Passiflora
ONLINE JOURNAL

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sub sole sub umbra virens

THIS MONTH'S ISSUE Laurifoliae of the Amazon. Passion flower stained glass skylight. *Passiflora incarnata* propagation. Botanical drawings. Hybridisation. PSI 2015 meeting and more.

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Front Cover: 3D Stained glass skylight © Gary Uhouse

Inside Cover: *Passiflora* 'Violetta' by Leopold Ševčík 1993 © Myles Irvine

Back Cover: *Curtis · Bot. Mag. 2: t. 66. 1788. "Passiflora alata-winged passion flower–West India"*

We invite submissions from all *Passiflora* enthusiasts, from cartoons, garden tales, recipes and growing tips to articles about new species and hybrids and reports of wild collecting trips. Please contact the editor as above. Articles in any language are welcome but will be translated and published in English only for reasons of space.

We reserve the right to edit or refuse articles and ask contributors to note that we may be able to offer scientific peer review depending on the topic. Please note that contributors are not paid. Letters to the editor for publication are also welcome.

Note that new species should first be submitted to the appropriate scientific botanical journals so that the validity of the name is established, after which time we may carry an article about them. If you wish to formally register a hybrid, which is optional, you should apply to the Passiflora Cultivar Registrar who, if your application is accepted, will publish your hybrid in the Passiflora Society International Journal & Newsletter.

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Contents Issue 7

Propagation of *Passiflora incarnata* by either seed germination or root cuttings

By Patrick Worley
Photography by Padric Stephenson

Propagation of *Passiflora incarnata* from seed:

For many growers *Passiflora incarnata* seeds have proven difficult to germinate. I offer an easy, step by step method that I have used over the years to germinate both these and other difficult to sprout seed. Many have had success with chilling the seed. I have had sparse germination rates with that method.

Passiflora seed, whether fresh or dried, often have a clear thin tissue on the surface that must be removed to enhance germination. Rub the fresh or dried seed on a strong cloth surface using the index finger. I just wear jeans and rub the seed on my upper thigh to remove the seed covering. Any firm cloth or towelling should work to remove the seed coat.

Make a strong infusion of black tea. Use only black tea. I have found that the tannic acid in the black tea simulates the rotting and the leaf mold chemicals found in the natural environment. Use four to five tea bags in 12 ounces of boiling water. Let the tea steep until the water is room temperature. Squeeze out the tea bags and discard them. It only takes enough tea to cover the seeds in a small cup or container.

Put the seeds in small plastic cups and pour in the tea, covering the seeds. If the seeds are white or not fully mature they will often float after a soaking and should probably be discarded. I use plastic labels and soft pencils to label the seed type, the date, and where the seeds were collected or purchased. After a 24 hour soak, carefully strain the tea from the seeds. Place the seeds on a paper towel to dry a bit.

Use small shallow pots and a sterile potting mix. I use my own mix*. Any good seed medium should work well. Make sure that there are drainage holes in the pots. Wet the medium thoroughly and allow it to sit for a short time to make sure that the mix is evenly moistened.

Plant the seeds in even rows close together. I often plant all the seed that I have if the age is not known to me. Using a pencil as a dibble I make evenly spaced holes and plant the seeds about 0.5 cm apart and cover. Water gently to settle the seed and then allow the excess water to drain. Place the flat or flats depending upon size, in a clear plastic zip bag and seal after blowing in a bit of air to slightly inflate the bag.

Put the bags in the sunniest part of the greenhouse in full light. I use my window sill in the south window to get them as warm as possible. I then put them outdoors in full sun anchoring them to insure the wind would not disturb them. I check after 4 or five days. When the seeds are just starting to germinate I move them to a brightly lit area to continue the sprouting process.

The first few times I tried this method I was surprised that the seeds sprouted like grass. I had planted very thickly thinking that maybe a few would geminate. That had been my experience. I now plant carefully anticipating that any good seed will germinate.

When the first true leaves appear I gradually open the bag over a few days to harden the seedling then remove them from the bag and treat them as I would any other seedlings. I replant my seedlings when tiny into small pots. I suggest you space and transplant as in whatever configuration is comfortable for you.

*I use 2 parts peat moss, 1 part perlite and 1 part vermiculite. I wet the mix thoroughly and allow it to drain before using it.

Propagation of *Passiflora incarnata* from root cuttings:

I have had the best success propagating *Passiflora incarnata* from root cuttings. I am frustrated when using top, stem or tip cuttings because they seem to rot or not root or the roots are weak. When they do root the percentage for me is very low. In a sandy area in Florida many years ago, there were acres of wild *Passiflora incarnata*. There were flowers but no fruit. The plants were all one clone from a single main plant. Root runners were abundant and rife with nematodes so I did not collect them. The vigor and prolific nature of the plant can make it invasive. That is not a concern for me.

The running root:

Once the plant is at least a year old whether growing in the wild, in a pot or planted in a garden it produces root runners. They are white and 0.25 - 0.5 cm in thickness. If they are thicker, so much the better. When grown in a pot, I simply un-pot and find as many runners of proper size as I can. Cut them to the length of about 5 -10 cm. I have used shorter if the root is very thick. Often runners will be found trying to exit holes in the bottom or sides of a pot. If there are leaves at the tip, preserve them with 4 inches of white stem and pot them up as a plant.

In the garden, check for runners up to 3 m from the main plant. This can be difficult if the soil is hard or compacted. I find the sprouts then wet the ground between the sprout and the main plant. Once the ground is soft enough, dig from the sprout to the main plant carefully following the root runner. Sometimes one can find other branches and carefully expose and pull them out as well.

Can you dig it?

In the wild, digging is sometime difficult or problematical. Dig up to 60 cm away from a main plant if there are no runners visible. When I encounter runners, and if I have cut them, I work out from the plant for as many roots of proper size as I can find. If one finds sprouts at a distance, work inward watering to soften the soil if water is available. This can be daunting but worth the effort.

Keep the roots moist and collect what you need. I often cut them to size as I am pulling them. I put the roots in a small pot. I use a 10 cm one. I curve the root into a U shape and cover with about 4 cm of potting soil and water in well.

Place the pot (s) in a warm and sunny spot. If prepared in spring or early summer, one should get plants in a month or less. However, keep in mind that times do vary. and while some sprout quickly others seem to take a very long time. Cuttings taken late may work. I have only tried earlier times.

Once the roots have sprouted leaves, treat them as you would a seedling. Water and fertilize during the growing season. If kept in pots until the next season, protect them and keep them cold and dormant.

And finally:

There are some really interesting and beautiful forms that would be great to share in cultivation. I look for color variation and for fruit of large size and good quality. So far, I have only seen green colored fruit, but I have heard there are some forms with yellow fruit. Self-fertile plants would be a great find. I know of no self-pollinating types of *Passiflora incarnata*. Of course, large flowers, unusual colors and patterns are possible. Another consideration is finding the forms that are the farthest north and very cold hardy. Let us find them and share them.

Patrick Worley, from Minnesota, USA, is a well known grower and hybridiser of both Begonias and Passiflora. P. phoenicea 'Ruby Glow' *and P.* 'Sunburst' *are two of his best known Passiflora hybrids. His interest started with a Passiflora caerulea bought by his grandmother when he was nine. He has written and published a cookbook for Passion fruit and continues to enjoy the beauty of these wonderful vines.*

Some Passiflora from series Laurifoliae found growing along the Amazon

By Andrew Adair

Realm of the rainbow rivers

Near Belem, Brazil, the Amazon River flows into the Atlantic Ocean. At this point it is about 80 kilometers wide and is draining water from Venezuela, Colombia, Ecuador, Peru and Bolivia. It has the name Rio Amazonas from the mouth to Iquitos, Peru, but also Rio Solimoes from Manaus to Tabatinga/Leticia and Rio Maranon from the Brazilian border to past Iquitos.

In this article, we begin at Rio Huallaga, in the Andean foothills, that passes near the Peruvian town of Tarapoto and then flows into Rio Maranon.

graphy—and sometimes by ow black, darkened g. From the south they up the sky's dean highlands, nel as it ndar of

Orinoco

VENEZUELA

Unique natural link between two major river systems, the Casiquiare Canal permits rivercraft to navigate from the Amazon to the Orinoco.

Roraima 9,094+

GEORGETOWN

GUYANA

SURINAM (NETHERLANDS)

FRENCH GUIANA

Atlantic Ocean

BOUNDARY IN DISPUTE

BOUNDARY IN DISPUTE

Uraricoera

Boa Vista

Maroa

Orinoco

Guainía

San Carlos

Cucuí

Unlike most blue-water streams, the Rio Branco flows milky white with sand washed from northernmost Brazil's treeless plains.

Branco

Vaupés

DEVILS CATARACT

EQUATOR

Negro

COLOMBIA

ANDES

QUITO★

ECUADOR

Curaray

Napo

Putumayo

Sangay +17,159

AMAZON

Iquitos

San Pablo de Loreto

Leticia

AMAZON

Juruá

Tefé

Coari

Manaus

Trombetas

Jari

Caviana I.

EQUATOR

FURO DO GUAJURU

Marajó Island

Pará

Belém

Óbidos

AMAZON

Santarém

Altamira

Tocantins

BR 010

Tapajós

Xingu

Santiago

PONGO DE MANSERICHE

Marañón

Chiriaco

Ucayali

Juruá

An international waterway, the Amazon was opened to world traffic by Brazil's Emperor Dom Pedro II in 1866. Vessels of any nation may, without restriction, ascend to the countries of the Amazon's headwaters.

