

UTRICULARIA CONTAINMENT: TRYING TO PREVENT THE GREAT ESCAPE

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Introduction

Terrestrial and some epiphytic *Utricularia* species are easily grown on the tray system (D'Amato 1998; Slack 2000). The tray system is often preferred since it is space efficient, but the plants frequently send stolons out of the drainage holes in the pot and into the tray. These escaped stolons, if not corralled promptly, can then invade adjacent pots, which results in intermingling of species. This is disastrous for botanical collections where each pot contains a different strain or species of plant that needs to remain separate. In particularly bad cases, the roaming plant can completely overrun the plant in the invaded pot.

The most obvious solution for keeping different plants separate is to grow each one in a separate, undrained container. Unfortunately, this is not pragmatic since it means all the plants have to be hand watered or have a separate water emitter¹ which involves more facility resources (i.e. staff time or equipment) than is typically invested in *Utricularia* collections. Automated watering systems, unless equipped with a water-level shutoff sensor, have the disadvantage that the water level will always inundate the undrained pot to the maximum level, which is not desirable for many species and also encourages the plants to spill over the top of the pots.

Another possible variant would be to use undrained pots and then punch a hole in the side of the pot at the desired water level for each species. Alternatively, a drained pot could be placed in a shorter undrained pot. The pots could then be watered overhead by hand or automated irrigation and the excess water would drain out the hole on the side of the pot. Stolons escaping the pots would dry out on the greenhouse bench. Unfortunately, this approach still requires extensive hand watering or automated irrigation for each pot.

The purpose of this research was to determine if *Utricularia* could be grown on the tray system by containing the plants within the pots while allowing water to permeate into the pot. Both stainless steel screens (100 mesh) and glass fiber filters were evaluated as mechanisms to screen the drainage holes of the pots to contain the *Utricularia* within the pot while allowing water to pass into the pot.

Materials and Methods

The experiment tested three containment conditions, namely no seal (control), stainless steel screen seal, and glass fiber filter seal. The stainless steel (316 type) screen was 100 mesh-size screen² (McMaster-Carr Supply Company, Los Angeles, CA) while the glass filters were GF type F filters (Whatman International Ltd., Maidstone, UK). The stainless steel screen was tough material that was unlikely to be damaged by the *Utricularia*, but it also has relatively large holes compared to the glass filter. In contrast, the glass filters had tiny pores, but the material was weak and may be pried apart by the stolons or damaged by handling. Plastic pots (10.2 cm or 4 inches) with four drainage holes were used for the treatments. Two types of pots were used during the experiment; the control and steel screen pots were vented on the sides while the glass filter pots were vented on the bottoms. The glass filters were difficult to seal on the side-vented pots,

¹Using a separate emitter for each pot means that many of emitters would be required, and for a large number of plants the resulting rat's nest of tubing would be undesirable, especially for display collections where aesthetics are an important consideration.

²100 mesh screen has holes that are approximately 0.15 mm across.

which is the reason bottom-vented pots were used for this species. Waterproof silicone seal was used to seal the steel screens or glass filters over the drainage holes.

The three containment conditions were tested with eight species of commonly cultivated *Utricularia*: *Utricularia livida*, *U. sandersonii*, *U. dichotoma*, *U. praelonga*, *U. longifolia*, *U. nephrophylla*, *U. bisquamata*, and *U. calycifida*. Therefore, there were three pots for each species: one control, one stainless steel screen and one glass filter screened. For each species, a small cutting of equal sized was added to the three treatment pots. To reduce the chance of plants escaping over the top of the tops, the pots were filled to 2.5 cm below the rim with the soil mixture that consisted of 50% peat moss and 50% horticultural sand.

The plants were placed in a 21.25 × 10.75 cm trays, and a depth of approximately 2.5 cm of water was maintained in the trays for the duration of the experiment. The trays were maintained between 18-27°C (64-81°F) with a photoperiod of 14.5 hours, in the Botanical Conservatory greenhouses at the University of California, Davis.

The plants were grown for 9 months. Every month, the number of stolons that escaped out of each hole were counted for all the pots. Since the four holes in any given pot are pseudo-replicates of the pot, the data for each hole was recorded separately but then totaled for each pot. Any plant material that extended out of the pot was considered an “escape”.

Results

The results (see Table 1) showed that glass fiber filters were the most successful in containing *Utricularia*, but even this treatment condition was not perfect. *Utricularia praelonga*, *U. longifolia* and *U. calycifida* still escaped from the pot by growing through the filter. Given enough time, I suspect that other species would also penetrate the filter. Unfortunately, the stolons pried open holes in the filter as they grow through the holes, thus the filter screening was damaged by the growth of the plant. In addition, the glass filters were more restrictive of water percolation into the pots. During the relatively dry and hot summer, a few of the pots with glass screens were considerably drier than the control or the steel screened pots.

