UF IFAS Extension UNIVERSITY of FLORIDA

EENY-062

Polydamas Swallowtail, Gold Rim, Tailless Swallowtail, *Battus polydamas lucayus* (Rothschild & Jordan) (Insecta: Lepidoptera: Papilionidae: Troidini)[1]

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Introduction

The Polydamas swallowtail is one of only two US swallowtails of the genus *Battus*. It is our only US swallowtail without tails (Figure 1).

Figure 1. Polydamas swallowtail (*Battus polydamas lucayus* [Rothschild & Jordan]).
Credits: Donald W. Hall, UF/IFAS

Nomenclature

The Polydamas swallowtail was originally described and named *Papilio polydamas* by Linnaeus but was later transferred to the genus *Battus* (Scopoli 1777) and selected as type species of the genus by Lindsey (1925).

The name *Battus* is from Battus I, founder of the ancient Greek colony Cyrenaica and its capital, Cyrene, in Africa. The specific epithet *polydamas* is from Polydamas, a character from Greek mythology (Opler and Krizek 1984).

Larvae of the Polydamas swallowtail and those of the other swallowtails belonging to the tribe Troidini feed exclusively on plants in the genus *Aristolochia* and are commonly referred to as the *Aristolochia* swallowtails.

Distribution

In the United States, *Battus polydamas lucayus* occurs as a regular resident in peninsular Florida and the Florida Keys, and occasional strays wander to other Gulf states and as far north as Missouri and Kentucky (Scott 1986). Subspecies *polydamas* occurs in southern Texas (Figure 2) (dos Passos 1940).

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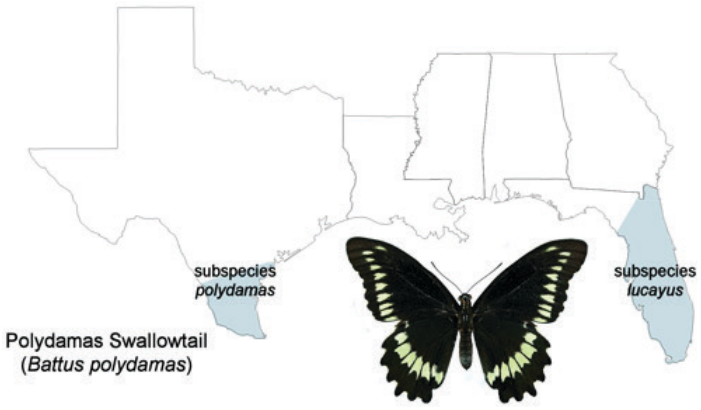

Figure 2. Polydamas swallowtail, (*Battus polydamas lucayus* [Rothschild & Jordan]), United States distribution map.
Credits: Donald W. Hall, UF/IFAS (Based on dos Passos 1940, Minno et al. 2005, Opler and Krizek 1984, Scott 1986)

Description

Adults

The wingspread range is 9.2–11.6 cm (approx. 3.6–4.6 in) (Opler and Malikul 1998). Females are larger than males. The upper surface of the wings is black with submarginal yellow bands and marginal yellow spots. The underside of the wings is black with a submarginal row of yellow spots on the front wing, and a submarginal row of wavy red lines and a marginal row of yellow spots on the hind wing. The body of the adult is black with red dots dorsally on the anterior part of the thorax and red-orange dots laterally on the thorax and coxae. A reddish-orange lateral line runs the length of the abdomen (Figure 3).

Figure 3. Adult Polydamas swallowtail, (*Battus polydamas lucayus* [Rothschild & Jordan]), dorsal (top) and ventral (bottom) views.
Credits: Donald W. Hall, UF/IFAS

The yellow bands of *lucayus* are wider than those of subspecies *polydamas*, and the underside of the hindwing of subspecies *lucayus* is paler than that of subspecies *polydamas* (Rothschild and Jordan 1906).

Battus males have androconia (scent scales) hidden in a fold of the inner margin on the upper surface of the hind wing (Field 1938) (Figure 4). The scales are fluted—possibly to increase the surface area for release of pheromones (Miller 1987, Racheli and Oliverio 1993). When courting, males "helicopter" around the females while fanning the androconial chemicals over them (Tyler et al. 1994, p. 53).