BR 319

Madeira

HIGHWAY

BR 406

TRANS-AMAZON

Purus

(UNDER CONSTRUCTION)

PERU

Huallaga

Marañón

Aguaytía

Pucallpa

MARAÑON GORGE

BR 236

Pôrto Velho

Theodore Roosevelt River

BRAZIL

BR 364

Guajará-Mirim

TRANS-ANDEAN HIGHWAY

Madre de Dios

Beni

Mamoré

Guaporé

Itenez

Araguaia

Juruena

BR 080

Cachimbo

XINGU NATIONAL PARK

Banana Island

BR 153

Callao★ LIMA

Pacific Ocean

Apurímac

Urubamba

APURIMAC GORGE

Cuzco

Trinidad

MATO GROSSO PLATEAU

Mortes

Sao Marcos

Farthest source of the Amazon, an ice-fed pond in Peru's Andes gives birth to a trickle that 4,000 miles later becomes a flow sixty times greater than the Nile. The author accompanied an Inter American Geodetic Survey expedition to help pinpoint the source, named Laguna

Cailloma

+19,682

Illampu +20,873

Lake Titicaca

LA PAZ★

+Illimani 21,201

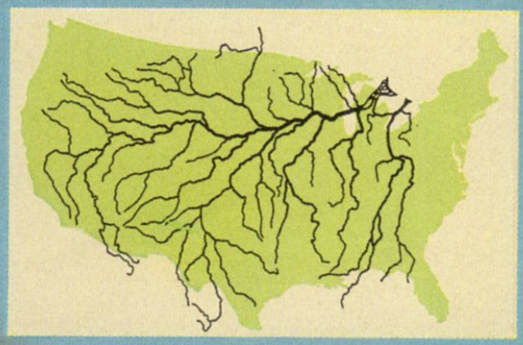
BOLIVIA

Arequipa

As a hotbed of competing life forms, the Amazon region yields to no other. English naturalist Henry Walter Bates a century ago discovered an amazing 14,712 species in the area, of which 8,000 were new to science. Today the known total exceeds 100,000. Plant species by the thousands intermingle so exuberantly that no solid stands of marketable timber exist in two million square miles of

BRASÍLIA★

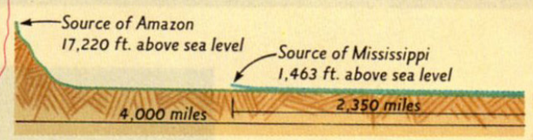
BR 060



Veins of the River Sea lace a basin three-fourths the size of the contiguous United States. A huge freshwater lake may have covered the area millions of years ago.

VERTICAL SCALE EXAGGERATED 25 TIMES

The Amazon at Óbidos—1 1/2 miles wide and 200 feet deep—handles ten times the Mississippi's volume at Vicksburg, where that river is a third of a mile wide and 70 feet deep.



Rampaging down Andean mountainsides, Amazon waters drop an average of 27.3 feet every mile in the first 600 miles, then only three inches a mile on the remaining journey to the sea.

Elevations in feet

0 300

STATUTE MILES


CIDADE CARAUARI
CIDADE DE CARAUARI


RAINHA DA PAZ


Sol Tapajós

P. sp. 'Tarapoto' unripe fruit.

Yellow colored passion fruit, with large white dots, were being sold by vendors at the markets of Lamas (800 m), the nearby town of Tarapoto (360 m) and at Yurimaguas (150 m). The fruits were smaller at Yurimaguas and no seed was saved. Seeds from the other towns were sent and grown on in Cairns, Australia, and Buenos Aires, Argentina. From there one seed was forwarded to Merida, Venezuela. This species grows well under varying conditions, as demonstrated by flowering in deep shade, or in full sun in Australia, and it has flowered as far south as Buenos Aires and at the altitude of Merida. The plants of this Tarapoto species being grown in Australia show variations in the flowers' first coronal row filaments. Some plants have a first row with filaments 5-15 mm long and of varying widths and lengths, even on the same flower, as shown below. With some other plants the first row filaments are unnoticeable, being very short and narrow. If flowers with the reduced first row were dried and pressed they could appear to represent *Passiflora riparia*.

The Tarapoto species also shares similarities with P*assiflora pergrandis*, these being the sepal awn position and bract shape and coloring.

P. sp. 'Tarapoto' with variable first coronal row filaments.

P. sp. ‘Tarapoto’ with unnoticable 1st coronal row filaments.

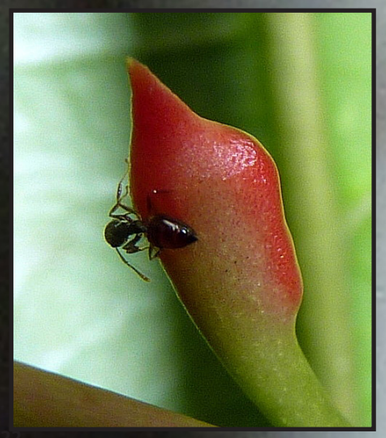
Down river, near Iquitos, *Passiflora phellos* grows beside the river. During the wet season when the river level rises, young plants are covered by several meters of water. Only vines growing amongst tall trees and mature enough would have parts above water.

The quality and frequency of the riverboats leaving Iquitos makes the option of the jetboats more appealing. These boats have 2 large outboard motors, leave in the early morning and even though they stop anywhere the passengers wish to disembark they can still arrive at the Brazilian border by mid-afternoon. Tabatinga is the Brazilian border town where another Passiflora, with petiole glands near the middle, grows. Its excellent yellow fruit, with large white dots is similar but not exactly the same as *Passiflora pergrandis* or the Tarapoto species. The stipules and leaf colors and shapes are different also.

Passiflora phellos

P. sp. “Tabatinga” fruit.

River travel on the Amazon, in Brazil, is easy and enjoyable. The Jet boats may be fast but the tight seating leaves little room to even wiggle a little. Short distances are even uncomfortable. There are several large boats each week heading out of Tabatinga for Manaus. The towns along the way are not large because their small road systems are not linked to the outside world. About half way to Manaus is the town of Fonte Boa. Farm plots dot the sides of the road that leads away from the river and towards the forest.



After a 2 hour walk, uncleared forest was reached and found growing within was a special *Passiflora*. It appears to be from series Laurifoliae and the term "supersize" comes to mind. A leaf from new season growth was 330 x 180mm and the usual leaf size was 250 x 145mm but the size of the stipules was most special. The height of 14mm was impressive but the breadth of 3mm and width of nearly 2mm was jaw dropping. A *Passiflora* stipule usually needs the help of a magnifying glass to appear in 3D.

P. sp. "Fonte Boa"

Passiflora nitida is relatively common along the edges of roads, in towns between Iquitos and Manaus. The flowers at Fonte Boa had 7- 8 cm coronal filaments, about half the length being zig-zaggy. The petals tips were cupped and at 5.6 cm were 2 mm longer than the sepals. The cupped petals help contain the folded filaments in the unopened flower.

Being on the riverboats is a good and restful travelling experience. No hotels or restaurants to find, no buses or planes to catch, just swinging in your hammock or sitting in a chair, by the rail, and watching the forest glide past.

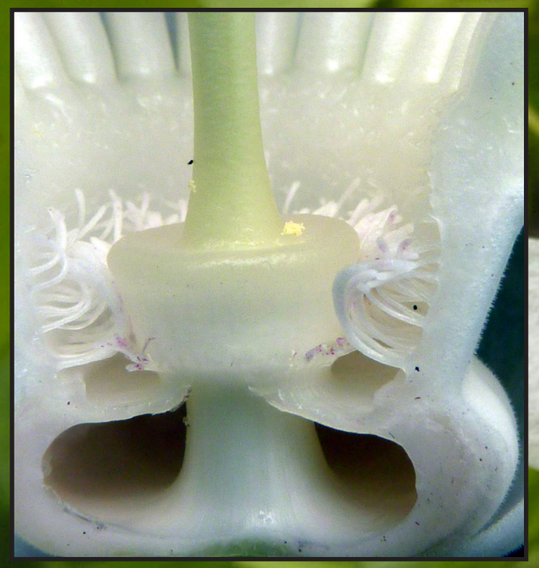
Passiflora nitida

Arriving at Manaus is a bit of a surprise. After continuous tall trees with the occasional clearing and wooden dwelling, suddenly there is a busy port with high-rise residential buildings.

Passiflora acuminata, can be found at Manaus, further down river at Obidos and north of Manaus at Presidente Figueiredo. Also at the town of Presidente Figueiredo were 2 more candidates for series Laurifoliae. Petiole glands were at the middle for one and below the middle for the other, both without flowers. Leaves of series Distephana and series Laurifoliae are sometimes similar. Neither was the recently described *Passiflora fissurosa* nor the odd fitting *Passiflora kikiana*. Boats going down river from Manaus are more plentiful and more crowded. There is more action and seemingly louder music around the bars, which are located on the top decks of most river boats.

Passiflora acuminata

A day past Obidos and on the same side of the river is the small town of Almeirim. A large white flowered *Passiflora* was found growing at the base of a forested hill. The back side of the hill was a sand quarry and this revealed the hill to be a tall sand dune, that supported quality forest made up of large trees. There was only one outer coronal row with this *Passiflora*. The lengths of the inner rows, shown below, reached 6mm and folded back from the trochlea in order to fit within the small space. A strong proboscis is required to penetrate this "bowl of spaghetti". It has been suggested that this *Passiflora* may be, or closely related to, *Passiflora crenata*.



P. aff. crenata

At the mouth of the Amazon *Passiflora laurifolia* fruits can be found for sale in the markets. Fruits from different markets produced flowers that are slightly different but the sizes of the flowers are much larger than the typically distributed Caribbean form.

Waiting for boats, and the speed at which they travel, makes travelling along the Amazon a slow process and so this journey has been a compilation of several visits to the region. More work on describing species from the region is starting to happen. In the past, if a species had its petiole glands located at, or below, the middle of the petiole then it was assumed to be *Passiflora riparia*. By stopping at just a few ports along the river, half a dozen species have been found to have petioles with glands at this position. Let's hope not, but it may be a while until a convincing specimen is found that will satisfy all, that a recent specimen of *Passiflora riparia* has been found.

Andrew Adair, from tropical North Queensland, Australia, has been growing tropical fruit from the wet tropics of Asia and the Americas for over 35 years. This interest extended to, mainly edible, lowland Passiflora and a desire to observe series Laurifoliae in the Americas and also grow them in a single outdoor location, in order to better understand their differences.

Passiflora laurifolia

Botanical drawings By Mattias Lanas

As with many of you, my infatuation with the *Passiflora* genus began when I first laid eyes on a *P. caerulea* growing in a neighbor's backyard. I was fascinated by these plants' utterly alien and truly mesmerizing blooms, the (oftentimes) intense tropical aromas and flavors of the fruits, and the incredible adaptations and morphology of the leaves and stems. Every aspect of the plant is so delicate and wonderful—even the seeds, upon close examination, are like potholed, teardrop jewels.

