

January 1994 - Central Spine

ON THE DRY SIDE

by Timothy Chapman

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Evolution is a wonderful thing. Life's genius for adaption has given us the cockle's sturdy shell, the anteater's toothless snout, and the centipede's astonishing gift for tapdancing. A large part of the succulent's charm is the creative way it has accepted and yielded to the daunting pressures of a dry and difficult environment. Spines, compact shape, and ribbing are visible signs of this adaptation, and we appreciate them for their unusual beauty. Perhaps it's time to consider a less obvious bit of xerophytic inspiration: crassulacean acid metabolism, or CAM for short.

All green plants utilize the sun's energy in the manufacture of the sugar they use as food. Using the complicated process of photosynthesis, which I actually understood in my college days, carbon dioxide and water are combined with salts brought up through the roots to form sugar and oxygen gas, the latter being expelled into the atmosphere to the great benefit of those of us who have to chase our food around.

An important group of players in this scheme are the stomata, the tiny pores in the surface of the plant which allow for the exchange of carbon dioxide and oxygen. One consequence of having all these little pores open, or any kind of breathing for that matter, is moisture lost as water vapor. Plants that normally find water relatively easy to come by (mesophytes) open their stomata during the daylight hours when photosynthesis is taking place. Water lost is quickly replaced by water brought up from the soil. At night, when photosynthesis isn't taking place, the need for CO_2 is a low priority and the stomata close until the first light of morning.

Well, life is not so luxuriously simple for the desert dweller. Heat complicates things. The warmer air is, the more water it will hold, and exponentially so. When, for instance, a cactus stem heats up during the heat of the day -- and the stem will often become hotter than the atmosphere surrounding

it -- the air in the intercellular spaces inside the cactus becomes quite saturated with water. Stomata open during the day would mean a staggering water loss for the plant, and cactophiles pulling their hair out in handfuls.

The obvious solution for a succulent plant is to forget this business about leaving one's stomata open during the day and open them at night when temperatures are lower. A cooler stem means less water vapor in the abovementioned air spaces, which in turn means less water lost through the pores. But how does the plant then go about the task of making sugar if nighttime atmospheric CO₂ is so isolated from daytime sunlight? Plants that utilize crassulacean acid metabolism have taken advantage of a chemical pathway that is a little different than that of your average mesophyte. CAM plants have the ability to store carbon dioxide in the form of organic acids, and they do so with admirable efficiency. Photosynthesis can thus take place during the day using the supply of CO₂ acquired through the open stomata during the night.

As for the name of this process, it is "crassulacean" because it was in a member of the Crassulaceae where this daily cycle was first observed in 1813. The increased nighttime acidity of the plants, however, may have been noted long before by Roman botanists when, during their drunken revelry, they ate some of the subjects of their study. But don't quote me on that.

Interestingly, while succulence and crassulacean acid metabolism often go hand in hand, not all succulents have made the switch to CAM. Some notable holdouts are the Moraceae (including Dorstenia and Ficus), the Moringaceae, and the Fouquieriaceae. On the other hand, the order Bromeliales, while not consisting of succulent members, are indeed CAM plants.

I've begun to see succulent plants as role models. The cactus has become my symbol for living well under difficult circumstances. Adaptation is not an aggressive thing: the little mesophyte who tries brazenly take a stand in the desert faces an ignominious finish. Succulents have accepted their

tough lives, and in so doing have become things of beauty. And as I go through my days I am learning to relax, accept, and adapt rather than grit my teeth and curse my circumstances. I think it's better to face the mighty wind like a willow and bend, rather than be like the oak who breaks. If you'll forgive my mesophyte metaphor.

TIMOTHY CHATMAN



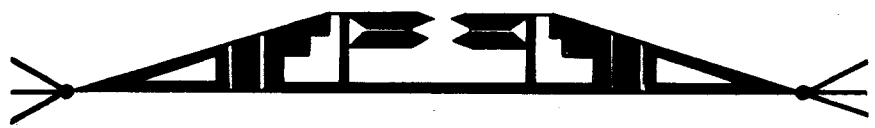
TRY IT-----YOU'LL LIKE IT!

Well, that is what we keep hearing about insecticidal soap products since they first came on the market.

It was of special interest to us cactus growers, what with all our pest problems. So far it looks like it is going to be very useful for us, especially because it can be used on the crassulaceae, which are rather touchy about insecticides. Also it is non-toxic to humans, and has an odor we can live with, unlike our old friend malathion.

There is no such thing as a cure-all for pest problems, but this rproduct could be an invaluable one, if used wherever mealy bugs are spotted.

Most "garden-wise" dealers have it.



Sit down before fact as a child, be prepared to give up every pre-conceived notion, follow wherever Nature leads, or you will learn nothing.



