

***Etilingera elatior*: The Tropical Flower Set To Sweep the Cut Flower Market**

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EXECUTIVE SUMMARY

Etilingera elatior, or torch ginger, is a member of the ginger family. Its native range includes Malaysia, Indonesia, and many pacific islands. It is a completely edible plant and also has medicinal uses. The main showstopper of torch ginger are its beautiful showy flowers, which come in a wide range of colors, from pink to white to red. These compound flowers have glossy, waxy petals and long showy bracts that have a lovely tropical beauty. It easily catches the eyes of consumers and the gentle scent of the flowers make it even more appealing. Torch ginger is a perennial and produces flowers continually, if its environment requirements are met. It also reproduces primarily by rhizomes, which makes its potential as a cultivated ornamental plant high, since uniform sales stock could be produced. All of these features make torch ginger a wonderful candidate for the cut flower industry. Torch ginger would be best produced in a greenhouse, as the environment requirements can only be met in very small portions of the continental United States. Given a relatively humid, warm greenhouse environment and partial shade, the torch ginger could potentially be produced year round anywhere in the world. There are many areas for research and development when it comes to long term greenhouse production of torch ginger, but it still shows wonderful potential. Breeding programs that focus on improving the post-harvest longevity and per-plant flower production are recommended for improving overall plant productivity.

I. INTRODUCTION

A. Study Species.

Etilingera elatior, commonly known as the Torch Ginger or Torch Ginger Lily, is soon to revolutionize the floral industry.

B. Taxonomic Classification and Geographic Distribution in the Wild.

Etilingera elatior is a member of the Zingiberaceae family, the ginger family. In that family there are 5 major groups, Costaceae, Hedychieae, Alpineae, Zingibereae, and Globbeae. *Etilingera elatior* is a member of the Alpineae group, which includes 25 genera and a common culinary herb, cardamom (*Elettaria cardamomum*). This group is categorized by stems perpendicular to the rhizomes, expanded styles, and medium-length stamen. The majority of the genera from this group are found in the Indo-Pacific region. The *Etilingera* genus is also native to the Indo-Pacific region, and contains 100 known species.

Etilingera elatior is originally native to Malaysia and Indonesia. It naturally grows in tropical forests and prefers a shady, humid environment. It grows in large colonies of underground rhizomes that can be identified by 5 meter tall stems covered in waxy, alternate leaves. Naked flower stalks rise from rhizomes and bloom 155 days after first vegetative emergence (Choon 2016). These blooms are showy cone-shaped inflorescence consisting of many small fertile flowers surrounded by drooping showy bracts. They have a tendency to spread readily and are categorized as naturalized and invasive in multiple countries. They are naturalized in China and Hawaii. It is considered invasive and threatening in the wet forests of Costa Rica, which were otherwise untouched woodlands (Rojas-Sandoval and Acevedo-Rodrigue 2019). They spread via rhizome and seed in these areas and create dense thickets that native plants cannot compete with.

The entirety of this plant is edible and it is a staple in Indonesian and Malay cuisine. The flowers are used as a common herb in seafood dishes while the stems can be chopped up and used as vegetables in stews and curries. The fresh seed pods are also used in culinary dishes, in a similar style to its relative, cardamom. A jam made from the flower petals and rhizome is

available for purchase in parts of Malaysia. Due to ancient trade routes, this plant has been spread to many parts of south Asian and the Pacific islands, and is even used in many traditional Hawaiian dishes. In these regions it has been nativized and is a staple in everyday life. It has many common names in the languages of these regions.

Not only is the torch ginger eaten in everyday dishes, but the rhizomes and essential oils made from the flowers are used medicinally across its native and nativized regions (Maruzy 2016). It contains high levels of flavonoids, terpenoids, and phenols, so it is commonly used as an antimicrobial and antioxidant (Juwita et al. 2018). Common ailments that are treated with *E. elatior* include sore throat, ear infection, and indigestion. It is also commonly used in personal hygiene and beauty products, including deodorant, lipstick, and soap. Homemade deodorants are one of the plants most common hygiene uses, as it grows wild in many environments and is readily available to those who cannot afford commercially produced deodorant and hygiene products.

II. CROP SPECIES

A. History and Potential Uses.

Etilingera elatior has a large cultural history of trade and domestication in its native range, though it was used primarily as a food and medicinal source. The goal with this domestication was not to highlight the color and beauty of the showy flowers that this plant produces. The history of *E. elatior* being cultivated as an ornamental or cut flower is much shorter in comparison, because interest in this plant has grown only over the past 10 years. Torch ginger has amazing potential as an ornamental, because herbaceous rhizome propagation allows for exact clones of mother plants and uniformity in sale stock. It also has beautiful tropical blooms that will catch the eye of consumers.