Growing up in Santiago, Chile, my family fostered in me a love for the outdoors, and I naturally gravitated toward environmental sciences. After graduating from a program in Earth Systems from Stanford University, however, I ventured into a career in education. I got to work with high schoolers for two years teaching a semester-long course entitled "Art and the Natural World," which merged science, natural history and the arts.

Like a passionflower vine, I found that art was creeping its way to the forefront of my interests. In 2014, I switched gears and applied to the Science Illustration Certificate Program at California State University, Monterey Bay. I completed this program in June and am now, officially, a full-fledged science illustrator. It was during my illustrator training that I began to focus on botanical illustration of passionflowers. Whenever we were given open-ended assignments in a new medium, or were exploring a new technique, my default subject was *Passiflora*.

My first large-format gouache painting was a trompe l'oeil titled "Passion Flower Study," which depicts the materials a field botanist might use in making notes of this genus, prominently featuring *P.* 'Coral Sea'. I found that watercolor worked wonders on the semi-translucent quality of passionflower petals, and combined it with graphite to make my first botanical plate, featuring *P.* 'Purple Haze'. Additionally, the intricate corona filaments, tendrils, and leaf venation textures lend themselves to being rendered in pen and ink or traditional ink on scratchboard (as shown in the scratchboard piece featuring *P. apetala*.) I see the botanical exploration of these plants through art as a lifelong pursuit.

I was honored to be able to attend the 2015 Passiflora Society International meeting in San Francisco, where I met a diverse array of friendly, botanically-inclined folks. I look forward to becoming much more involved in the *Passiflora* community from here on out, and to delving further into cultivating, drawing and painting more species and hybrids. Rendering these plants forces me to explore their every nuance, and inadvertently become more acquainted with them. I would encourage anyone interested to sit down and take a stab at drawing your plants at home, or at your local botanical garden. Even if you don't create a masterpiece on that first attempt, the experience will be valuable as an exercise in observation, and you might even find new reasons to appreciate these plants. I am always eager to give drawing advice, and can be contacted through my website with any queries: mattiaslanas.com

'Passion Flower Study'

Passiflora 'Purple Haze'

P.assiflora apetala

Passiflora 'Snow Queen' A new hardy RIVERSIDE® hybrid by Myles Irvine
Widely available in Europe UK & USA from mid 2016
Protection Status: Plant Breeders Rights pending
US Plant Patent Rights asserted

Passion fruit bavarois with pineapple, mango & coconut

By Cameron Rutherford

Recipe:

Passion fruit bavarois:

- 5 egg yolks
- 300g sugar
- 500ml passion fruit juice strained and seeds removed
- 4 leaves of gelatine soaked in ice water to soften
- 600ml double cream whisked to soft peaks

Method:

Whisk the egg yolks until pale adding the sugar a small amount at a time until fully incorporated.

Warm the passion fruit juice and pour over the egg yolks and sugar. Pour the egg yolk/passion juice mixture back into a pan and warm gently on the stove allowing the liquid to thicken like custard but do not boil as this will curdle the eggs. Once the mix is thick enough to nicely coat the back of a spoon stir in the pre-soaked gelatine and mix thoroughly. Pour the mixture into a bowl and place into the fridge.

Allow the mixture to semi-set (around 30 minutes.) Whisk the mix to break down its structure a little then fold in the whisked cream a little a time. Pour the mixture into serving rings or even tall glasses or bowls. Allow to set overnight.

Passion fruit jelly:

- 250ml passionfruit juice strained
- Sugar to taste
- 2 leaves gelatine soaked in ice water to soften.

Method:

Warm the juice gently on the stove and dissolve enough sugar to mellow the acidity but not too much to kill the natural flavour. Dissolve the gelatine and let the jelly come to room temperature. Once cooled pour 1 tablespoon of jelly on top of the bavarois, which should be fully set in the fridge, and allow to firm up before serving. (1 hour

Coconut meringue:

- 4 egg whites
- 115g caster sugar
- 115g icing sugar
- 2 tablespoons desiccated coconut

Method:

Whisk the egg whites until frothy then slowly pour the caster sugar in. Once the whites puff up stop whisking and

beat in the icing sugar with a spatula. This should make the meringue silky and smooth. Fold in one tablespoon of coconut then pipe little mounds of meringue onto a baking sheet, sprinkle with the remaining coconut and bake in the oven at 100° C (212° F) for 45 minutes.

Mango sorbet:

- 5 Alphonso mangoes (if in season. If not any mango will work)
- 200g caster sugar
- 200g water
- 1 lime juiced

Method:

Boil the sugar and water together to make a syrup. Peel the mangoes and place the flesh into a blender with the syrup. Blend until smooth then push through sieve to remove any lumps. Add the lime juice then churn in a ice cream machine as per the manufacturer's instructions.

Ready to serve:

To finish of the dessert slice 2 pieces of pineapple and lightly grill. Place the bavarois on a plate and gently warm the sides of the ring to release the bavarois then remove the ring. Add the pineapple to plate to give a nice warm/cold contrast. Scoop the sorbet and lastly decorate with the coconut meringues. Enjoy!

Cameron Rutheford is a private Chef.

The hidden path of hybridization in *Passiflora*: microscopic steps to create a novel variety

Verónica Bugallo[1], María Julia Pannunzio[2]; Susana Cardone[1], Gabriela Facciuto[2].

1: Department of Agronomy, University of Buenos Aires, Argentina.
2: Institute of Floriculture, National Institute of Agronomic Technology (INTA), Argentina.

Interspecific hybridization is one of the most important sources of genetic variation in breeding ornamental plants (van Tuyl & De Jeu, 1997). This method allows the breeder to obtain a novel variety combining features of two plants acting as parents. Due to its simplicity and spectacular results, interspecific hybridization has been widely used in *Passiflora* genus breeding (Giovannini et al., 2012; Bugallo et al., 2011; Segalen, 2011; Ramírez, 2006; Ulmer & MacDougal, 2004; Payán & Martín, 1975). Although artificial pollination is quite simple, there are some microscopic processes that affect the outcome of which breeders are often unaware.

The aim of this article is to reveal the steps, hidden to the naked eye, that occur when one species of *Passiflora* crosses with another. Interspecific hybridization is the process whereby two species are crossed to form a hybrid. The crossing is performed by sexual media, therefore it is necessary that one plant behave as the male parent and the other as the female.

In all Angiosperms, including *Passiflora,* the flowers are the reproductive organs. The flowers in *Passiflora* are almost always hermaphroditic*; meaning that they can act as either mother or father because they have both male and female sex organs. The female sex organs are the stigma with the style and the ovary containing the ovules (**Fig.1**). The male sex organs are composed of the anther, containing pollen grains, and the filament that holds it to the flower (**Fig. 1**).

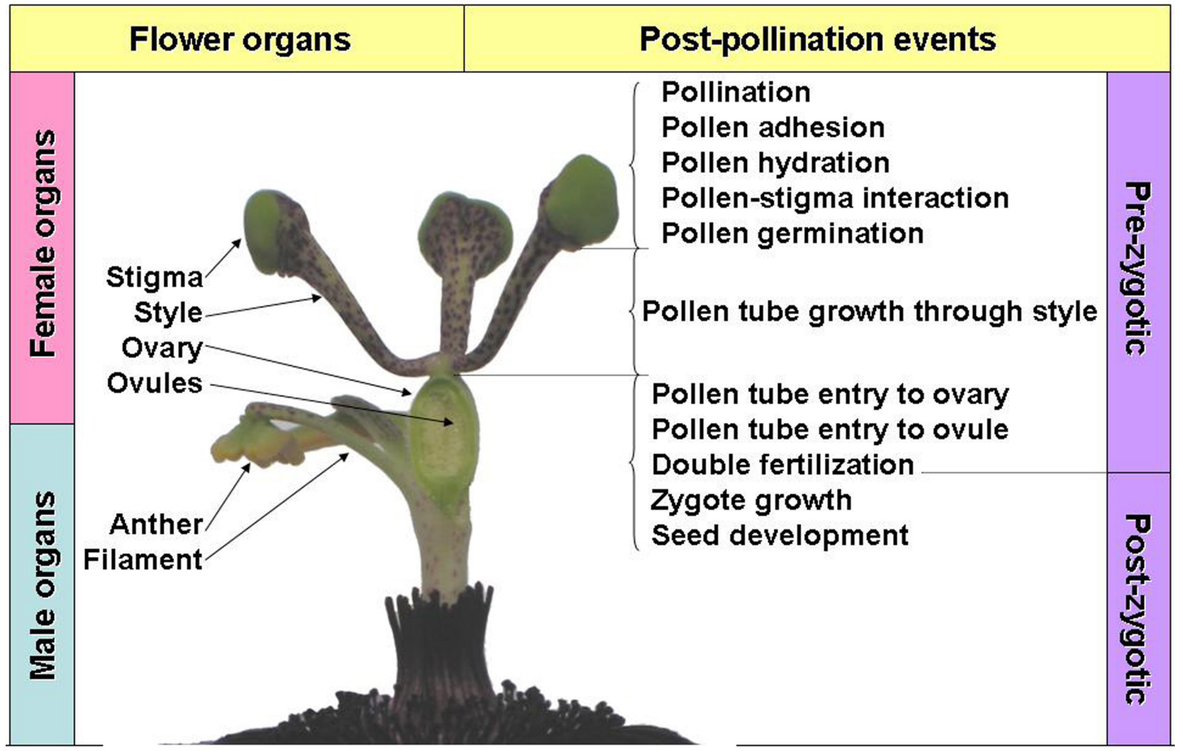


Figure 1: Passionflower cross-section showing flower organs and post-pollination events.

The main criterion for selecting parents for our hybrid will be that each of them has characteristics that we want to combine in a new variety, for instance, the beautiful flower colour from one of the parents and cold winter temperature tolerance from the other (**Fig. 2.a-c**).

Crossing will of course affect all the genetics of the new hybrid, not only flower characteristics but also growth habit, leaf shape, stipules, petiole glands, etc. It is also possible to cross for obtaining intermediate characteristics of the parents in the hybrid, as in the shape of the leaf or in the flower colour (**Fig. 2.d-f**).