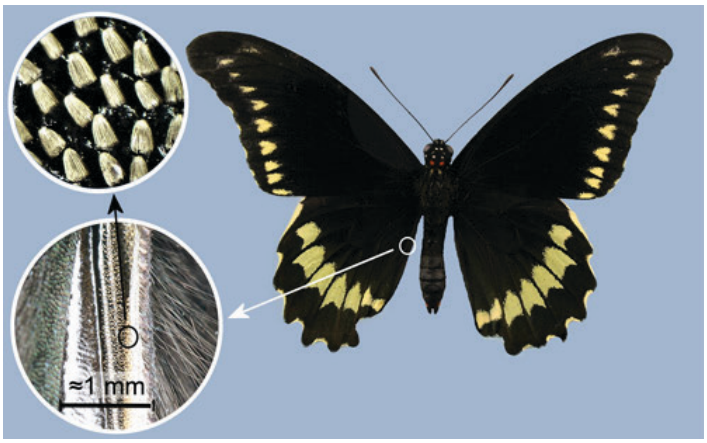

Figure 4. Male Polydamas swallowtail, (*Battus polydamas lucayus* [Rothschild & Jordan]), showing location of androconia (scent scales) along vein on the inner margin of the hind wing. Insets: magnified area of vein (lower left) and androconia (upper left).
Credits: Donald Hall, UF/IFAS

Eggs

Eggs are approximately 1 mm in diameter and vary from yellow to orange—appearing slightly greenish as they mature—due to the developing larvae that show through the egg shell (Figure 5). Eggs of our other US *Battus* species (*Battus philenor* [L.]) are reddish-orange.

Figure 5. Polydamas swallowtail (*Battus polydamas lucayus* [Rothschild & Jordan]), eggs on leaf (left) and stem (right).
Credits: Donald W. Hall, UF/IFAS

The eggs of all *Aristolochia* (troidine) swallowtails are partially covered by a hard, nutritious secretion that is usually laid down in vertical bands (Comstock and Grimshawe 1935, Tyler et al. 1994). There are numerous relatively large droplets on the bands. The secretion is produced by a large gland that lies above the female's ovipository duct (Tyler et al. 1994).

Larvae

Full-grown larvae are approximately 5.3 cm (approximately 2.1 in) in length (Minno et al. 2005). Detailed descriptions of the larval instars were given by Brown et al. (1980[81]) and Comstock and Grimshawe (1935).

First instar larvae are tan and have numerous small tubercles, each bearing a single hair (Figure 6). After molting to the second instar, larvae are dark brown and have larger tubercles, each bearing numerous hairs (Figure 6).

Figure 6. Polydamas swallowtail (*Battus polydamas lucayus* [Rothschild & Jordan]), first (bottom) and second (top) instar larvae.
Credits: Donald W. Hall, UF/IFAS

The cuticle of second instar larvae has a rough-textured appearance (Figure 6), whereas the cuticle of third (and subsequent) instars appears smoother and somewhat glossy (Figure 7).

Figure 7. Polydamas swallowtail (*Battus polydamas lucayus* [Rothschild & Jordan]), third instar larvae. Note smooth, glossy cuticle.
Credits: Donald W. Hall, UF/IFAS

Full-grown larvae are variable in color, ranging from dark brown with black-tipped, orange tubercles to light tan with pale tubercles (Figure 8). The cuticle also has a pattern of darker lines that may be difficult to see in the darkest specimens (Figure 8, bottom image). Lighter-colored specimens are less common.

Figure 8. Polydamas swallowtail (*Battus polydamas lucayus* [Rothschild & Jordan]), full-grown larvae (fifth instars) showing some of the color variation.
Credits: Donald W. Hall, UF/IFAS

Pupae

Pupae may be either brown or green (Figure 9).

Figure 9. Polydamas swallowtail (*Battus polydamas lucayus* [Rothschild & Jordan]), green and brown pupae.
Credits: Donald W. Hall, UF/IFAS

Life Cycle

Polydamas swallowtails have many flights all year in southern Florida and southern Texas, but they are rare during the winter northward. They favor open woods, gardens, and

disturbed areas (Brown et al. 1980[81], Spade et al. 1988). Volatiles from the pipevine host plants may aid females in their search for oviposition sites (Pinto et al. 2009b). Eggs are laid preferentially on plants in sunny areas even though survival of larvae is greater in shady areas (Rausher 1979).

