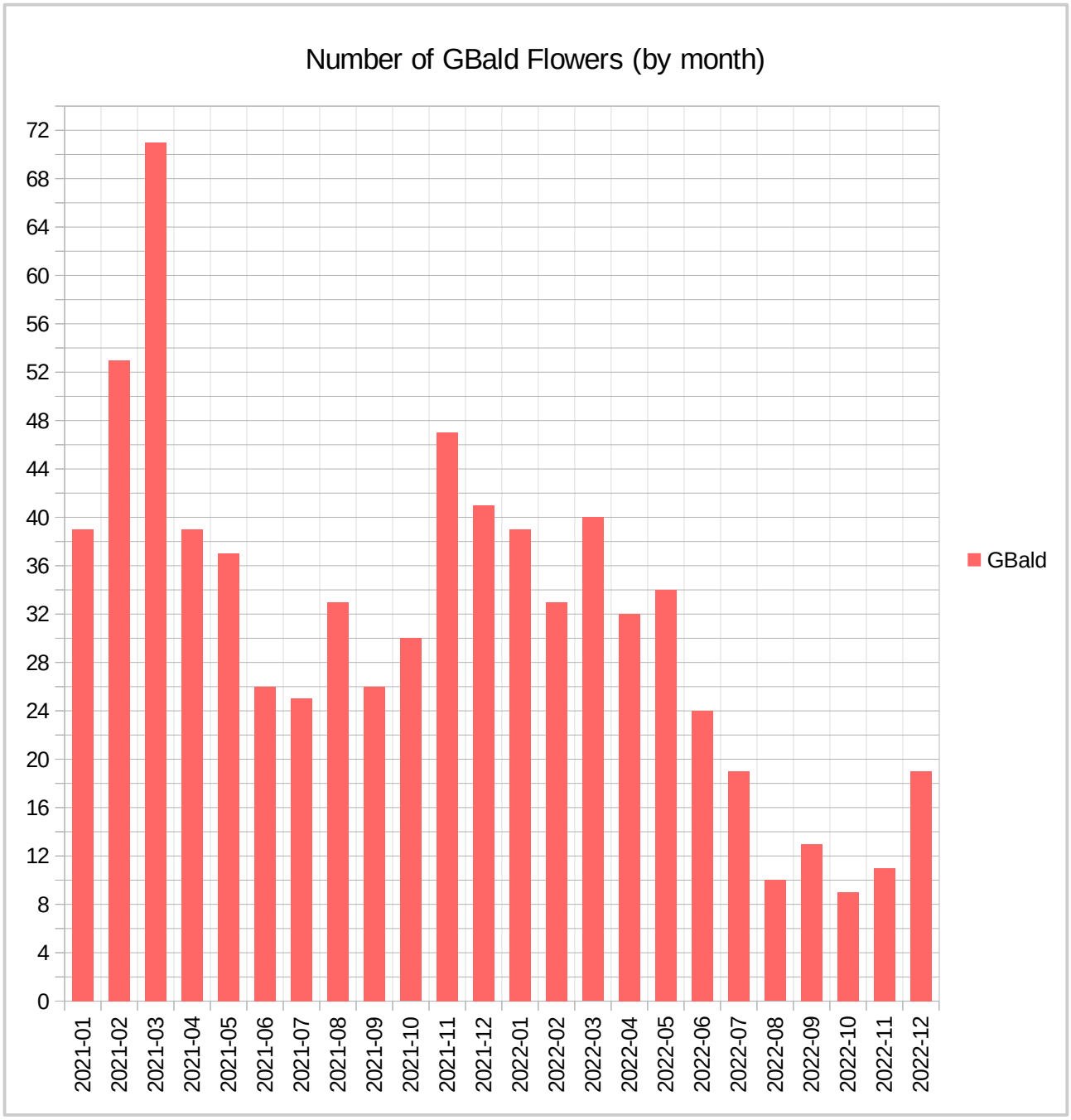


10 flowers on 6 GBald specimens in late March 2017. There was also a burst of flowers early in the month. Add flowers from the grafted GBald, and the total just surpasses 30 flowers – an early demonstration of what's possible with GBalds.



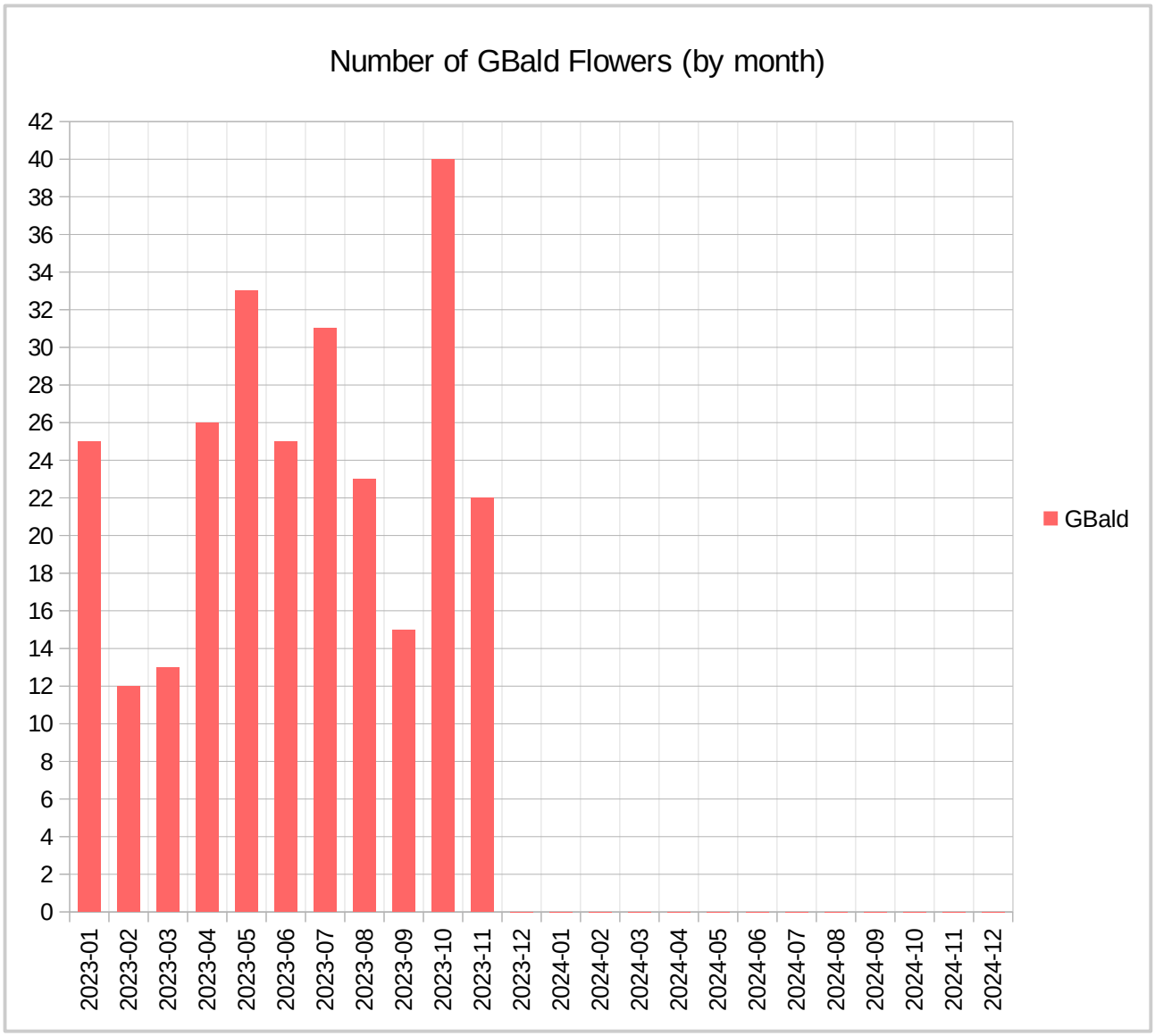
The massive increase in GBald flowers from April 2020 onwards was mainly powered by six GBald-on-MGeo grafts. They were grafted in April 2019. For example, in October 2020, the six grafted specimens (identified as 2019A–2019F in my spreadsheet) contributed 4, 2, 5, 6, 3 and 6 flowers, respectively, for a total of 26 flowers in that month. The other 12 flowers were produced by 7 normal GBalds.

