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STALKING A NON-NATIVE SPECIES ON SOCIAL MEDIA: UPDATING THE DISTRIBUTION OF *PAYSANDISIA ARCHON* (BURMEISTER, 1879) IN CROATIA THROUGH CITIZEN SCIENCE

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In Europe, the palm borer moth, *Paysandisia archon* (Burmeister, 1879) is a non-native species which was introduced in the early 2000s. Since then, the moth has rapidly spread across the Mediterranean parts of Europe and started causing damage to both native and non-native palm trees. The first record for Croatia dates to 2011 when the moth was recorded in Split and Zadar. Since then, the spread of the species has not been documented in the scientific literature but being an unusual and invasive species, its expansions was reported across a wide array of internet sources, including social media. To comprehensively understand the current distribution of *P. archon* in Croatia, we sytstematically compiled data from citizen science platforms, social media, websites, and both published and personal observations. Our findings reveal a total of 112 records spanning most of the Mediterranean parts of Croatia, indicating a rapid and expansive distribution of the species. The caterpillars of this species develop within palms causing them to rot and eventually dry which causes economic and aesthetic losses. Severe economic damage in the horticultural sectors has been previously reported in countries like France and Italy, while in the western Mediterranean, it poses a conservation threat to native palm populations. Further monitoring and damage assessments should be carried out to understand to the full the impact of this non-native species in Croatia.

Key words: coastal distribution, palms, impact of non-native species, aesthetic impact

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Palmin drvotoč, *Paysandisia archon* (Burmeister, 1879), alohtona je vrsta unesena u Europu početkom 2000-ih. Od tada se ovaj leptir brzo proširio po mediteranskim dijelovima Europe i počeo nanositi štetu kako domaćim, tako i alohtonim vrstama palmi. Prvi nalazi u Hrvatskoj datiraju iz 2011. godine, kada je zabilježen u Splitu i Zadru. Nakon toga širenje vrste nije dokumentirano u znanstvenoj literaturi, ali budući da je riječ o neobičnoj i invazivnoj vrsti, njeno širenje zabilježeno je putem različitih izvora na internetu, uključujući društvene medije. Kako bismo sveobuhvatno razumjeli trenutačnu rasprostranjenost vrste *P. archon* u Hrvatskoj, sustavno smo prikupljali podatke s platformi građanske znanosti, društvenih medija, web stranica, te iz objavljenih i osobnih opažanja. Sveukupno je do sada poznato 112 nalaza ove vrste koji obuhvaćaju većinu mediteranskih dijelove Hrvatske, što ukazuje na brzo i opsežno širenje vrste. Gusjenice ove vrste razvijaju se u palmama, uzrokujući njihovo truljenje i konačno sušenje, što uzrokuje ekonomske i estetske gubitke. Značajne ekonomske štete u sektoru hortikulture već su prijavljene u zemljama poput Francuske i Italije, dok na zapadnom Sredozemlju

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predstavlja prijetnju autohtonim populacijama palmi. Kako bi razumjeli širenje i utjecaj te invazivne vrste leptira na području Hrvatske, potrebno je uspostaviti sustavno daljnje praćenje i procjenu šteta.

Ključne riječi: obalna distribucija, palme, učinak stranih vrsta, estetski učinak

INTRODUCTION

The palm borer moth, *Paysandisia archon* (Burmeister, 1879) is a neotropical species whose native range spans through central South America with records in Paraguay, central Argentina, Brazil and Uruguay. The knowledge of its ecology in its native range is very scarce and poorly studied (Alario, 2004). It is known that this species inhabits open areas with palms and that adults can be observed from November to May (Sarto I Monteyes, 2002).

Throughout its life cycle, the caterpillar consumes various parts of the plant starting from leaves and/or fruit in earlier instars to the trunk but mostly it can be found in the trunk. The symptoms of presence include sawdust on the palm crown and trunk, perforated leaves, marks of chewing on the leaves, tunnels inside the trunk, presence of remains of pupa, presence of caterpillar frass on the plant, deformations and bent palm trunks (Masten Milek & Šimala, 2012; Sarto I Moneteys, 2013). The pest can destroy a palm tree in as little as three to four years if the infestation is not treated (Masten Milek & Šimala, 2012).

