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Research Article

First record of *Triplax melanocephala* (Latreille, 1804) (Coleoptera: Erotylidae) in the cork oak at Collo forest (Algeria)

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Abstract

The Erotylidae family remains poorly documented in North Africa, with very limited published data available on its distribution and ecological preferences. This study provides the first confirmed record of Triplax melanocephala (Latreille, 1804) within Algerian cork oak (Quercus suber) forests, significantly expanding the known range of this species in the region. A total of 71 specimens were documented, collected primarily through soil-surface interception traps deployed across multiple sites. Among these, 25 individuals were captured between 2015 and 2016 in different sections of the surveyed oak groves. Field observations revealed that T. melanocephala exhibits a strong association with decaying cork oak wood, particularly in trees heavily colonized by mature tinder fungi (Fomes spp.). Further investigation through careful dissection of these fungal growths uncovered an additional 30 specimens, reinforcing the species' reliance on this microhabitat. The beetles were most frequently found in moist, shaded areas of decomposing wood, suggesting that microclimatic conditions may play a key role in their distribution. The study sites included Oued Agouf, where 2 specimens were collected in 2015 and 4 in 2016; Ain Fegoum, with 6 specimens in 2015 and 8 in 2016; and El Maktoua, where 4 specimens were recorded in 2015 and 6 in 2016. These findings indicate a consistent presence of T. melanocephala across multiple locations, though population densities varied between sites. This discovery not only fills a gap in the understanding of Erotylidae in North Africa but also highlights the ecological importance of old-growth cork oak forests and their associated fungal communities in supporting specialized beetle fauna.

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1. Introduction

The Collo forest is characterised by numerous ancient trees. The presence of decaying wood creates an ideal habitat for the growth of wood-inhabiting fungi. Genus *Quercus* Linnaeus, 1753 is home to significant entomological diversity (Dajoz, 1985). Most European Erotylidae species are included in the European red list of saproxylic beetles (Alvarenga, 1994; Nieto & Alexandre, 2010). This family includes 136 genera and 3,000 species worldwide. It is also known as the 'Pleasant Fungal Beetles' because of the diversity of its shapes, its bright colors and its feeding behavior towards fungi (Houl et al. 2024). The family Erotylidae is poorly documented in North Africa, particularly in Algeria, with limited records and a lack of comprehensive faunal data available in the literature. Delkeskamp (1981) conducted extensive taxonomic revisions on African Erotylidae, within which *Triplax* Herbst, 1793 is classified under the tribe Tritomini and the family Erotylidae. Species of this genus are mycetophagous. This beetle is extensively found across the Europe, North Africa, northern and central Asia, parts of the Middle East, Eastern and Nearctic areas (Goodrich & Skelley, 1997; Wegrzynowicz, 2007; Dodelin, 2014; Skelley, 2020; Troukens, 2022; Houl et al., 2024). A total of 93 species have been documented, including 67 found in the Palaearctic region. They are solely linked to decomposing fungi on deceased timber, classifying them as obligate lignicolous. Franc (2001) asserts that *Triplax* species serve as indicators of well-preserved forest ecosystems characterised by high biodiversity. These mycetophagous insects reside and proliferate within wood-decaying mushrooms (Alexander, 2008). They are typically found in forests that are minimally disturbed or unused, as their survival depends on the presence of fungi, which in turn rely on the availability of dead wood. Representatives of this genus are mycetophagous species associated with lignicolous fungi or under the bark of old trees colonised by various fungi (Bahillo de la Puebla et al., 2011). Data on *Triplax* species are limited in North Africa. All available information is restricted to a publication by Chûjô (1990) for Algeria. *Triplax* larvae can grow on dehydrated mushrooms and appear later in the season. Although nymphs are occasionally discovered in fungus, pupation usually occurs in the soil. These nocturnal insects are often seen traversing decaying trees and fungal formations. In Morocco, *Triplax melanocephala* (Latreille, 1804) was reported by Chavanon (2018). On the other hand, the latter, which is new to the fauna and unknown to the Algerian fauna, has just been identified in the Collo area oak forest (Skikda). The family Erotylidae, which had not yet been recorded in our study, includes *Triplax melanocephala* (Latreille, 1804), a small, discreet and relatively little-studied insect species.