October 2020 was a very productive month: 13 GBalds flowered, in addition to 6 *Parodia*s.



There was an impressive peak of 71 GBald flowers in March 2021. But extended stretches of wet weather in April and May has the disrupted spraying of fortified water, so I believe that I am not getting the maximum out of these GBalds after March 2021.

One of the 2019 grafted specimen is dead (2019A) but it wasn't a super performer in terms of flower production. The cause of death may have been bacterial. Six new GBald-on-MGeo grafts were completed in October 2021, but an uptick in GBald flower production did not materialize because of the crisis of stalled growth. A minimum of 9 GBald flowers was reached in October 2022.

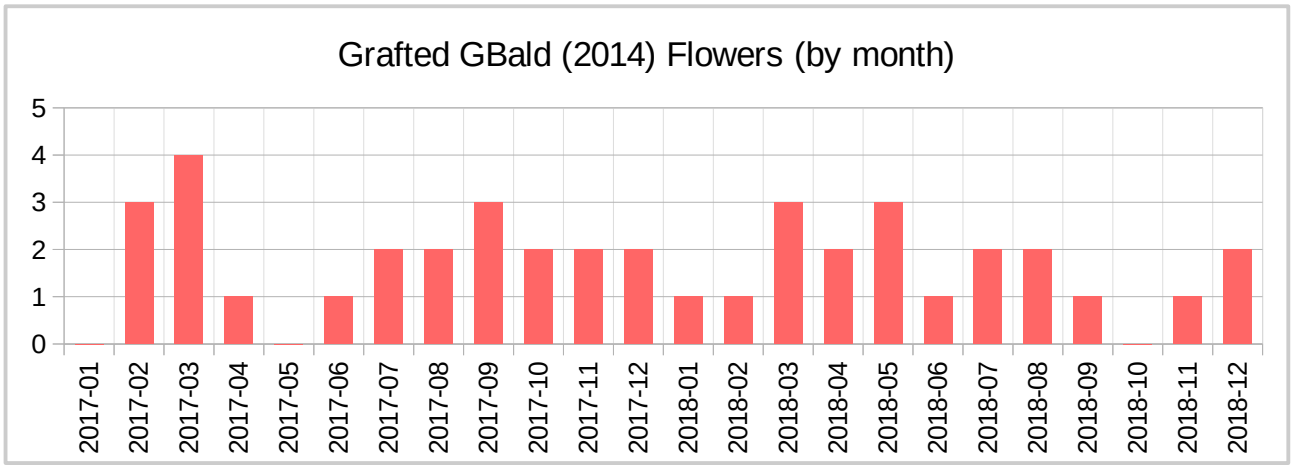


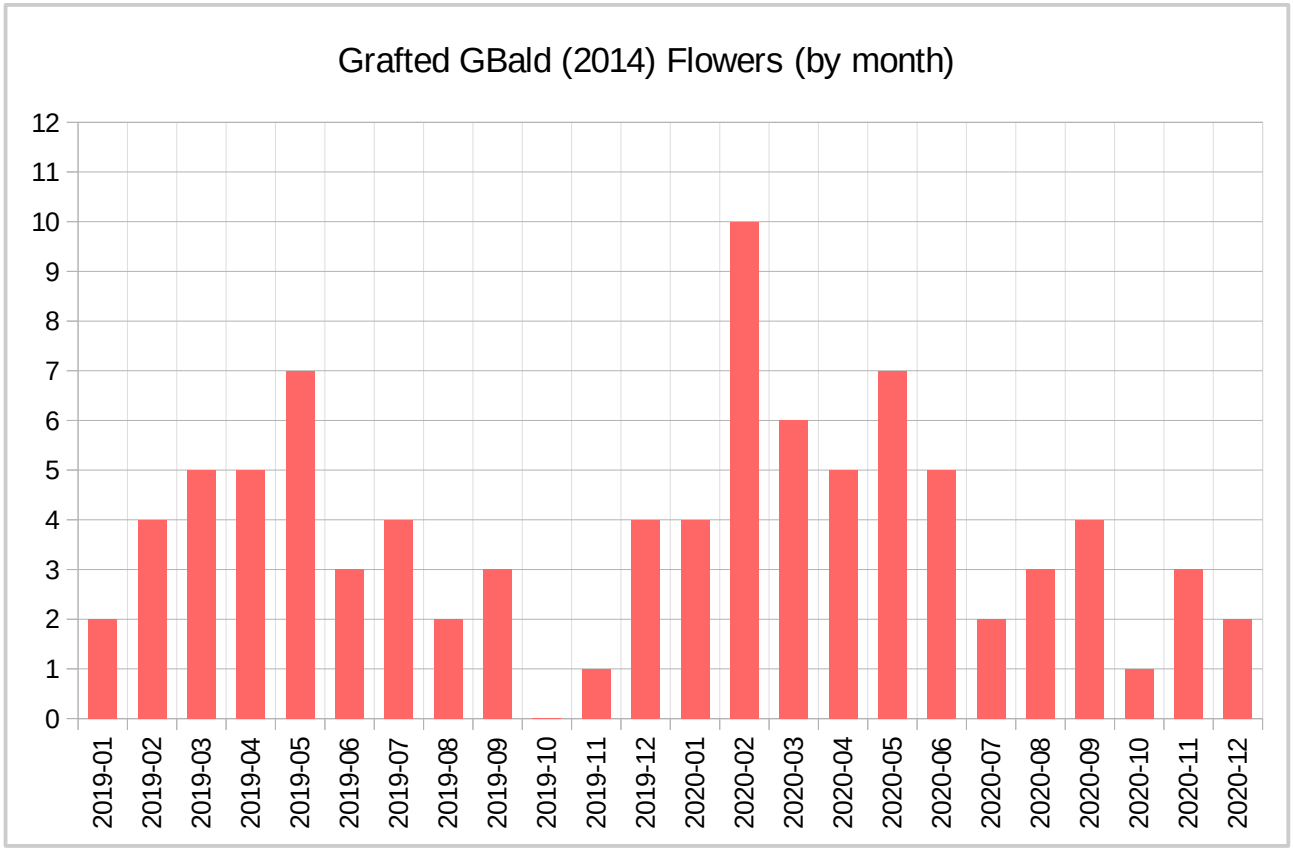