Soon after its introduction, it was proclaimed to be invasive in Europe. This was somewhat surprising as it is in fact, quite scarce and local in its native range, but this may be due to the lack of targeted surveys. In its native range, there are no records of it being a pest on palm trees except a few from Buenos Aires (Sarto I Moneteys *et al*., 2005).

Paysandisia archon was introduced accidentally in Europe probably through the import of palm trees from South America in the 1990s, which period coincides with the two main imports from Argentina in 1992 and 1998 (Sarto I Monteys *et al*., 2001). It was first recorded in Catalonia in 2001 and the same year only a few months later it was recorded in France (Drescher & Duffay, 2001; Sarto I Monteys *et al*., 2001). A year later, it was recorded in Italy and the United Kingdom (Espinosa *et al*., 2003; Patton & Perry, 2002). In most Mediterranean countries, the species quickly expanding its range and started destroying the palm trees of many coastal cities (Isidoro *et al*., 2017).

Countries that border on Croatia have also recorded the presence of the moth. The first record for Slovenia dates back to 2008 when the moth was recorded in Piran, Izola and Fiesa (Beloglavec Benko *et al*., 2009; Prirodoslovni muzej Slovenije). There are no published records of the moth in Montenegro and Bosnia and Herzegovina. An interesting observation comes from Hungary where the moth was recorded in the summer of 2023 (Sáfián *et al*., 2023) which shows the potential for this species to colonise the mainland. The species has also been observed in some other European landlocked countries such as Austria, Switzerland and the Czech Republic, however, it is considered to have been eradicated (Höttinger, 2018; Sáfián *et al*., 2023). The moth has also been recorded in Albania, Greece and Bulgaria (Sáfián *et al*., 2023). Some of the landlocked countries on this list might indicate that the moth does not exclusively inhabit only coastal areas, however, it might not be able to overwinter in the mainland due to the colder climate conditions.

The first record of *P. archon* in Croatia dates to 2011, when the species was recorded in nurseries in Split and Kožino, Zadar, and it was observed on *Phoenix canariensis* (Chabaud), *Chaemerops humilis* L., *Washingtonia fillifera* (Lindl.) and *Washingtonia robusta* H. Wendl. (Masten Milek & Šimala, 2012). Afterwards, no published records of this species for Croatia are available. The goal of this paper is to offer new and recent insights into the distribution of the *P. archon* in Croatia as well as discuss and emphasise possible environmental and economic impacts of the moth presence in Croatia.

MATERIALS AND METHODS

The data about the presence of the targeted species was collected up to February 1st 2023 using the following sources of data on distribution: available scientific literature, personal observations, Facebook groups "Leptiri Hrvatske/Lepidoptera of Croatia" and "Koji je ovo pauk/kukac ?", Instagram of Lepidoptera section of Biology Students Association – BIUS, local Facebook groups, web news portals like Regional Express, Tportal, Zadarskilist.hr, Dubrovnikportal.com and lastly citizen science platforms Biologer and Inaturalist. To collect data from social media, we took two approaches. Firstly, we frequently tracked the posts on groups Leptiri Hrvatske/Lepidoptera of Croatia and Koji je ovo pauk/kukac? within the flight period of this species. When an observation was recorded, the authors of the post were contacted and asked for more detailed data. Secondly, a small campaign on bius_leptiri Instagram account was conducted, named „Have you seen me?"; an endeavour was made to reach more observers by reposting it on the Instagram story. The web portals were searched with the use of the following key words: palmin+drvotoč+zadar+dubrovnik+pula+istra+split+šibenik+hrvatska. In addition, we gathered all available public data from citizen science platforms like Biologer and Inaturalist. Lastly, we examined all the publicly accessible literature. Afterwards, we imported the data into Microsoft Excel, georeferenced them and created charts of the number of records per county and flight period. The map was created using GIS.

RESULTS

Throughout this research, a total of 112 records of *P. archon* from Croatia were gathered (Tab. 1.). Most of the records came from citizen science platforms; Inaturalist (56) and Biologer (18). From the web pages on the internet, we gathered 10 records, while from Facebook groups we gathered 11 records. We obtained seven records by our own observations, six from the literature records and four using the campaign "Have you seen me?". All the records were made within the Mediterranean region of Croatia indicating that the distribution of the moth is still limited to the coastal area of the country (Fig. 1). However, almost all of the coastal area of Croatia has been colonized as the moth has been recorded in almost every coastal county of Croatia at least once.. The county with the most records is Istarska, followed by Primorsko-goranska, then Šibensko-kninska, Zadarska, Splitsko-Dalmatinska and Ličko-Senjska (Fig. 2). The moth is yet to be officially recorded in Dubrovačko-neretvanska county. In addition to the mainland, the moth has also colonized several islands like Brač, Brijuni, Cres, Košljun, Krk, Maškin, Murter, Sv. Andrija, Ugljan and Zlarin. The flight period of this species in Croatia is from early June to late August with a peak in July and occasional observations in September (Fig. 3).