2. Materials and method

The Collo Massif, located at coordinates 37° 0′ 23″ N, 6° 33′ 39″ E, is a densely forested mountain range located in the north-eastern region of Algeria, where it constitutes an integral part of the Tellian Atlas. It ranges in altitude from 980 to 1,183 metres and experiences a humid to subhumid Mediterranean climate characterised by distinct seasonal variations. The region has a temperate and wet winter from December to March, followed by a hot, dry summer from June to September. Three unburnt study sites were selected across diverse locations within the massif for this investigation. Cork is derived from the bark of the cork oak (*Quercus suber* L.), a species characterised by semi-evergreen foliage, moderate longevity, and considerable resistance drought and fire conditions, as noted by Villemant & Fraval (2002). Two sampling methods were used: pitfall traps and the dissection of polypores (collected one to three times per month) from cork oaks colonised by the tinder fungus. Data were gathered over a three-month span (April to June) during two consecutive years (2015 and 2016) at three locations: Oued Agouf, Ain Fegoum, and El Maktoua (Figure 1). Interceptor traps baited with vinegar (Bertoia et al., 2023) were used for trapping. At each station, twelve traps were placed in protected areas at a random distance of 1 to 5 metres from the tree trunks. Each Barber pitfall trap had a little amount of detergent and a preservative solution (vinegar) that served as a wetting agent to keep insects from climbing the sides and escaping. Then, to stop precipitation from penetrating, a protective cover (stone, tile, or bark) was positioned roughly 1 cm above the trap's border. The pitfall traps were set for a period of three months over two successive years at the same study sites. These locations feature aged, dead, and unburnt cork oak forests, which are habitats for the fungus *Fomes fomentarius* (Figure 2). The traps remained in place for 48 hours, with sampling carried out fortnightly. Sampling was carried out by direct observation of the vegetation, trunks, rocks, etc., sometimes supported by a white tray placed under the plants that were affected. Sometimes supported by a white tray placed under the plants, which are struck to collect the insects that fall. These samplings made it possible to locate and identify species belonging to the Erotylidae family (Molina, 2021).

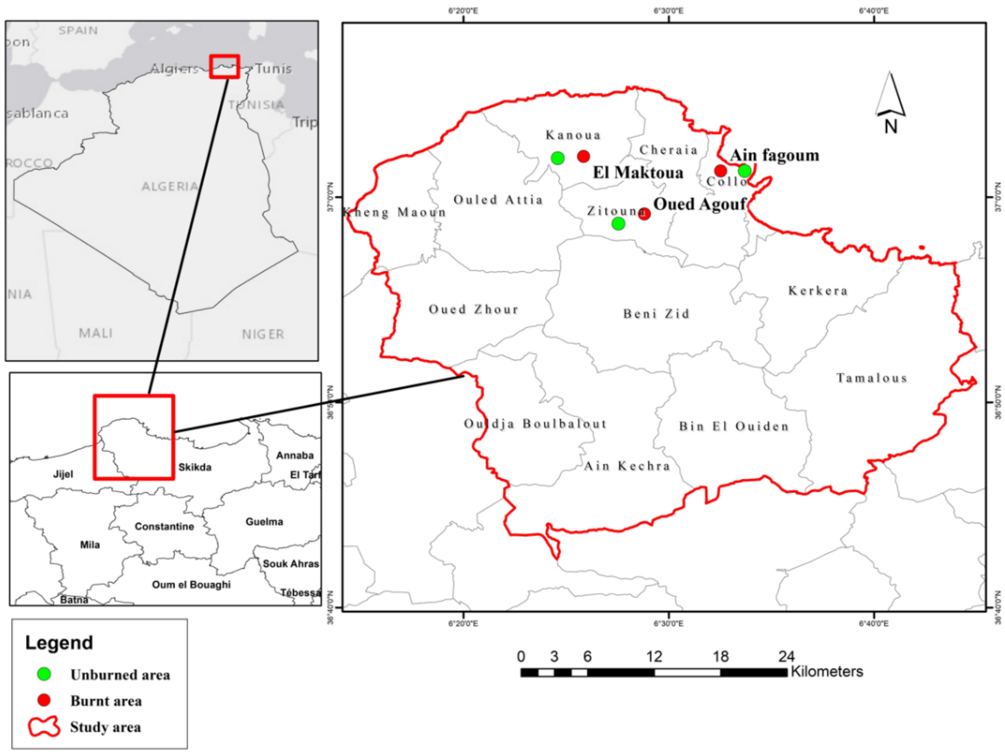

Figure 1. Study site

The collected biological samples were placed in labelled and dated bottles, with each bottle noting the unique details of the sampling location. The captured species are prepared and preserved in 70° alcohol in the zoology laboratory for identification. Confirmation was carried out by Professor Faiza MARNICHE. Keys to dichotomous bases of Dajoz (1985), Chûjô (1990), Alvarenga (1994), Goodrich & Skelley (1997), Merkl (2004), Wegrzynowicz (2007), Hackston (2009), Calmont (2011), Ruta et al. (2011), Bekchiev et al. (2012), Dodelin & Saurat (2014), Chavron, (2018), Molina, (2021), and the online resources www.kerbtier.de and www.koleopterologie.de.

3. Data analysis

The results obtained were evaluated using an ecological index, total richness and relative abundance, and also on structural ecological indices like the Shannon index and equitability.

3.1. Ecological composition indices

3.1.1. Specific richness

Figure 2. a. General view of the Collo massif; b. El Maktoua forest (unburned subera); c. Fomes fomentarius, in the El Maktoua forest, an old, unburnt cork oak (Quercus suber) was examined, leading to the discovery of the species Triplax melanocephala.

This is the typical main factor that characterizes a population, the overall richness (S) of a biocenosis corresponds to all the species in its environment (Ramade, 2020).