Genetically, a hybrid is the result of the union of two gametes— a process called fecundation or syngamy. A gamete is a haploid cell with half of the genetic information of a body (somatic) cell. One gamete comes from the father (inside each pollen grain), and one comes from the mother (inside each ovule in the ovary). When the two gametes are joined, the resulting offspring gain half of the necessary genetic information from each gamete.

Prior to the joining of the gametes, they must be formed in the parent plants, through a process called "meiosis.".

Meiosis occurs in stages in somatic cells of each parent plant ,within anthers and ovules, and produces four gametes with half of the genetic information of the original cell (**Fig. 1**). In the first stage (named prophase I), the plant chromosomes join in pairs; each one with its homologous chromosome (**Fig. 3.a**). Next, in metaphase I, the chromosome pairs meet in the equatorial plane (a line down the center) of the cell. After that, they divide into two sets of chromosomes (anaphase I and telophase I) (**Fig. 3.b**). At this moment, each chromosome contains two sister chromatids carrying the information in the two cores of the cell from meiosis I. The two sets of chromosomes are sorted again, each one in its equatorial plate (metaphase II) (**Fig. 3.c**) for re-dividing. This time, rather than separating whole chromosomes from each other, each chromosome is split into two sister chromatids (anaphase II and telophase II) (**Fig. 3.d**).

In this manner, each cell forms a tetrad (**Fig. 3.e**) with four gametes, each one with half of total genetic information for a mature plant. .Meiosis, like pollination is a very delicate process that can be affected by, physiological, physical, and genetic issues reducing the viability of gametes (or fruit in the case of pollination).

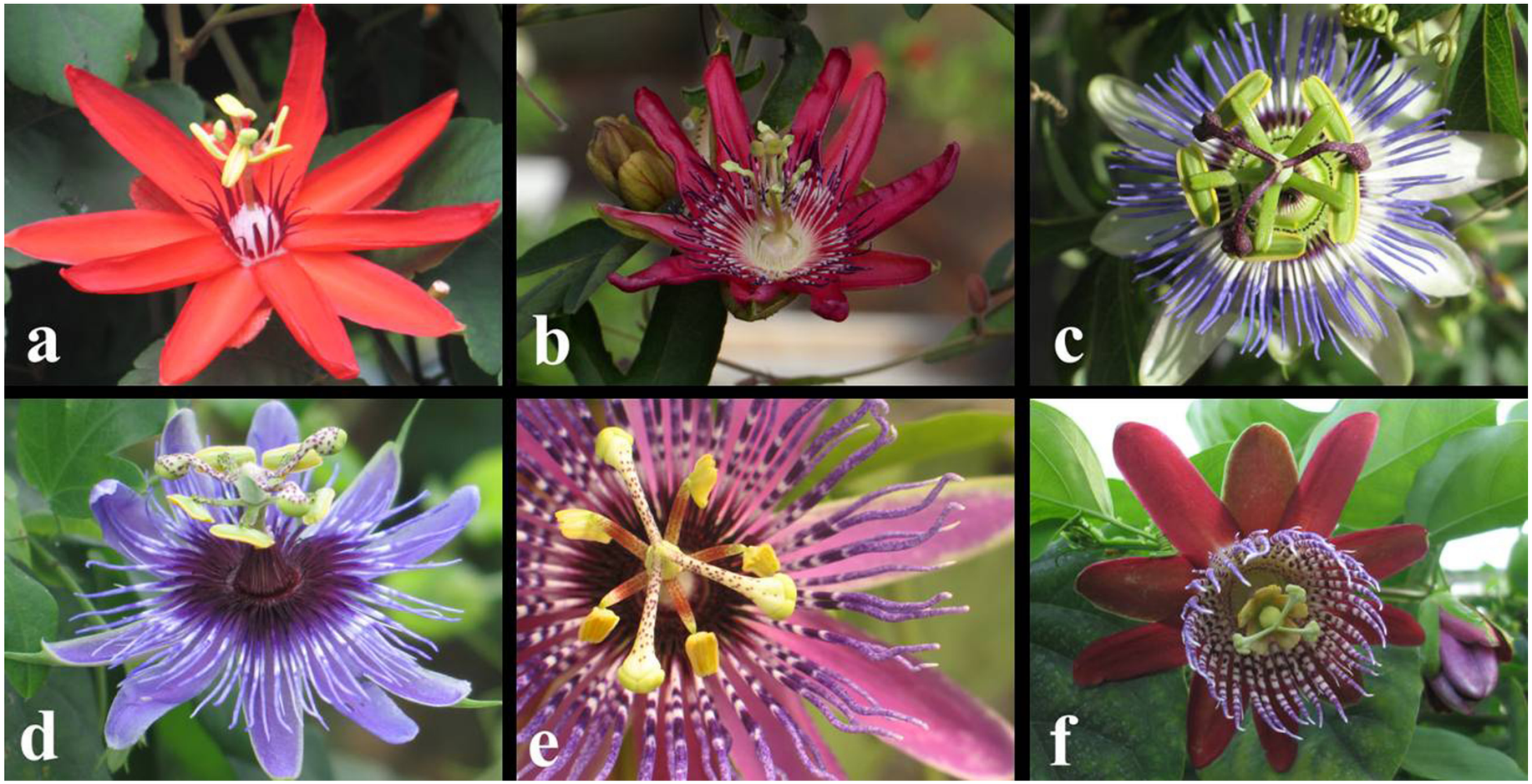


Figure 2: Passionflower hybrids and their parents.

a: *P. coccinea*; **b:** P. *coccinea* × *P. caerulea* hybrid made with the aim of combining flower colour and cold tolerance; **c:** *P. caerulea*; **d:** *P. amethystina*; **e:** *P. amethystina* × *P. alata* hybrid showing an intermediate flower colour from those of their parents; **f:** *P. alata.*

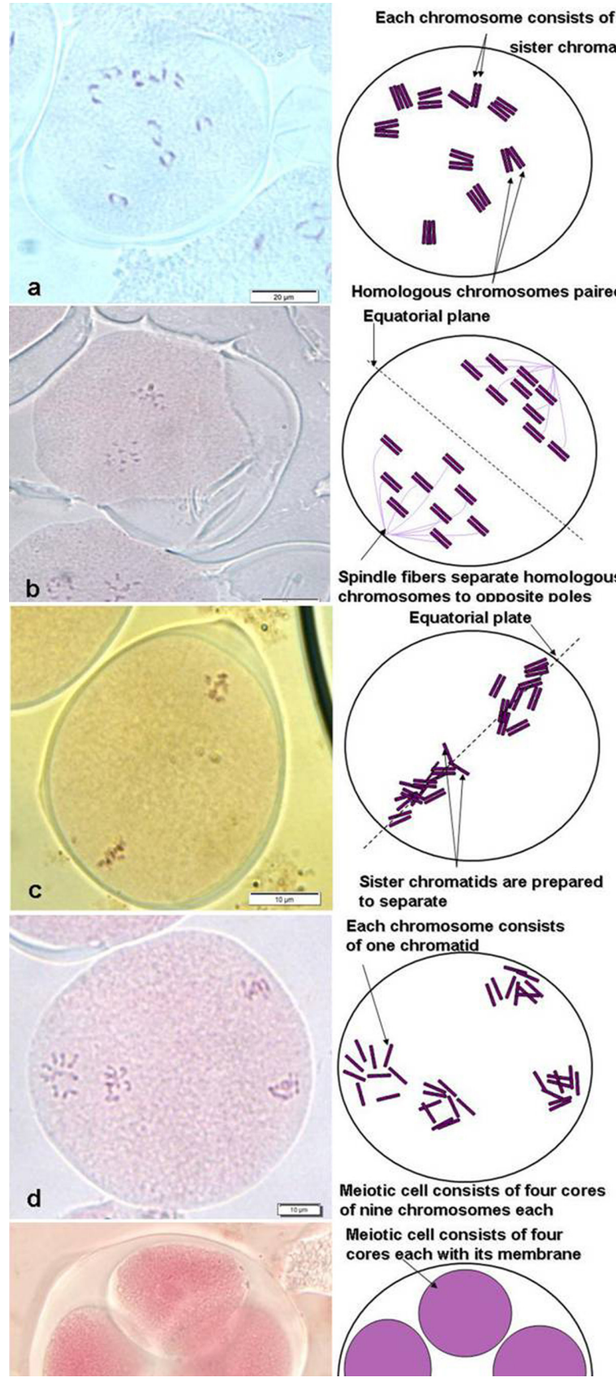


Figure 3: Passionflower with 18 chromosomes at meiosis.

a: Chromosome pairing at diacinesis of prophase I in *P. amethystina*; **b:** Anaphase II in *P. elegans*; **c:** Metaphase II in *P. amethystina* × *P. caerulea* hybrid; **d:** Anaphase II in *P. alata;* **e:** Tetrad of microspores in *P. edulis f. flavicarpa*

Passionflowers and pollinators have evolved together to serve mutually beneficial roles for each party's survival. Passionflowers are helped by pollinators to transfer pollen from one flower to another either on the same or on a different plant. Conversely, pollinators utilize the pollen or nectar for their own purposes.

In artificial pollination, the breeder takes pollen from the plant chosen as the male parent (typically with a brush or by cutting the anther) and transfers it to the receptive stigma of the plant chosen as the female parent (Segalen, 2011).

The adhesion of the pollen grain on the stigma is the first post-pollination event. It occurs due to the hydration of the pollen grains with water from the stigma. Later, proteins of the pollen wall come in contact with stigma exudates. This is the first chemical interaction between both parents, and it is the base of the recognition phenomenon (Shivanna & Sawhney, 1997) (**Fig.1**).

While one might think that the mother plant has a passive role in hybridization, this is far from the truth. There are different mechanisms by which both the stigma and the style recognize the giver of pollen and may prevent further growth of the pollen tubes avoiding fertilization by certain parents. This system acts not only to prevent fertilization with pollen from different *Passiflora* species but also, in some passionflowers, preventing self-fertilization (self-incompatibility).