There are 5 official *E. elatior* cultivars found on the market in the United States that have a beautiful variety in flower color and flower structure, as seen in Fig.1.



FIGURE 1. *Etilingera elatior* cultivars currently on the market (**Botanical Growers Network** 2022). 1) *E. elatior* “Giant Red” 2) *E. elatior* “Borneo Pink” 3) *E. elatior* “Yamamoto” 4) *E. elatior* “Thai Queen” 5) *E. elatior* “Sweet Pink”

To the best of my knowledge, all current cultivars found in the continental United States are produced and sold through the Botanical Grower’s Network located in Gainesville, Florida. They have multiple stores that are a part of this network, which are mostly managed online and all sell *E. elatior*. They sell them as potted ornamental perennials. Torch ginger prefers USDA hardiness zones 10-12. Due to their invasive nature, planting them in gardens in their hardiness zones could have adverse effects to the local ecosystem. They could, however, work as patio plants. Their showy blooms could add tropical beauty to any patio from zone 4a to 12. Since they prefer partial shade, urban buyers could also utilize this plant if they do not have much direct sunlight. A potential control for their invasive tendencies would be cutting the flowers before

they go to seed. Seed control would not be ensured, however, unless the plants themselves are sterile.

In terms of the cut flower industry, different cultivars of *E. elatior* as listed above are not readily available. Some color variations exist in the cut flower market, though some color variations such as “Salmon Pink” seem dubious in nature, as, to the best of my knowledge, no such cultivar is listed on the market. The bare, straight stems on which flowers bloom make this

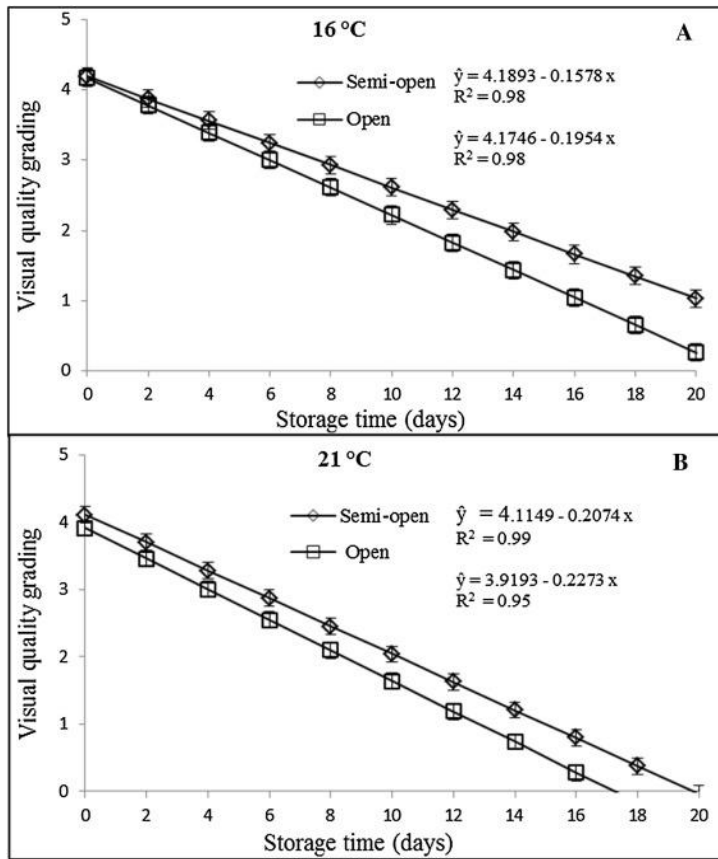


FIGURE 2. *Etlingera elatior* cut stem flower visual quality over time at two different temperatures and two different stages of bloom (semi-open, open) (Choresca et al. 2019). A visual quality grading of 3 and above is sellable at market value.

plant perfect for the cut flower industry. Due to the relatively short post-harvest lifespan, as seen in Fig.2, cut flower exports must be sold relatively close to the original harvest point (Mattos et al. 2017).

This makes it a popular cut flower in Hawaii, where they grow readily.

One of the best aspects of developing *E. elatior* into a commonly used ornamental flower is that it has high genetic variability (Ismail et al.

2019). There is large genotypic variety in the wild populations, and due to this genetic variability, there are more possibilities in terms of *E.*

elatior breeding. New cultivars could be easily created due to this trait, and then, using herbaceous propagation, successfully cloned to create genetic uniformity in sale stock. New

cultivars with better stem water retention could be the key to introducing torch ginger into the cut flower market.

