

CAPS Datasheets provide pest-specific information to support planning and completing early detection surveys.

## *Paysandisia archon*

### Scientific Name

*Paysandisia archon* (Burmeister, 1880)

### Synonyms:

*Castnia archon* Burmeister, 1879

*Castnia josepha* Oberthür, 1914

### Common Names

South American palm borer, castniid  
palm borer, palm borer moth

### Type of Pest

Moth, borer

### Taxonomic Position

**Class:** Insecta, **Order:** Lepidoptera,

**Family:** Castniidae

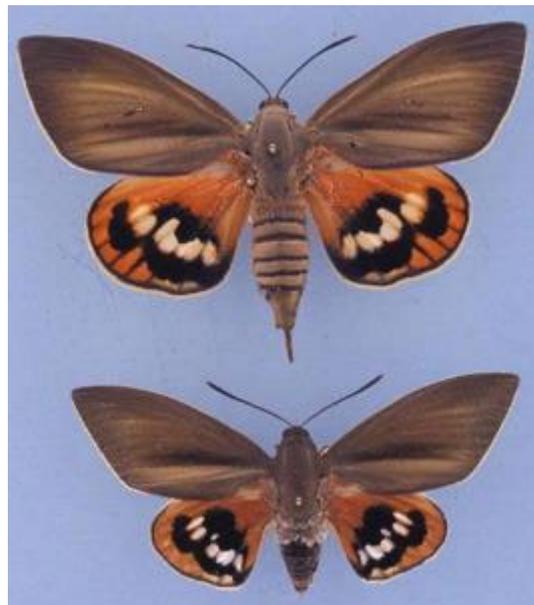
### Pest Recognition

*This section describes characteristics of the organism and symptoms that will help surveyors recognize possible infestations/infections in the field, select survey sites, and collect symptomatic material. For morphological descriptions, see the Identification/Diagnostic resources on the AMPS pest page on the CAPS Resource and Collaboration website.*

#### Pest Description

**Adults** are large, fly by day moths with clubbed antennae, olive-brown forewings, and bright red, black, and white hindwings (Drescher and Dufay, 2002). They are easily mistaken for butterflies (Gilligan and Passoa, 2015). Females are slightly bigger than males. They have a long ovipositor and an average wingspan of 86 mm vs 75 mm (Figure 1) (Drescher and Dufay, 2002; Sarto i Monteys and Aguilar, 2005).

**Eggs** resemble rice grains, measuring about 4.7 mm (<sup>3</sup>/<sub>16</sub> in) long with longitudinal ridges. When freshly laid, they deepen in color from creamy pink or tan to reddish-brown over several days; after the larvae emerges, broken shells appear dull white. Eggs are laid singly in the fibers of the palm trunk or where the leaf meets the trunk; they are well-hidden but not attached to the plant (Sarto i Monteys and Aguilar, 2005).



**Figure 1.** Adult *Paysandisia archon* female (top) and male (bottom). Source: [Victor Sarto i Monteys](#), Servei de Protecció dels Vegetals, Bugwood.org, licensed under [CC BY-NC 3.0](#).

Newly hatched **larvae** are about 7.3 mm ( $\frac{5}{16}$  in) long and 1 mm ( $\frac{1}{16}$  in) at their widest. They are rose-colored with brown heads but fade to white within the first instar. After the first instar, larvae are ivory-white and much less mobile (Sarto i Monteys and Aguilar, 2005). Late-stage larvae reach 90 mm ( $3\frac{9}{16}$  in) long and 15 mm ( $\frac{9}{16}$  in) wide (Figure 2) (Sarto i Monteys and Aguilar, 2005). Larvae are grub-like with four pairs of pseudopods (Drescher and Dufay, 2002). They avoid light and seek food and shelter as soon as they emerge, tunneling into their host within minutes and dropping down on silk threads to a better site if needed; this is likely the only time larvae will be visible outside the palm (Sarto i Monteys and Aguilar, 2005). The location of larval boring damage varies with the palm species, the instar, and the age of the plant (Kontodimas et al., 2017). Early instar larvae may tunnel into trunks, fruit, or leaf rachises, while the later, larger instars are more likely to bore into trunks (Sarto i Monteys and Aguilar, 2005).



