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## New dwarf F1 *Canna* from seed

Editors interview Tomoaki Harada, Takii Seed Co.

The Takii seed company of Japan introduced a new dwarf *Canna*, the F1 South Pacific Scarlet in the 2013 California Spring Trials. It is the first F1 *Canna* from seed and is more uniform in germination than their earlier Tropical series. It also has good basal branching. The breeder,



*Canna* F1 South Pacific Scarlet

Mr. Tomoaki Harada, answered a few questions we posed to him via an e-mail interview.

**How long have you worked for Takii Seed?** 35 years after graduating from the university. I began to work on *Canna* when I joined Takii.

**Why did you choose to work on *Canna*?** I was sure that *Canna* has big possibilities to be one of the reliable bedding and pot plants in future.

**Are *Canna* difficult to breed?** Rather difficult because the seed setting is not stable due to this plant's genetic background.

**Since most *Canna* have been sold as rhizomes, was there a need for a seed-produced *Canna*?** Almost all people think that *Canna* is grown just from rhizomes. But, the rhizomes of *Canna* are not easy to treat, and, sometimes easy to rot. By developing the seed variety, these problems are solved. There was a potential request.

**What were your original objectives when you started to breed *Canna*?** To breed *Canna* that are easy to grow from seed.

**What particular qualities does this variety have that merited its introduction?** The first F1 seed *Canna*, which is dwarf (1.2m tall in its final stage), very uniform and vigorous with intensive scarlet color and a high germination rate.

**I assume that your seed propagated *Canna* is true breeding and we would like to know the mechanism for that. Did you create a double haploid, or an amphidiploid, or would it be from several generations of inbreeding? Or might it be a species selection that does not segregate for any horticultural characteristics?** I bred just by the ordinary ways of breeding. No double haploid, no amphidiploid, no species selection.

**Has polyploidy played any role in your program?** So far it has not played in any special role.

**How long does it take from sowing seed to being able to flower the plants?** About 75 days.

**Is this new seed-produced *Canna* faster to come into bloom than traditional varieties?** It depends on the varieties. They are almost the same in general.

**From the time that you made the first crosses, how long did it take until you were satisfied that this was**



Mr. Tomoaki Harada, plant breeder for Takii & Co., Ltd.



Canna F1 South Pacific Scarlet

**good enough to release?** I was satisfied by the first crossing. That means 1 year.

**Was this seed-produced hybrid your first *Canna* release?** It is the second one. A Tropical series, which are open pollinated varieties with 6 colors now, was released in 1991.

**How do you test your varieties of *Canna*? (Do you have cooperators elsewhere who grow it out and return evaluations to you?)** Takii has subsidiaries to test in different climates.

**We know there are 19 species, but we don't know anything about their cross compatibility. Are F1 hybrids generally fertile? Have you used many species in your breeding program?** I've not tried all the crosses. In

my experience, many interspecific crosses are difficult to get progeny from for my seed breeding program.

**Do you have other *Canna* hybrids in process that will be for the seed-produced market? (I would assume so since you list this in the South Pacific™ series.)** We have not released any other varieties. For the future, it is confidential.

**What other flower crops do you work with?** Pansy, Petunia, Sunflower, etc.

**What are some of your other best achievements in plant breeding?** Maybe Sunflower Sunrich series. Thank you.

For more information about Takii & Co. go to [www.takiiseed.com](http://www.takiiseed.com).

#### The Purpose of HSI

The purpose of HSI is to increase the enjoyment and understanding of *Heliconia* (Heliconiaceae) and related plants (in the families Cannaceae, Costaceae, Lowiaceae, Marantaceae, Musaceae, Strelitziaceae, and Zingiberaceae) of the order Zingiberales through education, research and communication. Interest in Zingiberales and information on the cultivation and botany of these plants is rapidly increasing. HSI will centralize this information and distribute it to members.

The **HELICONIA SOCIETY INTERNATIONAL**, a nonprofit corporation, was formed in 1985 because of rapidly developing interest around the world in these plants and their close relatives. We are composed of dues-paying members. Our officers and all participants are volunteers. Everyone is welcome to join and participate. HSI conducts a Biennial Meeting and International Conference.

Membership dues are (in \$US): Individual \$40, Family \$45, PDF \$25, Student \$10, Contributing \$50, Corporate \$100, Sus-

taining \$500, Lifetime Member \$1000. Membership fees constitute annual dues from 1 July through 30 June. All members receive the BULLETIN (usually published quarterly) and special announcements. Join or renew your membership at [www.heliconia.org](http://www.heliconia.org).

#### HSI Officers and Board of Directors for 2012-2014

Carla Black, President and Membership; David Lorence, Treasurer; Jan Hintze, Secretary, Membership and Etlingera Cultivar Registrar; Dave Skinner, Webmaster, Costaceae Cultivar Registrar and Conservation Centers; Chelsea Specht, Student Grants; Bryan Brunner, Heliconia Cultivar Registrar; Sandra Barnes, Archivist; and Directors: W. John Kress, Vinita Gowda, Victor Lee, Carlos Castro, Annon Ongsakul and Colton Collins.

The HSI BULLETIN is the quarterly publication of the HELICONIA SOCIETY INTERNATIONAL. Inquiries: Jan Hintze, [admin@heliconia.org](mailto:admin@heliconia.org). Website: [www.heliconia.org](http://www.heliconia.org)

## Heliconia Society Cultivar Registration

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The Heliconia Society International is the official International Cultivar Registration Authority (ICRA) for the genera *Heliconia*, *Etilingera*, *Costus*, *Cheilocostus*, *Chamaecostus*, and *Paracostus*. A cultivar name must comply with the standards as found on the website of the International Society for Horticultural Science (ISHS) at ([www.ishs.org/sci/icra.htm](http://www.ishs.org/sci/icra.htm)). A cultivar name is "accepted" if it is compliant with the naming standards of the ISHS. The name becomes "established" only after it has been published in hard copy with a description in a publication that meets the requirements of the ISHS. The Heliconia Society International will periodically publish accepted cultivar names of *Heliconia*, *Costaceae* and *Etilingera* and will provide registration services, following the rules of the ISHS.

Generally, the following information is required to register a new cultivar:

1. Cultivar name
2. Parentage of cultivar - genus/species of plant and/or hybrid parents
3. Origin of cultivar - Where did it come from? Who discovered or bred it? Who named and introduced it?
4. Written description of cultivar with characteristics that distinguish it from other similar cultivars or species.
5. Photo of the inflorescence and/or other plant parts that distinguish it.
6. Citation of the earliest dated hard copy publication, if any, of the cultivar.

If you would like to register your cultivar name, you may contact the Heliconia Society by email to [CultivarRegistry@heliconia.org](mailto:CultivarRegistry@heliconia.org) for further information. Your email will be forwarded to the appropriate Registrar. The Registrar will send you the registration forms and procedures for that genus.

Heliconia Cultivars - Bryan Brunner  
Etilingera Cultivars - Jan Hintze  
Costaceae Cultivars - Dave Skinner

A Heliconia cultivar checklist was published in the quarterly Bulletin, Volume 12, Numbers 3 & 4 containing 1,066 unique cultivar names as of 2005. To see the current cultivar list go to the website of the Heliconia Society of Puerto Rico [www.heliconiasocietypr.org/cultivar\\_registration.htm](http://www.heliconiasocietypr.org/cultivar_registration.htm). You can also find a form and instructions there for submitting a new Heliconia cultivar.

A Costaceae cultivar checklist with high resolution photos is available on the Heliconia Society website at [www.heliconia.org/Registry/CostaceaeChecklist.pdf](http://www.heliconia.org/Registry/CostaceaeChecklist.pdf). The *Etilingera* checklist will be added to the website at a later date.

## The *Etilingera* cultivar registry

Jan Hintze  
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At last the paperwork is organised, and the Heliconia Society International has been appointed the Registrar for the cultivars of the genus *Etilingera*. And the HSI Board has courageously asked me to fill that role. The following



**'Almost White'** PARENTAGE: *Etilingera elatior*

ORIGIN: Unknown, common in cultivation

DESCRIPTION: Colour very pale pink, torch shape, narrow bracts, rolled laterally, loose central cone, same colour bracts and cone. Dayflowers normal red and yellow.