After a lot of repotting starting from late 2022, the first half of 2023 is a period of recovery and revival for GBald specimens. Monthly GBald flower production has improved to around 20. While not every GBalds have recovered enough to produce large flower flushes regularly, many were healthy enough to boost the average flowers per month for the second half of 2023 to about 25.

In order to increase GBald flower production, I will have to do some grafting again. My next batch of GBald grafts will probably not use MGeo rootstocks, because I need to experiment more widely since we need strong and healthy root growth in order to get all those grafted GBald flowers.

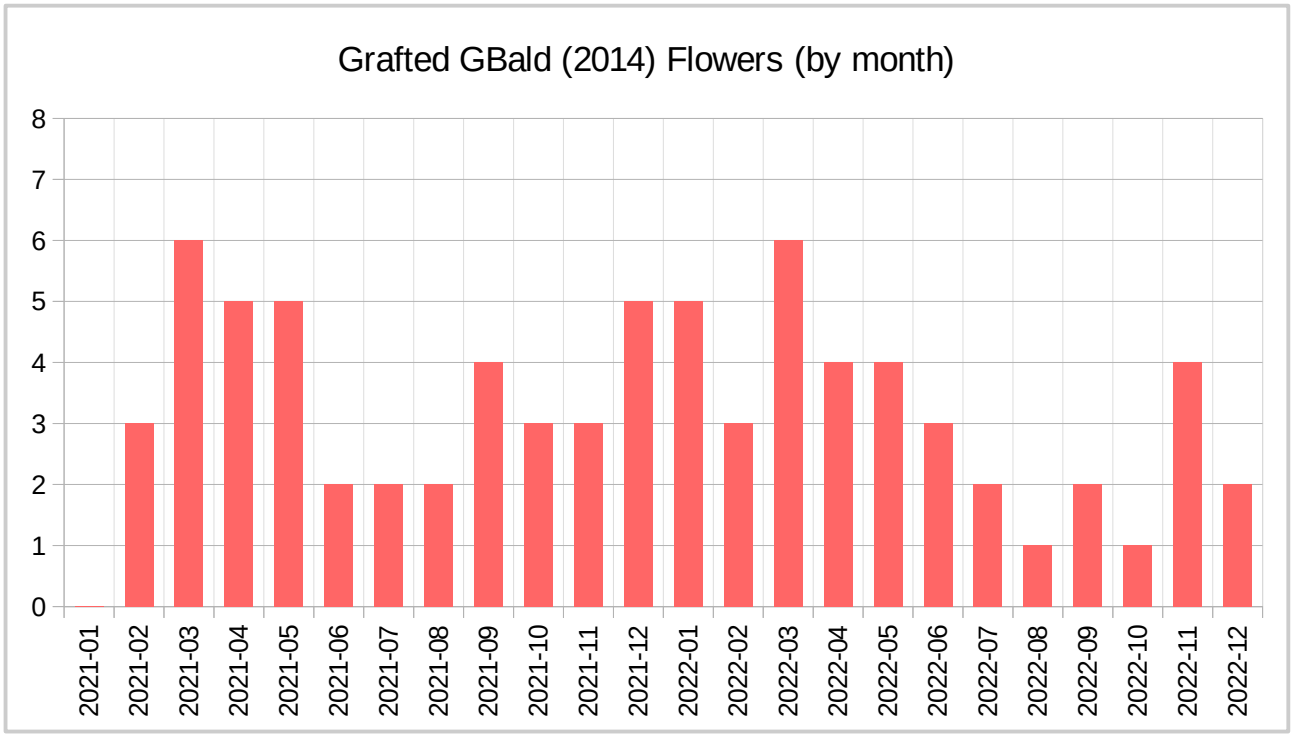
Grafted GBald (2014) Flowers by Month

These charts track flowers produced by the GBald-on-MGeo graft from 2017 onwards. The specimen was grafted in March 2014. It is described in detail in the chapter on Grafting Part 1.