Tab. 1. Records of palm borer (*Paysandisia archon*) in Croatia.

Site	Date (dd/mm/yy)	Longitude	Latitude	Source
Split	2011	43.51	16.44	Masten Milek & Šimala, 2012
Zadar	2011	43.9685	15.4078	Masten Milek & Šimala, 2012
Pula	2014	44.866667	13.85	Web page
Poreč	2014	45.227222	13.595833	Web page
Medulin	2014	44.821944	13.935	Web page
Umag	2014	45.433333	13.516667	Web page
Brač	2014	43.383333	16.483333	Web page
Split	2014	43.513568	16.500591	Web page
Zadar	2014	44.166667	15.2	Web page
Pazin	2023	45.2	13.9	Own observation
Split	27.7.2012	43.51	16.44	Web page
Pula	6.7.2013	44.895194	13.810934	Inaturalist
Muline, Ugljan	29.7.2013	44.137818	15.072495	Web page
Brijuni	26.9.2016	44.916524	13.769684	Own observation
Pula	9.7.2017	44.866623	13.849579	Inaturalist
Opatija	2.7.2018	45.342217	14.314963	Inaturalist
Kurili, Kanfanar	5.7.2018	45.111103	13.784708	Inaturalist
Ližnjan	1.7.2019	44.833333	13.95	"Have you seen me ?" campaign
Červar Porat, Poreč	20.7.2019	45.271944	13.6	Facebook groups
Novigrad, Istarska	28.8.2019	45.315749	13.561947	Inaturalist
Lanterna, Poreč	20.6.2020	45.301278	13.593842	Inaturalist
Poreč	3.7.2020	45.22673	13.595955	Inaturalist
Fažana	5.7.2020	44.916111	13.831111	Biologer
Grad Cres	6.7.2020	44.96	14.408056	Facebook groups
Pula	16.7.2020	44.874166	13.854166	Biologer
Skradinski buk, Šibenik	21.7.2020	43.806328	15.963797	Inaturalist
Opatija	28.7.2020	45.347325	14.319244	Inaturalist
Fažana	11.8.2020	44.916388	13.831111	Biologer
Biograd na Moru	14.8.2020	43.938424	15.450146	Inaturalist
Zadar	12.6.2021	44.166214	15.256936	Biologer
Šibenik	13.6.2021	43.702875	15.923982	Facebook groups
Pirovac	20.6.2021	43.816667	15.666667	Facebook groups
Medulin	20.6.2021	44.824722	13.939722	Facebook groups
Pakoštane	29.6.2021	43.905277	15.515278	Inaturalist
Šibenik	1.7.2021	43.736057	15.947087	Inaturalist
Rovinj	4.7.2021	45.081111	13.638889	Facebook groups
Zlarin	10.7.2021	43.698817	15.836141	Biologer
Umag	12.7.2021	45.383515	13.537186	Biologer
Livade	13.7.2021	45.354922	13.829371	Inaturalist
Šibenik	14.7.2021	43.735875	15.897794	Biologer
Šibenik	16.7.2021	43.735908	15.897788	Biologer
Fažana	17.7.2021	44.917186	13.831576	Own observation
Fažana	19.7.2021	44.916104	13.830632	Own observation
Opatija	20.7.2021	45.337392	14.308717	Inaturalist
Cres	25.7.2021	44.959348	14.405420	Biologer
Privlaka	28.7.2021	44.269399	15.115767	Inaturalist
Fažana	28.7.2021	44.916355	13.830901	Own observation