REFERENCE: J. Hintze submission

notes may help members and others to be clear about what we are doing here. And it should be noted that this Registry is open to all, not just members of the HSI.

This genus *Etilingera* is large, having some 200 species, mostly native to India and Asia. The plants vary in size, with leaf stems reaching 5-6 metres in *Etilingera elatior*, while some others are quite small, less than 1 meter. Many species have minimal ornamental value, although many provide food and medicine for local people. The inflorescences are often on very short stems, if not subterranean, and the day flowers or true flowers very short lived. However a few species, such as *E. elatior*, and *E. venusta*, *E. corneri*, *E. hemispherica* and *E. pyramidosphera* have flowers growing on quite tall pedicels, with the true flowers grouped in very ornamental arrangements of bracts, the central, fertile ones cupping the flowers and the outer sterile bracts folding over the cone.

This Genus has been widely grown for many years - it was first described by J. K. Koenig in 1779, although a lot of the species in the genus were given other generic names until relatively recent times, when *Etilingera* was given the precedence over others such as *Nicolaia* and *Phaeomeria*, which are sometimes still seen in gardening books, etc.

*Etilingera elatior* is probably the most commonly used horticultural and floricultural species in the genus, and it has been planted in many countries in the tropical zones, world wide. It is quite adaptable to climatic change and can be grown successfully in a wide range of conditions.

Many different varieties are available—offering a range of colours and shapes. This species is very variable, when grown from seed, the colour can range from pure white to deep scarlet, with a wide variety of pinks and pink and white combinations, as well as variations in bract form. Hybrids between species have also been made, leading to more differences in shape and colour.



**'Bloody Mary'** PARENTAGE: *Etilingera elatior*

ORIGIN: Unknown, common in cultivation

DESCRIPTION: Extremely dark red colour, white edges to bracts, standard torch ginger. Bracts and cone same colour. True flowers standard red and yellow.

REFERENCE: J. Hintze submission

The relative ease of raising seedlings has led to many cultivars of similar appearance having differing names in different locations, and this Register is an attempt to rationalize this situation. The first four varieties to appear on the Register and to be published in the HSI Bulletin, are all well-known, and have been in horticulture for a very long time, making it difficult to pinpoint their origins. Generally it is required to specify the parents of a hybrid or the source of the cultivar, but many cultivars are so widely distributed that their origin is difficult to determine. Efforts should be made to discover the first printed mention of a name but in the case that this is not possible, the publication of the name in the HSI Bulletin becomes that initial mention, and this authenticates the name of the cultivar. It is possible that a list of synonyms could be kept for those clones which have different names in different countries. If there is evidence of an earlier publication of a name, then that becomes the official name for that cultivar, and all others become synonyms.

Once the existing cultivars are listed and formally named, then making new additions will be relatively simple, and of course the development of digital photographs will allow for easier identification of differences between existing named cultivars and new ones.

For those intending to register cultivars it should be understood that the difference between an existing cultivar and a new offering should be significant and consistent across



**'Frlly Pink'** PARENTAGE: *Etilingera elatior*

ORIGIN: Unknown, common in cultivation

DESCRIPTION: Soft salmon pink, standard torch shape, green foliage. Highly reflexed and laterally rolled outer bracts, loose bracts on cone expanding in chrysanthemum style when fully open. Same colour throughout. True flowers standard yellow and red.

REFERENCE: J. Hintze submission

all inflorescences of that clone in time, since sometimes temperature and other factors such as nutrition can induce temporary variations in form. Although not strictly necessary for the registration of a new cultivar, it is desirable to have details of parentage for hybrids, if known, as well as a detailed description of the cultivar's distinguishing characteristics for all new registrations.



**'Red Torch'** PARENTAGE: *Etilingera elatior*

ORIGIN: Unknown, common in cultivation

DESCRIPTION: Colour red, standard torch ginger, foliage red reverse, green upper, red stems, rhizome, and flower stems. This could be considered the standard "Torch Ginger" - round ball shaped flower when open, broad outer bracts extremely reflexed, inner cone uniform colour, True flowers usual red and yellow.

REFERENCE: J. Hintze submission

The application form for the registration of cultivars of *Etilingera* is available through the website of the Heliconia Society International, <[www.heliconia.org](http://www.heliconia.org)>. Just send an email to [admin@heliconia.org](mailto:admin@heliconia.org). The HSI Bulletin will be used to publish new registrations and to keep members, and any others interested, up to date.

## The Costaceae cultivar registry

Dave Skinner

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### 'Carla'

PARENTAGE: *Costus* aff. *laevis* x *guanaiensis*

ORIGIN: Unknown origin, received from Carla Black in Panama, named and introduced by Dave Skinner.

DESCRIPTION: Vegetative parts are similar to *Costus laevis* with dark green leaves and purplish undersides, mostly glabrous stems and leaves. Mature stems are deep purple, up to 5 cm in diameter supporting very large mature plants up to 4-5 meters high. Young leaves have the typical silvery stripe of *C. laevis*, ligules are lobed, and about the same length (Ca 2 cm) as the petioles. The inflorescence is a *C. guanaiensis* type with green appendaged bracts and flowers with spreading labellum mostly white with red stripes, similar to *C. guanaiensis* flowers.

REFERENCE: [www.gingersrus.com/DataSheet.php?PID=7530](http://www.gingersrus.com/DataSheet.php?PID=7530)

PHOTO: [www.heliconia.org/Registry/Costus\\_Carla.jpg](http://www.heliconia.org/Registry/Costus_Carla.jpg)



### 'Cliff Dweller'

PARENTAGE: *Costus* aff. *comosus* x \_\_\_\_\_

ORIGIN: Collected, named and introduced by Dave Skinner, found very localized growing only on steep bluffs and in rocky soil along the beach of the Pacific Coast at Cabo Matapalo, Costa Rica.

DESCRIPTION: Appears to be a hybrid or variety of *C. comosus*, plant is sterile, produces green bracts with long pendent triangular foliaceous appendages and yellow tubular flowers. Bracteole and calyx are white to pale green. Vegetative parts are glabrous to velutinous and ligule is extremely short (1-2 mm) and truncate. Leaf base is cordate unlike description of *C. comosus*.

REFERENCE: [www.gingersrus.com/DataSheet.php?PID=7376](http://www.gingersrus.com/DataSheet.php?PID=7376)

PHOTO: [www.heliconia.org/Registry/Costus\\_CliffDweller.jpg](http://www.heliconia.org/Registry/Costus_CliffDweller.jpg)



### 'Darth Vader'

PARENTAGE: *Costus*

ORIGIN: Origin unknown, distributed by Heliconia Paradise in Thailand as *Costus speciosus*, named and introduced by Dave Skinner.

DESCRIPTION: Dark red bracts with fibrous margins, *C. scaber* type flowers are dark orange,



mature inflorescences turning dark brown on maturity and decayed on inflorescence that is continuing to flower. Vegetative parts are mostly glabrous, ligule typically has long fibers at margins and a purplish ring around the margin.

REFERENCE: [www.gingersrus.com/DataSheet.php?PID=7183](http://www.gingersrus.com/DataSheet.php?PID=7183)

PHOTO: [www.heliconia.org/Registry/Costus\\_DarthVader.jpg](http://www.heliconia.org/Registry/Costus_DarthVader.jpg)

### 'El Gato'

PARENTAGE: *Costus*

ORIGIN: Collected, named and introduced by Dave Skinner, found at several locations in Ecuador and Peru. Also collected at Cajamarca, Tolima, Colombia. Living and herbarium specimen from this collection is at the National Tropical Botanical Garden in Hawaii, NTBG#74505.

DESCRIPTION: The primary distinguishing character is the pendent inflorescence, otherwise found only in *Costus bracteatus* in Central America. Bracts are dark red, non-appendaged, and without fibrous margins. The bracts are distinctively concave in shape forming a cone somewhat similar to *Costus scaber*, but the flower has a broad, open labellum, mostly white, with a yellow throat and variable amounts of pink color on the labellum wings. The labellum wings are usually parallel to each other giving a flattened appearance to the flower. There are also noticeable spots on the stems, most pronounced on the lower part of the stems.