Haworthias are the perfect succulent for growers with little space. They do well on windowsills or under fluorescent lights. You could even try planting some in the ground, in an area protected from the direct sun.

They come in many forms and sizes. The leaves are usually in rosettes, but in some the stems become elongated, with the leaves densely arranged along them, overlapping each other. In some species the leaves are covered with pearl-like tubercles; in others they are smooth and green, brownish to almost black, often with bristles along the margins or at the tips. Some Haworthias have translucent window-like spots on the leaves which allow light into the interior of the plant for photosynthesis. These "window Haworthias" are found in habitat buried in the ground to avoid the burning sun, with only the windowed leaf surfaces exposed above the soil. Many Haworthias are sensitive to strong sunshine. The plants produce anthocyanin if overexposed, which turns the leaves red. (They revert to green when placed in the shade.)

The flowers are produced in racemes, are small and usually greenish-white. It is safe to say that no one grows Haworthias for their flowers, unless they wish to produce seed. Cut off the long flower stalks so that more strength goes into the plant. John Pilbeam, in his book on Haworthias, claims that there are some varieties that never bloom in cultivation. He speculates that they may be hybrids. There is a form of *H. reinwardtii* which produces a flower stem that constantly branches and rebranches, never getting around to producing flowers. It may be the closest thing to a monstrose form in the genus, which otherwise has no crested or monstrose forms.

Many Haworthias exhibit a dormant period during which water should be withheld--or plants watered only lightly. June through September is the dormant period in our hemisphere. Overwatering is one of the commonest ways to kill these plants. Using wide, shallow pots is recommended in order to counteract a heavy hand with the watering can.

Summer dormant Haworthias: *marginata*, *pumila*, *minima*, *poellnitziana*, *herbacea*, *reticulata*, *margaritifera*, *mirabilis*, *pulchella*, *variegata*, *arachnoidea*, *archeri*, *bolusi*, *semiviva*, *turgida*, *heidelbergensis*, *magnifica* (*schuldtiana*), *habdomadis* v. *inconfluens*--and all forms and varieties of these species.

These Haworthias can be watered in summer (kept drier in winter): *nigra*, *pilifera* (*cooperi*), *cymbiformis*, *truncata*, *maurghani*, *limifolia*, *tessellata* (*venosa*)--and all forms and varieties of these species.

These species come from areas that get rainfall all year around: *viscosa*, *scabra*, *retusa*, *herrei*, *pygmaea*, *starkiana*, *coarctata*, *attenuata*, *comp-toniana*, *batesiana*, *reinwardti*, *translucens*, *chloracantha*, *parkiana*.

This list was compiled by Grace Rollerson, Burnaby, B.C., in CSIE.

There are a number of books on Haworthias: John Pilbeam's book; two editions of Bruce Bayer's "Haworthia Handbook"; Charles Scott's book. You can find them in our club library.

Many thanks to Sue Hagfmen
The Pismo CSS



Haworthia fasciata



Haworthia reinwardtii



Haworthia cymbiformis



Haworthia viscosa



Haworthia limifolia



Haworthia tortuosa



Haworthia tessellata

GERMINATION FROM SEED ? IT SHOULD BE EASY

The way to obtain the best germination of cacti from seeds, of course is to do everything you possibly can to provide the proper conditions for success. These include:

1. Use of a germination chamber
2. Control of temperature
3. Use a correct soil mix
4. Proper placement of seeds
5. Control of light conditions
6. Control of moisture
7. Good handling after germination.

THE GERMINATION CHAMBER:

Most households will already have on hand items such as plastic or aluminum pans which can be readily adapted for use as a germination chamber. An aluminum cake pan with a clear plastic cover for moisture retention, could work very well. Containers like these can be used either of two ways:

- a. Fill with soil mix to about 1" in depth, then sow seeds in controlled areas for separation of kinds; Or
- b. Just use the pan as a "holder" for a series of pots sitting in the pan, then use the pan as a "water from the bottom" watering device. The pan can also serve as a handy carrying tray if moving it to an area of differing light or temperature becomes necessary.

Which ever method is used, some type of cover for moisture retention to prevent drying out is a necessity.

Those who plan to engage in germination of seeds on a continuing basis may wish to construct their own germination chamber, the most simple of which is a wooden box of the size and depth that will accomodate the quantities and kinds of seeds you wish to germinate. A removable cover is a necessity for this box, and it can be a simple frame with transparent plastic stapled across it. Three-quarter-inch exterior type plywood can be used; unless your particular requirements dictate otherwise, sidewalls should be 6 or 7 inches high.

Nearly all seeds require high moisture conditions for germination, and the primary purpose of a covered chamber is to control moisture; the secondary purpose is to help control temperature.