Eggs are laid in small groups on stems or less frequently on new leaves (Figure 5) of pipevines (*Aristolochia*: Aristolochiaceae). In Lepidoptera eggs, a small quantity of yolk remains trapped between two of the embryonic membranes (amniotic and serosa) that remain inside the egg shells after hatching (Barbier and Chauvin 1976, Richards and Davies 1977 [p.337]). Soon after hatching, larvae eat the egg shells (Figure 10), and the residual embryonic yolk and the secretion on the outside of the eggs (Moss 1919, Tyler et al. 1994, p. 113) serve as their first meal. Larvae also eat their exuviae (old exoskeleton) after each molt to conserve nutrients (Figure 11).

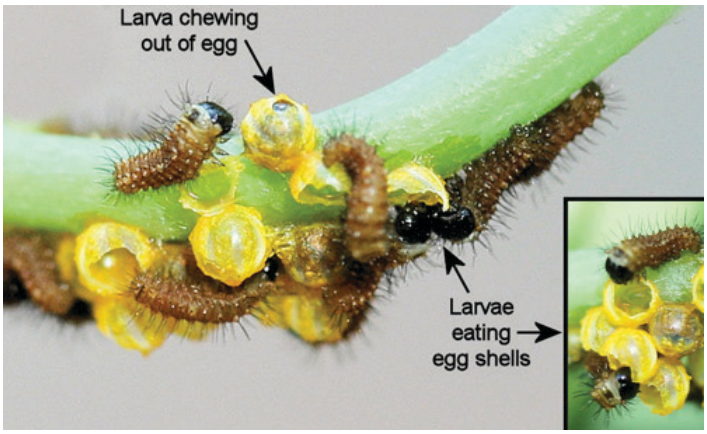

Figure 10. Polydamas swallowtail (*Battus polydamas lucayus* [Rothschild & Jordan]), newly emerged larvae eating egg shells (chorions).
Credits: Donald W. Hall, UF/IFAS

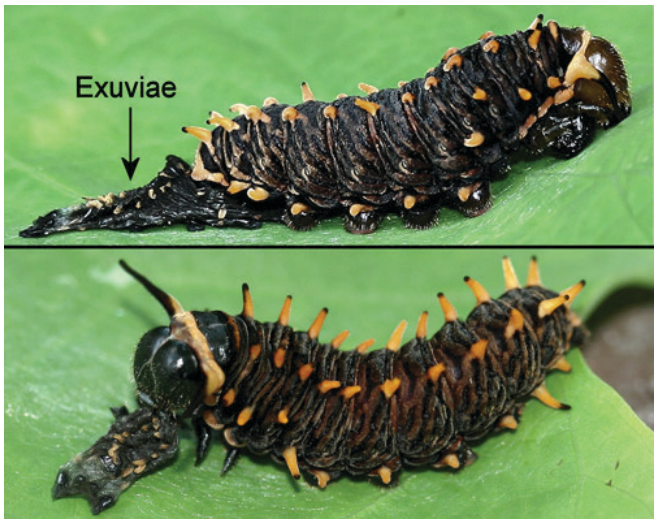

Figure 11. Polydamas swallowtail (*Battus polydamas lucayus* [Rothschild & Jordan]). Fifth (last) instar larva immediately after molting (top) and eating exuviae (bottom).
Credits: Donald W. Hall, UF/IFAS

Young larvae feed on the tender new leaves and young stems. Older larvae will also eat the older leaves, stems, and flowers of the host plants. The aristolochic acids of the host plants may serve as feeding stimulants (Pinto et al. 2009a). Young larvae are gregarious (Figure 12), but become solitary as they mature. Sometimes hosts are completely defoliated, and larvae may find new hosts by detecting volatiles from nearby plants (Pinto et al. 2009b).

Figure 12. Polydamas swallowtail (*Battus polydamas lucayus* [Rothschild & Jordan]).
Credits: Donald W. Hall, UF/IFAS

Full-grown larvae typically migrate away from the host plant for pupation. In preparation for pupation, they attach by their terminal set of prolegs to silk pads spun on the new substrate and hang by silk girdles also attached to the substrate (Figure 13).

