

First Record of the Palm Borer Moth, *Paysandisia archon* (Lepidoptera: Castniidae), in Montenegro

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Summary: *Paysandisia archon* (BURMEISTER 1880) is a large, diurnal moth of South American origin (family Castniidae), which has become an invasive pest of ornamental palms across various parts of Europe. Since its accidental introduction via the ornamental plant trade around the year 2000, the species has rapidly expanded its range, being recorded in multiple European countries, including Spain, France, Italy, Greece, Slovenia, Croatia, and Albania. In this study, we report the first confirmed record of *P. archon* in Montenegro, representing a new country record for both the species and the family Castniidae.

Two female specimens were recorded in June 2023 in the coastal area of Donji Štoj, Ulcinj municipality, southern Montenegro. One specimen was collected using an entomological net, while the second was found as a roadkill. A third individual was observed in flight but not captured. Given the characteristic morphology and flight behavior of the species, misidentification is highly unlikely. The widespread presence of ornamental palms in the Montenegrin coastal region, along with favorable Mediterranean climatic conditions, suggests the potential establishment of a local population. This underscores the need for continued monitoring, particularly through citizen science initiatives. Similar approaches have proven successful in neighboring countries such as Croatia, where a recent study documented 112 observations, mostly contributed by volunteers.

Considering the ongoing spread of *P. archon* and increasing palm cultivation in southeastern Europe, we also highlight the potential for future establishment in Romania, especially along the Black Sea coast. This record from Montenegro emphasizes the continued expansion of *P. archon* in the region and the growing importance of public engagement in invasive species monitoring.

Key words: *Paysandisia archon*, Lepidoptera, Castniidae, invasive species, palm pests, citizen science.

Introduction

The intensification of international trade in ornamental plants has significantly increased the risk of accidental introduction of non-native species with invasive potential (ISIDORO *et al.* 2017; MUÑOZ-ADALIA and COLINAS 2020). One such species is the palm borer moth, *Paysandisia archon* (BURMEISTER, 1880).

P. archon is a large moth belonging to the family Castniidae (Isidoro *et al.* 2017). It is a non-native species in Europe, originally native to South America, specifically Uruguay, Paraguay, Argentina, and Brazil (MUÑOZ-ADALIA and COLINAS 2020; SÁFIÁN *et al.* 2023). More recently, it has also been recorded in Colombia and Ecuador (SÁFIÁN *et al.* 2023).

The species was first accidentally introduced into Europe around the year 2000, with initial reports from Spain (AGUILAR *et al.* 2001; MÉRIT and MÉRIT 2002). According to PEREZ and GUILLEM (2019), however, *P. archon* may have arrived in Europe between 1992 and 1998. The introduction pathway was through the ornamental plant trade, particularly via imported palm trees (AGUILAR *et al.* 2001). The species began spreading rapidly and was reported in France (Fig.1) the same year (DRESCHER and DUFFAY 2001; SARTO I MONTEYS *et al.* 2001; REYNAUD *et al.* 2002). Currently, it is established in southern France and Corsica (VANDROMME *et al.* 2020).

In 2002, *P. archon* was recorded for the first time in the United Kingdom (PATTON and PERRY 2002), followed by Italy in 2003 (ESPINOSA *et al.* 2003; RIOLO *et al.* 2004; PORCELLI *et al.* 2005), where it is now present both on the mainland and several islands, including Sardinia, Sicily, and Pantelleria (MORI *et al.* 2022; SÁFIÁN *et al.* 2023). The species has also been reported in Greece (VASSARMIDAKI *et al.* 2006), on both the mainland and various islands, as well as in the Netherlands (VOS 2008), Cyprus (VASSILIOU *et al.* 2009), Slovenia (BENKO BELOGLAVEC *et al.* 2009), and Croatia (MILEK and ŠIMALA 2013; BUŽLETA and KOREN 2024) (Fig.1).

Additional occurrences include Portugal (CORLEY *et al.* 2012), and in 2012, *P. archon* was recorded for the first time in Crete, where it was also observed on *Phoenix theophrasti*, an endemic palm species (NIAMOURIS and PSIROFONIA 2012).