REFERENCE: [www.gingersrus.com/DataSheet.php?PID=7509](http://www.gingersrus.com/DataSheet.php?PID=7509)

PHOTO: [www.heliconia.org/Registry/Costus\\_ElGato.jpg](http://www.heliconia.org/Registry/Costus_ElGato.jpg)



### 'El Whiskey'

PARENTAGE: *Costus*

ORIGIN: Believed originally Tim Plowman collection, plant from Tingo Maria Botanical Garden, Peru, distributed to several botanical gardens in the US and Europe. This is an undescribed new species. Name came from collection location, has been referred to as "El Whiskey" by botanists. Introduced by Dave Skinner.

DESCRIPTION: Plant grows to about 1 meter tall, with large leaves deep green upper side and dark purple underneath. Leaves tend to point upwards. Vegetative parts are covered with thick hairs. Ligule is truncate to slightly lobed. Inflorescence is of *C. guanaiensis* type, usually terminal on a leafy stem, with red bracts with green bract appendages. Flowers are creamy white with spreading type labellum that has reddish lines.

REFERENCE: [www.gingersrus.com/DataSheet.php?PID=7260](http://www.gingersrus.com/DataSheet.php?PID=7260)



PHOTO: [www.heliconia.org/Registry/Costus\\_EIWhiskey.jpg](http://www.heliconia.org/Registry/Costus_EIWhiskey.jpg)

### 'Emerald Crinkles'

PARENTAGE: *Costus guanaiensis*

ORIGIN: Collected, named and introduced by Dave Skinner, found in two locations in Amazon basin near Iquitos, Peru.



DESCRIPTION: This form of *Costus guanaiensis* is named for the wavy, undulating form of the bract appendages. The plant grows to about 1 1/2 meters tall. Inflorescence is terminal on a leafy stem, bracts have foliaceous green appendages, flowers are creamy white with red lines on the spreading labellums. Vegetative parts are hairy.

REFERENCE: [www.gingersrus.com/DataSheet.php?PID=7529](http://www.gingersrus.com/DataSheet.php?PID=7529)

PHOTO: [www.heliconia.org/Registry/Costus\\_EmeraldCrinkles.jpg](http://www.heliconia.org/Registry/Costus_EmeraldCrinkles.jpg)

### 'Eskimo Kiss'

PARENTAGE: *Costus*

ORIGIN: Per Glenn Stokes he received this from Mark Collins.

DESCRIPTION: Stokes Tropicals Catalog describes as follows: Inflorescence is bright shiny red round balls with tight bracts from which canary yellow flowers appear in a spiral. Plant has a spiraling stem and grows 3' to 4'.

IDENTICALLY DESCRIBED AT [www.plantgrouphawaii.com](http://www.plantgrouphawaii.com)

REFERENCE: Stokes Tropicals Catalog 2003-04, [www.plantgrouphawaii.com](http://www.plantgrouphawaii.com)

PHOTO: no photo available

### 'Foster Variegated'

PARENTAGE: *Cheilocostus speciosus*

ORIGIN: Unknown

DESCRIPTION: Apparently non-flowering, variegated foliage. The variegated foliage has broad, creamy white stripes and contrasts well with the dark red stems.

REFERENCE: Hardy Gingers, T. M. E. Branney 2005

PHOTO: no photo available

### 'Green Mountain'

PARENTAGE: *Costus productus* X *varzeorum*

ORIGIN: Tim Chapman hybrid, named and introduced by Stokes Tropicals.

DESCRIPTION: Described in Stokes Tropicals catalog as follows: Similar in all respects to *C. curvibracteatus* as described below except reddish orange bracts of inflorescence have beautiful green tips.

REFERENCE: Tim Chapman, Stokes Tropicals

PHOTO: no photo available

### 'Grey Ghost'

PARENTAGE: *Costus erythrophyllus*

ORIGIN: Original collection believed from Colombia. See

Lyon #99.0136 and USBG #94-680. Named and introduced by Dave Skinner.

### DESCRIPTION:

Leaves are plicate, distinctively light grey on upper sides with dark purple undersides. Long, deeply lobed ligules. Taller than common form of *C. erythrophyllus*, frequently flowers both basally and terminally. Bract appendages are green with purplish streaks.

REFERENCE: [www.gingersrus.com/DataSheet.php?PID=7300](http://www.gingersrus.com/DataSheet.php?PID=7300)

PHOTO: [www.heliconia.org/Registry/Costus\\_GreyGhost.jpg](http://www.heliconia.org/Registry/Costus_GreyGhost.jpg)



### 'Hieroglyphics'

PARENTAGE: *Costus pictus*

ORIGIN: Per communication from Glenn Stokes, they obtained it from Thomas Wiedeman in Costa Rica.

DESCRIPTION: Described in catalog as follows: We have dubbed it 'Hieroglyphics' because of its interesting and busy pattern of red markings on the stems. It may be related to *Costus pictus*. It grows 7' (2.1m) to 8' (2.4m) in medium to full sun. Like *C. pictus* it produces both terminal and basal cones. Has rather thin stems and narrow leaves. Obtained from Costa Rica. Strikingly marked stems and cone inflorescences make great cut flowers.



This plant is widespread in cultivation sometimes found under slightly different spelling. It can further be distinguished by the long stiff hairs at the ligules and the undulating form of the leaves.

REFERENCE: Stokes Tropicals catalog 1998

PHOTO: [www.heliconia.org/Registry/Costus\\_Hieroglyphics.jpg](http://www.heliconia.org/Registry/Costus_Hieroglyphics.jpg)

### 'Hot Lips'

PARENTAGE: *Costus*

ORIGIN: Circulated on the internet, sold on eBay, origin unknown. Name origin also unknown.

DESCRIPTION: Similar to *C. woodsonii* but the bract tips curl outwards giving the effect of having appendaged bracts. All vegetative parts are glabrous, ligule is truncate, 8-10 mm long. Bracts are red maturing to deep maroon in color. Flowers are red-orange. Bracteole and calyx are red in contrast to the whitish bracteole and calyx of *C.*



*woodsonii*. Flower has more open labellum than *C. woodsonii*.

REFERENCE: [www.gingersrus.com/DataSheet.php?PID=4121](http://www.gingersrus.com/DataSheet.php?PID=4121)

PHOTO: [www.heliconia.org/Registry/Costus\\_HotLips.jpg](http://www.heliconia.org/Registry/Costus_HotLips.jpg)

#### 'Java Pink'

PARENTAGE: *Cheilocostus speciosus*

ORIGIN: Originates from Indonesia

DESCRIPTION: Most commonly found pink flowering form. Naturally evergreen. Pink corolla, delicate, blush pink labellum.

REFERENCE: Hardy Gingers, T. M. E. Branney 2005

PHOTO: no photo available

#### 'Lemon Chiffon'

PARENTAGE: *Costus*

ORIGIN: Collected in 1974 by Tim Plowman in El Valle



Colombia, distributed by Waimea Arboretum, cultivar named and introduced by Dave Skinner.

DESCRIPTION: This is an undescribed species, closest to *Costus laevis*. The plant grows to about 3 meters, all vegetative parts glabrous, truncate ligule 6-8 mm long, petiole 10 mm. Cherry red bracts, bracteole to 18 mm, calyx 10 mm. Broad, spreading flower, creamy yellow corolla with pale yellow labellum 8 cm wide when spread. Pink throat with lemon yellow stripe. Stamen pink with deeply incised apex and 22 mm from thecae to apex.

REFERENCE: [www.gingersrus.com/DataSheet.php?PID=7418](http://www.gingersrus.com/DataSheet.php?PID=7418)

PHOTO:

[www.heliconia.org/Registry/Costus\\_LemonChiffon.jpg](http://www.heliconia.org/Registry/Costus_LemonChiffon.jpg)

#### 'Lita Red'

PARENTAGE: *Costus* aff. *laevis*

ORIGIN: Collected, named and introduced by Dave Skinner, found in



but with cherry red bracts and matching red flowers with a large open labellum. Plant grows to about 3 meters tall, vegetative parts all glabrous, ligule and petiole 15 mm long. Bracts are deep red with distinct nectar callus, corolla and stamen are red. Labellum is broad and spreading cherry red with a yellow throat.