Figure 13. Polydamas swallowtail (*Battus polydamas lucayus* [Rothschild & Jordan]). Prepupae clinging to silk pads with their terminal prolegs and hanging by silk girdles.
Credits: Donald W. Hall, UF/IFAS

Shortly before emergence, the patterns of the adult wings and body show through the pupal exoskeleton (Figure 14).

Figure 14. Polydamas swallowtail (*Battus polydamas lucayus* [Rothschild & Jordan]). Preadult with wing and body patterns showing through pupal exoskeleton.
Credits: Donald W. Hall, UF/IFAS

Adults usually emerge in the morning and are ready to fly by afternoon (Brown et al. 1980[81], Moss 1919). After emergence, the adult remains near the pupation site while its wings expand and dry (Figure 15). During this time, it also voids the reddish, liquid meconium (waste products from the breakdown of old larval tissues during the pupal stage) from its anus.

Figure 15. Polydamas swallowtail (*Battus polydamas lucayus* [Rothschild and Jordan]). Recently emerged adult drying its wings.
Credits: Donald W. Hall, UF/IFAS

Comstock and Grimshawe (1935) give the following developmental times:

Egg stage: four to six days—average five days at 80 degrees

Larval stage: 19–24 days—average 24 days at 78 degrees and 19 days at 86 degrees (early instars molt approximately every four days)

Pupal stage: average 18 days (temperature not specified)

Host Plants

Larval host plants: Troidine swallowtail larvae feed exclusively on plants belonging to the genus *Aristolochia* (Aristolochiaceae) (Urzúa & Priestap 1985), often called Dutchman's pipes or simply pipevines because the flowers of some species are shaped like tobacco pipes (Figure 16).

Figure 16. Unopened flower bud of woolly pipevine, *Aristolochia tomentosa* Sims, and tobacco pipe graphic showing the similarity of shapes.
Credits: Photograph of flower bud by Donald W. Hall, UF/IFAS. Tobacco pipe graphic from PNG Clip Art (graphic modified and pasted into photograph by Donald W. Hall, UF/IFAS)

Battus polydamas larvae can likely develop on most (if not all) of the Neotropical and temperate *Aristolochia* species (Lambremont 1954, Masters 1967, Mega et al. 2015, Minno et al. 2005, Scott 1986, Weintraub 1995). However, local populations may differ in how well they develop on a given *Aristolochia* species (Rios et al. 2016).

Uses of Aristolochia species in traditional medicine: *Aristolochia* species are also known as birthworts ("wort" is Old English for herbaceous plant) because of their historic use in child birth. The name *Aristolochia* is from the Greek roots "aristos" (best) and "lochia" (delivery or child birth) (Crosswhite and Crosswhite 1985, Flora of North America). All members of the family Aristolochiaceae are believed to contain the pharmacologically active aristolochic acids (Chen and Zhu 1987).

Aristolochic acids in herbal medicine products have been implicated as causative agents of renal toxicity and also may be carcinogenic (Heinrich et al. 2009, Schaneberg et al. 2002). An extract of the southwestern pipevine, *Aristolochia watsonii* Wooton & Standl., was the main ingredient in the snakeroot oil sold by traveling "snakeroot doctors" at medicine shows in the Old West during the 19th century (Crosswhite and Crosswhite 1985).

Although they are now officially banned in many countries, *Aristolochia*-derived herbal products or parts of the plants themselves are still used in many areas of the world to treat various conditions, including snake bite, gastrointestinal problems, respiratory problems, wounds, infectious diseases, and fever (Chen and Zhu 1987, Schaneberg et al. 2002). *Aristolochia serpentaria* L. (Figure 17), which ranges from central Florida northward in much of the eastern United States, has been used for many medical applications (Heinrich et al. 2009, Moerman 1998).