III. PRODUCTION INFORMATION

A. Anticipated Cultural Requirements.

Etilingera elatior is a perennial ornamental, and could be used as such in the landscape.

Though due to its invasive nature, great care must be taken if this crop is to be used in a landscape where it can survive perennially. It could even be deemed invasive and illegal in some warmer regions if given the chance to establish there. The torch ginger cannot survive temperatures lower than 10°C at night, which makes it best suited for USDA hardiness zones 10-11. It prefers moist environments and is not drought-resistant (Lim 2014). This would only make it suitable as a perennial in the southern tip of Florida and parts of southern California. While it could be displayed in an indoor pot to restrict invasive rhizomes, the 5' tall leafy shoots may need to be cut back before retail to allow for balance of design in contrast with the pot size. A cultivar with a greater size balance between leafy shoots and floral inflorescences would be ideal so that customers do not need to provide as much care to the potted plant. A dwarfing method developed for *E. elatior* uses Paclobutrazol to inhibit gibberellin synthesis, resulting in a more aesthetically pleasing potted plant (Muangkaewngam and Te-Chato 2018).

While *E. elatior* has potential as a potted ornamental, its true potential lies in that of the cut flower industry. *Etilingera elatior* flowers all year round in ideal conditions, with an increase in productivity from January through April (Kunnath et al. 2013). This suggests a potential prime photoperiod for forcing, though to the best of my knowledge, photoperiod research has not been done on this species. This would be a potential area of study for future research. The growth period for flower inflorescence is relatively slow when first planted, but once inflorescences begin to develop, the supply of flowers is continual. When rhizomes are first planted, it takes 22 days for first shoot leaf emergence. Around 70 days later, the first floral inflorescence emerges

and begins to grow, with 18-24 flowers forming on each inflorescence during the torch ginger's peak growing season (Kunnath et al. 2013). It then takes around 60 days from first emergence to full bloom (Choon 2016). Overall, it takes around 5 months from planted rhizome to harvestable bloom. It is suggested that an additional year be added to that time in the case of growing from seed.

Due to the cold intolerance of *E. elatior*, a greenhouse environment would be best suited for production of any kind. Torch ginger prefers partial shade in the wild, so a sunblock may need to be used for some parts of the day. For cut flower production, large containers (2-3ft diameter) filled with well drained soil would be preferable, so that the perennial plant has room to grow and produce flowers continually throughout the year. In-ground greenhouses are another potential production environment, though keeping the patches of torch ginger from spreading would require more labor. *Etilingera elatior* prefers fertile soil that is rich in humus and kept relatively moist (Lim 2014). Due to the high humidity of its native range, maintaining high humidity in the greenhouse would be ideal. Common diseases or pests of torch ginger in protected environments are, to the best of my knowledge, unknown. Further research and observation would be required in that field to properly create a pest control plan. Daily low-level fertilization will be necessary for healthy flower growth, with levels of nutrients adjusted as needed.

B. Market Niche.

As a tropical cut flower, customers could find use for torch ginger during any season. Summer would potentially be the most common season for tropical bouquets and arrangements, but depending on the climate, customers may enjoy a taste of the tropics during the middle of winter as well. Due to the beauty and unique quality of the torch ginger, couples may enjoy them in wedding bouquets along with *Leucadendron* foliage or *Heliconia*. In fact, they are used as statement flowers in weddings in Hawaii, where they grow wild (Fig. 3). They add a striking

visual element to bouquets and arrangements that rivals Protea flowers. If used primarily for weddings and tropical bouquets, this could put a general timeframe for when torch ginger would be the most in demand, around May through September.

Since *Etilingera elatior* can produce continually, it could potentially be forced for a whole season (Kunnath et al. 2013). Different genotypes produce a different number of floral stalks per year, and older clumps of torch ginger produce more floral stalks than younger clumps (Araujo et al. 2018; Loges et al. 2008). Cultivars developed in Brazil produce ~40 floral stalks per plant per year (Araujo et al. 2018). Certain cultivars, such as “Thai Queen” can produce up to 120 floral stalks per plant per year (Hoult and Marcsik 2000). Breeding for higher floral stalk production would be in the best interest of commercial producers of this flower. Keeping plants for many years of production would also be in the best interest of producers to increase floral stalk yield.

The biggest limitation of *Etilingera elatior* cut flower production would be the issue of water retention and post-harvest life span. “Thai White” has a vase life of 6-10 days post-harvest (Hoult and Marcsik 2000).