Tab. 1. Continued

Site	Date (dd/mm/yy)	Longitude	Latitude	Source
Fažana	29.7.2021	44.911515	13.810415	Own observation
Premantura	29.7.2021	44.805183	13.91188	Facebook groups
Pićan	31.7.2021	45.185913	14.025462	Biologer
Premantura	1.8.2021	44.805126	13.910844	Inaturalist
Pićan	1.8.2021	45.185310	14.025262	Biologer
Vodnjan	6.8.2021	44.965521	13.801450	Biologer
Biograd na Moru	12.8.2021	43.936035	15.444650	Inaturalist
Biograd na Moru	14.8.2021	43.938424	15.450146	Inaturalist
Zlarin	17.8.2021	43.697154	15.839971	Inaturalist
Tisno	21.8.2021	43.803898	15.636355	Biologer
Poreč	22.8.2021	45.230969	13.603592	Biologer
Mošćenička draga	24.8.2021	45.244708	14.248301	Inaturalist
Rovinj	19.6.2022	45.081166	13.638707	Inaturalist
Medulin	20.6.2022	44.821158	13.864578	Inaturalist
Banjole	20.6.2022	44.821158	13.864578	Inaturalist
Rovinj	25.6.2022	45.100866	13.625608	Inaturalist
Zadar	25.6.2022	44.106776	15.234091	Facebook groups
Nova Vas, Poreč	27.6.2022	45.358159	13.613254	Inaturalist
Opatija	30.6.2022	45.334805	14.309755	Inaturalist
Šibenik	1.7.2022	43.736057	15.947087	Inaturalist
Pula	2.7.2022	44.892739	13.846432	Inaturalist
Senj	3.7.2022	44.978713	14.913379	Inaturalist
Vodice	3.7.2022	43.74792	15.797729	Biologer
Brač	3.7.2022	43.327073	16.449244	Inaturalist
Višnjan	15.7.2022	45.284729	13.714756	Inaturalist
Krk	20.7.2022	45.023250	14.590038	Inaturalist
Vodice	24.7.2022	43.759838	15.781159	Facebook groups
Labin	26.7.2022	45.074888	14.162439	Inaturalist
Opatija	26.7.2022	45.333073	14.304126	Inaturalist
Rijeka	2.8.2022	45.337924	14.445040	Facebook groups
Pula	7.8.2022	44.895193	13.810934	Inaturalist
Jakačići, Gračišće	11.8.2022	45.184437	13.998940	Inaturalist
Selce, Crikvenica	18.8.2022	45.156256	14.725589	"Have you seen me ?" campaign
Tribunj	19.8.2022	43.756752	15.753095	Inaturalist
Krk	18.12.2022	45.022482	14.571893	Inaturalist
Vodice	26.3.2023	43.747920	15.797729	"Have you seen me ?" campaign
Fažana	16.6.2023	44.858179	13.853549	Own observation
Novi Vinodolski	19.6.2023	45.128188	14.792951	Inaturalist
Košljun, Krk	20.6.2023	45.026597	14.618236	Web page
Pakoštane	27.6.2023	43.914628	15.507163	Inaturalist
Rijeka	4.7.2023	45.328319	14.450978	Inaturalist
Rijeka	10.7.2023	45.320264	14.464345	Inaturalist
Tribunj	10.7.2023	43.756922	15.747565	Inaturalist
Porozina, Cres	15.7.2023	45.131578	14.287855	Inaturalist
Rovnj Otočić Maškin	18.7.2023	45.055445	13.627704	Inaturalist
Rovinj Otočić Sv. Andrija	19.7.2023	45.059789	13.624444	Inaturalist
Rijeka	20.7.2023	45.357078	14.368396	Facebook groups

Tab. 1. Continued

Site	Date (dd/mm/yy)	Longitude	Latitude	Source
Puntera	21.7.2023	45.053112	14.022649	Inaturalist
Rijeka	22.7.2023	45.315589	14.469803	Inaturalist
Krk	22.7.2023	45.137153	14.644895	Inaturalist
Krk	23.7.2023	45.204175	14.501711	"Have you seen me ?" campaign
Marčana	24.7.2023	44.957381	13.955834	Biologer
Šibenik	25.7.2023	43.737186	15.888239	Biologer
Šibenik	1.8.2023	43.734415	15.896957	Biologer
Krk	2.8.2023	45.078263	14.546962	Inaturalist
Štrmac	3.8.2023	45.125916	14.109832	Inaturalist
Zadar	10.8.2023	44.112148	15.228309	Inaturalist
Pula	18.8.2023	44.86832	13.846582	Inaturalist
Opatija	18.8.2023	45.3282	14.300802	Inaturalist
Murter	20.8.2023	43.815948	15.604786	Inaturalist
Vodice	22.9.2023	43.757475	15.776015	Inaturalist