REFERENCE: <http://www.gingersrus.com/DataSheet.php?PID=7517>

PHOTO: [www.heliconia.org/Registry/Costus\\_LitaRed.jpg](http://www.heliconia.org/Registry/Costus_LitaRed.jpg)

#### 'Long Kiss'

PARENTAGE: *Costus longibracteolatus*

ORIGIN: Per Glenn Stokes, he received this from Tom Wood.

DESCRIPTION: Described in Stokes Catalog as follows: A great looking ginger from Ecuador with a 10"-12" floral cone. Grows 6'-8'.

REFERENCE: Stokes Tropicals Catalog 2003-04, [www.plantgroupshawaii.com](http://www.plantgroupshawaii.com)

PHOTO: no photo available

#### 'Marcos Pride'

PARENTAGE: *Costus* aff. *claviger*

ORIGIN: Collected in southern Ecuador by Marco Jimenez, named and introduced by Dave Skinner.

DESCRIPTION: *Costus claviger* type inflorescence but with narrow, acutely triangular bract appendages and flower more closed and tubular in shape. Vegetative parts are mostly glabrous, ligules about 10 mm and truncate. Terminal flowering, bracts are red turning green toward the apex of the appendage, bracteole 10 mm and calyx about 8 mm long, flower overall is pinkish in color with reddish cast to corolla lobes and labellum.

REFERENCE: [www.gingersrus.com/DataSheet.php?PID=7465](http://www.gingersrus.com/DataSheet.php?PID=7465)

PHOTO: no photo available

#### 'Maroon Chalise'

PARENTAGE: *Costus productus*

ORIGIN: Per Glenn Stokes he received it from Mark Collins.

DESCRIPTION: Described as follows in Stokes Tropicals Catalog: A startling ginger with a maroon stem with overcupping ligules, solid green leaves and a brilliant red inflorescence - all in one package. Grows 3' -4' tall. NOTE: this is same as 'Ruby Chalise' but published name takes precedence.

REFERENCE: Stokes Tropicals Catalog 2003-04

PHOTO: no photo available

#### 'Mellow Yellow'

PARENTAGE: *Costus* aff. *villosissimus* x *wilsonii*

ORIGIN: Collected, named and introduced by Dave Skinner, selection from seedlings, origin was Costa Rica.

DESCRIPTION: 'Mellow Yellow' has broad, spreading, *C. villosissimus*-type flowers but with non-appendaged bracts and generally shorter, sparser hairs on the vegetative parts. Basal stems display a pattern similar to the 'Heiroglyphic' form of *C. pictus*. Ligules are short, about 3-5 mm long with longer hairs at the ligule than the rest of the stems and leaves. The bracts are green and non-appendaged



except for the lowest bracts. Flowers are broad and yellow.

REFERENCE: [www.gingersrus.com/DataSheet.php?PID=7518](http://www.gingersrus.com/DataSheet.php?PID=7518)

PHOTO: [www.heliconia.org/Registry/Costus\\_MellowYellow.jpg](http://www.heliconia.org/Registry/Costus_MellowYellow.jpg)

### 'Moonluster'

PARENTAGE: *Costus*

'Sweet Charlotte' x

'Belize Yellow'

ORIGIN: Dave Skinner hybrid, bred, named and introduced by Dave Skinner.

DESCRIPTION: Hybrid with the compact size and spreading shape of

'Sweet Charlotte' and the non-appendaged bracts and tubular flowers from 'Belize Yellow'. Stems and ligules are glabrous, leaves are slightly puberulous. Bracts are non-appendaged, dark red with green and yellow hi-lites, flowers are a unique deep coral color.

REFERENCE: [www.gingersrus.com/DataSheet.php?PID=7480](http://www.gingersrus.com/DataSheet.php?PID=7480)

PID=7480

PHOTO:

[www.heliconia.org/Registry/Costus\\_Moonluster.jpg](http://www.heliconia.org/Registry/Costus_Moonluster.jpg)

Costus\_Moonluster.jpg



### 'Morning Star'

PARENTAGE: *Costus*

aff. *claviger*

ORIGIN: Collected, named and introduced by Dave Skinner, found near Shapaja, Peru.

DESCRIPTION: This *C. claviger* form has long, triangular bract appendages and creamy white flowers that have deeply incised margins to the labellum. The vegetative parts are densely hairy, ligules are short (about 5 mm) and truncate to slightly lobed. Plant had basal inflorescence when found in habitat but all cultivated plants have produced terminal blooms. Bracts are red, becoming green on the triangular appendages, flowers are have a deeply incised labellum.

REFERENCE:

[www.gingersrus.com/DataSheet.php?PID=7522](http://www.gingersrus.com/DataSheet.php?PID=7522)

PID=7522

PHOTO:

[www.heliconia.org/Registry/Costus\\_MorningStar.jpg](http://www.heliconia.org/Registry/Costus_MorningStar.jpg)

Costus\_MorningStar.jpg



### 'Orange Sherbet'

PARENTAGE:

*Cheilocostus globosus*

ORIGIN: Received from Natural Selections Exotics as unnamed *C. globosus* variety, may be a Mark Collins collecti-

tion. Named by Dave Skinner.

DESCRIPTION: *C. globosus* form with yellow-orange basal flowers. Plant is glabrous except for undersides of leaves which are velutinous. Ligules are long (up to 4 cm.) and deeply lobed, becoming papery with age. Bracts, bracteoles and calyx are red and densely puberulous.

REFERENCE: [www.gingersrus.com/DataSheet.php?PID=7512](http://www.gingersrus.com/DataSheet.php?PID=7512)

PID=7512

PHOTO:

[www.heliconia.org/Registry/Cheilocostus\\_OrangeSherbet.jpg](http://www.heliconia.org/Registry/Cheilocostus_OrangeSherbet.jpg)



### 'Peach Cobbler'

PARENTAGE:

*Cheilocostus globosus*

ORIGIN: Received from

Tom Wood as un-

named *C. globosus* variety. Origin unknown. Named by Dave Skinner.

DESCRIPTION: *C. globosus* form with unusual leaves and yellow flowers with red markings in the throat of the labellum. New leaves are peach colored turning green with maturity and having a distinctive rugose (wrinkled) texture. Leaves are glabrous on both surfaces. Normally flowers basally but this cultivar sometimes makes a terminal inflorescence. Bracts, bracteoles and calyx are densely hairy and green with only a blush of red near the margins.

Flowers are globular in shape, labellum is yellow with distinctive red markings in the throat.

REFERENCE:

[www.gingersrus.com/DataSheet.php?PID=7513](http://www.gingersrus.com/DataSheet.php?PID=7513)

PID=7513

PHOTO:

[www.heliconia.org/Registry/Cheilocostus\\_PeachC](http://www.heliconia.org/Registry/Cheilocostus_PeachC)

Cheilocostus\_PeachC



### 'Pink Lips'

PARENTAGE: *Costus*

*pulverulentus*

ORIGIN: Named and distributed by Joseph Fondeur, Tropical Paradise Nursery, Davie,

Florida. Origin unknown but similar plant is found in cultivation and has escaped from cultivated areas in Hawaii, considered invasive there.

DESCRIPTION: A compact form of *C. pulverulentus* with pale pink bracts and pink flowers. Plant grows to 1 meter tall or less, stems, ligules and leaves are glabrous. Ligules are truncate to slightly lobed, 2-3 mm long and usually with a purplish margin. Inflorescence is fusiform and flowers have a stamen far exceeding the labellum - all characters common for the species *C. pulverulentus*.

REFERENCE: [www.gingersrus.com/DataSheet.php?PID=7382](http://www.gingersrus.com/DataSheet.php?PID=7382)

PID=7382

PHOTO: [www.heliconia.org/Registry/Costus\\_PinkLips.jpg](http://www.heliconia.org/Registry/Costus_PinkLips.jpg)

**'Pink Panther'**

PARENTAGE: *Costus*  
 ORIGIN: Seedling of plant later named as 'El Gato', collected near Gualaquiza, Ecuador. Named and introduced by Dave Skinner.