In Austria, the species was first reported in 2017 (HÖTTINGER 2017), and in Gibraltar in 2018 (PEREZ and GUILLEM 2019). Since then, *P. archon* has also been reported from Belgium, Germany, Denmark, Switzerland, and the Czech Republic (HÖTTINGER 2017), as well as from Albania, Bulgaria, and Hungary (Fig.1) (SÁFIÁN *et al.* 2023). In many of these countries, the species has been observed primarily in greenhouses or plant shops selling ornamental palms, since local climatic conditions do not generally support

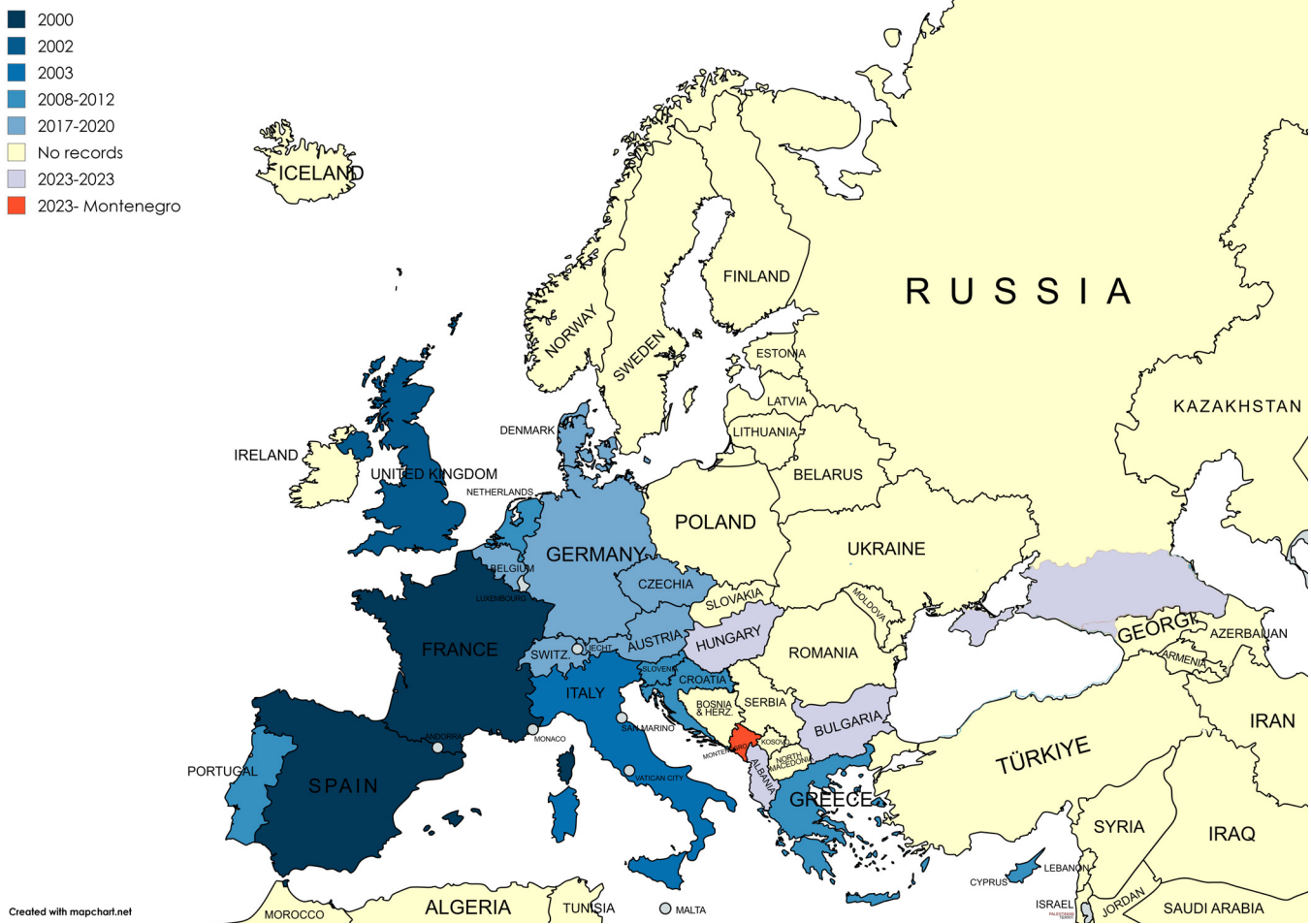


Fig.1. Distribution of *Paysandisia archon* in Europe. The intensity of the blue color reflects the year or period when the species was reported in the respective country. Map created with mapchart.net.

the overwintering of palms outdoors. However, FEHR *et al.* (2024) recently confirmed, for the first time, the establishment of *P. archon* in southern Switzerland.

Many of these observations and species records have been provided by citizens or volunteers involved in citizen science projects, in a context where, in Europe, a significant proportion of biodiversity monitoring data is already collected by volunteers (SCHMELLER *et al.* 2009; BOWLER *et al.* 2022). It is estimated that nearly half of the observations stored in the Global Biodiversity Information Facility (GBIF), the largest global biodiversity database, originate from citizen science contributions (CHANDLER *et al.* 2017; BOWLER *et al.* 2022).

To date, there have been no reports of the species in Montenegro or Bosnia and Herzegovina (SÁFIÁN *et al.* 2023; BUŽLETA and KOREN 2024).

In the present study, we report the occurrence of this species in Montenegro.