Figure 17. Virginia snake root (*Aristolochia serpentaria* L.), a host of the polydamas swallowtail (*Battus polydamas lucayus* [Rothschild and Jordan]) larva.
Credits: Donald W. Hall, UF/IFAS

The host for the Polydamas swallowtail in the Florida Keys is probably Marsh's Dutchman's pipe, *Aristolochia pentandra* Jacq. (Comstock and Grimshawe 1935, Minno and Emmel 1993). In New Orleans (von Reisenstein 1863) and Arkansas (Masters 1967), larvae have been recorded from *Aristolochia serpentaria*.

The native pipevines, woolly pipevine (*Aristolochia tomentosa* Sims) (Figure 18) and Dutchman's pipe (*Aristolochia macrophylla* Lam.—synonyms: *Aristolochia durior* Hill and *Aristolochia sipho* L'Heritier, Stirp.) (Figure 19), are sometimes planted in Florida (south of their native ranges) and are used as hosts by *Battus polydamas* larvae.

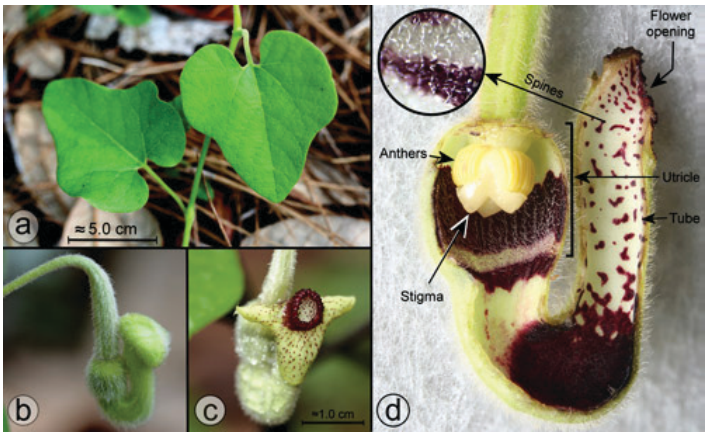

Figure 18. Woolly pipevine (*Aristolochia tomentosa* Sims), a host of the Polydamas swallowtail (*Battus polydamas lucayus* [Rothschild & Jordan]) caterpillar. a) foliage; b) unopened flower bud; c) opened flower; d) longitudinal section through flower showing internal structure.
Credits: Donald W. Hall, UF/IFAS

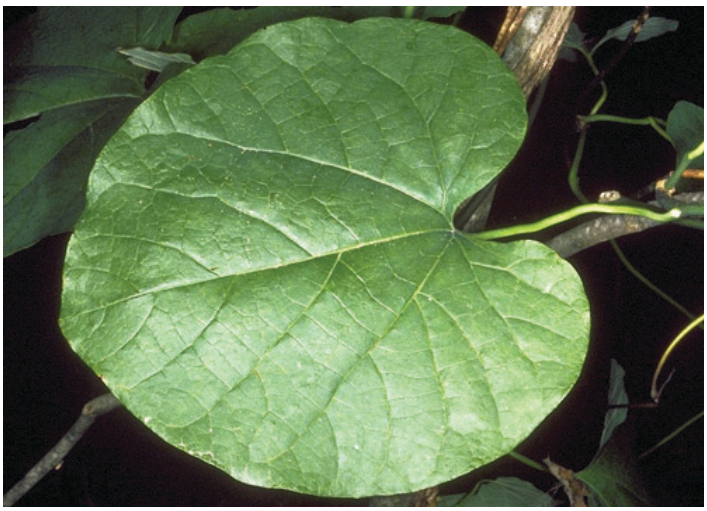

Figure 19. Dutchman's pipe (*Aristolochia macrophylla* Lam. [synonyms: *Aristolochia durior* Hill and *Aristolochia sipho* L'Heritier, Stirp.]), a host of the Polydamas swallowtail (*Battus polydamas lucayus* [Rothschild & Jordan]) caterpillar. Photographed at Cascade Falls trail, Giles County, Virginia.
Credits: Donald W. Hall, UF/IFAS

In addition to native species, various exotic ornamental pipevines (e.g., elegant Dutchman's pipe or calico flower, *Aristolochia elegans* M.T. Mast [synonym: *Aristolochia littoralis* Parodi]) (Figure 20) and *Aristolochia gigantea* Mart. and Zucc. (Figure 21) are also cultured in Florida and are commonly used by *Battus polydamas* larvae for hosts. Often the larvae become pests by defoliating the vines and eating the flowers. Unfortunately, *Aristolochia elegans* (and possibly some of the other exotic pipevines) may be a death trap for our other native troidine

swallowtail, *Battus philenor* (L.). Female *Battus philenor* readily oviposit on *Aristolochia elegans*, but most of the larvae cannot survive on it (Scott 1986, Tyler 1975). Therefore, planting of *Aristolochia elegans* is not recommended where *Battus philenor* occurs (central Florida and northward).

