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Evaluation of University of Hawaii Anthurium Accessions, 1986–2001

Jennifer A. Ehrenberger, Adelheid R. Kuehnle,
and Teresita D. Amore
Department of Tropical Plant and Soil Sciences

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Jennifer A. Ehrenberger, Adelheid R. Kuehnle, and Teresita D. Amore
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Abstract

Since 1986 the University of Hawaii at Manoa anthurium breeding and research program has received 189 plant accessions from the Missouri Botanical Gardens and various other sources in the Netherlands, Latin America, and elsewhere. Of these, 49 accessions were evaluated for spathe and spadix width, length, and color, flower yield, and other characteristics such as disease resistance. The results should be useful for anthurium breeding, research, and germplasm programs.

Introduction

For a productive plant breeding program, the acquisition of new plant germplasm is essential to enable discovery research and incorporate new traits into improved commercial cultivars. The University of Hawaii (UH) anthurium breeding program began in Honolulu in 1950 and has since developed 34 hybrids for commercial cultivation (Kamemoto and Kuehnle 1996). A total of 189 accessions (733 plants, including duplicates) were obtained by the program through April 2002.

Researchers, anthurium producers, and hobbyists benefit from descriptive inventories of newly acquired hybrids and species, and two such volumes have been published previously by the UH program. A description of 47 accessions acquired during the first decade of the breeding program was published in 1963 (Kamemoto and Nakasone 1963). Evaluations of 94 accessions acquired from 1965 to 1984 were also described (Kamemoto et al. 1986).

Plant characteristics that continue to be important in evaluating accessions for breeding cut-flower and potted anthuriums are color, spathe shape, yield, foliage shapes, and fragrance (Halloran and Kuehnle 1998, Kuehnle et al. 1996b). Spathe sizes to meet current market grades and standards for anthurium cut-flower production are also to be considered when evaluating germplasm (Kuehnle et al. 1996a). Resistance to bacterial blight caused by *Xanthomonas campestris* pv. *dieffenbachiae* also remains a concern since the late 1980s (Nishijima 1994). Blight impacted the UH plant collection and resulted in the death of many accessions, but this aided the selection for tolerant material. The table presented in this publication describes 49 of the surviving plant accessions acquired between 1986 and 2001.

Accessions

Plants were accessed from Hawaii, the Missouri Botanical Gardens, the Netherlands, New Zealand, and from the private sector (Twyford and Oglesby) between 1986 and 2001. Sources of the plants are noted in the table. An accession may have consisted of one plant with many offshoots or several plants in separate pots. Plants were placed directly into an 80 percent saran shadehouse at the UH Magoon Research Facility in Manoa on Oahu (latitude 21°N, longitude 157°S), either in their own pots and potting medium or after replanting in an appropriate size pot with wood shavings. Fertilizer was applied by topdressing at 3-month intervals, alternating between Gaviota™ anthurium organic fertilizer (6.5-17-7.6, Brewer Environmental Industries, Honolulu) and Osmocote® slow-release fertilizer (14-14-14, Scotts Co., Marysville, OH). Plants were watered daily by overhead irrigation. Data were collected from May 2001 until May 2002.

Evaluation

Flowering dates and measurements were taken on individual or replicate accessions; the highest values obtained are reported here. When an accession consisted of more than one plant within a pot (mother plant and offshoots), the largest and most vigorous shoot was flagged for observation. Yield calculations, measurements, and observations of spathes and spadices are described. The occurrence and severity of bacterial blight

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Table 1. University of Hawaii at Manoa *Anthurium* accessions acquired from 1986 to 2001.