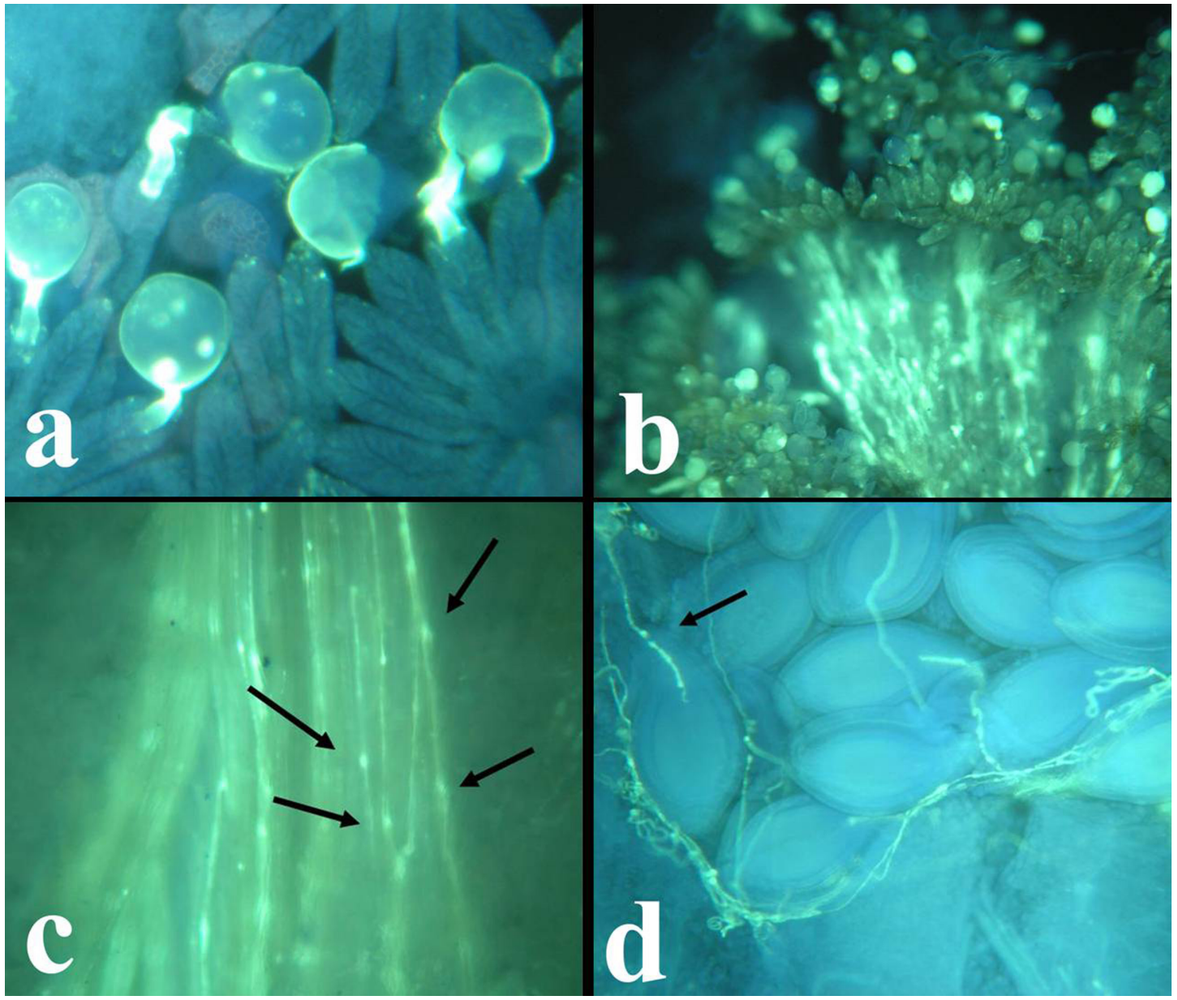


Figure 4: Passionflower pollen tube growth showing interspecific hybridization.

a: Pollen grains of *P. alata* in P. *caerulea* stigma; **b:** *P.* ´Amethyst´ × *P. caerulea*; **c:** *P.* ´Amethyst´ × *P. caerulea* (arrows in **c:** callose plugs); **d:** *P. caerulea* pollen tubes in *P. amethystina* ovary (arrow in **d:** Pollen tube entering an ovule).

In compatible crosses, pollen grains adhere to the stigma and germinate, emitting a pollen tube. In the *Passiflora* genus, pollen tubes must break through the stigmatic papillae (**Fig.4.a-b**). The gametes formed during meiosis in the anther travel near the pollen tube tip. In the pollen tubes, plugs are formed at regular intervals along the style to help advance male gametes to ovules (**Fig. 4.c**). Once in the ovary, pollen tubes are directed toward a small opening at the end of the ovule, the micropyle, by which male gametes are released into the embryo sac (**Fig. 4.d**).When fertilization occurs, ovules are transformed into seeds and ovary into fruit (**Fig. 5.a**). Fertilization not only forms the embryo (**Fig. 5.b-c**) but also produces reserve substances that surround it and will be the food of the embryo until the seedling can be nourished by photosynthesis.

Each *Passiflora* species produces very different fruits that are characteristic in shape, size, and colour, which often change as they ripen. *P. elegans* fruits (**Fig. 5.d**) are spherical, orange, and 3 cm in diameter while those of P. *cincinnata* (**Fig. 5.e**) have the same shape but are purple and 5 cm diameter. The fruits of *P. alata* (**Fig. 5.f**) are ovoid, orange and 9 cm in diameter, in contrast with the small and purplish *P. suberosa* only 1 cm (**Fig. 5.g**) in diameter.

When fruits reach their final colour, the seeds are ripe and ready for harvest, most dropping to the ground though some stay attached.

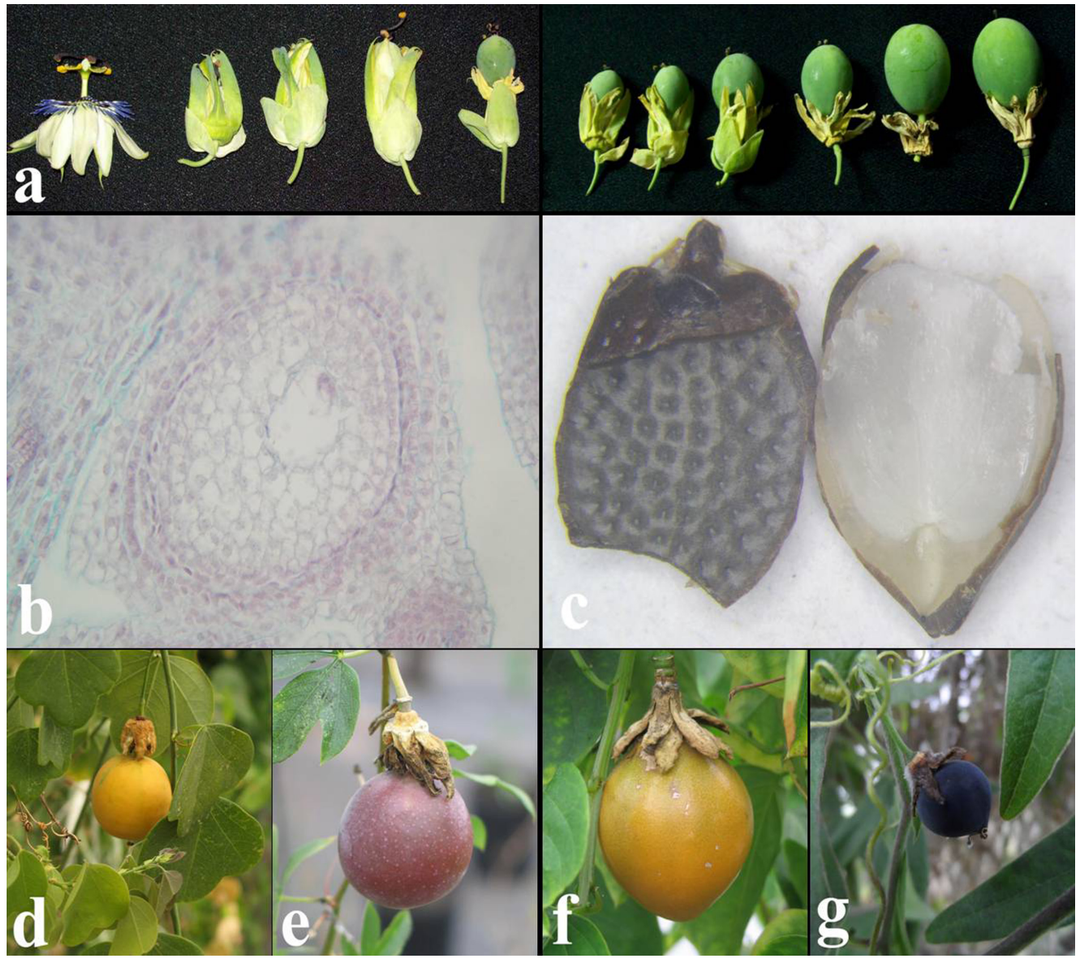


Figure 5: Passionflower fruit set.

a: Evolution of the fruit since flower pollination in *P. caerulea* b: microscopic cross-section of a developing seed of *P. suberosa*; c: Macroscopic cross-section of a seed of *P. edulis f. flavicarpa*; d: P. *elegans* fruit; e: *P. cincinnata* fruit; f: *P. alata* fruit; g: *P. suberosa* fruit.

In mature seeds, the embryo is in a dormant state. Imitating what happens in nature, where birds feed on the seeds and inadvertently sow them after having gone through their gritty digestive tract, the seeds are removed from the fruit along with the arils which may contain chemicals that inhibit germination. The seeds can be scarified by rubbing with sandpaper (mimicking digestion in birds) and rinsed in running water for 24 hours (Ferreira, 2005). Sowing may be accomplished with bags of vermiculite (**Fig. 6.a**) that are placed in a warm room with a minimum temperature of 15 º C.

The germination process begins with the entry of water into the seed. From that point, the embryo may become active, though germination is unpredictable in many *Passiflora.* The embryo feeds on reserve substances, principally starches but also some fat and protein that surround it in the seed. Embryo cells divide by mitosis to grow in size becoming a seedling (**Fig. 6 a-b**). Unlike meiosis, mitosis is a doubling and splitting where one mature cell makes another mature identical cells, rather than the four gamete cells made in meiosis. At seed germination, seedlings can be transplanted to a plug tray with sterilized substrate (**Fig. 6.b**). When the seedling reaches about 5 cm height, it can be transplanted into pots of 14-16 cm in diameter (**Fig. 6.c**). The plant will continue to grow until it must be transplanted into final location, pots of at least 10 litres or directly in soil.