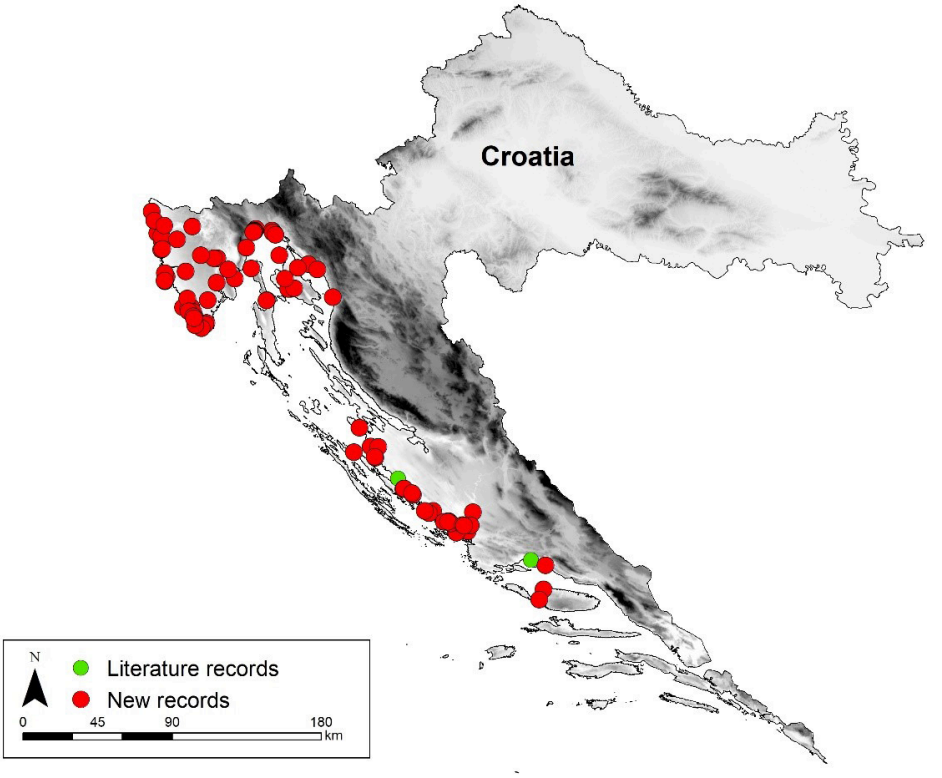

Fig. 1. Distribution of *P. archon* in Croatia in the period from 2011 to 2023 (red dots represent new records, while green dots represent previously known literature records).

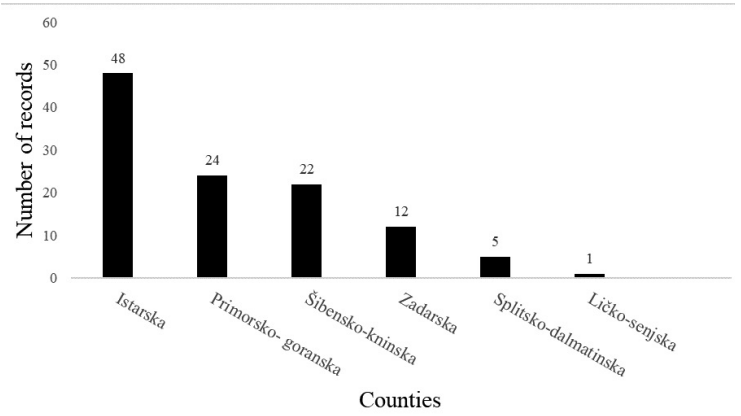

Fig. 2. The counties in Croatia ranked per number of records of *P. archon* indicating the severeness of impact (counties were ranked from highest number of records to lowest number of records)