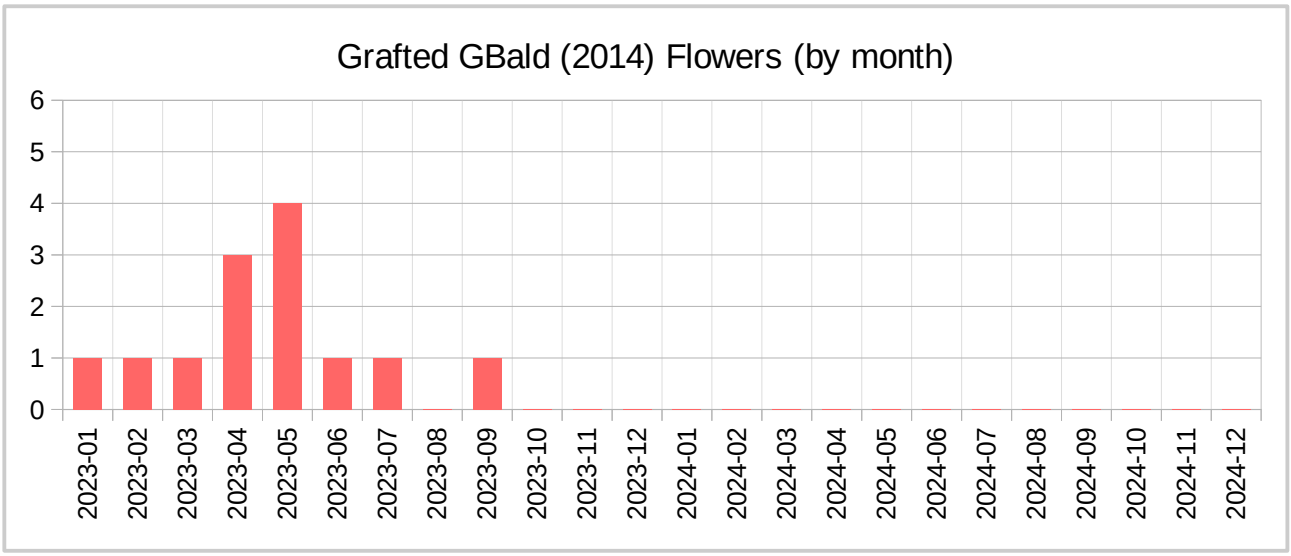




The GBald scion fell off from its MGeo stock in late January 2020. One of the four flowers in that month opened just after it detached. At first there was strong growth, but it seemed to run out of steam after about half a year. I thought it was weakening around October 2020, when one bud aborted, but it picked up again and seems to be plodding along.



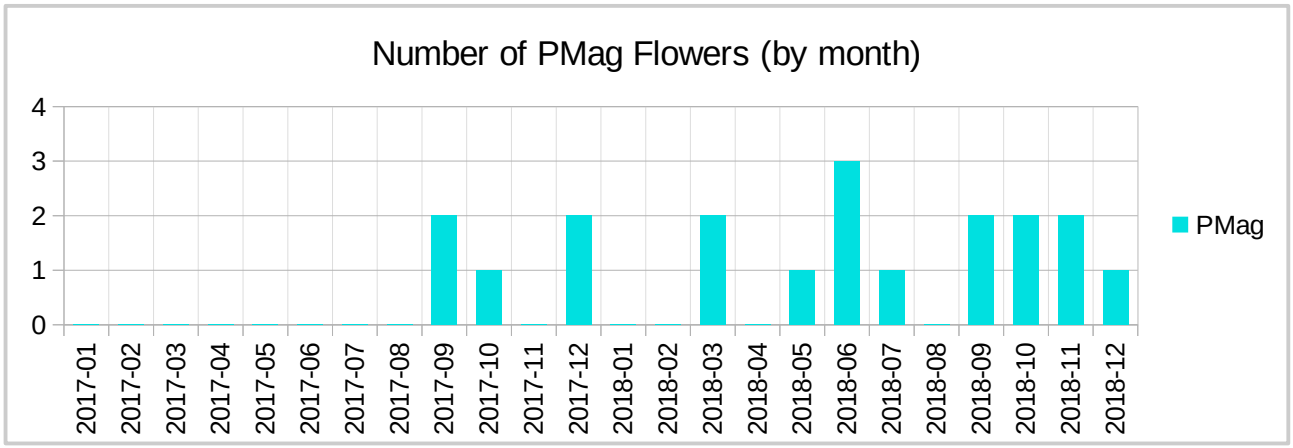
The specimen picked up again in February 2021 and steadily produced flowers throughout most of 2021 and 2022. It was repotted at the end of September 2022, leading to a revival in November. The flower totals for 2021 and 2022 is 40 and 37, respectively. By comparison, grafted GBalds can do better: the grafted GBald 2019E produced 68 flowers in 2021.



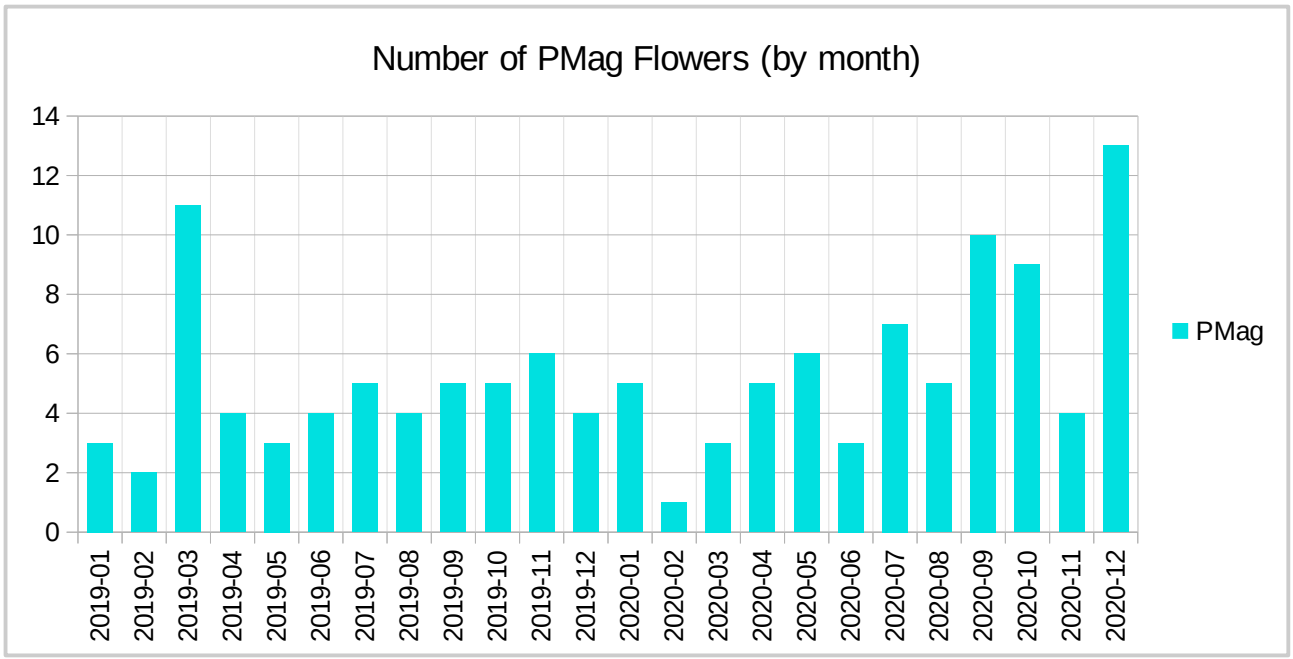
By March 2023, it has been 9 years since the GBald was grafted. In the first half of 2023, flower buds have been aborted at a late stage on occasion. From about June 2023, it became more common for flower buds to fail. By August, the GBald looked like it was really struggling. In October 2023, it was removed from its pot and the root system was found to be in poor condition. I am now experimenting on it, trying to learn how to keep an old GBald alive.