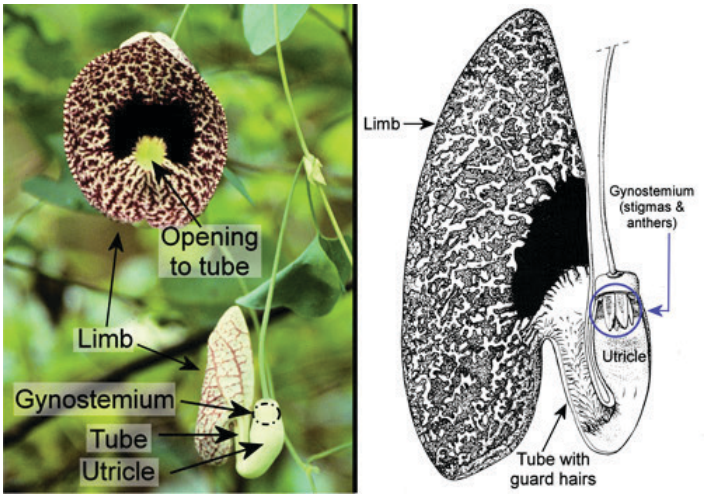

Figure 20. Elegant Dutchman's pipe or calico flower, *Aristolochia elegans* M.T. Mast [synonym: *Aristolochia littoralis* Parodi]), a host of the Polydamas swallowtail (*Battus polydamas lucayus* [Rothschild & Jordan]) caterpillar.
Credits: Donald W. Hall, UF/IFAS; drawing of longitudinal section of flower by Margo Duncan

Figure 21. *Aristolochia gigantea* Mart. & Zucc., a host of the Polydamas swallowtail (*Battus polydamas lucayus* [Rothschild & Jordan]) caterpillar.
Credits: Donald W. Hall, UF/IFAS. (Flowers of the Brazilian form of *Aristolochia gigantea* have long lobes [Minno et al. 2005])

Aristolochia pentandra, *Aristolochia tomentosa*, and *Aristolochia macrophylla* are vines (Pfeifer 1966) with flattened seeds. The seeds are probably dispersed by wind and possibly also by flowing water and animals. Two Russian *Aristolochia* vines with similar seeds that grow in similar habitats have been shown to be primarily dispersed by wind and water and to a lesser extent by birds (Nechaev and Nakonechnaya 2009). *Aristolochia serpentaria* is a small herb. Its seeds have an attached oil body (elaiosome) and are dispersed by ants, which collect the seeds for the edible elaiosomes (D. W. Hall, personal observation).

Aristolochia species have fascinating pollination biologies (Proctor et al. 1996). When the flowers first open, the stigmas are receptive, but the anthers are not releasing pollen—a phenomenon known as protogyny (from the Greek roots **proto** [first] and **gyne** [female]). During the first day of bloom, the flowers are attractive usually to small flies (often but not always scuttle flies in the family Phoridae [Hall and Brown 1993]), which enter the flowers carrying pollen from another flower. The flies are then prevented from leaving by the presence of downward projecting guard hairs or tiny spines and slippery surfaces in the tube of the flower (Proctor et al. 1996, Zomlefer 1994) (Figures 18 and 20).

On the second day (after pollination), the stigmas become nonreceptive, and the anthers dehisce (open), releasing pollen, which becomes attached to the flies. The guard hairs in the flower tubes wither (and in some species [e.g., *Aristolochia grandiflora*] the flowers also droop into a more horizontal position [Burgess et al. 2004]), releasing the flies that are now carrying the new pollen.

Nectar host plants: *Battus polydamas* adults feed on nectar from a variety of flowers and are reported to be particularly fond of the flowers of the common exotic weed *Lantana camara* L. (Opler and Krizek 1984) (Figure 22).