**Figure 2.** Top: A later instar larva retreating into a gallery. Bottom: A pupa inside a cut cocoon. Source: [Victor Sarto i Monteys](#), Servei de Protecció dels Vegetals, Bugwood.org, licensed under [CC BY-NC 3.0](#).

**Prepupal larvae** bore a tunnel to allow access to the outside of the palm and build a cocoon of palm fiber and silk in the resulting cavity (Sarto i Monteys and Aguilar, 2005). **Cocoons** are flat on one side and about 58 mm ( $2\frac{5}{16}$  in) long, varying from 17 mm ( $\frac{11}{16}$  in) at the narrowest to the 19 mm ( $\frac{3}{4}$  in) at the widest (Sarto i Monteys and Aguilar, 2005). They are located near or on the surface of the trunk or where the leaves meet the trunk and are typically camouflaged by the trunk's fibers (Figure 2) (Sarto i Monteys and Aguilar, 2005).

### Signs

Larvae bore through palm trunks, creating galleries (Sarto i Monteys and Aguilar, 2005). Because they are hidden, infestations can be difficult to detect unless adults are present (Drescher and Dufay, 2002; Reid and Moran, 2007). Signs of infestation include any of the following: debris plugs or empty cocoons on the palm's surface or on the ground (Drescher and Dufay, 2002; Kontodimas et al., 2017), sawdust on the palm crown or trunk, perforations on leaves from feeding, galleries within the palm trunk, abnormally developed axillary buds, thick brown liquid oozing from the plant, trunk deformation, slow growth, and drying of the

plant, particularly the core leaves (Figure 3) (Kontodimas et al., 2017; Reid and Moran, 2007; Sarto i Monteys and Aguilar, 2005). However, palms may not show symptoms unless heavily infested (Vassiliou et al., 2009) or until they collapse (Kontodimas et al., 2017).



**Figure 3.** Signs of infestation in *Trachycarpus fortunei* (Chinese windmill palm). Left: Damaged palm. Center: Sawdust on trunk. Right: Pupal exuviae on trunk. Source: [Victor Sarto i Monteys](#), Servei de Proteccio dels Vegetals, Bugwood.org, licensed under [CC BY-NC 3.0](#).

Newly hatched larvae may tunnel into young, tightly packed palm fronds, resulting in visible damage as the fronds develop and expand. In *Phoenix* species and other pinnate-leaved palms, this causes scattered perforations in the leaves. In *Chamaerops humilis*, *Trachycarpus fortunei*, *Trithrinax campestris*, and *Washingtonia filifera*, the perforations appear in a circular arc (Figure 4).

### Easily Mistaken Species

Because they fly during the day and have clubbed antennae, *P. archon* moths may be mistaken for butterflies. However, their large size and unique wing pattern and coloration distinguish them from other North American moths and butterflies (Gilligan and Passoa, 2015).

*Paysandisia archon* infestations cause some of the same symptoms as other pests and environmental conditions; these include abnormal crown growth and damaged, discolored, or dry leaves (Kontodimas et al., 2017). Red palm weevil (*Rhynchophorus ferrugineus*) damage, in particular, resembles that caused by *P. archon*. Leaf perforations can help distinguish which pest is causing the damage: *Paysandisia archon* perforates the fronds in an arc or circular shape (Figure 4), while red palm weevil perforations appear in more of a “>” shape (Kontodimas et al., 2017). When the species co-occur on the same plant, *P. archon* has been found around the base, in subterranean roots of small palms, and in the “peripheral zone” of the stipe of larger palms; red palm weevil has been found in

the upper parts of small palms and the central section of the stipe of larger palms (Kontodimas et al., 2017). Red palm weevil is not present in the United States, but the closely related South American palm weevil (*Rhynchophorus palmarum*) occurs in southern California where it causes similar damage (Hoddle, 2018).