Big PMag Flowers by Month

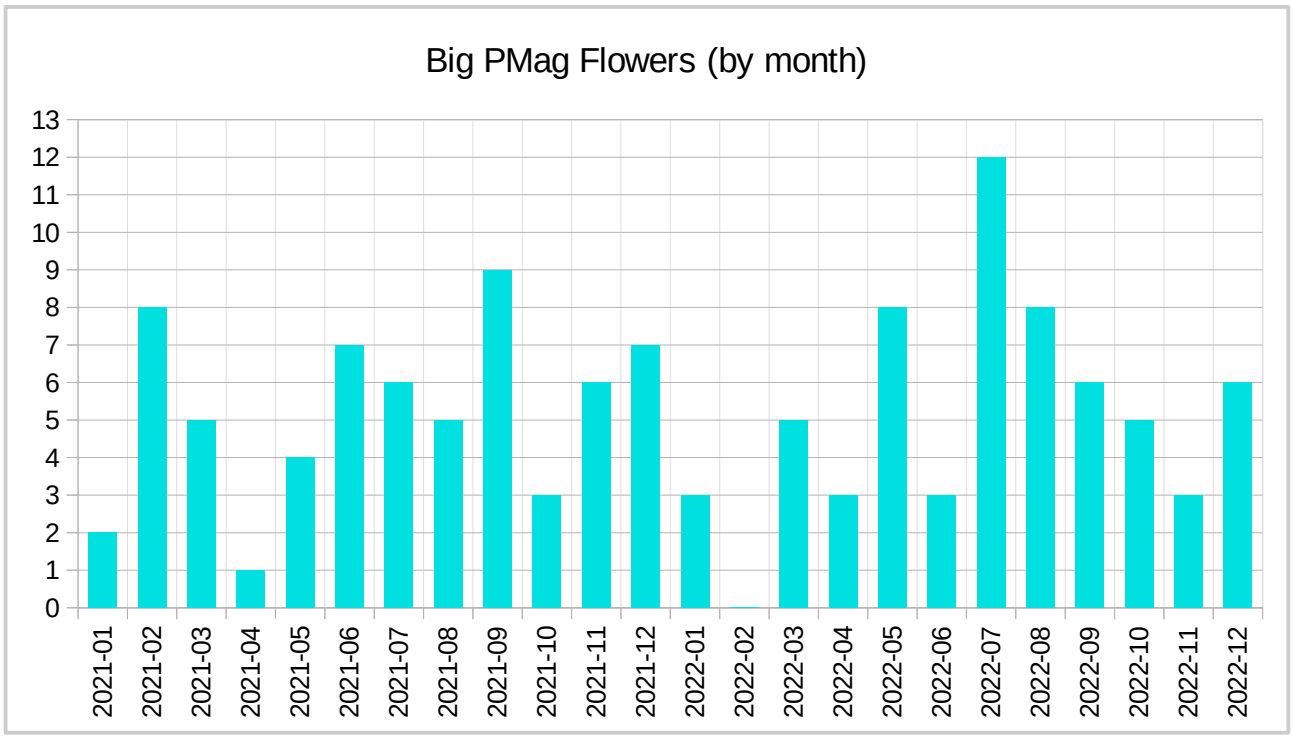
These charts track flowers produced by my biggest PMag specimen from 2017 onwards. The specimen was repotted in April 2017 and December 2018. Note the long stretch without flowers from January 2017 to August 2017 – the primary cause was the root system being pot-bound. It was repotted a second time (in December 2018) because I felt it was performing poorly, with few flowers.



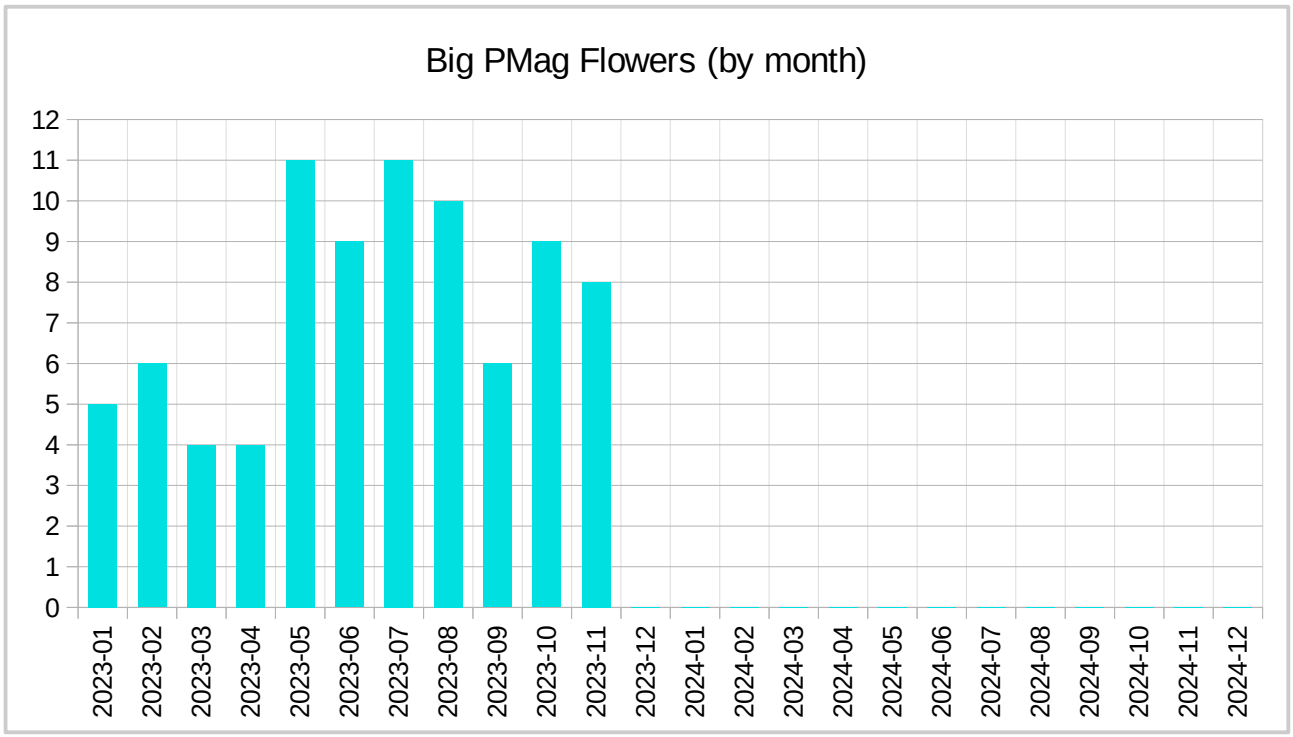
The peak in March 2019 may be the result of the root system having a lot of space to grow. Increased number of flowers in the second half of 2020 is probably due to more frequent spraying and better nutrition.