DESCRIPTION: This selection from *Costus* 'El Gato' (the cat) has mostly pink labellums instead of mostly white, but otherwise is nearly identical, with a pendent inflorescence, red bracts not appendaged, and usually with spotted stems.

REFERENCE: [www.gingersrus.com/DataSheet.php?PID=7563](http://www.gingersrus.com/DataSheet.php?PID=7563)

PHOTO: [www.heliconia.org/Registry/Costus\\_PinkPanther.jpg](http://www.heliconia.org/Registry/Costus_PinkPanther.jpg)

**'Pink Shadow'**

PARENTAGE: *Cheilocostus speciosus*

ORIGIN: Per Glenn Stokes he obtained from Jesse Durko Nursery in Davie, Florida.

DESCRIPTION: Described in Stokes Tropicals catalog as a variation of *C. speciosus* with white flowers blushed with pink. Flowers emerge from terminal red cones.

REFERENCE: Stokes Tropicals Catalog 1999

PHOTO: no photo available

**'Pocosol'**

PARENTAGE: *Costus* aff. *curvibracteatus*

ORIGIN: Collected and named by Dave Skinner, found in the Tilaran Mountains of Costa Rica near the Pocosol Research Station.

DESCRIPTION: Much shorter than the common form of *C. curvibracteatus*, with lobed ligules, red bracts, yellow tubular flowers that far exceed the bracts. Plant grows to about 1 meter high, vegetative parts are glabrous, ligule lobed, about 1 cm. Bracts are nearly solid red with a faint nectar callus line in red-orange. Flowers are 5 cm long and extend well beyond the bracts with yellow corolla lobes and labellum. Stamen is red tipped.

REFERENCE: [www.gingersrus.com/DataSheet.php?PID=7454](http://www.gingersrus.com/DataSheet.php?PID=7454)

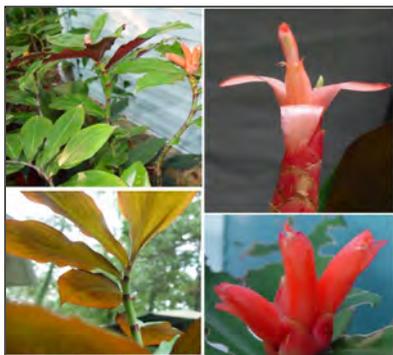
PHOTO:

[www.heliconia.org/Registry/Costus\\_Pocosol.jpg](http://www.heliconia.org/Registry/Costus_Pocosol.jpg)

**'Purple Passion'**

PARENTAGE: *Costus pulverulentus*

ORIGIN: Unknown origin, received from Carla Black in Panama.



Named and introduced by Dave Skinner.

DESCRIPTION: 'Purple Passion' is similar to 'Pink Lips' except that the undersides of the leaves and the ligules are a deep purple color. The plant grows to about 1 meter high with a strong spiral shape, vegetative parts are glabrous, ligule deep purple, truncate, 5 mm long.

REFERENCE: [www.gingersrus.com/DataSheet.php?PID=7519](http://www.gingersrus.com/DataSheet.php?PID=7519)

PHOTO:

[www.heliconia.org/Registry/CostustusPuplePassion.jpg](http://www.heliconia.org/Registry/CostustusPuplePassion.jpg)

**'Rancho Sunrise'**

PARENTAGE: *Costus* aff. *pulverulentus* x *villosissimus*

ORIGIN: Collected, named and introduced by Dave Skinner, found near Rancho Mastatal, Costa Rica.

DESCRIPTION: This is apparently a natural

hybrid of *C. pulverulentus* with *C. villosissimus*. The plant grows to about 2 meters tall, with short, sparse hairs on stems and leaves, ligule is slightly lobed and about 1 cm long. The bracts are mostly unappendaged except for some of the lower bracts and bract color ranges from green to reddish green. The flowers are tubular with pale orange corolla lobes but solid yellow labellums and a stamen that extends beyond the labellum.

REFERENCE: [www.gingersrus.com/DataSheet.php?PID=7453](http://www.gingersrus.com/DataSheet.php?PID=7453)

PHOTO:

[www.heliconia.org/Registry/Costus\\_RanchoSunrise.jpg](http://www.heliconia.org/Registry/Costus_RanchoSunrise.jpg)

**'Rattler'**

PARENTAGE: *Costus villosissimus* X *pictus*

ORIGIN: Dave Skinner hybrid.

DESCRIPTION: This is a hybrid of *C. villosissimus* with the 'Heiroglyphics'

form of *C. pictus*. It is named for its green and orange colors of the Florida A & M University "Rattlers". The plant grows to about 2 meters tall with dense hairs on stems and both surfaces of the leaves. The ligule is truncate and about 5 mm long. The bracts are green and non-appendaged, the flowers are bright orange and tubular.

REFERENCE: [www.gingersrus.com/DataSheet.php?PID=7533](http://www.gingersrus.com/DataSheet.php?PID=7533)

PHOTO:

[www.heliconia.org/Registry/Costus\\_Rattler.jpg](http://www.heliconia.org/Registry/Costus_Rattler.jpg)



This registry will continue in the Bulletin 20(1)

## Systematics and evolution of Costaceae's South American Clade: *Dimerocostus* Kuntze, *Monocostus* K. Schum. and *Chamaecostus* C. Specht & D.W. Stev

Thiago André<sup>1</sup> and Chelsea Specht<sup>2</sup>

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References are available at [www.heliconia.org](http://www.heliconia.org)

### Introduction

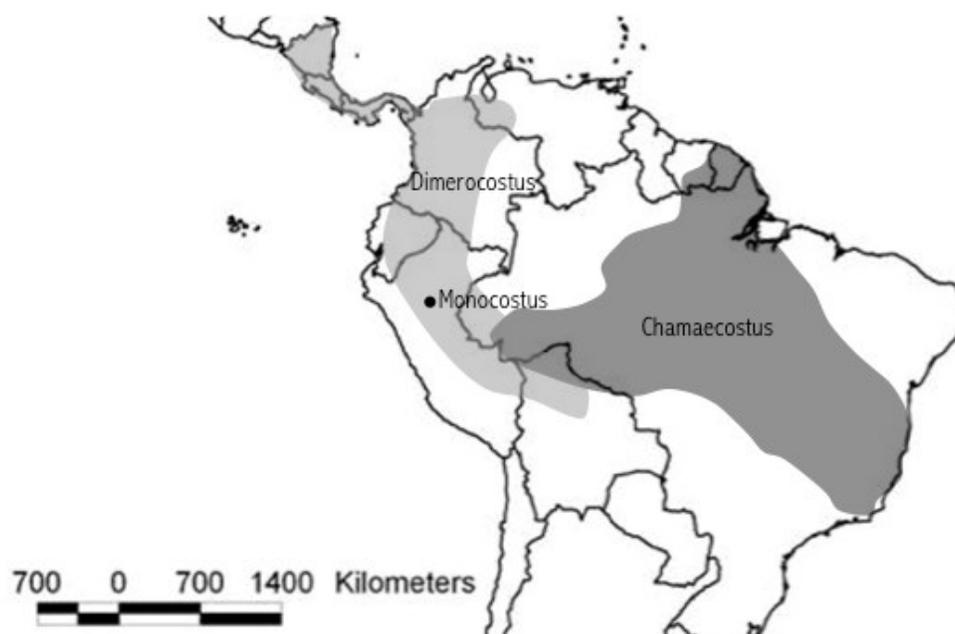
The spiral gingers (Costaceae Nakai) comprise approximately 125 tropical species placed in seven genera; *Costus* L., *Chamaecostus*, *Monocostus*, *Dimerocostus*, *Hellenia* Retz. and *Tapeinochilos* Miq. *Costus* is by far the most species-rich genus in the family, with species occurring natively in tropical Africa as well as Central and South America, although the majority of the diversity in *Costus* species number and morphology occurs in the neotropics (Specht 2006). Their charismatic spiral foliage and bold-colored inflorescences make *Costus* species prominent features of most lowland neotropical forests.