Biology of the Species

The larvae are endophagous, undergoing nine instars, and can reach up to 9 cm in length prior to pupation (SÁFIÁN *et al.* 2023). They utilize a wide range of palm species (Arecaceae) as host plants, including *Brahea armata*, *B. edulis*, *Livistona* spp., *Jubaea* spp., *Butia* spp., *Phoenix canariensis*, *P. dactylifera*, *P. reclinata*, *P. roebelenii*, *P. sylvestris*, *Sabal romanzoffiana*,

Trachycarpus fortunei, *T. campestris*, *Washingtonia filifera*, and *W. robusta* (I MONTEYS and AGUILAR 2005; ISIDORO *et al.* 2017). Additionally, the larvae also affect the two palm species native to Europe: *Chamaerops humilis* and *Phoenix theophrasti*—the latter being endemic to Crete (SÁFIÁN *et al.* 2023; NIAMOURIS and PSIROFONIA 2012).

The larval stage is the only developmental stage that causes damage to palms (MUÑOZ-ADALIA and COLINAS 2020). Larvae feed on young leaves, fruits, and rachises (MONTAGUD 2004).

Adults are active from May to October (RIOLO *et al.* 2004; I MONTEYS and AGUILAR 2005; LIÉGEAIS *et al.* 2014; ISIDORO *et al.* 2017). This species is diurnal, with adults flying during the sunniest hours of the day (HAMIDI and FRÉROT, 2016; MUÑOZ-ADALIA and COLINAS 2020) and remaining inactive on cloudy or rainy days (ISIDORO *et al.* 2017). The adult lifespan is typically 2–3 weeks (MUÑOZ-ADALIA and COLINAS 2020).

Results

In June 2023, during a vacation in Montenegro, Ulcinj (Fig.2), two specimens of *Paysandisia archon* (BURMEISTER 1880) were collected (Fig.3). The first specimen was captured using an entomological net in the garden of the guesthouse where we were staying, while the second was found two days later as a roadkill along the roadside.

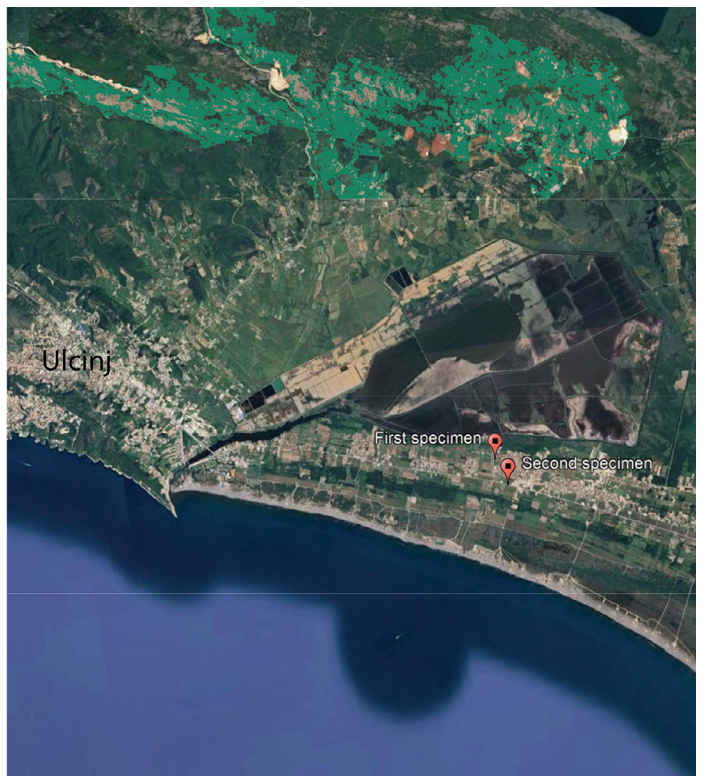
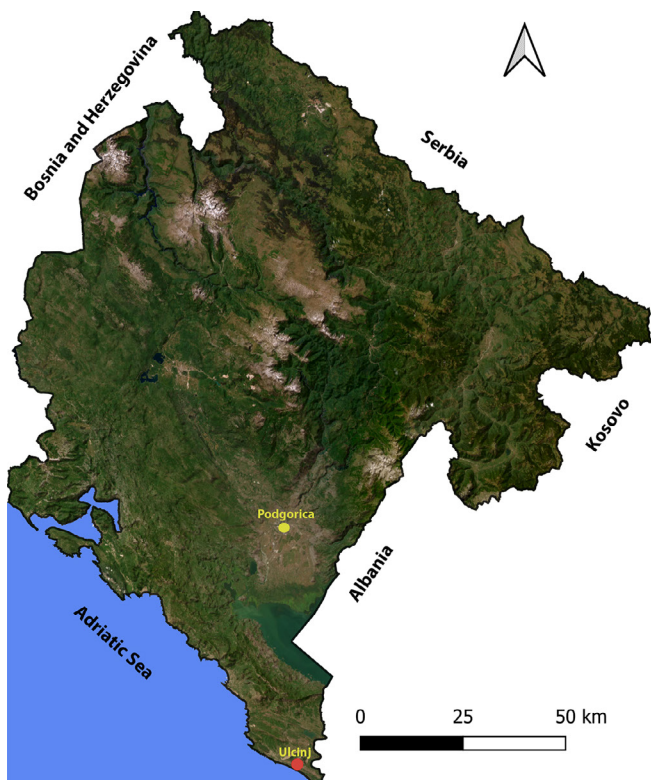