**Figure 4.** Chinese windmill palm (*Trachycarpus fortunei*) fronds perforated by the larvae. Source: [Victor Sarto i Monteys](#), Servei de Protecció dels Vegetals, Bugwood.org, licensed under [CC BY-NC 3.0](#).

### Biology and Ecology

Literature that describes the life cycle and behavior of *P.*

*archon* is almost exclusively based on observations and studies from the species' invasive range in the Mediterranean (France, Italy, and Spain). The moths fly in hot, sunny weather; it is between 71.6-104 °F for males and for females, it is at 77-86 °F when relative humidity is below 32 percent and winds are low (Liégeois et al., 2016). Males tend to patrol their territory by flying over the same areas before returning to the same spot to land (Sarto i Monteys and Aguilar, 2005). Adults fly from mid-May to mid-October, but typically peak in June and July (Drescher and Dufay, 2002; Sarto i Monteys and Aguilar, 2005). The moths have a proboscis (mouthpart) but do not feed (Sarto i Monteys and Aguilar, 2005). After mating, females lay eggs singly in the fibers of the palm trunk or where the leaf meets the trunk (Sarto i Monteys and Aguilar, 2005). They may lay up to ten eggs near each other (Hamidi and Frérot, 2016) and up to 140 eggs total (Sarto i Monteys and Aguilar, 2005). Eggs are found in late May to mid-October (Sarto i Monteys and Aguilar, 2005).

Eggs hatch in 12 to 21 days, depending on the temperature (Sarto i Monteys and Aguilar, 2005). Larvae, typically, go through nine instars (Sarto i Monteys and Aguilar, 2005). The life cycle of this moth is usually annual but can be biannual if larvae hatch in autumn. Depending on when they hatch, individuals can spend 10 or 18 months as larvae (Muñoz-Adalia and Colinas, 2020; Sarto i Monteys and Aguilar, 2005). Larvae feed inside the trunk, but the first instar may briefly feed on the outside of the trunk (Sarto i Monteys, 2002).

Late-stage larvae bore a tunnel to the outside of the palm and build a cocoon of palm fiber and silk near or on the trunk's surface or where the leaves meet the trunk (Sarto i Monteys and Aguilar, 2005). Adult moths typically emerge from these cocoons in the late morning or early afternoon. They climb onto vertical surfaces and fly within an hour or two (Sarto i Monteys and Aguilar, 2005). In late summer and early autumn, all life stages may be present (Closa et al., 2017). All

larval stages can be found in palms during winter (Sarto i Monteys and Aguilar, 2005).

For an extensive account of the moth's biology, see Sarto i Monteys and Aguilar (2005).

## Known Hosts

Larvae feed on a wide variety of palms (Arecaceae) (Sarto i Monteys and Aguilar, 2005), including young palms in nurseries and mature palms in landscapes and gardens (Núñez Vázquez, 2013; Porcelli et al., 2006). In Europe, where *P. archon* is invasive, it attacks *C. humilis*, *Phoenix canariensis*, and *T. fortunei* most frequently (Andre and Malicorne, 2013; Beaudoin-Ollivier et al., 2017). These species, along with *Washingtonia filifera* and *W. robusta*, are considered to be susceptible to *P. archon* (Isidoro et al., 2017). However, the moth rarely attacks *Washingtonia* species even when they are abundant (Andre and Malicorne, 2013; De La Torre Manca et al., 2014; personal communication, Sarto i Monteys, 2019). Also, *P. archon* is not typically considered to be a significant pest in South America (Isidoro et al., 2017), but it does attack ornamental palms, particularly *P. canariensis* and *Trithrinax campestris*, in urban areas (De La Torre Manca et al., 2014).