A558

Name (Origin) **'Lady Jane'** (Twyford)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Light red (Red 45A)	9	4.8
Spadix	White / pink	6.8	0.7

Yield (stems/yr) 6.2

Comments Non-colorfast; dark green foliage; blight resistant; potted and landscape plant

A563

Name (Origin) **'Leilani'** (Lyon Arboretum, Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Light lavender (White 155D)	9	2.2
Spadix	Lavender	4.5	0.5

Yield (stems/yr) 6.5

Comments Fragrant

A567

Name (Origin) **'Lavender Prince'** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Light lavender (Violet 84C)	5.3	3.3
Spadix	Lavender	3	0.5

Yield (stems/yr) 9.7

Comments Potted plant; miniature

A568

Name (Origin) **'Tayama Tulip'** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Blush (Red 46A)	7.2	5.6
Spadix	Light red / light orange	6.1	0.7

Yield (stems/yr) 5.4

Comments Tulip shape; flowers above leaves

A569

Name (Origin) **'Miura'** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Light red (Red 46C)	12.5	10.2
Spadix	Red	6	0.7

Yield (stems/yr) 5.5

Comments Red flower changes to obake type; good suckers; flowers above leaves; re-acquired A355

A583

Name (Origin) **'Acropolis'** (Anthura, Holland)

	Color	*Length (cm)*	*Width (cm)*
Spathe	White (White 155A)	14	12.5
Spadix	White / yellow	9.5	0.9

Yield (stems/yr) 6.2

Comments Spadix upturned with maturity; good sucker production; commercial cut flower; moderately resistant to anthracnose

A591

Name (Origin) **'Tropical'** (Anthura, Holland)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Red (Red 46B)	13	10
Spadix	White / yellow / green	7.5	1

Yield (stems/yr) 7.8

Comments Colorfast; keeled lobes; resistant to anthracnose

A592

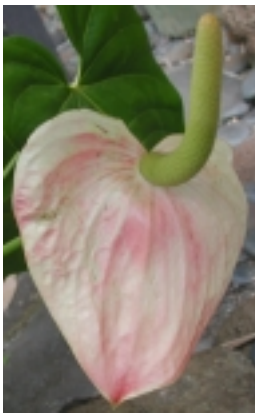
Name (Origin) ***A. sanctifidense***, (Panama via Missouri Botanical Gardens) Section Calomystrium

	Color	*Length (cm)*	*Width (cm)*
Spathe	Lt. green (Yellow-green 145B)	16.5	5
Spadix	Light green	10.5	1.2

Yield (stems/yr) 6.1

Comments Blight-susceptible

A601



Name (Origin) **'Shipman Pink'** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Pink (Red 50C)	15	14
Spadix	Light green	13.5	1.5

Yield (stems/yr) 4.7

Comments Non-colorfast; dark green foliage; blight resistant; potted and landscape plant

A602

Name (Origin) **'Lady Beth'** (Oglesby)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Dark pink (Red 54D)	8	4.8
Spadix	Lavender / purple	5.4	0.6

Yield (stems/yr) 5.5

Comments Non-colorfast; sweet fragrance; appears very blight-resistant; dark green foliage; potted plant

A604

Name (Origin) **'Ellie's White'** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	White (White 155D)	6.3	5.7
Spadix	White / yellow	4.2	0.6

Yield (stems/yr) 5.9

Comments Lilac scented; blight resistant; vigorous plant

A605

Name (Origin) **'Kobayashi Pink'** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Dark pink (Red 52D)	14.2	11.2
Spadix	Pink / white	8.1	0.9

Yield (stems/yr) 6.0

Comments Non-colorfast; dark green foliage; blight resistant; potted and landscape plant

A606

Name (Origin) **Unnamed hybrid** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Red (Red 53A)	18.5	8
Spadix	White / green	5.5	1

Yield (stems/yr) 6.0

Comments Colorfast; occasionally a double spathe; blight-resistant; minty, sweet floral scent; dark green foliage

A607

Name (Origin) ***Anthurium* sp.** (Panama via Missouri Botanical Gardens)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Med. green (Yellow-green 145C)	12	4
Spadix	Light green	13	1

Yield (stems/yr) 6.4

Comments Very large plant; flowers beneath foliage

A611

Name (Origin) ***Anthurium* sp.** (Hawaii)
Section Semaeophyllium

	Color	*Length (cm)*	*Width (cm)*
Spathe	Lt. Green (Yellow-green 145B)	18.5	2.7
Spadix	Green	12	0.8