Fig. 2. The locality of the first record of the species, in the southern part of Montenegro.

Material examined

1♀ – 27.06.2023, Montenegro, Ulcinj municipality, Donji Štoj, N 41.907316, E 19.298345, leg. Sitar C. & Mărcuş B.

1♀ – 29.06.2023, Montenegro, Ulcinj municipality, Donji Štoj, N 41.903413, E 19.300092, leg. Sitar G. & Pascal L.

The material is stored in the Cristian & Geanina Sitar collection.

Discussion

The occurrence of *P. archon* represents the first confirmed record of both the species and the family Castniidae in Montenegro. Its presence was anticipated, given that the species has recently been observed in neighboring Albania. A third individual was seen in flight on 30.06.2023 but could not be collected. Due to its large wingspan and characteristic flight pattern, *P. archon* is unlikely to be mistaken for any other moth species.

In the Montenegrin coastal region, palms are widely planted, being used both as ornamental plants in private gardens and as street trees. Considering the country's Mediterranean climate and the abundance of larval host plants, it is highly likely that *P. archon* has established a resident population. This assumption requires further observation and species monitoring.

Recent records from areas surrounding the Black Sea, such as Crimea, Russia (Western Caucasus region), and Abkhazia (Fig.1) (SINEV 2022; SÁFIÁN *et al.* 2023), also suggest the potential presence of

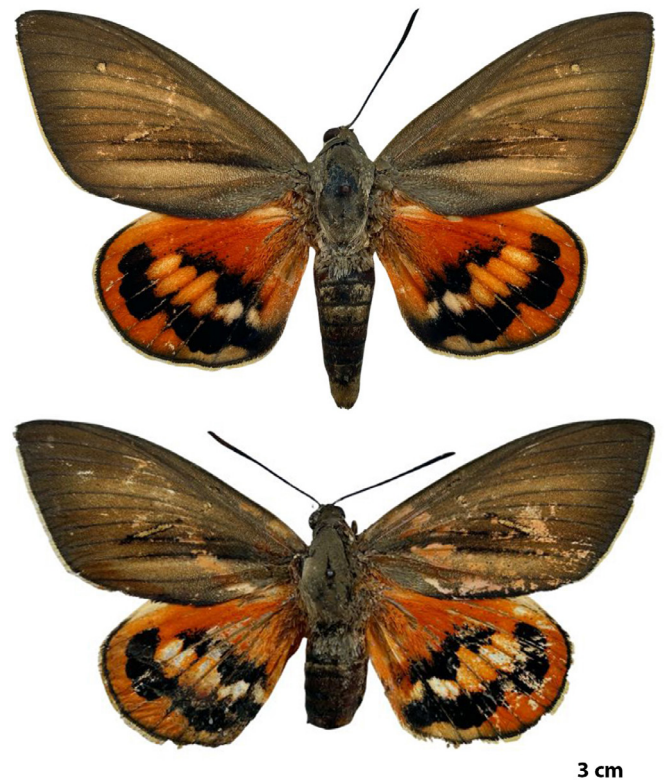


Fig. 3. The specimens of *Paysandisia archon* collected in Montenegro).

the species in Romania. Increased attention should therefore be directed toward the Black Sea region, particularly the Romanian coastline and urban areas such as Bucharest. The presence of *P. archon* in Crimea, together with the increasing number of ornamental palms planted in some regions of

Romania, indicates that the species could soon appear there as well. However, to date, *P. archon* has not been reported from Romania (RAKOSY and GOIA 2021).

Citizen involvement plays a vital role in collecting distribution data and monitoring the spread of invasive species. This has been clearly demonstrated in the study by BUŽLETA and KOREN (2024), who documented the distribution of *P. archon* in Croatia based on 112 records, most of which originated from citizen science platforms such as iNaturalist and Biologer.

Considering the declining number of professional taxonomists and the limited spatial coverage scientists can achieve, volunteers participating in environmental citizen science can help bridge this gap (AUGUST *et al.* 2020). Volunteers can provide highly valuable data on the distribution of plant and animal species, while also reducing the cost and effort required for biodiversity monitoring within the scientific community (FELDMAN *et al.* 2021).

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