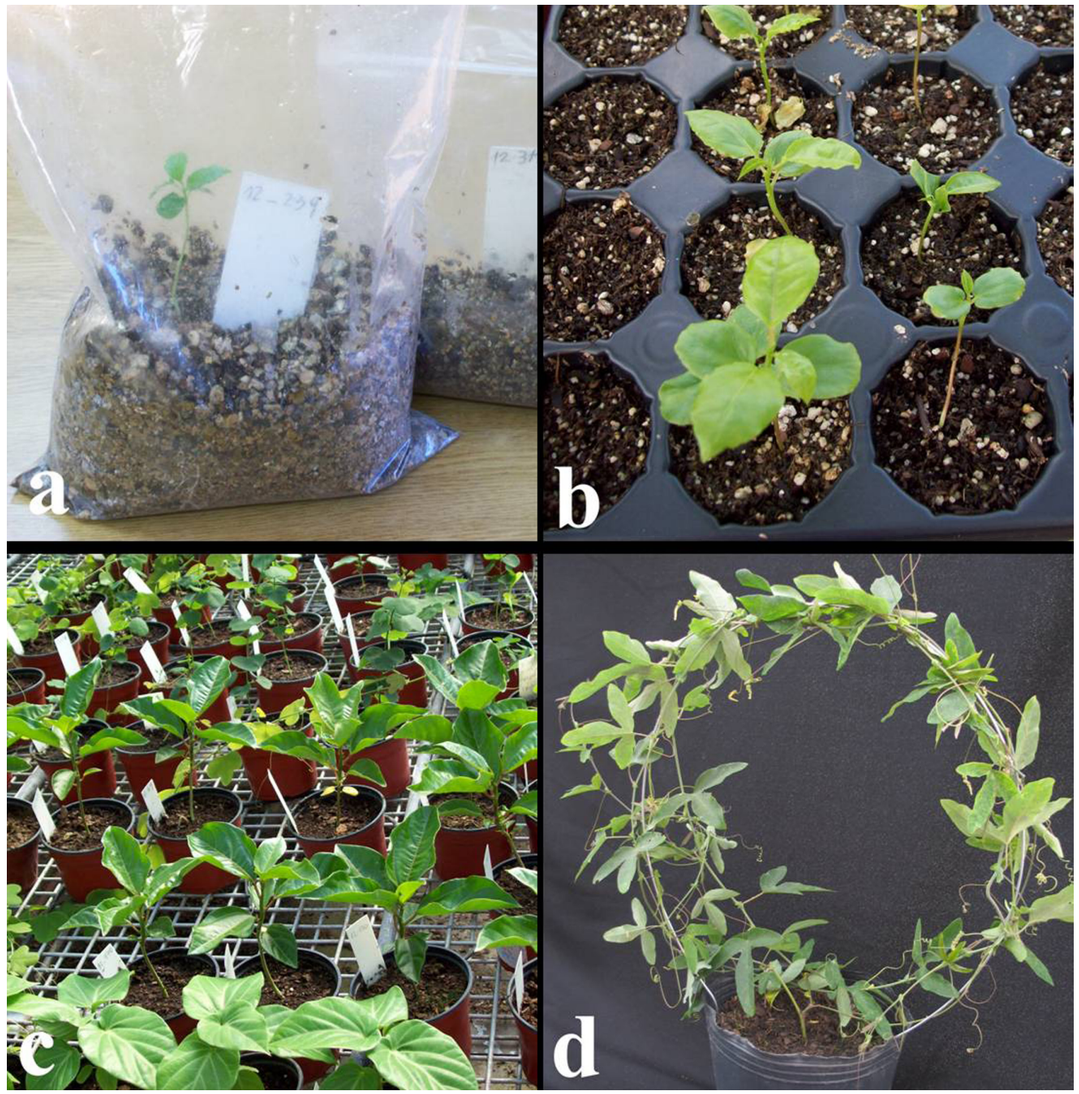


Figure 6: Passionflower seed germination and hybrid seedling growth.

a: Seed germination bags; **b:** Passion flower plantlets seedlings in honeycomb tray; **c:** Hybrid plants in 14 cm pots; **d:** grown adult plant in 10 litres pot.

Once the plants mature, all that remains to be done is to wait for flowering. That said, some hybrids are shy flowering or may not flower at all. The characteristics of the flowers in terms of shape, colour, and size will be the ultimate secret to be revealed in the long path of passionflower hybridization.

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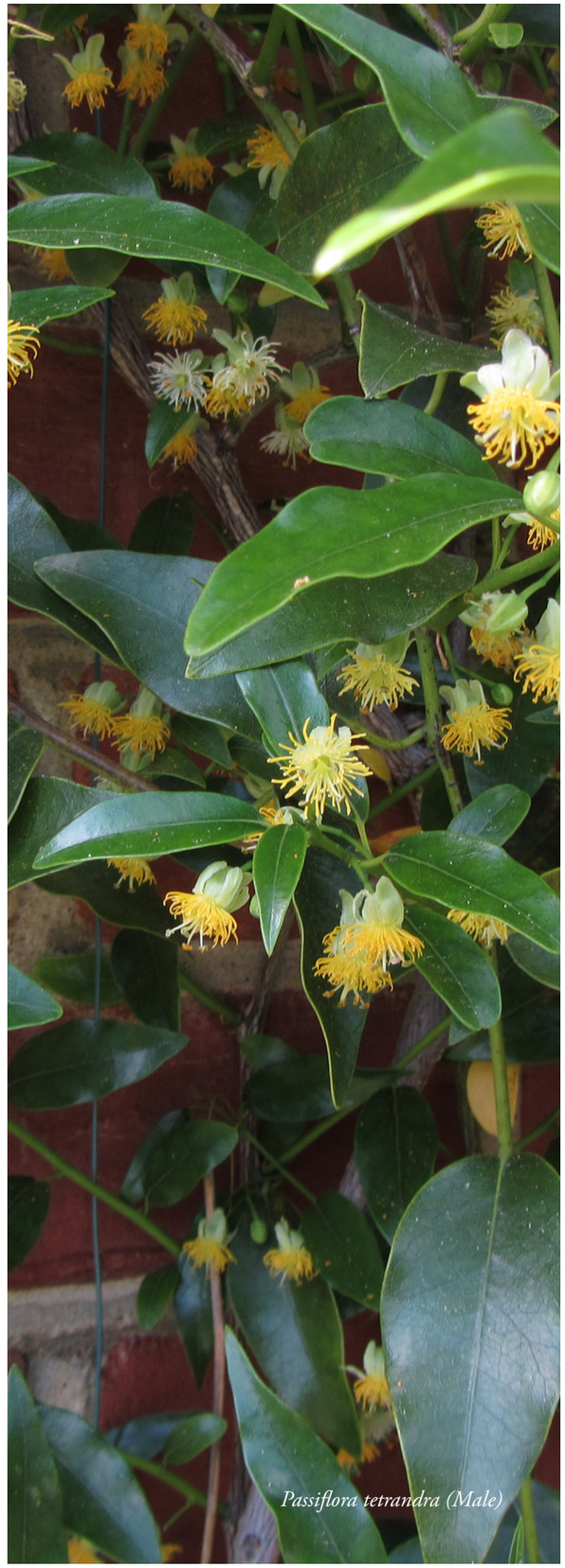
* A rare and primitive exception is *Passiflora tetrandra* from New Zealand, which has separate plants either producing all male or all female flowers. The flowers are tiny with hundreds opening at once.


Passiflora tetrandra (Male)

3D Passion Flower Skylight

By Gary Uhouse
www.garancelot.com

I've always been motivated by the arts. In fact I believe that art is the universal celebration of the human appreciation of life. When we witness art we tap into the evidence of reverence. When we create we are very much in the present moment, which I believe is the closest we are to divine existence.

I live in San Francisco and have a garden design and build business with my partner. Over the years the level of creativity has evolved from creating simple gardens with a focus on plants and irrigation to designing creative and tranquil spaces equipped with patios, walls, trellises, water features, fire pit, and interesting plant combinations.

With a background in psychology and art I've always had earnest intentions of helping people escape the confines of urban madness by bringing nature into the city while pushing myself creatively. In the last 5 years I have taken to expanding my personal creative arena outside of gardens by creating pieces of art, some of which have been worked into our gardens. Projects include: custom cat tree, garden lamps, illuminated water features and furnishings. In our own garden I created an outdoor medieval dining room with illuminated furnishings including dining table, bar and a gothic arch throne. This sort of lifestyle warrants immersion in the natural and creative world for inspiration.

While exploring the Russian River area in Northern California I had the great fortune of meeting Jim Raidle, The surviving partner of the former Little-Raidle Art glass studios in Cazadero, Ca. We became friends. While he was downsizing I helped him move his garden and received a nice assortment of glass in exchange. This set me on a new creative course working custom lamps and furnishings into garden projects.

After receiving glass I had studied the art of glass work under Master Stained Glass Artisan Dan Gamaldi of Cradle of the Sun Glass in San Francisco for 2 years. He is the type of teacher who encourages ingenuity and offers clever skills that only an experienced master with 40+ years of experience can provide. I had created a 3D Brugmansia lamp shade and found that using wire to enhance the tips of flower created a nice effect so I thought I was up to the task of trying something more challenging and fun.

I find the passionflower to be one of the most beautiful and striking flowers in the world. Our temperate climate in San Francisco allows for growing a variety of plants that range from cold hardy to sub-tropical. Passionflowers, especially cloud forest varieties grow remarkably well in our climate. Over the years our local Botanical Garden at Strybing Arboretum in Golden Gate Park has provided a wellspring of information and plant specimens at their monthly plant sales, and many varieties of this wonder plant have moved through, allowing locals to experiment and grow some gorgeous vines.

After cutting all the pieces and attaching foil to the outer edges the panel was soldered on both sides to form a strong bond.

About the piece:

This piece was created to replace a 76 cm square piece of frosted glass in a skylight at the top of our stairs. The design was born out of my love for passionflowers, medieval architecture and the honorable craft of stained glass.