For many, the germination chamber may be a 2 or 3 inch pot, or pots in a large pan, using one pot for each different kind of seed. Use the "squat" kind of pots if you have them, as they tip over less easily when handled. Covers for these pots may be found in the kitchen as clear plastic tops that come on various cartons; or, a thin transparent film may be held in place with rubber bands. One consideration you will want to keep in mind is the ease of removal for adding moisture when needed.

CONTROL OF TEMPERATURE:

Most seeds need warmth to germinate, and the closer to optimum you can achieve, the closer to complete success you will achieve. Of course the first requirement is to obtain a good thermometer; next determine the optimum temperature you require. After that, there are several devices that can be used for temperature regulation. They include:

- a. A soil heating cable
- b. An electric heating pad
- c. Judicious use of the pilot light on your gas range
- d. Movement in and out of the sun during the day
- e. If you have a greenhouse, you can let its temperature controls assist you in providing this need.

The application of artificial heat requires attention; as soon as the thermometer indicates proper soil temperature has been reached, remove immediately from the heat source and allow it to cool gradually. Close watching is necessary to prevent overheating. In fact a great deal of attention during the whole process of germination is necessary. Successful germination is not a matter of putting the container in a forgotten corner, and quietly waiting to see if anything is going to happen.

If the soil cools too much overnight, warming it up once in the morning may be adequate, although whether additional warming during the day is necessary will depend on conditions of the area. Use of direct sun for warming must also be carefully watched to prevent the soil from becoming too warm. One advantage of sunlight, however, is the continuing warmth thru the day followed by "natural" cooling during night time. This cycle is the natural condition of habitat.

Ordinary greenhouse conditions will normally provide adequately for temperature regulation. If you have no greenhouse (yet), a little experimentation and observation on your part with sunny windows, garages, or even basements, will start you on the road to success. Let your watchful eye and your trusty thermometer tell you when to make the move to achieve the control you need.

THE SOIL MIX:

The medium in which seeds are placed for germination has an important bearing on success, since good seed contact, and therefore good germination, is determined by the general texture of the mix. Of course everyone has his "favorite" soil mix. If you have one that works for you, use it. Mesa Gardens in Belen NM offers this proven recipe:

40% coarse sand (avoid fine sand like poison)
30% Canadian sphagnum peat, screened
10% Vermiculite
10% pumice
10% regular potting soil (humus).

The main idea to keep in mind is for the soil mix to be rather light and well aerated. It must stay moist, but drain well. Like the "feel" for wetness or dryness in an ordinary pot, your own sense of touch will help tell you if your mix is "about right."

The surface of the soil mix will be improved if a small flat tool is used to lightly press the surface down evenly. A small piece of board or a small flat disc will serve this purpose very well. The surface is slightly compacted by this which will help insure good seed contact; but don't press it too hard.

PROPER SOWING OF SEEDS:

Carefully sprinkle seeds over the surface as evenly as you can. Then gently tap the chamber, or pot if that is used, on the side; the tapping helps to settle the seeds into the soil a little. Large seeds such as *Peniocereus* or *Ferocactus* can be gently pressed into the soil with a small board. If seeds are large but fragile, like *Aloe* or *Astrophytum*, they should be sprinkled over with a layer of soil so they are barely covered. Then the soil surface may be covered with a thin layer of tiny pea gravel. This layer should be just enough to block the soil from view and no more than 1/8 inch deep.

A few species like *Escheveria* or *Dinteranthus*, have tiny seeds. These may be sowed by first covering the soil surface with tiny pea gravel, then sprinkle the seeds over the top of this. Next, mist the pot from above to help move the tiny seeds down between the particles of gravel and into contact with the soil.

The layer of pea gravel serves two purposes; it discourages the formation of fungus infections because top surfaces of the tiny stones dry quickly; secondly, the bottoms of the little stones help retain moisture where the seeds lie thus enhancing germination.

If different kinds of seeds are sown in one large pan, care should be exercised that areas do not overlap in sowing. This is one disadvantage of using a whole pan, and points up the advantage of using a separate pot for each kind of seed. There are other advantages of separate pots: if you choose watering from the bottom, it is easier to accomplish; if some seeds germinate more quickly than others, the early germinating pot can be removed from the chamber as soon as ready; and, if light intensity varies from one kind of seed to another, they may be separated for individual control.

You will soon learn that an important factor in seedling success is how thick you sow the seeds. Over crowding is to be avoided. More thinly planted seedlings can be allowed longer time before transplanting, when the rootlets will not be quite so tender or delicate, and can stand this operation better.

CONTROL OF LIGHT:

Until the time of sprouting, light or dark is of no concern; but light level is of immediate concern when shoots appear, and is critical for seedling survival. Low levels of light may be an advantage at first, and should be increased gradually as seedling growth proceeds. Movement from a lightly shaded area into sunlight is suggested as seedlings get stronger.