Yield (stems/yr) 1

Comments Flowers seasonally (April–March); orange pollen; foliage trilobed (tripartite)

A624

Name (Origin) ***A. crystallinum* x *A. armeniense*** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Blush (Yellow-white 158A)	12.5	2
Spadix	Light brown	12.5	0.6

Yield (stems/yr) 5.2

Comments Cinnamon-scented; prominent stipe

A625

Name (Origin) **'Hilo Hybrid'** (Hawaii)
(*A.andraeanum* (pink) x *A.antioquiense*) x *A. formosum*

	Color	*Length (cm)*	*Width (cm)*
Spathe	Medium pink (Red 48B)	14.2	7
Spadix	Dark pink	10	10.2

Yield (stems/yr) 5.8

Comments Fragrant; flowers beneath leaves

A628

Name (Origin) ***A. antioquiense* x *A. armeniense*** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Light pink (White 155D)	10.5	2.6
Spadix	Light lavender	6	0.8

Yield (stems/yr) 5.8

Comments Fragrant

A631

Name (Origin) **'Blushing Bride'** (Hawaii)
(*A.andraeanum* (pink) x *A. antioquiense*) x *A. andraeanum*

	Color	*Length (cm)*	*Width (cm)*
Spathe	Blush (Red 36A)	12	8.7
Spadix	Rose / orange	6.75	0.7

Yield (stems/yr) 5.6

Comments Blight-susceptible; UH release, re-acquired

A633

Name (Origin) **Unnamed hybrid** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Medium pink (Red 54C)	7	3.5
Spadix	Lavender	4	0.7

Yield (stems/yr) 5.2

Comments Fragrant; blight resistant

A637

Name (Origin) **Unnamed hybrid** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Dark pink (Red 48B)	11.5	5.6
Spadix	White / dark pink	8.3	1.1

Yield (stems/yr) 6.2

Comments Dark green foliage

A638

Name (Origin) **'Gervais Orange'** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Orange (Orange-red 33A)	10.5	10
Spadix	White / yellow / orange	6	0.7

Yield (stems/yr) 5.9

Comments Obake; open lobes; good sucker production

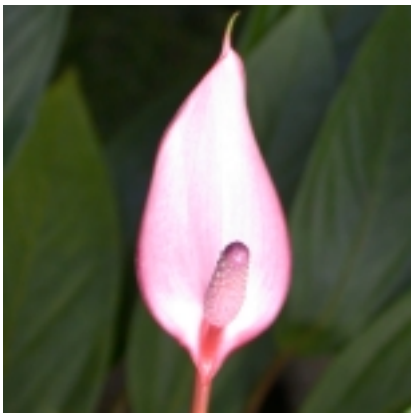
A650

Name (Origin) **Anthurium hybrid** (Florida)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Medium pink (Red 54C)	6	2.6
Spadix	Purple	4	0.5

Yield (stems/yr) 11.4

Comments Non-colorfast; very blight resistant; attractive, medium-green foliage



A652

Name (Origin) ***A. brownii***
Section Belolonchium

	Color	*Length (cm)*	*Width (cm)*
Spathe	Green (Yellow-green, 146A)	22.5	5
Spadix	Maroon	32	1.5

Yield (stems/yr) Not available

Comments Large, orange berries; blight-resistant; flowers below very tall leaf canopy

A656

Name (Origin) **'Flamingo'** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Light pink (Red 50D)	12.5	9.5
Spadix	Dark pink	7	1

Yield (stems/yr) 5.3

Comments Non-colorfast; long internodes; re-acquired A555

A658

Name (Origin) ***A. standleyi*** (Missouri Botanical Gardens)
Section Pachyneurium

	Color	*Length (cm)*	*Width (cm)*
Spathe	Med. green (Yellow-green 146C)	23	3.5
Spadix	Green	32	1.5

Yield (stems/yr) 4.8

A665

Name (Origin) **Unnamed hybrid** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Light blush (White 155D)	10	2.4
Spadix	Lavender	5.5	0.6