Figure 22. Orange (top) and pink (bottom) varieties of the invasive exotic *Lantana camara* L., a favored nectar host plant for the Polydamas swallowtail, *Battus polydamas lucayus* (Rothschild & Jordan). Note new, light-colored flowers on interior of clusters.
Credits: Donald W. Hall, UF/IFAS

The new flowers of *Lantana camara* are in the center of the flower cluster. They are lighter in color (shades of yellow) and produce nectar. After pollination, they turn a darker color (pink or red), they stop producing nectar and flower volatiles, and the stigmas become unreceptive (Raguso and Weiss 2015, Ram and Mathur 1984, Weiss 1991, Weiss 1997). Butterflies learn to visit only the lighter-colored, nectar-producing flowers. However, the old flowers (now on the outer rings of the cluster) remain on the plant—possibly to make the larger flower cluster more attractive to new pollinators and to provide a landing platform for larger pollinators (e.g., butterflies).

Lantana camara is listed as a Category 1 invasive on the Florida Exotic Pest Plant Council's 2015 List of Invasive Plant Species (accessed 11 February 2022). Therefore, this species should not be planted.

Flower Gardens

Minno and Minno (1999) have extensive lists of both native and exotic nectar plants for butterflies. When possible, native plants should be planted as nectar sources rather than exotics that have the potential to be invasive.

Most states have native plant societies that are valuable sources of information on native plants and many also hold native plant sales. For Florida and the Deep South, (http://www.floridawildflowers.com/) (Accessed 23 March 2020) is an excellent source of information and also has wildflower seeds for purchase.

To maximize butterfly populations in yards and gardens, both caterpillar hosts and nectar plants for adults should be planted. The choice of which one(s) to plant is dependent on locality.

Medicinal Uses

Larvae of the *Aristolochia* swallowtails sequester aristolochic acids and secondary metabolites from their host plants (Priestap et al. 2012). An alcoholic extract (usually in rum) of *Battus polydamas* larvae (that have fed on *Aristolochia trilobata* L.) has been used as a medicinal product, known as Chiniy-trèf, on the Caribbean island of Martinique (Cachet et al. 2016, Nossin & Weniger 2008) (**Figure 23),** but its sale is now prohibited.

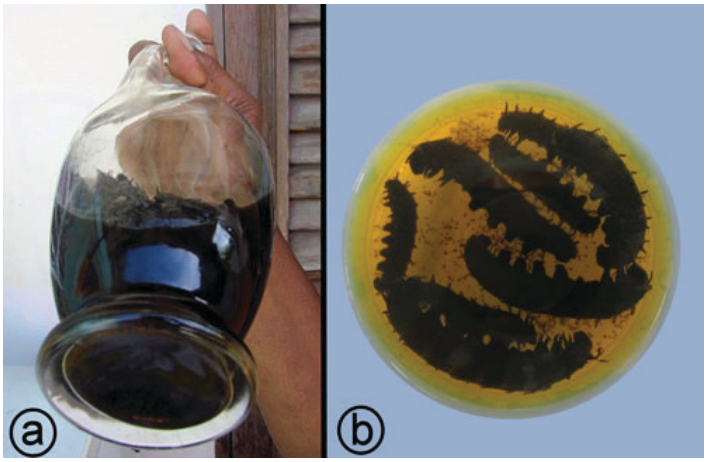

Figure 23. Chiniy-trèf, an alcoholic extract of *Battus polydamas* larvae. a) batch preparation; b) sample, showing larvae.
Credits: a) Emmanuel Nossin, Hôpital du Lamentin, Service Pharmacie, Martinique; b) Cécile Bottai, Faculty of Pharmacy, Paris Descartes University, Paris, France

Defenses

Eggs

Young (1973), in a discussion of another *Aristolochia* swallowtail (*Parides arcas mylotes* Bates), stated that it is unknown whether the secretion on the outside of the eggs may be defensive against ants and other potential predators. The fact that the brightly colored secretion (Figure 24) makes the eggs conspicuous suggests a possible aposematic (warning) function.