This PMag specimen sets many more seed pods than the large PClav specimen, and these seed pods will slow down flower production. Still, 38 flowers in 2019 and 50 flowers in 2020 is pretty good. This PMag is a solid performer, but I think it could be better if the root system has space to roam.



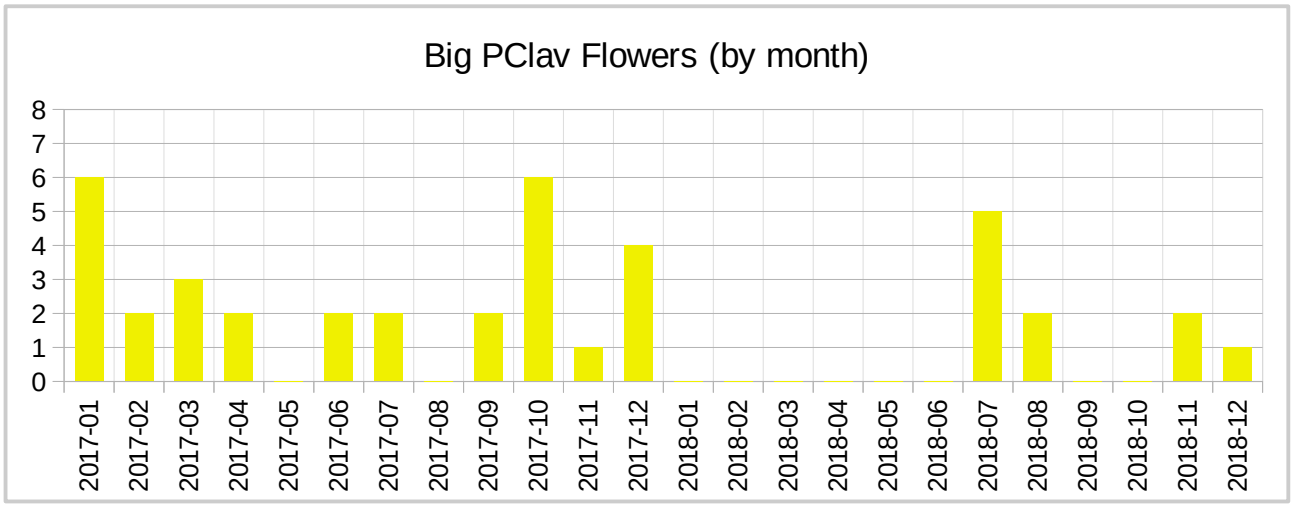
Even without repotting the PMag, its productivity has not declined. As I got more comfortable with feeding my plants, I pushed more and the specimen responded, producing more flowers: 63 in 2021 and 62 in 2022. I have probably not yet reached peak performance for this big PMag.