Yield (stems/yr) 10.3

Comments Fragrant; dark green foliage; blight-susceptible; potted plant

A666

Name (Origin) **UH724** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Lt. green (Green-white 157C)	5.5	2.2
Spadix	White	4	0.5

Yield (stems/yr) 9.3

Comments Fragrant; dark green foliage; potted plant

A667

Name (Origin) ***A. amnicola*** (Christ Church Botanical Gardens, New Zealand) Section Porphyrochitonium

	Color	*Length (cm)*	*Width (cm)*
Spathe	Light purple (Purple 76A)	3.5	2
Spadix	Purple	2	0.5

Yield (stems/yr) 9.5

Comments Minty scent; potted plant; re-acquired A417, A468

A668

Name (Origin) ***A.* x *ferriense*** *(Missouri Botanical Gardens)*

	Color	*Length (cm)*	*Width (cm)*
Spathe	Pink (Red-purple 58C)	14.5	9.5
Spadix	White-pink	9	0.8

Yield (stems/yr) 4.5

Comments Flowers beneath foliage

A671

Name (Origin) **Unnamed hybrid** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Red (Red 45B)	28	19
Spadix	White-yellow	8	1

Yield (stems/yr) 3.9

Comments Obake, blight-resistant

A672

Name (Origin) **Unnamed hybrid** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Brown (Greyed-brown 174D)	18	14
Spadix	White / green	7.5	1.1

Yield (stems/yr) 4.8

Comments Spathe turns completely green with age

A689

Name (Origin) ***A. watermaliense*** (Hawaii)
Section Pachyneurium

	Color	*Length (cm)*	*Width (cm)*
Spathe	Maroon (Greyed-purple 187A and brown 200A)	19.5	4
Spadix	Maroon	12.9	0.9

Yield (stems/yr) 3.5

Comments Plant has a very large canopy

A695

Name (Origin) **'New Pahoa Red' mutant** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Light orange (Red 41C)	20.2	14.6
Spadix	White / yellow	8	1.2

Yield (stems/yr) 4.5

Comments Red splash on spathe; mutant from tissue culture

A697

Name (Origin) **'New Pahoa Red'** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Red (Red 45B)	15	11.7
Spadix	White / yellow	6.5	0.7

Yield (stems/yr) 8.2

Comments Colorfast; flowers above leaves; propagates easily; long internodes; blight resistant; commercial cut flower

A703

Name (Origin) **‘Nicolien’** (Oglesby)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Light red (Red 51B)	7.5	4.3
Spadix	Dark red	4.5	0.6

Yield (stems/yr) 7.7

Comments Colorfast; blight-susceptible; potted plant

A706

Name (Origin) **‘Small Talk’** (Oglesby)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Medium pink (Red 51A)	5.6	4.1
Spadix	White / pink / green	4.6	0.6

Yield (stems/yr) 5.5

Comments Spathe greens with age; very compact; short growth; potted plant

A710

Name (Origin) **‘Elspeth’** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	White (White 155D)	15.8	13
Spadix	White / light green	9.1	1.5

Yield (stems/yr) 5.2

Comments Very sweet fragrance; blight-susceptible

A711

Name (Origin) **‘Gemini’** (Twyford)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Red (Red 53A)	10.35	6.05
Spadix	Light red	6.35	0.8

Yield (stems/yr) 7.2

Comments Colorfast; very dark green foliage; potted plant

A712

Name (Origin) **'Emerald'** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Med. green (Yellow-green 144A)	14	11
Spadix	White / green	5.5	0.5

Yield (stems/yr) 2.7

Comments Medium green foliage; blight-susceptible

A715

Name (Origin) **Orange 'Kalapana'** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Orange (Red 45C)	11	11.2
Spadix	White / yellow	3.5	0.6