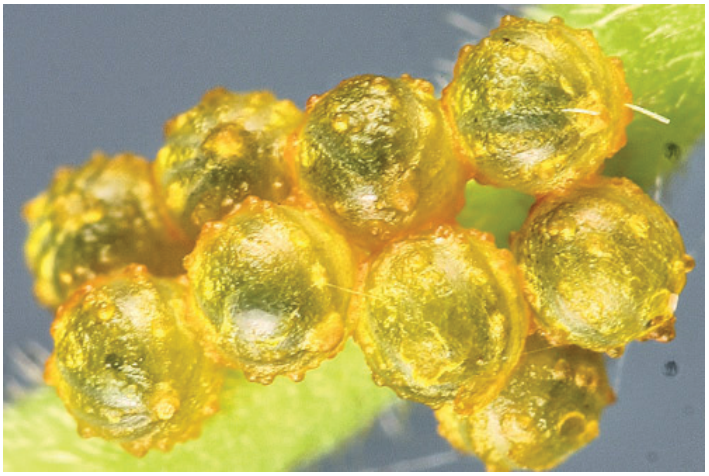

Figure 24. Polydamas swallowtail (*Battus polydamas lucayus* [Rothschild & Jordan]). Eggs showing detail of brightly colored secretion.
Credits: Donald W. Hall, UF/IFAS

Larvae, Pupae, and Adults

Larvae of the *Aristolochia* swallowtails sequester aristolochic acids from their host plants, and concentrations in their tissues are probably due to the relative concentrations in the host plants (Urzúa and Priestap 1985). Also, the aristolochic acids (and possibly other *Aristolochia* phytochemicals [Morais et al. 2013]) render larvae, pupae, and

adults unpalatable to many natural enemies. This chemical defense is enhanced in adults by their bright aposematic (warning) coloration. Pupae resemble green or brown leaves and likely gain more protection from their cryptic coloration than from chemical defenses.

In laboratory studies, *Battus polydamas* larvae were repellent to domestic chickens (*Gallus gallus domesticus* [L.]) and the carpenter ant *Camponotus crassus* Mayr but not to the assassin bug *Montina confusa* Stål (Morais et al. 2013). In a field study, adult mortality of *Battus polydamas* was low—a result attributed to low predation rates by birds (Young 1972).

Adults of two other *Aristolochia* swallowtails, *Battus philenor* and *Parides neophilus* (Geyer), have been shown to be chemically defended against caged birds (Brower 1958, Brower and Brower 1962, Brower and Brower 1964).

All swallowtail larvae have eversible organs (osmeteria) on the anterior margin of the prothorax. The osmeterium of the Polydamas swallowtail is bright orange (Figure 25). The bright coloration of the osmeterium may startle potential predators. The osmeterium was ineffective against the attack of an ovipositing ichneumonid wasp, *Areoscelis rufa* Brullé (Tyler et al. 1994, Plate 6).

Figure 25. Polydamas swallowtail (*Battus polydamas lucayus* [Rothschild & Jordan]). Larva with osmeterium extruded.
Credits: Donald W. Hall, UF/IFAS

The osmeterial secretions of all other swallowtails that have been examined (species belonging to the tribes Graphiini and Papilionini of the subfamily Papilioninae and to the subfamily Baroniinae) are composed of isobutyric and 2-methylbutyric acids (Eisner et al. 1971). However, *Battus polydamas* (Papilioninae: Troiidini) secretes the two sesquiterpenes selin-11-en-4α-ol and β-selinene (Eisner et al. 1971) in addition to aristolochic acids (Priestap et al. 2012).

Prepupae retain the ability to evert the osmeteria right up to the time of pupation (Figure 26).

Figure 26. Polydamas swallowtail (*Battus polydamas lucayus* [Rothschild & Jordan]). Prepupa with osmeterium extruded (Note silk girdle [arrow] suspending prepupa).
Credits: Donald W. Hall, UF/IFAS

The reddish-orange bands on the abdomen of adults (Figure 27) contain glands that secrete an acrid odor when the butterflies are pinched (Tyler 1975, p.155).

Figure 27. Polydamas swallowtail (*Battus polydamas lucayus* [Rothschild & Jordan]) showing reddish-orange bands on abdomen.
Credits: Donald W. Hall, UF/IFAS

Acknowledgments

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