Brazilian cultivars “IAC 4” and “IAC Camburi” were observed to have a post-harvest vase life of 5 and 8 days respectively (Araujo et al. 2018). Vase life was observed to be extended for up to 5 days using 1-Methylcyclopropene (1-MCP) as a plant growth regulator (Bayogan and Gratuito



FIGURE 3. Torch ginger in wedding bouquet, Honolulu, HI. (Prima Photographic 2017)

2015). A treatment of 1-MCP can extend vase-life, but breeding for improved stem water retention would also improve the structure and stability of the stem post-harvest.

A potential competitor for *Etilingera elatior* could be flowers from the Proteaceae family, which are commonly available on the cut flower market. Protea flowers have a similar structure to that of torch ginger, and have the same tropical aesthetic that torch ginger could provide for the market. Protea are also available in a similar variety of colors, ranging from orange to red to pink. Protea flowers also have a longer vase life, said to last up to 21 days at room temperature (Stephens et al. 2003). Another possible contender would be another member of the Zingiberaceae family, *Zinger spectabile* or beehive ginger. This plant is also known as shampoo ginger, due to the sudsy nectar that the flower produces at maturity (though it is different from the true shampoo ginger, *Zingiber zerumbet*). The nectar in itself makes the beehive ginger less attractive as a cut flower than torch ginger. Overall, the torch ginger has amazing potential as a cut flower.

Marketing Story:

Growing under a canopy of fragrant foliage, the Torch Ginger blossoms like a candle in the night. Found at the edge of tropical forests, this plant has delicate, perfumed flowers that add a tropical beauty to bouquets and arrangements. With colors ranging from deep magenta to a dainty sunset pink to a lacey white, the Torch Ginger acts as a centerpiece flower in arrangements, drawing onlookers' attention. It can be easily grown from rhizomes, allowing even beginners to produce this tropical beauty in their own backyard. Updated floral cultivars are estimated to be on the market within the next five years, while potted dwarf varieties that can add fragrance and beauty to your home are estimated to be on the market even sooner. Keep your eyes peeled for these delicate flowers.

IV. PRODUCT INFORMATION GUIDE (PIG) & CROP SCHEDULE

My personal proposal for an *Etilingera elatior* crop production system has been touched on throughout this paper, but I will summarize that information in a more concise way. *Etilingera elatior* would be best grown in a greenhouse environment with relatively high humidity and a constant temperature range of 26°C to 32°C (temperature range of *E. elatior*'s natural habitat during its peak growing season, January through April). The use of a timed shade system providing shade for up to half of the day will simulate the partial-shade of the forest floor that *E. elatior* is used to. Large containers of *E. elatior* would be best for greenhouse cultivation. Pots with a 2-3 ft diameter filled with an aerated humus-rich potting mix would be best for long term cultivation. Rhizome cultivation is ideal for large-scale production systems, and *E. elatior* grows rhizomes readily. From rhizome planting to first harvested flower, it takes 145 days (~21 weeks). This is if the flower is harvested semi-open, which is the recommended method for post-harvest longevity (Choresca et al. 2019). If flowers are harvested at full bloom, it would take 152 days (~22 weeks) from rhizome planting to first harvested flower. The full life-span from rhizome planting to cut flower wilt can be seen in Table 1.

	First shoot emergence	First inflorescence emergence	Semi-open harvesting range	Cut flower stored in cooler is below market value	Cut flower stored at room temperature is below market value
Days since rhizome planting	22	92	145-147	153	152

TABLE 1. *Etilingera elatior* timeline from first rhizome planting to first cut flower wilt (Choresca et al. 2019; Choon 2016).

When viewing this proposed production timeline, a grower must keep in mind that *Etilingera elatior* is a perennial plant and continues to produce flowers throughout the year. As mentioned prior, some cultivars can produce up to 120 flower stalks per year, though this

number is fully dependent on cultivar (Hoult and Marcsik 2000). Another thing to consider is that post-harvest longevity also relies on the cultivar in mention. Post-harvest longevity can be extended with a 1-Methylcyclopropene (1-MCP) treatment after harvest (ratio of treatment may also be dependent on cultivar, and further research is needed in this field) (Bayogan and Gratuito 2015). So far, the best cultivar in terms of flower stalk production and post-harvest longevity is “Thai Queen”, which excels in both fields. The white flowers of “Thai Queen” may not be ideal for most growers, but the potential for crossing it with other cultivars and wild varieties is high.