Passionflowers are difficult to emulate with all of their parts on a 2 dimensional plane and any stained glass images I had seen on the internet of the flower fell short of capturing their glory so I set out to create something sort of groundbreaking - a 3D Passion flower to scale.

The first step was to draw out the pattern and start cutting glass, and the steps to enhance the 3D aspects evolved over time. The glass was cut to fill in shapes of the template, then foiled for later soldering.

The inner circle is where all the magic happened. In the passion flower it is called the “nectary”. I wanted to be able to look up into the middle of the flower so I used a faceted blue crystal wine glass without stem and drilled a large hole in the middle.

First view of the panel with light from behind.

Nectary made from blue wine glass with stem carved out.

I used copper snail tape to get a large band to add solder and eventual wires for the filaments. This would be the inverted part of the flower from which the androgynophore would stem.

The corona filaments are a series of wires, coated in solder and hammered on one side and soldered in place.

After soldering the corona filaments to the outer rim I was ready to invert the glass and prepare the androgynophore which would be another wine glass from a thrift store with the stem detached from the goblet and used to drop down and hold all the parts: ovary, stamen, anthers, style and stigma.

Corona Filaments in place and the blue goblet forms the nectary area of the flower. All ready to solder.

Now the filaments and nectary are in place and ready for the flower parts to be added to the androgynophore.

A thrift store goblet will act as a perfect stem to be inserted through blue goblet nectary once it is lovingly decapitated with a file score line and a hammer over a bucket. A file created a clean break of the goblet.

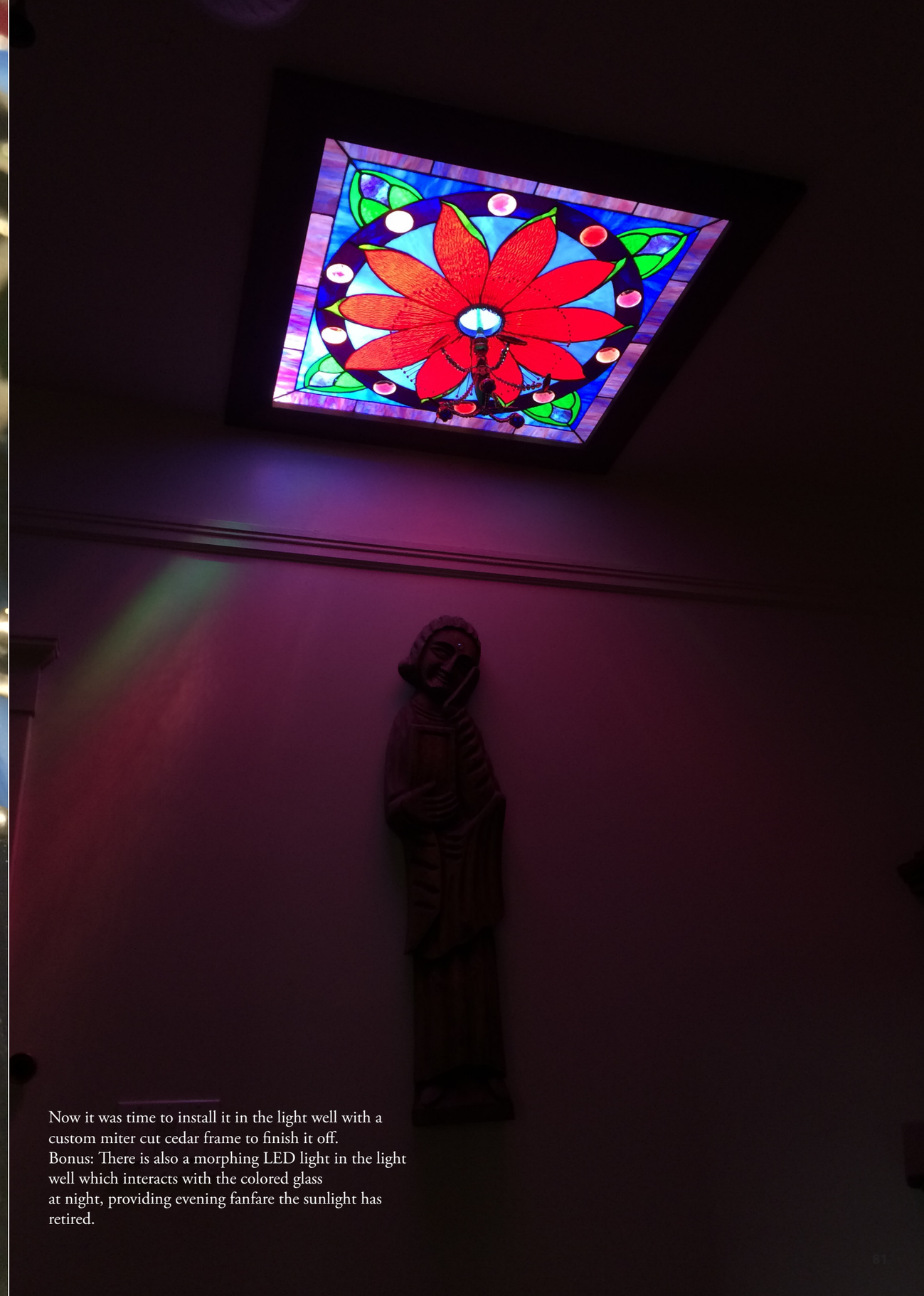
Once the goblet was removed, I used the stem to glue in a socket which will hold the lightbulb shaped ovary.

The ovary was drilled and ground at the tip of the bulb. Then 3 rigid wires (styles and stigmas) were hammered and twisted into shape and inserted into the tip with a clear glue. It can be screwed in at the end with its style and stigma, which were made with Murano glass beads.This delicate detail can be set aside and attached once the skylight was in place. (but not until a little bling was added.)

Now it was time to work on covering the filaments with Swarovski Crystal beads before soldering the anthers (topaz colored glass jewels.) The temporary frosted bulb held the form and allowed placement of the gold filigree at the base.

Crystals, filigree, and hand blown beads adorn the parts of the flower.

To ensure lateral integrity with much of the weight in the middle of the glass suspended from the light well, I used ⅜ inch thick plexiglass behind the panel. Wire soldered and small drilled areas, providing lateral strength and less concern for sagging over time. The plexi glass slipped over the wires on the back of panel gave much needed strength.



Now it was time to install it in the light well with a custom miter cut cedar frame to finish it off.
Bonus: There is also a morphing LED light in the light well which interacts with the colored glass at night, providing evening fanfare the sunlight has retired.

Annual Passiflora Society International Meeting:
7 – 9 August 2015 San Francisco, California, USA

Report by Kyle Rahrig
Photography by Deborah Peters

I had visited the San Francisco Botanical Garden, also known as Strybing, in Golden Gate Park before the 2015 Annual Society Meeting and met in person a few of the most active and friendly members in the Passiflora Society International. I wasn't prepared for the fervor or generosity with which the collected members would share their knowledge, experiences, and not least of all, plants at the annual meeting. A little less than 40 individuals from North and South America united in San Francisco to engage in some of the most specific, scientific, and terrific fun that I can imagine a group of *Passiflora* enthusiasts having.

Not knowing what to expect and being quite anxious to start the weekend early on a Friday, I was one of the first to show up at the gates to Strybing. There, the President and Treasurer of the PSI, Eric Wortman and Crystal Stone respectively, met me with open arms and a name tag. We chatted briefly about who was expected, travel woes, and all sorts of other general hob-knobbing while others homed in on the garden. I was informed that the fantastic sunny and warm weather I was enjoying was somewhat anomalous for San Francisco in August. It was a herald of the exuberant time that I would experience all weekend long.

As soon as all were gathered, we began our tour of the grounds. Eric and Crystal had performed two complete walk-throughs the prior day to ensure that we wouldn't miss a single *Passiflora* plant on the grounds. And, we didn't. We followed the curator, Don Mahoney, dutifully from fence to fence gawking at the *P. membranacea* plants hanging like little purple and white lantern-hewn strings 75 feet high in the trees; snapped photos of common but very healthy and sprawling examples of *P. x violacea* 'Eynsford Gem', *P. manicata*, *P. loefgrenii* x *P. caerulea*, *P. matthewsii* ', white form, *P. actinia*; and marveled with near reverence at *P. parritae* which was waning with blooms, but still a rare treat for most of us.

It had been arranged with the kind and very generous Carlos Rendon that we would have an exclusive *Passiflora* sale near the end of our touring. I liken him to the famous pop culture icon Bob Ross, who painted landscapes on American public access television for many years and who seemed like your favorite uncle when he spoke softly to the camera. After walking through the open ground nursery plot, we were all respectfully clamoring to see what jewels Carlos had to share with us. There were many species and hybrids like *P. antioquiensis*, *P.* 'Mission Dolores', *P. macropoda, P. gritensis*, *P. umbilicata*, and not the least of all, *P. parritae*. Our horde delighted over all the potential additions to our collections, and everyone that came to purchase these left with a box full of happy little plants. The ever perky Elizabeth Peters (Grassy Knoll) and genial Jim Nevers (Passiflorista) were in our company, so one might expect these to be available for purchase through their shops in the not too distant future.

Passiflora parritae

With the day warming up, and coming down from our Black Friday-like shopping spree, we ambled back toward the front gate for some pizza and conversation. All fed, it was time to disperse into the local shopping district and do some sight-seeing. Saturday would have much more in store for us, and all of the PSI annual meeting greenhorns, including myself, couldn't appreciate all that it would entail.

The second day of the conference was held in a hotel proximal to the SFO airport where many of us were staying for the weekend. "*Passiflora*" was displayed on the lobby sign indicating that the Presidential Hall was ours. Indeed, we made it our personal garden away from home. Eric and Crystal would begin our day. First, we heard Eric's retelling of a piece that he had written years prior on all of the characters that he had encountered at a PSI meeting; many of whom were present in the room once again. Each person was recalled fondly and with their proper quirks. We also learned about the state of the PSI and the size of its membership. Although the premium membership totaled only about 90, the free members equaled more than 700. Many of the latter group patronize the seed bank, which we were told was a significant contributor to the financial health of the PSI. In the 3 years since Eric and Crystal began their tenure, the PSI has doubled its holdings to approximately $8k. In addition to the seed bank, the various cost cutting and digital publications that were spearheaded have reduced operating costs, thus putting the PSI further in the black. The questions were raised to the audience: in what conservation efforts might the PSI begin to undertake? And, who might lead them? They were questions without answers.

