

Research Note

AMORPHOPHALLUS PAEONIIFOLIUS (DENNST.) NICOLS. (ARACEAE: LILIOPSIDA): BOTANICAL CURIOSITY IN PUERTO RICO^{1,2}

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The genus *Amorphophallus* Blume: Decne (family Araceae, the aroids) comprises some 170 tropical species distributed from West Africa to Polynesia. Members of this genus are herbaceous with an underground tuber or corm-like rhizome, and are typical lowland plants of secondary forests or disturbed spots in primary forests and forest ecotones in the paleotropics (Hettterscheid and Ittenbach, 1996). One of the most peculiar species of the group is *A. titanum* (Becc.) Becc., which produces the largest inflorescence in the plant kingdom. This plant is also known as the “gas mask plant” and the “corpse plant” because of the strong fetid odor produced by the inflorescence to attract flies to carry out pollination. The diverse scents produced by *Amorphophallus* have been studied chemically by Kite and Hettterscheid (1997).

Biological aspects of *Amorphophallus*, such as taxonomy, pollination, cultivation, and ecology, were treated in further detail by Pijl (1937), Hettterscheid and Ittenbach (1996), Singh and Gadgil (1996), Hettterscheid (1995, 1997, 1999), and the International Aroid Society (2001). Because of its bizarre appearance and its curious life cycle, the species *Amorphophallus paeoniifolius* (Dennst.) Nicols. (syn. *A. campanulatus* Decne) is occasionally planted as a botanical curiosity, but has not been reported in Puerto Rico. Thus, the purpose of this work is to document the cultivation of this species on the island.

Amorphophallus paeoniifolius has a solitary leaf up to 1 m long on a dark greenish, pale-spotted stalk. The purple and green white-spotted spathe, up to 25 cm across, has a protruding spadix with a very large, spongy and furrowed deep purple terminal knob. Pollen of *A. paeoniifolius* is 1.17 to 1.25 × 0.83 to 1.25 µm, globose, subglobose to broadly ellipsoidal, very pale yellow to hyaline, tectate-reticulate monosulcate, and thin-walled. *Amorphophallus paeoniifolius* is a common native species throughout Asia (especially tropical Asia), Australasia, Polynesia (Hettterscheid and Ittenbach, 1996), and has been introduced into Madagascar. The habitat is described as a loose leafy detritus in moist shady deciduous forest.

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This aroid is widely used as pig food but also as a secondary food crop in times of famine. An aroid specialist, Dr. Wilbert L. A. Hettterscheid (personal communication), explained that this plant contains high amounts of carbohydrates (e.g., glucomannan). In India, *A. paeoniifolius* is known as "Suran," and it is used as food. In Samoa, *A. paeoniifolius* is known as "Teve". Other names for the species are "Elephant yam" and "Telingo potato". This species has been found in cans in grocery stores in the United States (West Palm Beach Indian grocer). *Amorphophallus paeoniifolius* has shown an impressive survival ability under harsh conditions. For instance, after six-week dehydration in a mailbox, followed by a week of soaking in tap water to rehydrate, a corm broke dormancy after about four to five months.

We observed a cultivated individual of *A. paeoniifolius* at "La Finca de los Hibiscos" (LFH) located at Road 106, km 5.3 interior, Barrio Quemado, Mayagüez, Puerto Rico, property of Mrs. Elizabeth Acevedo. This farm is approximately 230 m above sea level and the general environment of the region is classified as a subtropical moist forest (Ewel and Whitmore, 1973). The rainy season in Puerto Rico ranges from May to June and August to September, with two rainfall peaks. Annual average rainfall in the western interior (including Mayagüez) is about 1,780 to 2,540 mm (Ravalo et al., 1986). According to 'Atmos Carib-Caribbean Atmospheric Research Center' at University of Puerto Rico-Mayagüez Campus, the annual average climatic conditions for Mayagüez from 2000 to 2001 were temperature, 24.8°C; relative humidity, 78.2%; pressure, 760.1 mm Hg; dew point, 20.3°C; heat index, 24.9°C; wind speed, 0.61 m/s; wind direction, 49.5 degrees.