*The host list, below, includes cultivated and wild plants that 1) are infected or infested by the pest under natural conditions, 2) are frequently described as major, primary, or preferred hosts, and 3) have documented primary evidence for feeding and damage. Commercially produced plants and pests that cause significant economic damage are highlighted in bold.*

## Frequent Hosts

*Butia capitata*<sup>\*†</sup> (jelly palm), *B. yatay* (yatay palm), ***Chamaerops humilis***<sup>†</sup> (dwarf fan palm), ***Phoenix canariensis***<sup>\*†</sup> (Canary Island date palm), *P. dactylifera*<sup>\*†</sup> (date palm), *Sabal palmetto*<sup>\*†</sup> (cabbage palmetto), ***Trachycarpus fortunei***<sup>†</sup> (= *T. wagnerianus*) (Chinese windmill palm), and ***Trithrinax campestris***<sup>†</sup> (thatch palm) (De La Torre Manca et al., 2014; Drescher and Jaubert, 2003; Isidoro et al., 2017; Pintaud and Castellana, 2017; Sarto i Monteys and Aguilar, 2005).

## Infrequent Hosts

*Acoelorrhaphe wrightii*<sup>\*†</sup> (Everglades palm), *Arenga engleri*<sup>†</sup> (Formosan sugar palm), *Brahea aculeata*<sup>†</sup> (Sinaloa hesper palm), *B. armata*<sup>†</sup> (blue fan palm), *B. dulcis*<sup>†</sup> (blue rock palm), *B. edulis* (Guadeloupe palm), *Howea forsteriana*<sup>†</sup> (sentry palm), *Jubaea chilensis*<sup>†</sup> (Chilean coco palm), *Livistona* spp., *L. australis*<sup>†</sup> (cabbage palm), *L. chinensis*<sup>\*†</sup> (Chinese fan palm), *L. decora*<sup>†</sup> (= *L. decipiens*) (ribbon fan palm), *L. saribus*<sup>†</sup> (serdang palm), *Nannorrhops ritchieana*<sup>†</sup>

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\* Hosts with native or naturalized populations in the United States (Kartesz, 2021; USDA NRCS, 2021).

† Hosts grown as ornamental or landscaping plants in the United States (Floridata, 2022; Stein, 2017).

(=*Nannorrhops arabica*) (Mazari palm), *Phoenix* spp.\* (date palm), *P. reclinata*\*† (Senegal date palm), *P. roebelenii*† (miniature date palm), *P. sylvestris*† (date sugar palm), *P. theophrasti* (Cretan date palm), *Sabal* spp.\* (palmetto), *S. bermudana*\*† (Bermuda palm), *S. mauritiiformis*† (Trinidad palm), *S. mexicana*\*† (Mexican palmetto), *S. minor*\*† (dwarf palmetto), *Serenoa repens*\* (saw palmetto), *Syagrus romanzoffiana*\*† (queen palm), *Trachycarpus* spp., *Trithrinax brasiliensis*† (= *T. acanthocoma*) (Brazilian needle palm), *Washingtonia*\* spp. (fan palm), *W. filifera*\*† (California fan palm), and *W. robusta*\*† (Mexican fan palm) (Andre and Malicorne, 2013; De La Torre Manca et al., 2014; Drescher and Jaubert, 2003; Isidoro et al., 2017; Niamouris and Psirofonis, 2012; Pintaud and Castellana, 2017; Sarto i Monteys and Aguilar, 2005).

## Pest Importance

*Paysandisia archon* is a significant pest in its introduced range, particularly in France, Italy, and Spain (Beaudoin-Ollivier et al., 2017). Between 2002 and 2012, it killed up to 90 percent of the *T. fortunei* palms in parts of France's Languedoc-Roussillon region. It also killed up to 75 percent of *C. humilis* palms in some areas and destroyed many *P. canariensis* palms (Andre and Malicorne, 2013). In 2003, it attacked several nurseries in Italy, sometimes killing 90 percent of the palms (Sarto i Monteys and Aguilar, 2005). In Spain, this moth attacked *P. canariensis* and *C. humilis* in palm nurseries as early as the 1990s and had attacked wild *C. humilis* (Sarto i Monteys and Aguilar, 2005).