After the Saturday kickoff, we heard from Dr. John MacDougal on the revisions to the taxonomic structure of the *Decaloba* subgenus. Although I am not particularly enthralled by this subgenus, I was transfixed by the amount of work that he and his team have invested in the herbarium research, genetic analyses, and algorithm exercises that have contributed significantly to our collective understanding of 300 species of *Passiflora*. In addition, we saw excellent comparisons of the similar and often confused species, examined the subgenus taxonomic tree with its various confidence values based on a four gene evaluation, and marveled at some recently discovered species including one that has morphology similar to a grass! We were reminded of the monstrous leaf diversity within *Passiflora* including the curiosities that are the egg mimics. When I first became involved in the scene of *Passiflora*, it was John MacDougal and Torsten Ulmer's book "Passiflora, Passionflowers of the World" that largely guided my research, so meeting John and hearing his lecture were a particular treat for me.

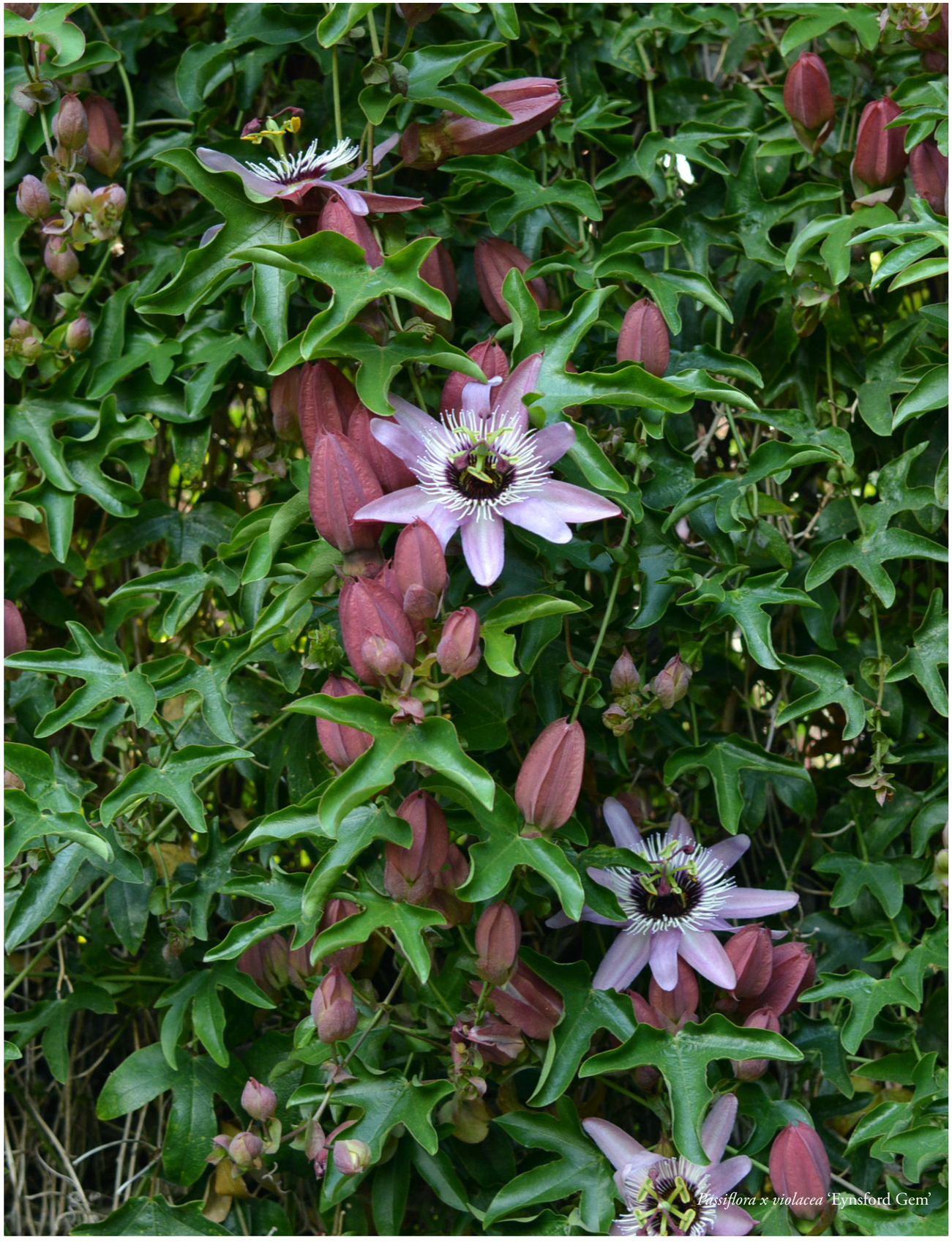
With the conclusion of the extensive Q & A session that followed John's lecture, we were able to purchase tickets for

the raffle. This resulted in many highly contested donated items whose sources were identified and applauded. The items included *P. antioquiensis* and *P. gracilis* seeds donated by Dave Hermeyer and Eric/Crystal respectively, a large and healthy *P.* 'Mission Dolores' plant from Strybing, a bottle of wine with a passion flower on the label from Eric and Crystal, extended premium PSI memberships, gift certificates to Grassy Knoll and Passiflorista, and perhaps the most sought after: a large *P. caerulea* print brilliantly painted by attendee and scientific illustrator, Mattias Lanas. The trading began during this first break, but continued throughout the day. However, to call it "trading" is somewhat of a misnomer as it generally resulted in many cuttings and seeds being offered freely. I found myself loaded down as if I were going to build a primitive shelter of vines and sow my own fields for sustenance. This attitude exhibited by the group was nothing short of pure generosity resulting from a sense of community and enthusiasm for the genus.

We resumed the presentations with Hal Love's excellent discussion on polyploidy and genetics. I had only a cursory knowledge in this arena and was again riveted while learning about the motivation and various chemicals used to produce tetraploids, the effects of crossing tets with diploids and the various potential results found in their progeny (or lack thereof), and the message to "try everything" because sometimes conventional logic only extends so far. I enjoyed the photographic examples of various crossings using *P. incarnata* and its many hybrids which effectively illustrated Hal's genetic lessons.

The rest of the afternoon was a blur of plant and seed trading sessions, presentations on the personal collections in Chile given by Mariana Acuna-Retemar and Jim Nevers' slideshow of Passiflorista's offerings; Jorge Ochoa's South American *Passiflora* hunting expeditions and fruit tastings delivered at great speed; Dr. Shawn Mattison's game which pitted each side of the room against the other to guess the parentage of some newly registered hybrids.

Embedded in these were workshops which taught grafting, rooting, and generation of inexpensive rooting gel. The grafting workshops were taught by Crystal Stone and Kevin and Carolyn Przybyla. Many rootstocks of *P.* 'Betty Myles Young' were donated by the Przybylas along with ample cuttings from Rick and Michelle McCain and Carlos for grafting and rooting. Two similar methods for grafting were demonstrated, and each person that participated went back for seconds or thirds with ample materials available at the end. I overheard many people say that they would be practicing immediately once they returned home. Randy Story taught a rooting workshop with a bucket of wet perlite, some powered hormone, packing tape, and a few transparent drinking cups. Being one that generally uses an aeroponic propagator, I was anxious to learn all of his tips and tricks for all of the species that I have a difficult time with in the cloner. Finally, Tim Skimina showed us how to create a batch of relatively inexpensive rooting gel using a liquid hormone, water, and hair gel!



Passiflora x violacea 'Eynsford Gem'

As the second day wound down, the final tickets for the remaining raffle items were drawn. The last was the botanical print of *P. caerulea*. A ticket was pulled from the ballot box, the number read, and John MacDougal jumped to his feet exclaiming "Yes!" to everyone's simultaneous dismay and pleasure. Without realizing it, I had become very tired. The travels, the walking in the gardens of Strybing, and the unblinking attention devoted to the excellent program arranged for us had drained me. It was time to refill at the restaurant and bar inside the hotel with my current and new friends until we all agreed that it was late enough to succumb to the sandman.

With the formal events concluded, some of the attendees returned home or continued their vacations elsewhere. Others elected to meet at the University of California at Berkeley Botanical Garden. There, Shawn Mattison and the lovely volunteers at UCBG; Carolyn Edmunds, Mary Yoder, and Patti Morrison; who had been with us for the prior two days, showed us the garden grounds and located all of the *Passiflora* growing there. Again, generously several cuttings were offered of *P. manicata* and *P. trisecta* and potted *Passiflora* were available for sale. The mood on this third day was that of relaxation; having gorged ourselves on both plants and information offered on Friday and Saturday. After our tour, more of us departed for home, including me, while others continued to Annie's Annuals.

The whole weekend had reinvigorated my zeal for these plants. I was anxious to return home with my new additions, try out some of the techniques I had learned at the workshops, and tell my "normal" friends about the pilgrimage that I had just made. Only the *Passiflora* people would really understand the mania and community we experience at the annual meeting. But, in an attempt to relay the experience to those not afflicted with the obsession, Mattias Lanas aptly noted that the whole event was like Comic Con for *Passiflora*.

One thing that I do not believe I can accurately relate in this account is the monumental effort that both Eric and Crystal impart on the annual meeting and in general on behalf of the PSI on a frequent basis. I do think the majority of the active members appreciate their devotion and commitment to the non-profit organisation, but I would like to take the opportunity to encourage all members of the PSI to demonstrate their appreciation for Eric and Crystal's efforts. Certainly public or private words are appropriate, but becoming actively and regularly involved in the PSI is a greater display of gratitude. Please consider donating your skills and time and as always your articles and seeds. It's true that without the members the PSI does not exist, but consider that without devotion of its leadership it will also dissolve and so may too many of the opportunities that the PSI provides.

John MacDougal and Carlos Rendon chatting.

Randy Story's rooting workshop.

Crystal Stone and Kevin Przybyla's grafting workshop.

Tim Skimina's rooting gel workshop (with Elizabeth Peter's baby).

Passiflora mathewsii, white form.

Passiflora manicata

Passiflora membranacea

Passiflora parritae