The stainless steel screens proved more effective than the control pots in terms of containing *Utricularia*, but ultimately most species were able to escape the pots. Only *U. dichotoma*, *U. nephrophylla* and *U. sandersonii* failed to breach the screen, although the later two species also failed to escape from the control pots as well. The total number of escaped stolons in the steel-screen pots were considerably lower than the control pots and it took longer for the plants to escape from the pot. Stolons both grew through the screen as well as pried between the silicone seal and the pot. Therefore, the screening slowed but did not prevent the escape of *Utricularia*. In contrast to the glass filters, the steel screens were not affected by the plants and the silicone seal was still largely intact, so the pots could be re-used after dividing or transplanting the *Utricularia*.

The purpose of this experiment was determine how to grow *Utricularia* in a single tray without the species intermixing. The experiment focused on preventing stolons from escaping individual pots and entering the watering tray. However, the second part of this equation is that an escaped *Utricularia* species in the watering tray has to invade an adjacent pot by growing into the drainage holes. Once again, the stolon would have to grow through the screen to invade another pot. The screening, either glass filter or stainless steel screen, would also slow the invasion step. I suspect that this invasion step would be even slower than the escape step since the stolons in the tray would not be as root bound as the stolons in the pots. This gives the botanical curator more time to catch and repot the escaped *Utricularia* before the species are intermingled. There were no observed invasions during the course of this experiment.

The last point is that this experiment focused on vegetative growth as the mechanism by which the *Utricularia* spread. Unfortunately, some *Utricularia* species are infamous for their production and dispersal by seed. *Utricularia subulata* and *U. bisquamata* are two weedy species that often spread by seed. None of the treatments discussed here would be effective against seed dispersal. Therefore, I can only recommend that species that spread by seed dispersal should be physically far removed from the rest of the *Utricularia* collection, or even eliminated from the collection altogether.

Table 1. Number of stolons escaping the drainage holes for the three containment conditions (control, glass fiber filters and stainless steel screen) for each month of the experiment.

	Time (Months)								
	1	2	3	4	5	6	7	8	9
	Control (no screen)								
<i>U. bisquamata</i>	0	0	1	1	4	7	5	10	8
<i>U. calycifida</i>	0	0	1	1	1	0	1	0	3
<i>U. dichotoma</i>	0	0	0	1	1	1	3	2	2
<i>U. livida</i>	0	0	0	1	6	8	14	18	27
<i>U. longifolia</i>	0	0	0	2	7	10	13	18	20
<i>U. nephrophylla</i>	0	0	0	0	0	0	0	0	0
<i>U. praelonga</i>	0	0	1	4	4	5	3	5	7
<i>U. sandersonii</i>	0	0	0	0	0	0	0	0	0
Total # of escapes:	0	0	3	10	23	31	39	53	
	Glass filters								
<i>U. bisquamata</i>	0	0	0	0	0	0	0	0	0
<i>U. calycifida</i>	0	0	0	0	0	0	0	0	2
<i>U. dichotoma</i>	0	0	0	0	0	0	0	0	0
<i>U. livida</i>	0	0	0	0	0	0	0	0	0
<i>U. longifolia</i>	0	0	0	0	0	0	0	0	2
<i>U. nephrophylla</i>	0	0	0	0	0	0	0	0	0
<i>U. praelonga</i>	0	0	0	0	1	4	3	9	8
<i>U. sandersonii</i>	0	0	0	0	0	0	0	0	0
Total # of escapes:	0	0	0	0	1	4	3	9	12
	100 Mesh stainless steel screen								
<i>U. bisquamata</i>	0	0	0	0	1	4	4	3	3
<i>U. calycifida</i>	0	0	0	0	0	1	1	2	2
<i>U. dichotoma</i>	0	0	0	0	0	0	0	0	0
<i>U. livida</i>	0	0	0	0	0	0	1	0	0
<i>U. longifolia</i>	0	0	0	0	4	4	3	6	6
<i>U. nephrophylla</i>	0	0	0	0	0	0	0	0	0
<i>U. praelonga</i>	0	0	0	0	1	1	1	1	1
<i>U. sandersonii</i>	0	0	0	0	0	0	0	0	0
Total # of escapes:	0	0	0	0	2	10	10	10	12

Ultimately, the stainless steel screen appeared to be the best choice for *Utricularia* containment. Stainless steel screens are also available in finer mesh sizes, up to 400 mesh, with smaller holes that may be more effective at containment or invasion control without any added maintenance. In the end, none of the containment mechanisms were perfect. Therefore, vigilance is still required to prevent species intermingling on the tray system, but the frequency of maintenance would be lower if the *Utricularia* pots were screened.

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