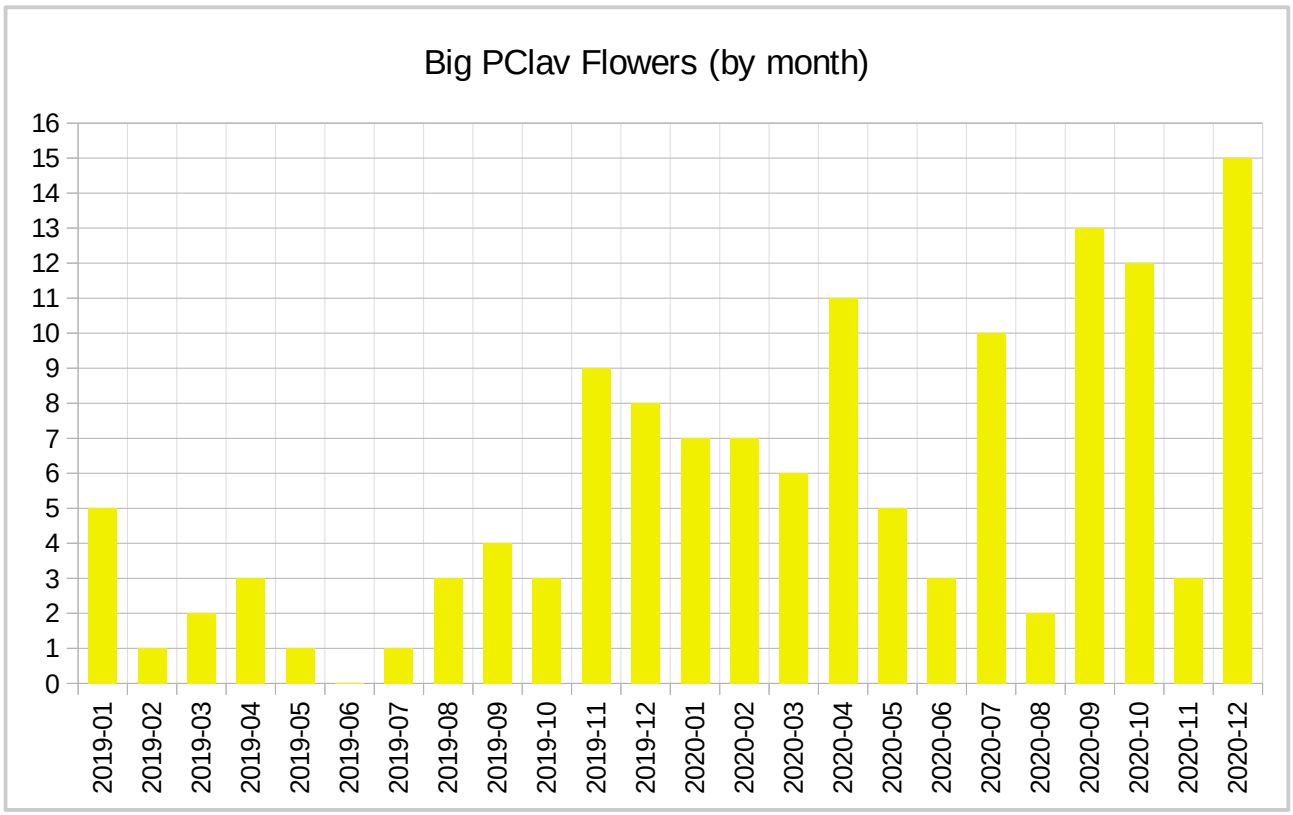


By pushing harder, the specimen has reached 39 flowers in the first half of 2023 alone. One possible side effect I've noticed: lately most of its seed pods don't have a lot of seeds in them.

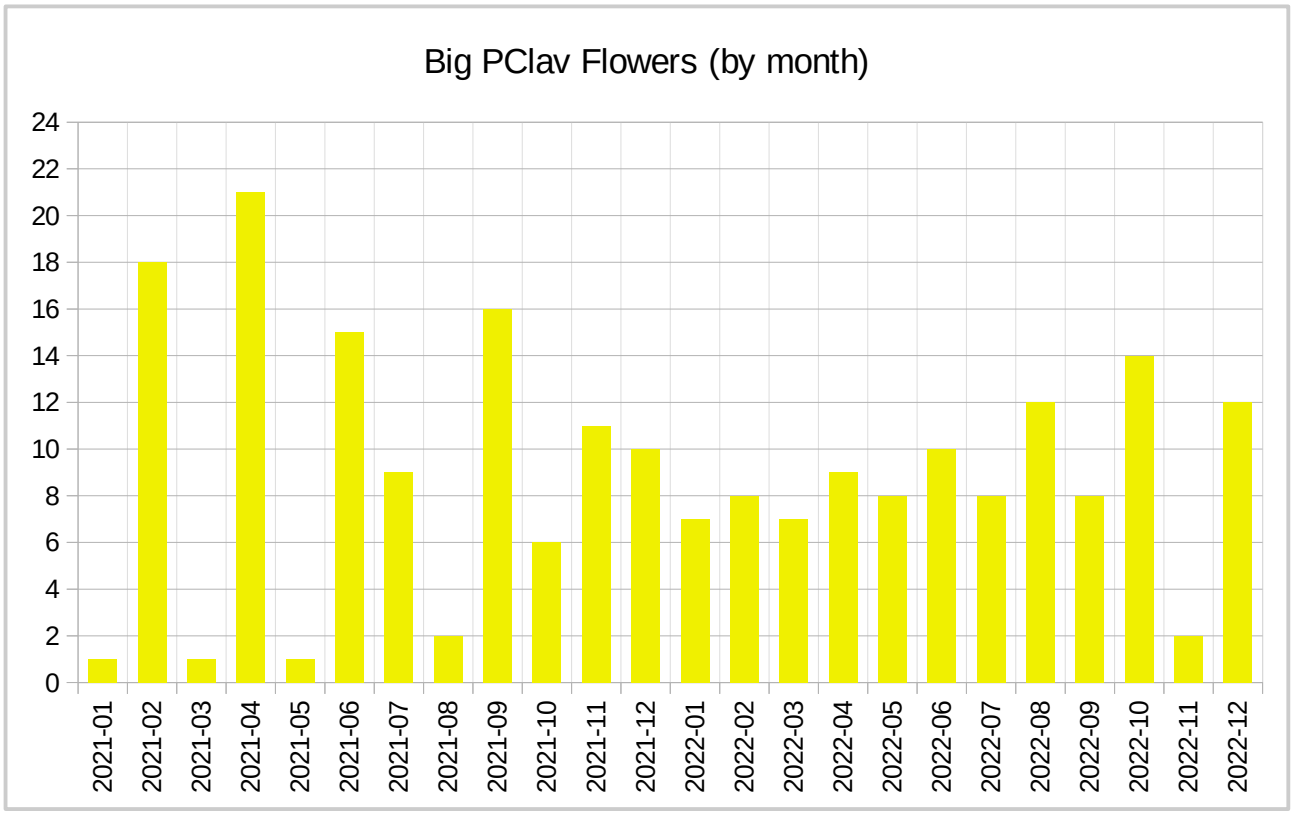
Big PClav Flowers by Month

These charts track flowers produced by my biggest PClav specimen from 2017 onwards. The specimen was repotted in April 2018 after a stretch of 4 months without any flowers.





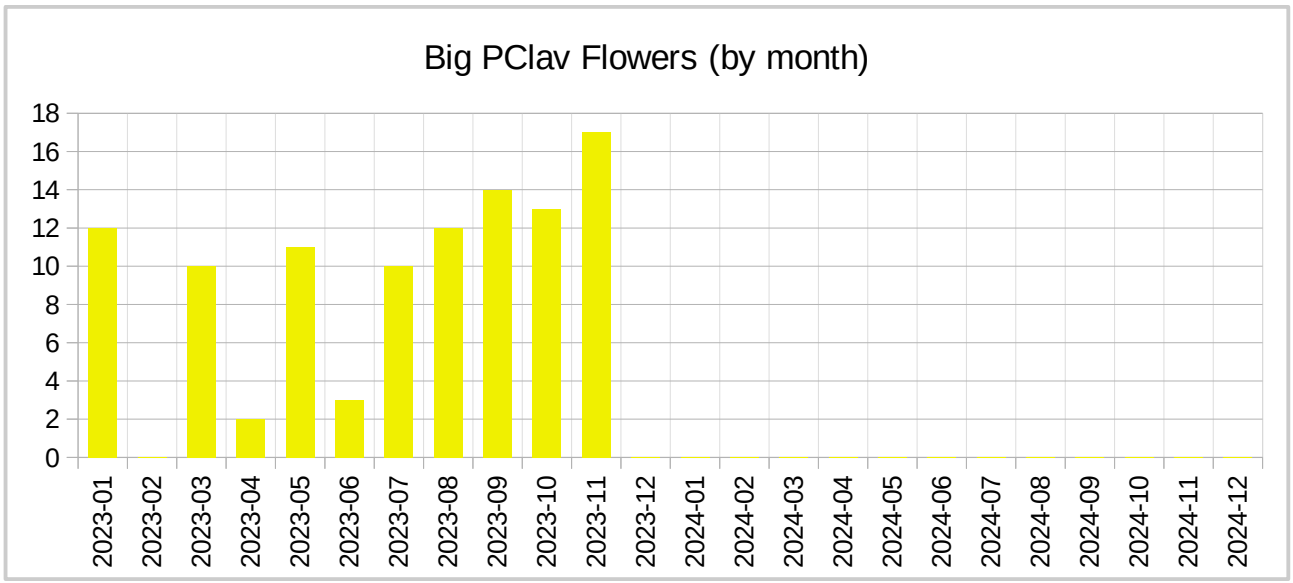
This big PClav likes to produce many flowers at a time, so the flower numbers look ‘bursty’, especially in 2020. It does not set many seed pods on its own, so it is more focused on flower production than the big PMag. 40 flowers were produced in 2019. Thanks to better care, this specimen produced 94 flowers in 2020.