The geologic formation of LFH (Maricao Formation, Kmr) was created by Curet (1986). Soils of LFH are classified as Humatas (HmD2, HmE2) and Consumo Clays (CoF2) (U.S. Department of Agriculture, 1993). The soil where *A. paeoniifolius* grows is slightly to moderately alkaline (pH = 8.0), dusky red (10R 3/3 to 3/4) to dark red (10R 3/6), has a very low percentage of water-holding capacity (0.59 to 1.0%), low humic content, although a medium to high content of organic matter. Soil color nomenclature was given according to 1994 Munsell Soil Color Charts. Macro- and micronutrients were measured by using the semi-quantitative kits: The Science Source Chemical Composition of Soil (#2000) and La Motte Soil Humus Test Kit (code 5542). Nitrogen in nitrates (NO_3^-), nitrites (NO_2^-) and in ammonium ions (NH_4^+), carbon in carbonates (CO_3^{2-}), potassium K^+ , sulfur in sulfates (SO_4^{2-}), and the micronutrient iron Fe^{2+} , Fe^{3+} are extremely low (or absent) in this kind of soil. However, the macronutrients magnesium Mg^{2+} , phosphorus in phosphates (PO_4^{3-}), and calcium Ca^{2+} are weakly or moderately present in this soil.

According to Mrs. Acevedo, Prof. Felipe Osborne (professor of Physics, retired, University of Puerto Rico at Aguadilla) brought *A. paeoniifolius* to Puerto Rico from a trip to Indonesia in 1991 and gave a corm to her. Mrs. Acevedo quickly planted the aroid directly into the ground on a shady bank of the property in an area surrounded by ferns of the genus *Nephrolepis*. After planting, the aroid took several years to emerge. The leaf (vegetative phase) appeared first, then disappearing before the formation of the inflorescence (reproductive phase). This cycle is completed biannually (one year for the vegetative phase, the other for the reproductive phase, and so on). According to Mrs. Acevedo, *A. paeoniifolius* has flowered three different years (1997, 1999, and 2001) since she planted it. She neither irrigated nor fertilized the soil where the corm was planted.

No data is available for the first inflorescence of *A. paeoniifolius* in May 1997. In its second flowering in 1999 the reproductive bud of the aroid was visible by mid April; by May 14 in the afternoon, the inflorescence opened, and on May 18 anthesis ended (Acevedo, personal observation). On July 17, 2000, a leaf (that lasted approximately a month) was about 132 cm long, with a leaf base 175 cm long and 25.4 cm DBH. The most recent flowering of *A. paeoniifolius* at LFH occurred April 17 (emergence of the bud); and May 7 to 17 (young inflorescence); May 18 (odor began after rainfall); May 20 (inflorescence at

anthesis); to May 22, 2001 (after anthesis). Complete inflorescence development (between the emergence of the bud until full bloom) took five weeks. The inflorescence was short lived, two days. A week after it was fully open, colors of the spathe and spadix started to become dull.

The intense fetid odor was somewhat similar to that of rotten meat and was perceivable for three to four days. The odor of *A. paeoniifolius* has a simple chemical composition, consisting mainly of dimethyl oligosulphides (Kite and Hetterscheid, 1997). Curiously, dimethyl oligosulphides have also been found to be responsible for the foul stench in the stinkhorn fungus *Phallus impudicus* Pers. (Phallaceae) (Borg-Karlson et al., 1994). We found that odor time for *A. paeoniifolius* coincides with that reported by Kite and Hetterscheid (1997), between 5:30 to 7:30 p.m. Apparently, the production of odors containing dimethyl oligosulphides (dimethyl disulphide, 47%; dimethyl trisulphide, 41%; dimethyl tetrasulphide, 4%) is a common feature of sapromyophilous flowers that attract insects (Kite and Hetterscheid, 1997). Insects such as the carrion beetle *Diamesus osculans* Vigors (Coleoptera: Silphidae) and the scarab beetle *Ardoretus* sp. (Coleoptera: Scarabaeidae) have been reported in spathes of *A. titanum* and *A. paeoniifolius* (Kite and Hetterscheid, 1997). We found the coffee ant *Myrmelachista ramulorum* Wheeler, the little fire ant *Wasmania auropunctata* (Roger) (Hymenoptera, Formicidae), the common house fly *Musca domestica* L. (Diptera: Muscidae), and the blow fly *Phaenicia* sp. (Diptera: Calliphoridae) in the spathe of *A. paeoniifolius*.

The successful propagation and maintenance of *A. paeoniifolius* at LFH demonstrates the feasibility of growing this interesting genus in Puerto Rico without special greenhouse conditions. To our knowledge, *Amorphophallus titanum* has never been grown on the island and should be the next species of the group to be propagated. Such material will be of interest to students and researchers in the fields of taxonomy, tropical ecology, plant physiology, pollination biology, biochemistry, and horticulture, as well as for the general public interested in tropical and subtropical plants.

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