However, *Costus* represents only one lineage of neotropical Costaceae: an ancient lineage of Costaceae also inhabits the New World tropics and is likely to have played a role in neotropical forest ecosystems long before the arrival of *Costus* from Africa (Specht 2006; see Figure 1). Despite their inherent beauty, this South American clade comprising *Monocostus* K. Schum. (1 sp.), *Dimerocostus* Kuntze (3 spp.), and *Chamaecostus* C. Specht and D.W. Stev. (7 spp.) has been largely overlooked perhaps due to their sparse distribution and low level of species diversity compared with neotropical *Costus*.

All neotropical Costaceae, including taxa now placed in *Costus*, *Chamaecostus*, *Monocostus* and *Dimerocostus* were most recently treated as a whole in Prof. Paul J.M.

Maas' Floral Neotropica monographs (1972, 1977). In these monographs, species currently placed in the genus *Chamaecostus* were included as members of *Costus* subspecies *Cadalvena*. Because members of *Cadalvena* group were demonstrated to be more closely related to *Dimerocostus* and *Monocostus* than to individuals in the genus *Costus* (Specht et al. 2001; Specht 2006), these species were removed taxonomically from the distantly related *Costus* and given the name *Chamaecostus* with the etymology indicating their small stature (1-3m) relative to plants remaining in the genus *Costus*.

While these less speciose lineages of the Costaceae are both evolutionarily and ecologically important, there have been few studies on *Chamaecostus*, *Monocostus* and *Dimerocostus* (aka the South American Clade) and minimal focus on the diversity inherent to this clade. However, various features mentioned in Maas' Floral Neotropica

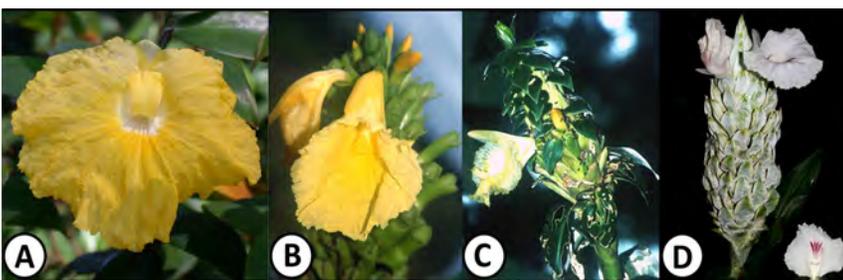


**Figure 1.** Estimated geographic range for the three genera of the South American clade of Costaceae: *Monocostus*, *Dimerocostus* and *Chamaecostus*.

monographs hinted to the close relationship between *Chamaecostus* species and species of *Monocostus* and *Dimerocostus*, including stigma shape (cup-shaped), bracteole shape (tubular and bicarinate; see Maas 1972 Fig. 4), and pollen type with *Monocostus* and *Dimerocostus* sharing a bilocular ovary and *Monocostus* and *Chamaecostus* sharing a similar floral structure of a labellum with a long, narrow tube and distinct limb (also shared by *Dimerocostus*). Maas was prescient in his understanding of the evolution of the group, recognizing close evolutionary ties between *Monocostus* and *Chamaecostus* (his *Costus* subgen. *Cadalvena*; see p. 10, Maas 1972) and considering both early divergent lineages compared to the large clade of *Costus* (his *Costus* subgen. *Costus*).

The monotypic genus *Monocostus* [see *M. uniflorus* (Figure 2)] was described by Schumann (1904). It is restricted in distribution to the Rio Huallaga region of central Peru. Its name is derived from the fact that it is the only Costaceae to have a solitary flower (*mono-*) that forms in the axils of its leaves rather than forming the often highly structured terminal inflorescence found elsewhere in the family. While always considered to be a separate and monotypic genus since its description, affinities to *Dimerocostus* and *Costus* species formerly placed in subgenera *Epicostus* and *Cadalvena* had been proposed (Kuntze 1891; Schumann 1904).

*Dimerocostus*, described by Kuntze (1891), occurs from Honduras to central Bolivia, from sea level to 1900m, showing an apparent association with comparatively higher elevations and younger soils common to inundated or disturbed areas. *Dimerocostus* plants are very large, often exceeding 5 meters in height and acquiring bamboo-like, almost woody, stems. Interestingly, many *Dimerocostus*



**Figure 2.** (A) *Monocostus uniflorus*; (B) *Dimerocostus strobilaceus* subsp. *strobilaceus*; (C) *D. argenteus*; (D) *D. cryptocalyx*. A-C are personal photographs of C.D. Specht; and D was kindly provided by John L. Clark (JLC13241).

plants are able to continue to make vegetative tissue following the formation of the inflorescence, leaving behind a leafless section of shoot once the flowers and fruit fall. *Dimerocostus* taxonomy was most recently revised by Maas (1972) where he synonymized several species resulting in the recognition of only two species in the genus: *Dimerocostus strobilaceus* Kuntz and *Dimerocostus argenteus* (Ruiz&Pavon) Maas. Three subspecies of *D. strobilaceus* were recognized; subsp *appendiculatus*, subsp *gutierrezii* and subsp *strobilaceus*. Since that time, a new species was described, *Dimerocostus cryptocalyx* Salinas & Betancur and a key published to the three species (Salinas and Betancur 2004) (Figure 2).

Species of *Chamaecostus* (Figure 3) are low herbs that hardly pass 1 m of height, and are commonly found in riparian forests and adjacent slopes over or near exposed rocks or in sandy soils in the forest understory. Geographic distribution is varied and includes Seasonally Dry

Forests (for the nearly acaulescent species *C. subsessilis*); high-altitude sites of Central Atlantic Forest (*C. cuspidatus*); periamazonic (*Chamaecostus lanceolatus*); and along the Guyana shield (*C. congestiflorus*, *C. curcuminoides*). Intermittency of aerial shoots added to occurrence in less visited regions, could explain why they have been scarcely collected. In addition, *Chamaecostus* in general seem to show an aggregated distribution, with high local abundance, but naturally rare regional occurrence, which could also account for the lack of occurrence records for *C. fusiformis* and *C. fragilis*, of which we know effectively nothing on general biology and geographic distribution. In fact, reproductive biology and biogeographic studies are currently lacking for species in this group.

Specht et al. (2001) presented the first investigation of the phylogenetic relationships within Costaceae, showing *Dimerocostus*, and *Monocostus* as a well-supported monophyletic group, with *Costus* being broadly paraphyletic. Specht and Stevenson (2006) then formally divided *Costus* in four genera, two of which occur in the neotropical forests (*Costus* and *Chamaecostus*). This phylogeny-based taxonomic treatment placed *Chamaecostus* as sister to *Monocostus* + *Dimerocostus* clade. However, in this broad scale analysis, *Chamaecostus* species diversity was under-sampled, mainly a reflection of the naturally rare condition of species of this group and the consequently slim representation in both living and herbarium botanical collections. Here, we present a comprehensive phylogeny for this group including all species of *Chamaecostus* currently described.