This big PClav improved to 111 flowers in 2021, followed by 105 flowers in 2022. In the first half of 2021, it was putting out bursts of flowers on a two-month cadence. For example, in the February 2021 flush there were 18 flowers. It then took the PClav 54 days to produce the next big flush, which was 21 flowers in April 2021. In between the two big flushes, there was a single flower in late March 2021. I have tried looking at some research papers and the takeaway is that such behaviour (the production of flushes of flowers) is due to a plant's resource use and accummulation.

Very big flushes of flowers have a higher number of simultaneous flowers, but the flowers have become smaller – the PClav doesn't have unlimited resources to expend. However, in the second half of 2021, flower production is more spread out, and continued in this fashion throughout 2022.

The low of 2 flowers in November 2022 is statistical, due to data binning. The PClav had produced a flush of 9 flowers near the end of October 2022. It then took most of the following month to recover and gear up for the next flush, which started with 2 flowers at the end of November, followed by another 7 flowers in early December 2022.



In the first half of 2023, there were 38 flowers. Peak performance was stymied by three large seed pods in April and one seed pod in June. Normally, this specimen does not set a lot of seed pods, but the three large seed pods in particular were the result of manual cross-pollination with GBald pollen.

Performance in the second half of 2023 was better: it produced 66 flowers for the July–November period. For 2023, it is expected to exceed 110 flowers for the year. That's over 100 flowers a year for 3 years in a row from one PClav stem.

Generally, I'm happy as long as the PClav is growing well. A significant downturn in flower production means that growth has slowed down and it may be time to repot the specimen. I do have some concerns about its roots being pot-bound. The shape of the PClav has also been changing. The lower parts are shrinking and looking more woody or corky, so it is not perfectly cylindrical or perfectly green these days. In general, it looks like an aging columar cactus now.

Future Updates

A few specimens in bloom in late October 2020, posed. I focus on only 3 species that are willing to flower in the tropics, so I am stuck with red and yellow flowers. The small GBald at lower right is in a 2 inch pot – GBalds may not need a very large root system to flourish. Instead, healthy root systems may be more important for GBalds.

How much did I pay for these plants? RM0.00 – nothing. All are rooted offsets.

This chapter is a work in progress. The spreadsheet is updated daily with flower counts. If there is any issue with the spreadsheet data, I can always check my picture archive for verification. The plan is, when there are fewer pressing issues to deal with, I will move the spreadsheet data into a simple CSV text file, with some error-checking during conversion, so that there is a dataset to play with using Python or R.

I can get some useful insights even with the spreadsheet tables alone. There appears to be some synchronization of PMag and PClav flowering times. It doesn't seem to be mere coincidence to me; they are probably sensing environmental signals. They also flowered along with rain lilies (*Zephyranthes*) a few times. GBalds do not appear to have synchronized flowering.

One GBald flower has lasted 11 days, in July 2021 on GBald graft 2019B. This is probably due to mild weather, adequate moisture, and it being a single flower on a very healthy grafted GBald. Individual flowers in a flush of GBald flowers last 6 to 8 days now; this has improved from a few years ago due to better feeding and watering practices. Around 2020, my estimate for GBald flower longevity was 5 days. Now I have data which can be studied so that improvements can be tested.

Table of cactus flower totals for 2017 to 2023.

Year	GBald	PClav	PMag	Other	TOTAL
2017[1]	129	30	5	4	168
2018[1]	36	21	14	0	71
2019[1]	92	44	56	1	193
2020	366	113	71	0	550
2021	467	115	95	3	680
2022	283	126	100	0	509
2023[2]	265	110	112	0	487
TOTAL	**1638**	**559**	**453**	**8**	**2658**

[1] Flower data is based on incomplete picture coverage in these years.
[2] Partial data. Complete for January to November 2023.

Finally, above is a table summarizing flower totals by year and by type. The PMag numbers are interesting: in a few years PMag flowers have ramped up steadily and now it matches the PClav flower total. It seems that in C&S cultivation, steady and patient care has its rewards. In ten years I will say that I have enjoyed thousands of cactus flowers.

Back when I was first drafting these chapters in 2019, I was happy with getting at least one cactus flower per month. As of 2023, flower quantity is no longer an issue. In urban Klang Valley, Malaysia, you can get as many cactus flowers as you want, chiefly by growing these three species of cacti – PMag, PClav, and GBald. It's a largely solved problem.

Getting cactus flowers with PMag and PClav should be pretty straightforward, since they grow to become large and tough specimens and will last for tens of years. I have already grown a commodity cacti PClav to produce flowers. GBald is more challenging because there is a lot of variation in the species and in commercially-sold specimens, and it is not a species that has evolved to live a long time. But when we can talk about sustained flower production – over 100 flowers per year for a PClav and over 60 flowers per year for a grafted GBald, I think we have come a long way. ♦

Version Information

This is the December 2023 Edition of this document.

Every released PDF can be found at: `https://www.mysmallcacti.net/`

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Colophon

Written on LibreOffice. Most images were produced using GIMP and IrfanView. PDF tested using SumatraPDF. Fonts used include Liberation Serif, Arimo and Liberation Mono. The document is sized for A4 or Letter printing with enough whitespace for comfortable reading.

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.