In its native South America, where natural enemies and declining habitat are thought to keep populations low (Drescher and Dufay, 2002), *P. archon* is rarely a damaging pest (Beaudoin-Ollivier et al., 2017; Drescher and Dufay, 2002; Sarto i Monteys and Aguilar, 2005). However, in the late 1920s, a sudden outbreak in Uruguay killed many mature exotic palms (Bourquin, 1933; Sarto i Monteys and Aguilar, 2005). It is now so rare in Uruguay that no control measures are taken against it (Sarto i Monteys and Aguilar, 2005). *Paysandisia archon* is not a pest in Argentina where it is native (Sarto i Monteys and Aguilar, 2005), but it has become a problem in cities such as Buenos Aires and Córdoba with the introduction of exotic ornamental palms (De La Torre Manca et al., 2014; Sarto i Monteys and Aguilar, 2005).

In 2019, twenty U.S. states grew landscaping palms commercially, with total sales valued at \$132.6 million (USDA NASS, 2020). Two years earlier, five states had grown dates commercially with most of the production in California (USDA NASS, 2019). The gross value of California dates produced from 12,200 acres was \$107.6 million in 2020 (CDFR, 2022). However, economic losses or impact as a result of *P. archon* on dates has not been reported.

The European and Mediterranean Plant Protection Organization recommends regulation over *P. archon* as a quarantine pest, in member countries where it is not present (EPPO, 2021a). Chile, the European Union, Guatemala, Japan, Monaco, Morocco, North Macedonia, San Marino, Serbia, Turkey, the United

Kingdom, and the Vatican City State consider it to be a harmful organism (PExD, 2022). Trade with these countries and regions could be impacted if the palm borer establishes in the United States.

## Pathogens or Associated Organisms Vectored

*Paysandisia archon* does not transmit any pathogens or other organisms. However, larval boring can lead to secondary fungal infections (Frigimelica et al., 2012; Sarto i Monteys and Aguilar, 2005) or create favorable reproduction sites for other palm pests such as the red palm weevil (Beaudoin-Ollivier et al., 2017).

## Known Distribution

*Paysandisia archon* is native to **South America**: Argentina (northeast, central), Brazil (Rio Grande do Sul), Paraguay (Paraguayan Chaco), and Uruguay (west) (De La Torre Manca et al., 2014; Sarto i Monteys and Aguilar, 2005).

In **Europe**, it has been introduced to Crimea, Croatia, Cyprus, France, Georgia, Gibraltar, Greece (including Crete), Italy (including Sicily), Russia, Slovenia, and Spain (including the Balearic Islands) (Colazza et al., 2005; Coutsis, 2012; Dbar et al., 2021; EPPO, 2021b; Karpun et al., 2015; Luquet, 2016; Masten-Milek and Šimala, 2012; Perez and Guillem, 2019; Sarto i Monteys et al., 2005; Sharmagi et al., 2021; Vassarmidaki et al., 2005; Vassiliou et al., 2009).

*Paysandisia archon* has been eradicated from the Czech Republic, Denmark, Germany, Switzerland, and the United Kingdom (England, Northern Ireland) (EFSA Panel on Plant Health, 2014; EPPO, 2021b). It is considered absent in Belgium since it has not been found in surveys subsequent to a detection in the early 2010's (EPPO, 2021b). In Bulgaria, it has been described as established (Sarto i Monteys, 2013) and transient or under eradication (EFSA Panel on Plant Health, 2014). Other than a single record in Bolivia in 1954 (Rodríguez-Ramírez et al., 2020) and an unconfirmed record of the species in Portugal in 2011 (EPPO, 2021b), nothing recent suggests that it is present in either country.