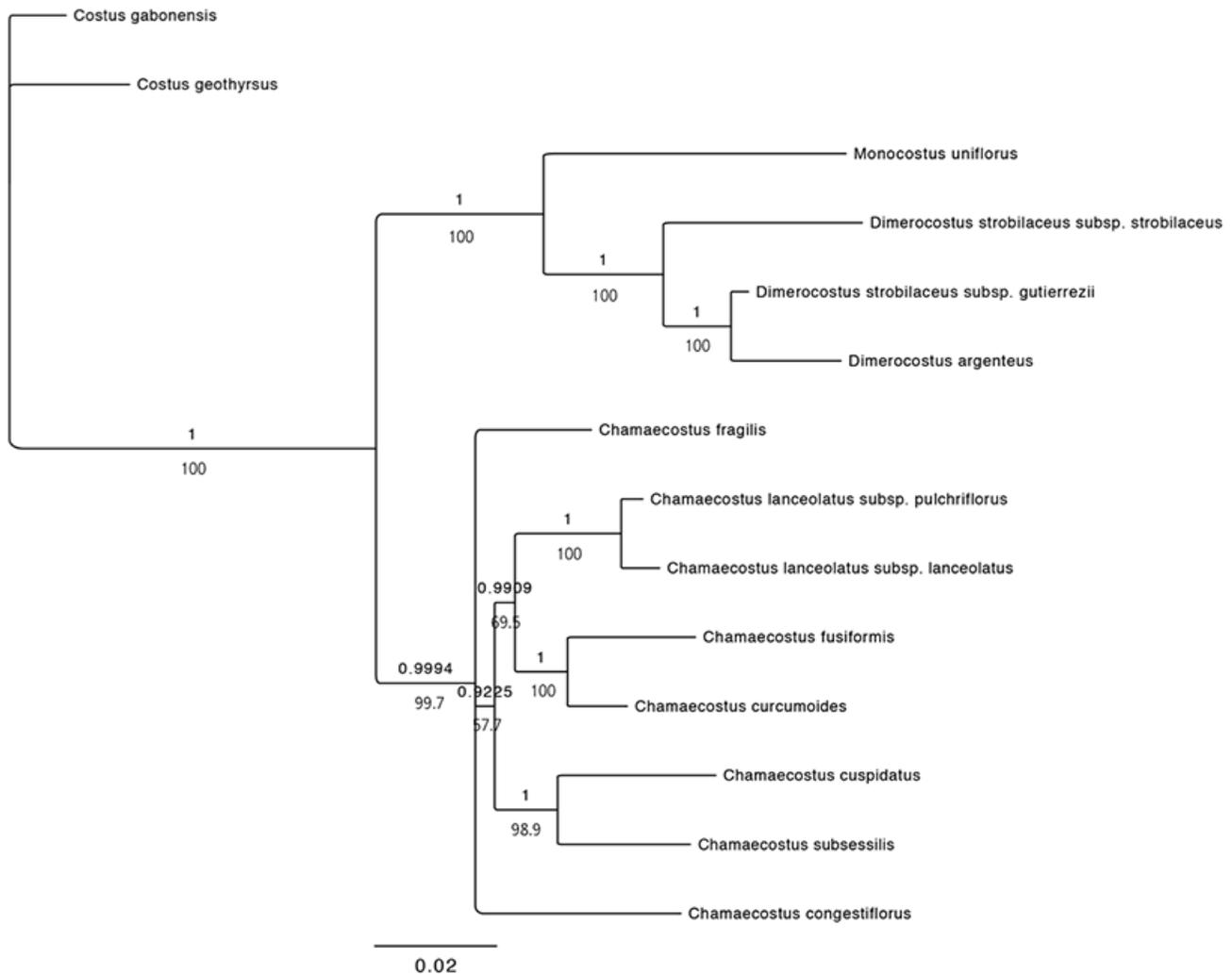
**Figure 3.** (A) *Chamaecostus subsessilis*; (B) *C. lanceolatus* subsp. *lanceolatus*; (C) *C. congestiflorus*; (D) *C. cuspidatus*; (E) *C. fusiformis*. A-D are personal photographs of T. André; E was kindly provided by Fernando Figueiredo.

### Methods

We included nearly all known species from the three genera, and designated two *Costus* species as outgroups. Total genomic DNA was isolated from silica-gel dried leaf tissue using CTAB extraction protocol (Doyle & Doyle 1990). We amplified and sequenced regions of the chloroplast (*trnL-trnLF*, *rps16-trnK*, *petG-trnP*) and nuclear (*RPB2*, *ETS* and *ITS*) genomes using published primers (Taberlet et al. 1991, Shaw et al. 2007, Hwang et al. 2000,

Specht et al. 2001, Kay et al. 2005, White et al. 1990, respectively). PCR fragments were generated using Phire Hot Start II DNA Polymerase (Thermo Scientific) with a 3 min. initial denaturing step at 98 °C, 45 cycles of 5 sec. at 98 °C, 15 sec. at gene-specific annealing temperatures, and 20 sec. at 72 °C, and a final 1 min. 72 °C extension. Cycle sequencing was performed using BigDye v3.1 (Applied Biosystems) following manufacture's protocols. Cycle sequencing products were sequenced on an Applied Biosystems 3730 DNA Analyzer automated DNA sequencer, at the UC Berkeley's Evolutionary Genetics Laboratory.

lognetic relationships in MrBayes (Huelsenbeck & Ronquist 2001), setting GTR model of sequence evolution and estimated proportion of variable sites and gamma distribution parameter, run twice for  $1.1 \times 10^5$  generations, and sampled every 1,000 generations. Convergence was assessed via a low ( $<0.01$ ) average standard deviation in split frequencies and first 10% of the sampled data were discarded as burn-in. Additionally, Maximum Likelihood using PhyML (Guignon & Gascuel 2003) with a total of 1,000 bootstrap replicates were generated to assess statistical support.



**Figure 4.** Phylogenetic relationship within the South American Clade of the Costaceae. Support values above branches are Bayesian Posterior Probabilities, while Most Likely Bootstrap proportions from 1,000 bootstrap replicates are found below branches.

We examined chromatogram files for biases and possible errors using Geneious version 6.1.7 ([www.geneious.com](http://www.geneious.com)). We aligned each marker using MUSCLE algorithm (Edgar 2004) implemented in Geneious, and subsequently checked alignments manually. Alignment regions that could not be unambiguously interpreted were excluded from analysis. Bayesian inference was used to infer phy-

## Results and Discussion

The entire concatenated DNA sequence matrix is 4,409 base pairs long, and the resulting phylogeny (Figure 4) is recovered in both Maximum Likelihood and Bayesian Inference analyses. The phylogeny overall is well supported, as shown by high node confidence provided by Bayesian posterior probabilities and ML bootstrap replicates.

Exceptions are the position of the *Chamaecostus subsessilis* + *C. cuspidatus* clade, and of *C. fragilis* and *C. congestiflorus*. Nevertheless, it seems likely that the Amazon basin is likely the ancestral distribution for the genus.

The close relationship between *Chamaecostus curcuides* and *C. fusiformis* is noteworthy due to their shared complex inflorescence, ovate-triangular yellow bracts, and because of their allopatric distributions, the later being found mostly in Eastern Amazonia South of the Amazon River, and the former a local endemic to French Guyana. Such adjacent but allopatric distribution is also found between sister taxa *C. subsessilis* and *C. cuspidatus*, which also share several morphological similarities (i.e. full-grown sheath, appendaged bracts, and yellow-orange obovate labellum) indicating their close phylogenetic relationship. This type of distribution pattern, where sister species occur in adjacent areas but with limited overlap, points to vicariance as main driver of speciation for *Chamaecostus* (Hovenkamp 1997).

In this analysis, we also recovered a well supported paraphyly of *Dimerocostus strobilaceus* subspecies. Indeed, *D. strobilaceus* subsp. *gutierrezii* (Kunze) Maas was previously treated as *D. gutierrezii* Kunze (Maas 1972), and this brings to the attention the need for an up-to-date revision of *Dimerocostus* including the newly described *D. cryptocalyx* and all subspecies of *D. strobilaceus*. We suggest that such a revision should consider broad population-level sampling that can account for intraspecific variability of both morphological and molecular characters.

Our analysis provides fundamental information about the phylogenetic relationships between these amazing Neotropical plants, which perhaps due to their mostly diminutive stature and rarity have been rather overlooked. This study also inspires novel hypotheses on the early evolutionary scenarios of Costaceae diversification; speciation events that likely occurred before the first *Costus* arrived in the new world. Our research group is thrilled to continue our work advancing the systematics, biogeography, evolution and natural history of these Neotropical endemics. Our immediate goals include: reconstruct ancestral geographic distributions and model biogeographic events that shaped current distribution patterns; analyze differences in climatic niche dimensions and test niche conservation over evolutionary time; review species circumscriptions using a multi-dataset approach, especially within the *Dimerocostus* genus; and correlate species' phenotypic variability and geographic range attributes. TA's graduate research additionally aims to estimate the timing and geographical pattern of divergence among populations and the demographic evolution of *Chamaecostus subsessilis* in South America Seasonally Dry Forests, using massive data from targeted high-throughput DNA sequencing carried out in the Specht Lab and the Evolutionary Genetics Lab (MVZ) at UC Berkeley.