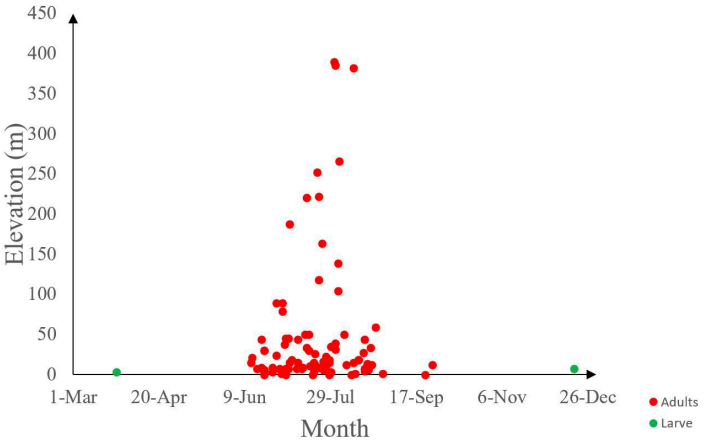

Fig. 3. A bar chart of the flight period throughout months of moth activity in relation to elevation in Croatia (red dots represent records of adults, while green dots represent records of larvae)

DISCUSSION

In the 12 years since the moth was recorded for the first time in Croatia, it has expanded significantly. Before this work, the presence of the *P. archon* in Croatia was known in the scientific literature only from Split and Zadar (Masten Milek & Šimala, 2012). However, during the decade many available records all over the coastal areas of Croatia have been reported and are summarized here for the first time. Accordingly, the known distribution of the moth has expanded to Istarska, Primorsko-goranska, Zadarska, Šibensko – kninska, Splitsko – dalmatinska and Ličko-senjska county.

There are several ways the moth can colonise new locations. Firstly, the moth can come to an area almost invisibly inside palms imported from areas already affected (Sarto I Monteys *et al.*, 2001). A second and less investigated way is natural dispersion through

flight. It has been recorded that adult moths are highly mobile and can fly distances >500 m which makes them great colonisers of new areas. Also, this species is a relatively fast flier, both sexes reaching flight velocities up to 6-7 km/h (Isidoro *et al.*, 2017). Lastly, the moth can also spread using human vectors such as cars, planes, boats, transport vehicles etc.; this way has not yet been confirmed for *P. archon*, but it is one of the mechanisms that non-native species regularly use and there is a possibility that this moth is also spreading in this manner (Hulme, 2009; Lemke *et al.*, 2019; Bertelsmeier, 2021).

The records on Croatian islands are probably a consequence of natural dispersion, because most islands on which the moth was recorded are less than 7 km away from the mainland which could imply that the moth can reach most of the close Croatian islands in less than one hour. Although the moth is probably present on many more islands, but has not been yet recorded, probably because there are fewer visitors and researchers on the islands, and fewer palm trees on the islands. The same reason could explain why the moth has not been recorded in the southernmost parts of Croatia. It should also be considered that this species competes for host plants with another non-native species, the red palm weevil, *Rhynchophorus ferruginneus* (Olivier, 1790) (Bombi, 2020) which could possibly have outnumbered the moth's populations in southern Croatia.

The flight time in Croatia for *P. archon* starts in June reaching a peak of activity in July and August and can occasionally be observed in September. Similar patterns in flight time have been observed previously; it begins in mid-May, peaks in July and ends in September and can be observed very rarely in October, in some warmer areas (Sarto I Monteys, 2013; Beaudoin-Ollivier *et al.*, 2017; Isidoro *et al.*, 2017). However, the moth is yet to be observed in May in Croatia with the earliest record of moth activity being in early June. In the southern hemisphere, where the moth is native, it has been observed flying from November to early May which corresponds to the flight season in the northern hemisphere (Sarto I Monteys & Aguilar, 2005). The species oviposits throughout its flight period and eggs and younger larvae can be observed from May to October (Isidoro *et al.*, 2017). Two larvae records from Krk and Vodice, observed in December 2022 and March 2023, indicate that this species overwinters in the larval stage hidden in the trunks of palms (Riolo *et al.*, 2004; Sarto I Monteys & Aguilar, 2005; Isidoro *et al.*, 2017). The larval stage is the longest stage of the life cycle lasting from 10 to 18 months with larvae moulting up to nine times; this is the only stage in Europe in which moth overwinters. The larvae exhibit a one to almost two-year cycle and are mature for pupation after one or approximately two years of feeding inside a trunk. One-year cycle larvae mature and construct their cocoons in early spring from March to April and adults emerge in late June throughout July and the rest of summer, while two-year-cycle larvae construct their cocoons in winter which leads to the emergence of adults in mid-May to mid-June (Isidoro *et al.*, 2017).

