Senters, Anna E.: *Welwitschia mirabilis* Cultivation. *AERGC Newsletter, Vol 10 (2), Summer 1997 p.5-7*

Introduction

Welwitschia mirabilis is an unusual plant endemic to the Namib Desert of South West Africa. Growing only two leaves during its entire lifetime, *Welwtischia* exhibits highly sophisticated adaptive mechanisms not found in any other species. Such an anomaly as *Welwitschia* deserves further examination

Known locally as n'tumbo, or "onion of the desert", *Welwitschia* is used for food by humans, springbuck, oryx, rhinoceros, elephants and zebra. A number of other biota feed and obtain shelter from the plant, which provides a cool green oasis on the desert plain (Mshigeni, 1996). Further evidence of the species ecologic significance is seen in its role as a microhabitat to several insects (Bornman, 1972).

Biochemical research on *Welwitschia* is limitless. Its unique longevity may be the key to extending the lives of other organisms. Natural pesticides and pharmaceuticals may be a component of any of its organs. Certainly it's drought resistance is of interest to agriculturalists.

For practical purposes, research is essentailly limited to greenhouse culture. Greenhouse cultivation of this species has been considered problematic for decades (Herre, 1954), and today is still considered the domain of experienced growers. To facilitate and encourage the establishment of culture, a broad assessment of current cultivation techniques is compiled in this paper. By following the guidelines set forth, growing *Welwitschia mirabilis* in captivity can be done successfully.

Cultivation

This compilation of successful cultivation techniques serves to make the *Welwitschia* specimens accessible for research and to ensure that this treasure be conserved for posterity. Making these techniques available for those who would like to grow *Welwitschia* is necessary in the pursuit of continued culture establishment.

Basis for Assessment

Success of various cultivation techniques was considered based primarily on the overall health of the plants themselves. Simulation of *Welwtischia's* native habitat was also taken into consideration, although it is clear that the species flourishes with additional accomodations. However, to understand the effect that some practices had on plant health, it is important to begin with a cursory survey of *Welwtischia* habitat and anatomy. Length of time between germination and strobilation was not considered, although this is an interesting basis for future assessment.

Habitat

Comprising only 15 percent of the total South West Africa land mass, the Namib Desert runs 1500 km along the coast of southwest Angola and northern Namibia. The Namib is one of the smallest and narrowest deserts in the world, venturing inland only 80-130 km. Rainfall in the desert is limited; ranging annually from 20 mm at the coast to 120 mm further inland (Trewartha, 1981).

A wide variety of flora and fauna populates the coastal regions. Moisture neccesary for life in this area comes from the cold desert fog produced by the Benguela current (Mshigeni, 1996). This life-giving fog, equivalent to almost 50 mm of precipitation annually, shrouds the parched landscape from early to mid-morning at least 300 days per year (Trewartha, 1981).

By late morning temperatures over 100 F burn off all remaining moisture (Bornman, 1972). Evening temperatures differ widely from day temperatures, reaching freezing in the winter months.

Paradoxically, the hottest days occur in winter, resulting in a drastic temperature fluctuatio (Logan, 1960).

Anatomy

Most desert plants are considered anatomically xeromorphic, meaning they display certain characteristics that aid in adaptation to dry climates. *Welwitschia*, however, displays leaf surface area and gas exchange mechanisms more typical of tropical plants.

Gas exchange is completed by small pores in the leaf surface called stomata. Most desert plants have few stomata on the bottom side of the leaf, protected by deep depressions. *Welwitschia* differs dramatically with as many as 22,000 stoma/cm2 on the upper and lower leaf surfaces together (Bornman, 1972). This outrageous number of pores play an active role in absorbing the desert fog; resulting in what is essentially a daily "freshening up" (Court, 1981). Consequently, *Welwitschia* leaves are also relatively thin, as the plant does not need to store the large quantities of water that gives other desert plants their succulence.

Of particular relevance to cultivators is *Welwitschia's* deep taproot. The root extends into the sand for several meters. Previously thought of as a water seeking mechanism, the taproot is now considered largely an anchor to help the plant withstand desert winds. Many fibrous roots lay near the ground surface to facilitate fog absorbtion.

General Cultivation Methods

General cultural conditions are those used by each grower with minimal variation. Significant differences or deviation are outlined in the following paragraphs.

Germination: Germination is attempted in the cooler months, often in late winter or early spring. A very coarse media is used; usually a pumice/sand mix. Media is sterilized and placed in small 4 inch plastic pots with seeds. Seeds are kept well watered and fertilized, being allowed to dry only slightly between watering. Fertilizer varies according to local need, but can be described as typical commercial water soluble fertilizer, 100-300 parts per million nitrogen, phosphorous and potassium.

Transplanting: After germinating (2 to 14 days) seedlings are repotted. The new containers need to be large enough for up to 5 years of growth. A slightly less coarse media is used in the new pot; cactus mix or a combination of large part pumice and small part peat works well. Seedling will have developed a taproot possibly 4 to 5 inches long. The root is very sensitive and should not be touched or disturbed during transplanting (Vandorpe, 1995). Once settled into the new pot, plants should continue to be watered and fertilized.