## Harvesting and Handling of Heliconia; At What Stage to Harvest

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Many, if not all temperate flowers in the market today are cut, handled, and transported in a specific way according to standards set by the industry. For example, roses are cut at the production site when the two outermost petals begin to unfurl. In other words, before the flowers open and reach maturity. They are placed in water following harvest, pulsed using one or more preservatives and anti-ethylene producing chemicals, put in a cool (refrigerated) holding area at a predetermined temperature, packaged, and shipped. Upon arrival at the wholesale house, stems are recut and placed in clean water reinforced with a suitable preservative and so on, until they reach the customer. This procedure ensures longer lasting flowers at the consumer level, which in turn results in the satisfaction of the end user.



*H. wagneriana* at 7-10 open bract stage. After having been cleaned and washed, bracts are still in excellent condition. Post-harvest life is as good as at the 3-5 open bract stage, lasting even longer than their younger counterparts.

Can the above method be implemented with the many beautiful long lasting tropical flowers, such as heliconia? Or, is it even practical to do so?

Our experience has shown that keeping quality of the larger heliconias, like *H. caribaea*, *H. bihai*, *H. chartacea*, *H. orthotricha*, etc., lasts just as well, and sometimes even longer when they are harvested beyond the minimum 3-5

open bract stage. When large heliconia varieties such as *H. caribaea* 'Richmond Red', for example, are harvested after five, and even after 15-20 open bracts, their keeping quality is as good as, or even better than when harvested at the 3-5 open bract stage.

Many florists have become so used to the 3-5 open bract stage that they consider those with more open bracts to be overly mature, and don't want to consider them for their designs.

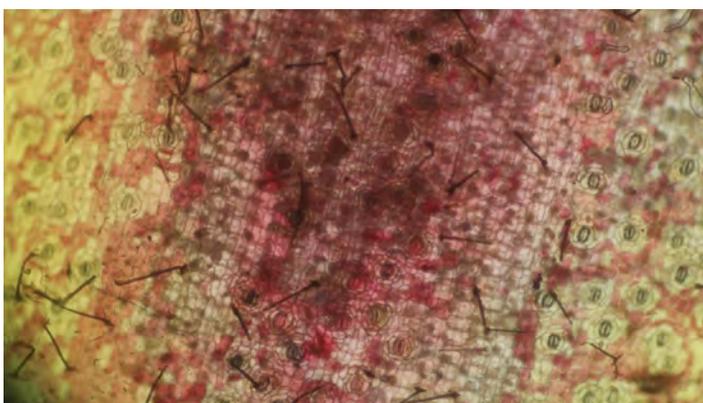
It is the uniqueness of heliconia that they can be used at different stages of maturity according to the occasion it is to be used for. A display in a hotel lobby, for example, requires the larger variety of heliconia with as many open



**Fig. 1.** Stomates on stem enlarged 100x. Number of stomates on stems:  $0.31/\text{mm}^2$

bracts to show its uniqueness. No other flower in this world is as showy and impressive as the tropical heliconia, which is a big selling point.

Heliconia and many other tropical flowers have different patterns of behavior after harvest. From years of personal observation, we have noted that once a heliconia flower stem is cut and removed from the plant, all growth stops and it does not absorb any more water with or without floral preservatives, regardless of the age and stage when it was harvested. Therefore, the number of open bracts



**Fig 2.** Stomates on bract enlarged 100x. Number of stomates on bracts:  $2.74/\text{mm}^2$ .

should not be used as a measure to indicate maturity, especially on larger upright and pendent varieties of heliconia which produce a lot of bracts. A heliconia is considered totally mature when it does not produce any more bracts.

Post-harvest handling procedures of heliconia cannot be equated with standard procedures of temperate flowers. Heliconia flower stems are usually devoid of any leaves, as they are removed at harvest time, and they are easy to ship because they do not need to be kept in water.



**Fig 3.** Stomates on leaf enlarged 100x. Number of stomates on leaves:  $4.69/\text{mm}^2$ .

One of the limitations of heliconia's postharvest life is browning of the bract edges, which is attributable to water loss that causes desiccation of tissues in that location. As Fig. 1 shows, most of the red *H. caribaea* observed in trials at P.T Mandiri Jaya Flora (MJ Flora) have only few stomates on the stem, so that for practical purposes, they can be ignored. On the other hand, leaves possess more stomates in comparison to stems and bracts (Fig. 2), but since all of the foliage is removed at harvest time, the presence of stomates on leaves is immaterial for our study.

Stomates on the bract surface are quite numerous (Fig. 2), more so than on stems but less than those found on leaves (Fig. 3). Most plants possess an average of about 100 stomates per  $\text{mm}^2$  (2) and even more on some plants, sometimes as many as ten times with a maximum recorded of 2230 per  $\text{mm}^2$  (1).

It is therefore understandable why the edges of bracts desiccate and turn brown sooner than the heliconia stem. Most moisture from available water in the stem passes through the transpiration stream, stomates, and then through vein endings (hydathodes) at bract edges (2). It seems logical to assume then, that prevention of rapid water loss can be controlled by providing very high humidity around stems and bracts or packaging bracts with plastic sleeves. Boxes should also be lined with plastic to keep high humidity around stems and bracts, and perhaps the application of anti-transpirant chemicals will further help prevent premature loss of post-harvest life.

Nowadays temperate flowers are beginning to be transported by ship rather than by air to reduce freight costs,

for use. If bananas can be transported by ocean freight from Costa Rica, reach Japan 22 days later and arrive as fresh as if newly harvested, the same may be possible in the case of heliconia, by employing post-harvest handling techniques we have today.

The prospect of being able to transport heliconia from tropical areas to long distance markets is very exciting. However, more homework and research need to be done on post-harvest handling aspects. What is so nice about this is that only tropical countries can grow heliconia, because there is no way for temperate areas to produce them due to the sheer economic cost involved for energy and labor required for its production.



*Heliconia orthotrica* 'She' with a fully open (eight bract) inflorescence

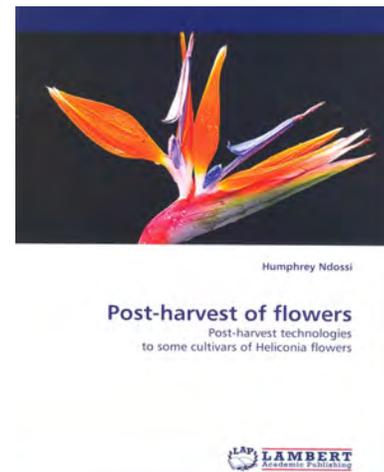
Tropical countries need to get together and collect the necessary funds to do research, such as in modified atmosphere storage, humidity and temperature control, application of an anti-transpirant as well as packaging techniques, and prevention of bruising during transit, which causes brown streaks on bracts. The prospect is very exciting indeed.

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## Book review

Ndossi, H, 2011. Post-harvest of flowers. Post-harvest technologies to some cultivars of Heliconia flowers. Lambert Academic Publishing, GmbH & Co. KG. 97 pages. ISBN 978-3-8443-0960-7



This little booklet is the M.S. thesis of Humphrey Ndossi, who received his degree from the University of Leuven in Belgium. There is no abstract. The content includes a literature review on post-harvest of cutflowers in general (25 pages), an overview of heliconia culture, problems, and a thin review of marketing and sources of production. In four pages, the materials and methods for the research are described. Essentially 18 varieties imported from Colombia were placed in water and held at 13C, and their useful life was recorded by degradation of bract color over 3 weeks. Data are reported in graphic form, with short discussions about the varieties that had the longest keeping life. Illustrations in the booklet are in black and white, which is not very helpful in showing the effects of time on keeping life. An interesting set of treatments using gibberellic acid, sucrose, and sodium hypochlorite is proposed for improving post-harvest life, but no results or details are given.

Ordered from the Amazon website, this book was priced at \$US 62. The color cover shows a *Strelitzia* flower, presumably selected from a commercial photo gallery. No editing of English was evident. Black and white photos do not do justice to the photos that show spotting, bruising, and other signs of deterioration of the bracts. The review of cultural practices misses a number of literature citations that would have been useful to include, but for a beginner in heliconia culture, it may be worthwhile. In this reviewer's opinion: Save your money.

Reviewed by Richard Criley, University of Hawaii



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*Heliconia rostrata* 'Green Tip'

*Heliconia spissa* 'Belize'

*Heliconia lankesteri* red flowered

*Heliconia lankesteri* yellow flowered

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