When seedlings first appear some light restriction can be achieved by keeping the pots in the moist germination chamber. They should remain there anyway until germination is well over -- which may be from 5 to as much as 10 days. Then you should start removing them from the chamber.

If light is too little or too much, several signs will develop as indicators that correction is needed. Indicators of too little light are: seedlings becoming tall and lanky; they don't stand upright and start to fall over. If light is too intense, seedlings may grow slowly or they may become reddish. Too little light can be corrected by removal of shade materials and placement of seedlings more directly into sunlight. Although the full light of the mid-day sun may be more than tender seedlings can take until they are several weeks old, direct sun only in early morning and late afternoon can be tolerated -- in fact may prove helpful. Scorching from the direct full rays of the sun can be prevented by use of a shade cloth, supported at adjustable heights.

CONTROL OF MOISTURE:

Every kind of seed requires moisture to sprout. Too much wetness can be as bad as too little. Two common methods for controlling moisture in the germination chamber are:

1. Water from the bottom. Set pots in a tray or pan and flood it to a depth of half inch, letting capillary action carry the water up into each pot. Water can be removed from the pan when water reaches the top of the soil in each pot.
2. Gently misting with a fog nozzle, applying water from the top.

Either method is satisfactory. Application of water is not the most important factor for determining whether to use individual pots or whole pans as a container.

Be as particular as you can about moisture control. Too much moisture prior to germination may result in fungus or other problems. Many diseases like moisture, too. Too little moisture after germination may result in stressing the seedlings and thus prevent them from developing into their growing, healthy best. Stressing at this time is likely to affect the plant for the rest of its life. Your watchful eye and sensitive "test" finger will help you. Use them.

Devices for measuring soil moisture may be purchased at garden supply stores; although they provide reasonable soil moisture readings, your skilled eye and sensitive finger can result in quite close control.

CONTROLS AFTER GERMINATION:

Sometimes, no matter how right you do everything, a batch of seeds just won't sprout. Although causes are many and varied, it is suggested you don't give up easily. When a pot of seeds has been kept moist for 4 weeks or so with no seedlings appearing at all, you can still give this pot another try. Take it out of the chamber and let it completely dry out for two weeks. Then repeat the moist, warm cycle again; sometimes this brings success. If it doesn't, you can just chalk it up to a "bad batch" of seeds and start over.

Close watching for signs of fungus, seedling rot or damping off are important for the first several days following germination. Catching this in time could save the whole batch. Too much moisture is a common cause of problems at this time. You may find gentle misting from above a little easier to control during this period than watering from below.

If you are already successfully growing cacti and succulents, odds highly favor you to succeed with germination projects. The conditions achieved for growing adult plants are very close to those needed for germination except for the high moisture requirement at

the very start. After all, in habitat, seeds "planted" by Nature, fall into the soil in the same area and under the same conditions, as the adult plant which produced those seeds.

It is important to continue maintaining chamber moisture even after germination is complete. In fact lack of moisture at the early seedling stage is more crucial even than before, as tender, delicate rootlets can be easily harmed or the seedling lost. Gentle misting will help to do this.

A COMPARISON:

Most cactus and succulent seeds germinate readily. Just be thankful you aren't trying to sprout Lodgepole Pine seeds. You might have to toss the seed-bearing cones in a bonfire. Lodgepole Pine seeds refuse to sprout until the area is burned over by a forest fire. After being thus heated, they'll grow. Scales on these pine cones remain tight until opened with heat. A heavy distribution of seeds, and rapidly growing, dense, pure stands of seedlings in a fire-cleaned area, usually follows a fire.

LAST RESORT:

If you have put up with all this so far but you really find that improvising your own controls or germination chamber is just not your thing, or if you're short of time, or if money is no object, then you will want to know that commercially manufactured germination units are available. They contain all the controls: for temperature; for moisture; for light -- the whole bit. They come ready to plug in, after which you are ready to read the instructions. Or, if all the above highly descriptive paragraphs turned you off, but it didn't kill your wish to sprout a few seeds, you'll want to go buy one. **Good Luck!**

CARL S PACKER



JUST FOR FUN

THIS?? IS HEAVEN?

Four mice died and went to heaven. They had been there about a month having a terrific time when they ran into St. Peter.

"How are things going for you in heaven?" he asked of the mice.

"Oh, heaven is just great," they said. "But there is so much to see, we really could use some wheels to get around." So St. Peter gave them each a pair of roller skates and sent them on their way.

About a month later four cats died and went to heaven. When St Peter saw them he asked how they were enjoying heaven.

"Heaven is everything we hoped is everything we whoped it would be," they said. "It even has Meals on Wheels!"



My sense of death affects me daily for the better. When you are slightly afraid of death you are less afraid of other things-----bosses, spouses, plumbers, bankruptcy, not being liked, the flu, aging.

Betty Rawlings

"The Best Years of My Life."