## Pathway

*Paysandisia archon* larvae are difficult to detect in palm trunks (Isidoro et al., 2017), which facilitates long-distance spread through the importation of infested palms. The species was likely introduced into Spain and France as larvae in palms imported from Argentina, such as *Butia yatay* and *Trithrinax campestris* (Sarto i Monteys and Aguilar, 2005). New detections in Europe can typically be traced back to palms imported from other European countries where the moth is present (e.g., EPPO, 2011, 2020; Perez and Guillem, 2019; Reid and Moran, 2007; Vassiliou et al., 2009).

*Paysandisia archon* adults probably spread locally by flying. They are strong fliers that have been found in mature palms as far as 30 km from infested nurseries (Sarto i Monteys and Aguilar, 2005). In one study, male moths stayed within a 4-hectare area, making short flights of no more than 224 meters to patrol

their territory, but most female moths immediately flew more than 500 meters out of the 30-hectare study area (Liégeois et al., 2016).

*Use the PPQ Commodity Import and Export manuals listed below to determine 1) if host plants or material are allowed to enter the United States from countries where the organism is present and 2) what phytosanitary measures (e.g., inspections, phytosanitary certificates, post entry quarantines, mandatory treatments) are in use. These manuals are updated regularly.*

**Fruits and Vegetables Import Requirements (FAVIR) Online Database:** The FAVIR database lists all import requirements for fruits and vegetables. To search by commodity, select 'Approved Name' at the top left of the page. Select the commodity from the drop-down menu and then click 'Search'. Click on the 'Commodity Summary' tab for details.

<https://epermits.aphis.usda.gov/manual/index.cfm?action=pubHome>

**Plants for Planting Manual:** This manual is a resource for regulating imported plants or plant parts for propagation, including buds, bulbs, corms, cuttings, layers, pollen, scions, seeds, tissue, tubers, and like structures.

[https://www.aphis.usda.gov/import\\_export/plants/manuals/ports/downloads/plants\\_for\\_planting.pdf](https://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/plants_for_planting.pdf)

**Cut Flowers and Greenery Import Manual:** This manual is a resource for regulating imported fresh, cut plants used for decoration and for protecting plants from extinction due to trade.

[https://www.aphis.usda.gov/import\\_export/plants/manuals/ports/downloads/cut\\_flower\\_imports.pdf](https://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/cut_flower_imports.pdf)

**Miscellaneous and Processed Products Import Manual:** This manual is a resource for regulating imported processed plant and non-plant that may introduce exotic pests.

[https://www.aphis.usda.gov/import\\_export/plants/manuals/ports/downloads/miscellaneous.pdf](https://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/miscellaneous.pdf)

**Treatment Manual:** This manual provides information about treatments applied to imported and domestic commodities to limit the movement of agricultural pests into or within the United States.

[https://www.aphis.usda.gov/import\\_export/plants/manuals/ports/downloads/treatment.pdf](https://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/treatment.pdf)

## **Potential Distribution within the United States**

We compared the species' distribution (GBIF, 2021) to a map of Global Plant Hardiness Zones (Takeuchi et al., 2018) and found reports of its presence in Zones 7-11. These Zones correspond to the coastal, southeastern, south central, and southwestern continental United States, as well as parts of Hawaii and Puerto Rico. Palms are native to or naturalized in all of these areas (Kartesz,

2021). *Paysandisia archon* could likely establish in areas of the United States within Zones 7-11 where host material is present. However, it could also survive in areas outside of these zones where palms are grown under protected conditions.

Areas with high densities of palms, such as nurseries or orchards, will likely be at a higher risk, including Florida, California, Texas, and Hawaii, which produce the majority of landscaping palms (USDA NASS, 2020).

## Survey and Key Diagnostics

### Approved Methods for Pest Surveillance:

For the current approved methods and guidance for survey and identification, see Approved Methods for Pest Surveillance (AMPS) pest page on the CAPS Resource and Collaboration website, at <https://caps.ceris.purdue.edu/approved-methods>.

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### **Versions**

August 2011: Datasheet completed (Version 1)

June 2022: Datasheet fully revised (Version 2)

### **Reviewer(s)**

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