Yield (stems/yr) 3.9

Comments Obake; commercial cut flower; mutation of UH release

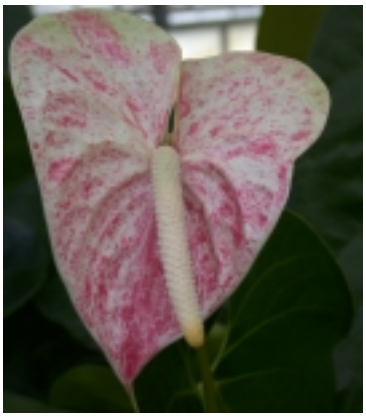
A716

Name (Origin) **'Splash'** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Red and blush (Red 50A, Orange 27C)	10	7.5
Spadix	White / yellow	7	1

Yield (stems/yr) 4.8

Comments Commercial cut flower



A717

Name (Origin) **'Nitta'** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Orange-red (Orange-red 34A)	11	9
Spadix	White / yellow	7	1

Yield (stems/yr) 2.4

Comments Colorfast; commercial cut flower; re-acquired

A718

Name (Origin) **‘Paradise Pink’** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Light red (Red 52A)	20.5	17.4
Spadix	White / yellow	9	1

Yield (stems/yr) 4.9

Comments Non-colorfast under high temperatures; UH release; commercial cut flower; re-acquired

A719

Name (Origin) **‘Ozaki’** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Red (Red 50A)	15	12
Spadix	Pink / orange	5.5	1.1

Yield (stems/yr) 3.6

Comments Colorfast; commercial cut flower before bacterial blight epidemic; re-acquired

A720

Name (Origin) **‘Hidden Treasure’** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Orange (Red 37C)	10	10.5
Spadix	White / yellow	3.5	0.7

Yield (stems/yr) 11.6

Comments Obake; spadix at base of plant; UH release; re-acquired

A727

Name (Origin) **Rose Pink** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Dark pink (Red 51B)	12.5	9
Spadix	White / pink	7	0.8

Yield (stems/yr) 4.9

Comments Slightly obake as flower ages; blight-susceptible under UH Magoon facility conditions

A728

Name (Origin) **UH927** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Red (Red 45A)	19.2	14.5
Spadix	White / yellow	8.1	0.8

Yield (stems/yr) 5.7

Comments Colorfast; blight-resistant

A733

Name (Origin) **'Pele's Pride'** (Hawaii)

	Color	*Length (cm)*	*Width (cm)*
Spathe	Red (Red 45A)	10.5	8.5
Spadix	White / yellow	7.5	1

Yield (stems/yr) 6.1

Comments Tulip shape; reddish-green foliage; red petioles

were noted if symptoms were evident or if disease susceptibility is known in the trade. Foliage color, which affects the attractiveness of the plant when not in bloom, was noted if it was particularly dark green, had red highlights, or was light green. Spathes of commercial varieties were noted as colorfast or non-colorfast (subject to fading). Fading due to high summer temperatures or during maturation is undesirable, as the grower needs consistent color to meet wholesalers' and florists' needs. Consistency in a spathe being obake (green lobes) or turning obake-like with age or during various growing seasons was also noted.

Yield

Yield is a very important attribute for anthuriums. A growing point (single stem) of a commercial variety may average six flowers per year: a one-flower deviation from this average has economic significance to a grower. With the high cost of land and labor in Hawaii, high yield becomes even more important as a breeding goal. The date when the spathe unfurled was noted for each flower. The average flowering interval in weeks between successive flowers over a period of at least a year was divided into 52 weeks to determine the number of flowers per plant stem per year, i.e., the annual yield (Kamemoto and Nakasone 1963).

Spathe color and size

Spathe color was observed on freshly cut, newly unfurled flowers under natural light using the 1993 Royal Horticultural Society Colour Chart (RHSCC, Vincent Square SWIP 2PE, London). The spathe length was measured from the top peak of the lobes of the spathe to the spathe apex. The width is the greatest distance across the spathe, usually directly under the spadix. Spathe color was categorized as shades of red, orange, pink, white, purple, lavender, and green; obake and spots were noted.