P. archon mostly attacks palms that are grown for horticultural purposes like *W. filifera*, *P. canariensis*, *T. fortunei* and other imported species. In Croatia, according to the Flora Croatica DataBase there are no native palm species therefore this species does not pose a threat to native biodiversity. However, a study from Spain implies that *P. archon* does indeed pose a threat to wild populations of the Mediterannean fan palms (*C. humilis*), which naturally occur in this area. They are used as a host plant by this moth which could have a negative impact on their abundance in nature (Bombi, 2020). This effect is of conservation concern since this is the only palm species naturally present in Europe, and it is naturally distributed only in parts of the Iberian peninsula, southern France and

Italy. This species of palm is present in Croatia as an ornamental plant in horticulture and the presence of this species on the Mediterranean fan palm has been recorded ever since the first records (Masten Milek & Šimala, 2012).

Sometimes non-native species have no natural enemies like parasitoids and predators and this could facilitate their spread which is known in invasion ecology as an "*enemy release hypothesis*" (Colautti *et al.*, 2004; Heger & Jeschke, 2014). For this moth species, there is very scarce information on predators, pathogens and parasitoids even in their native range. There are no scientific records of bacteria being effective in the eradication of this species, while viruses have shown very little to no efficacy (Ortega-García *et al.*, 2017). It is suggested that ants might predate the eggs of the moth, which has been previously recorded for other species from the family Castniidae (Esquivel, 1981, 1983). In its native range, the predatory wasp from the family Ichneumonidae has been observed performing biological control of the moth. Some bird species from the family Corviidae have been observed feeding on the larvae of moths in their native range (Sarto I Monteys & Aguilar, 2005). Reptiles, birds and small mammals could play a role in predation rates on this moth species (Muñoz-Adalia & Colinas, 2020). We would also like to add our record for domestic cats as predators as we observed one individual killed by a cat. It has been proven that one of the effective agents of biological control for the moth is entomopathogenic nematodes from the genera *Steinernema* Travassos, 1927 and *Heterorhabditis,* Poinar, 1976 as well as entomopathogenic fungi from the genera *Beauveria,*Vull. (1912) , *Trichoderma,* Pers. (1801) and *Cladosporium* Link. (1816) reaching laboratory mortality rates up to 50 – 100 % for eggs and larvae (Ortega-García *et al.*, 2017; Muñoz-Adalia & Colinas, 2020). These effective agents of biological control are fully in use around Europe.

P. archon could impact the horticultural sector and cause economic loss (EFSA, 2014). For example, in the Marche region in Italy, moth infestation reduced the production of palms in plant nurseries by 90 %. (Riolo *et al.*, 2004; Verdolini, 2013). In France, this species destroyed or caused significant damage to around 50000 – 60000 palm trees in a period of ten years (from 2002 to 2012) (Andre & Malicorne Tixier, 2013; Rochat, 2013). In one region of France, Languedoc-Roussillon, an 80-90 % decrease in *Trachycarpus fortunei* for 10 years was observed as a consequence of moth infestation. A similar pattern has been observed in Montpellier where a decrease of 80 % was recorded for *T. fortunei* during the same period (Andre & Malicorne Tixier, 2013). It is estimated that the economic damage caused by *P. archon* and *R. ferruginei* in the Mediterranean region amounts to 483 million euros which is also considered to be a value that is underestimated (EFSA, 2014). Along with its economic and biodiversity impact, the moth can also impact the aesthetic characteristics of the landscape by destroying palm trees which are a very popular and symbolic part of the Mediterranean landscape (Suma *et al.*, 2017) and this impact could affect the sector of tourism by reducing the numbers of visitors. Similar consequences are reported in Croatia all over the media, however, the impact of moth infestation, the economic cost, is yet to be accurately quantified and described.

CONCLUSIONS

The palm borer moth (*P. archon*) was recorded over 10 years ago for the first time in Croatia. The presence and the distribution of the moth have been confirmed 12 years later, and some new records have been published in this article. The species could pose a serious conservation threat to the Mediterranean fan palm populations; however, this

impact is yet to be addressed and is not of concern for Croatian biodiversity. This moth species is also considered an invasive pest species which is having an economic impact through its destruction of palm trees, the monetary consequences of which are yet to be estimated.

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