Pot: For at least 10 years, and probably up to 15 years, plants will be comfortable in large standard clay pots. However, as the plants age their taproot may require more room. A common solution to this problem is planting in a modified container made of a draintile and pot. Draintile may be from 12 to 48 inches as needed, and are fitted into a 9 to 12 inch pot. Plastic bottles with hole punches in the bottom for drainage are also usable (Lynse, 1995). Older plants need less water than younder plants, watering slightly more than once per week is sufficient.

Temperature: Greenhouse temperatures consistently range from 68F at night to 85F during the day. In the winter day temperatures may fall to 70F, though night temperatures are never set lower than 60F. Plants flourish when day temperatures are over 100F.

Method Variation

Some growers used techniques that deviated from those used by others. In some cases, the results were superior to those of the general practice.

Chuck Cody, Washington State University: Cody has a number of 9 month old seedlings and an older plant, one approximately 12 years old that he obtained 4 years ago. The seedlings are in good health,

but the older plant has been in declining health for several years. Any summer growth is compensated by equal dieback the following winter. Consequently, the plant has not increased in size in the last few years.

Of Cody's methods, only fequency of fertilization differs significantly from general techniques. Instead of 2 or 3 times per week, Cody supplies his *Welwitschia* with nutrients once per month. It is virtually impossible to conclusively state that this is the cause of the decline, given that the seedling appear fine and the plant began to decline not ling after being transplanted which could indicate shock or root disturbance. However, it should be considered as a factor.

William Lancaster, Humboldt State University: Lancaster has successfully been growing *Welwitschia* for 25 years, and has a number of alternative methods.

To germinate seeds, Lancaster uses a very coarse, low water holding capacity media of granite gravel: charcoal: #16 mesh sand, 5:1:1. Instead of using plastic pots, he uses 4 inch peat pots. Pots seed and media are set inside a covered 100 mm x 80 mm petri dish. The seeds are kept well watered. The combination of the absorbent peat pot and condensation from the inside of the petri dish provides enough moisture to the seed, which is kept away from the water by the coarse media. this method is highly reminiscent of *Welwitschia's* native Namibian fog. With peat drawing water away from the seed, the risk of rot is low. An unsuccessful version of this method was placing a piece of glass on top of a plastic pot. Condensed water is very close to the seed and is not absorbed or drawn off by anything. this method resulted in rotted seeds (O'Brien, 1995).

Perhaps in an effort to reduce transplanting needs, Lancaster moves his seedlings into larger pots much sooner than other growers. Only a few days after germination the seedling is transplanted into a standard 8 inch clay pot. (Another advantage of the peat pot: entire pot can be planted so there is little risk of disturbing root.) An inverted petri dish is set on top of the seedling. The cover ispropped open periodically to allow for air circulation after the cotyledons develop.

Leo Song, California Sate University - Fullerton: Another long time *Welwitschia* grower, Song is considered a master of successful cultural techniques. (In fact, Lancaster credits Song for any success he may have.) Song uses a variation on potting techniques that reduces the need to transplant for 30 years. Seeds are germinated directly in a 24 inch tall pot plus draintile. Keeping the seed moist is a potential difficulty, but careful watering and misting eliminate chances of drying out.

Doug Walker, Univeristy of California at Davis: Walker grows *Welwitschia* in southern California, and area with long days of intense light. the plants flourish in this environment and especially enjoy summer temperatures over 100F in the greenhouse. With night temperatures around 60F, the fluctuation in daily temperatures is similar to that of the Namib Desert. Walker's best looking plants grow outside, where they can recieve 100F days and cooler nights than in the greenhouse. this convincingly suggests that growth is faciliated by a wide temperature fluctuation and plenty of water.

Culture Recommendations

Ideal condtions for the promotion of *Welwitschia* culture are not difficult to establish. Seeds should be germinated in a coarse, sterilized media and should be kept damp. Germination according to methods used by William Lancaster is recommended, but requires careful attention to the possibility of rot. Seedlings need to be transplanted sometime before the taproot reaches the bottom of the original pot. If a peat pot is used, the root should not extend through the bottom. Peat pots are recommended for germination as they allow for transplanting without disturbing the root; however, their use mandates transplanting several days after germination.

Although a desert plant, *Welwitschia* will not flourish if allowed to dry out for long periods. Plants should be watered and fertilized regularly. Greenhouse temperatures of 68F-85F are sufficient, although ideal growth conditions occur with a 50F to 100F fluctuation.

Conclusion

Welwitschia mirabilis is a species that has confounded scientists and cultivators for years. A paradox in every sense, Welwitschia displays characteristics typical of tropical plants while surviving for generations in an extreme desert environment. It's amazing adaptive qualities are worthy of further studiy, and will no doubt prove a rich source of genetic material for scientific exploration.

Experienced cultivators of this desert species report very similar practices. Variation are few, but are significant in promoting maximum cultural health. Growers interested in reproducing these results can do so by following the recommended techniques above, and by individual experimentation. Though sensitive in some respects, Welwitschia is a species of great perseverance that will grow well in captivity with some accomodation.

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