Spadix color, size, and fragrance

Spadix color was judged visually. It included a description of color variation from the base to the tip. Spadix width was measured at the widest point. Fragrance, if present, was noted. Fragrance was previously evaluated in detail by Kuanprasert and Kuehnle (1999).

Dutch varieties

The program received 8 accessions from the Netherlands in 1992. Most of these accessions succumbed to bacterial blight prior to 2001, except for 'Acropolis' (A583) and 'Tropical' (A591). Data collected in 1994–1995 are included.

Discussion

Acquisition of germplasm is a key component in any plant breeding program. A plant breeder must have new materials that incorporate new genes for the desirable characteristics for an evolving market. This accession publication and those previously published (Kamemoto and Nakasone 1963, Kamemoto et al. 1986) comprise an inventory of some of the University of Hawaii's anthurium resources.

Several accessions are of interest because they may be useful in breeding for green spadices, a trait noticeably absent among cut-flower anthuriums released by UH to date. The UH program has started to intensify breeding for persistent green spadices, where the spadix remains green after maturity, utilizing accessions with green spadices such as 'Tropical' (A591), A606, A672, and 'Emerald' (A712). Several of these accessions were crossed with plants lacking green spadices, resulting in progeny with green spadices. This indicated that green spadix parents can be used effectively to breed for green spadices.

Additional obake materials were acquired. Although obake was a new entry in the top-10 cut-flower anthurium varieties in the 2001 Dutch auctions (Pathfast Publishing, 2003), it has been popular in Hawaii for decades, notably with the UH releases 'Anuenue' in 1969, 'Mauna Kea' in 1977, and 'Tropic Ice' and 'Kalapana' in 1993. Accessions 'Miura' (A569), 'Kobayashi Pink' (A605), 'Gervais Orange' (A638), A671, and A727 are obakes added to the collection. Although the obakes 'Kalapana' (A715), and 'Hidden Treasure' (A720) were previously named and released by UH, these cultivars were reacquired for the collection.

Additional orange and lavender or purple materials were acquired to augment existing germplasm. Accessions 'Gervais Orange' (A638), 'New Pahoa Red' (A695), an orange mutant of 'Kalapana' (A715), 'Nitta' (A717), and 'Hidden Treasure' (A720) are in the orange category. 'Nitta' (A717) was re-acquired as older 'Nitta' plants in the collection were either severely infected or succumbed to bacterial blight. Accessions 'Leilani' (A563), 'Lavender Prince' (A567), and *Anthurium amnicola* (A667) are in the purple-lavender category. *A. amnicola* is already a useful parent for purple potted-plant breeding despite the color being recessive in inheritance (Wannakrairoj and Kamemoto 1990). The UH program has bred and released purple 'ARCS' (Kamemoto et al. 1988), 'ARCS Hawaii'(Kamemoto et al. 1988), and 'Lavender Lady' (Kamemoto et al. 1989) using the older accessions of red-purple *A. kamemotoanum* and lavender *A. amnicola*.

Plant yield varied depending on the genotypes. Some plants did not flower at all within the evaluation period, or flowered less frequently than expected for well known commercial hybrids; these include 'Nitta'(A717), 'Paradise Pink' (A718), and 'Ozaki' (A719). Values below expected yield can be attributed to poor plant growth caused by bacterial blight. Thus yield figures presented provide a minimal baseline for the yield potential of the plant under high-input (commercial) cultivation conditions.

Lastly, fragrance is of interest particularly for developing potted-plant and landscape cultivars, as the scent of cut flowers is short-lived (Kuanprasert et al. 1998, Kuanprasert and Kuehnle 1999). Thus the following fragrant accessions may find utility in the breeding program: 'Leilani' (A563), 'Lady Beth' (A602), 'Ellie's White' (A604), A606, *A. crystallinum* x *A. armeniense* (A624), *A. antioquiense* x *A. armeniense* (A628), A633, A665, UH724 (A666), *A. amnicola* (A667), and 'Elspeth' (A710). Scent can be transmitted to progeny, although it appears to be quantitatively inherited (Kuanprasert et al. 1998, Kuanprasert and Kuehnle 1999).

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