In terms of breeding programs, *E. elatior* fruit set has been shown to be higher with artificial cross pollination in comparison to natural pollination (Kunnath et al. 2013). This shows great potential for breeding programs. Growing *Etilingera elatior* from seed has not been researched as in-depth, because the ease of growing it from rhizomes has often made seed propagation a less satisfying process. It is, however, necessary for breeding programs. In previous studies, seeds have been sanitized multiple times using a 70% ethyl alcohol solution and then rinsed three times with DI water under constant agitation (Rodrigues et al. 2015). Seeds were then planted in a MS culture medium under a flow hood. Culture medium was supplemented with 8.88 μ M N-6-benzylaminopurine (BAP) to induce shoots. After shoot emergence, seedlings showed best growth once transferred to a 60% pinus bark, 30% vermiculite and 10% humus growth mix. Seedlings were then grown out in a growth chamber and transferred to the greenhouse. Seedlings in the greenhouse had similar if not better growth to those grown from traditional rhizomes. It is estimated that an extra year be added to the standard time to flowering if growing from seed (Choon 2016). It is also important to note that *Etilingera elatior* anthesis occurs between 5:30 and 6:30 am (Kunnath et al. 2013). This is a great basis for growth of *Etilingera elatior* from seed and could be utilized by breeding programs to help increase production value.

Whether you are a grower or a breeder, long term care of this perennial plant must be taken into consideration if growing this plant in a greenhouse year round. There is a gap in research when it comes to caring for *Etilingera elatior* long term, but a care plan would be easy to create and tweak as time goes on. Every grower will have their own opinions on how to care for long term production plants, but I will outline a potential care plan for *Etilingera elatior* given my personal opinion, drawing from sources of similar long term plant care. Well established plants would need to be repotted every one to two years, with fresh soil. If the grower does not wish to increase the pot size, excess rhizomes can be harvested from plants during repotting to allow mother plants more room to grow. The excess rhizomes can then be repotted for a new generation of flower producers. Plants should be watered daily with a diluted fertilizer mix, though there is area for research on what ratio of nutrients *Etilingera elatior* prefers. There is also an area for research on common pests and diseases of *Etilingera elatior* in a greenhouse environment, and a proper pest control plan would need to be developed once there is more documented information on the subject. Diseases in the greenhouse could be mitigated with standard biosecurity.

Etilingera elatior post-harvest flower care is something that everyone along the distribution line (Fig.4) must take care of, including consumers. As mentioned prior, vase-life of *Etilingera elatior* can be extended up to 5 days using 1-MCP treatment. This gives most flowers an average vase-life of 9-11 days, varying with cultivar, harvesting method, and storage environment. The supply chain for torch ginger would need to be relatively short so that consumers would have access to the best quality flowers. Refrigerated transport would be necessary and transport would need to be incredibly rushed so that the product would still be

sellable to consumers while also giving consumers enough time to enjoy the flower in a vase or arrangement.

In conclusion, *Etilingera elatior* or torch ginger has great potential as a cut flower crop. Breeding programs based on improving *Etilingera elatior* post-harvest longevity and per-plant flower production are highly recommended to ensure that torch ginger sweeps the cut flower market. Research on photoperiod flowering response in torch ginger as well as research on common pests and diseases in protected environments would also be recommended before large scale production of this flower commences.

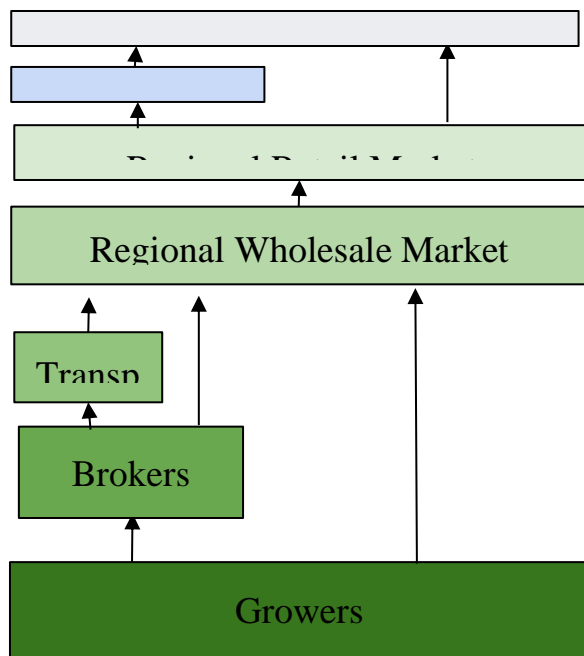


FIGURE 4. Proposed *Etilingera elatior* consumer chain. International sales not recommended based on the short lifespan of post-harvest flowers.

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