3.1.2. Relative abundance

Similarly, it represents centesimal frequency which is calculated as a percentage (AR%), shows the proportion of individuals of a species (ni) in relation to the total number of individuals (N). It is added by dividing the number of individuals of a species by the individual's total number, multiplying by 100: AR % = (ni / N) x 100 (Faurie et al., 2011).

3.2. Ecological composition indices

Shannon's diversity index is calculated from the following formula: H'= - Σ Pi log 2 Pi; H ': diversity index, expressed in bits (Ramade, 2020). Pi is the probability of meeting the species and it is calculated by the following formula: Pi = ni / N: is the number of individuals of species i. N: the total number of individuals. The index of equitability (E) corresponds to the ratio of the observed diversity H' to the maximum diversity H'max. It is calculated based on the following formula: E = H'/ H'max. (Ramade, 2020). The analysis was conducted with PAST software vers. 2.17 (Hammer et al., 2001).

4. Result and discussion

In this study, *Triplax melanocephala* was observed using Barber pitfall traps, with a total of 71 individuals recorded. Of these, 25 were collected in 2015 (3 at Oued Agouf, 7 at Ain Fegoum, and 15 at El Maktoua) and 46 in 2016 (6 at Oued Agouf, 16 at Ain Fegoum, and 24 at El Maktoua). Notably, *T. melanocephala* was exclusively associated with dead cork oak trees colonised by *Fomes* fungi. An additional 30 individuals were identified through direct observation. The results are grouped in Table 1.

Table 1. Triplax melanocephala (Latreille, 1804) was observed in several unburnt cork oak woodland sites (Collo, Skikda).

Methods	Barber pitfall traps											
Sites	Oued Agouf				Ain Fegoum				El Maktoua			
Years	2015		2016		2015		2016		2015		2016	
Parameters / month	ni	RA (%)	ni	RA (%)	ni	RA (%)	ni	RA (%)	ni	RA (%)	ni	RA (%)
April	2	66.67	3	50.00	4	57.14	7	43.75	4	26.667	6	25.00
May	1	33.33	2	33.33	1	14.29	5	31.25	5	33.333	8	33.33
June	0	0.00	1	16.67	2	28.57	4	25.00	6	40.000	10	41.67
Total (N)	3	100.00	6	100.00	7	100.00	16	100.00	15	100.000	24	100.00
Month /Methods	Dead Cork Oaks with Fomes											
IV	1	50.00	2	50.00	3	50.00	1	12.50	1	25.00	0	0.00
V	0	0.00	1	25.00	2	33.33	2	25.00	2	50.00	5	83.33
VI	1	50.00	1	25.00	1	16.67	5	62.50	1	25.00	1	16.67
Total (N)	2	100.00	4	100.00	6	100.00	8	100.00	4	100.00	6	100.00

IV : April; V: May; VI: June; ni : number of individuals; RA (%) : relative abundance in %.

Table 2 presents data on the catches of the species *Triplax melanocephala* (Coleoptera - Erotylidae) using Barber traps in three subareas of the Collo massif in Algeria. It demonstrates variations in catch rates and biodiversity across different sites over a three-month study period, conducted over two consecutive years.

Table 2. Shannon diversity and equitability indices for Triplax melanocephala (Latreille, 1804) were calculated across different sites over a two-year study period.

Years	2015	2016	2015	2016	2015	2016
Sites/Month	April		May		June	
Oued Agouf	2	3	1	2	0	1
Ain Fegoum	4	7	1	5	2	4
El Maktoua	4	6	5	8	6	10
Taxa_S	3	3	3	3	2	3
Individuals	10	16	7	15	8	15
Shannon_H’	0.46	0.45	0.35	0.42	0.24	0.35
Shannon_H'max.	0.48	0.48	0.48	0.48	0.30	0.48
Equitability_J	0.96	0.94	0.73	0.88	0.80	0.73

The catches increased slightly from 2015 to 2016 across all sites. In May, a significant increase was observed at some sites, such as El Maktoua, while in June, the catches increased in 2016 compared to 2015. In terms of sample richness, we observed that in April and May, it remained stable at S = 3 individuals for both years. However, in June, a decrease was noted in 2015 (S = 2 individuals) compared to 2016 (S = 3 individuals). The Shannon H’ (bits) and Equitability J indices show greater diversity in 2016 compared with 2015, reflecting a better distribution of the species caught. A value close to 1 indicates a fair distribution. A general trend towards less dominance (lower values) in 2016 indicates that populations are less dominated by a single species. These results suggest an improvement in environmental conditions or ecological variations favourable to the species. Insect populations fluctuate naturally in response to biological cycles, available resources and interactions with other species. 2016 could be a more favourable year in activity movement of *Triplax melanocephala* (Table 2).

During the dissection of aged tinder fungus, *Triplax melanocephala* was identified. This coleopteran species was exclusively found on dead cork oaks (*Quercus suber*) colonised by *Fomes fomentarius* (Table 3).

Table 3. The Shannon diversity and equitability indices for Triplax melanocephala (Latreille, 1804) were evaluated in relation to Fomes fomentarius during the study period.

Years	2015	2016	2015	2016	2015	2016
Sites/Month	April		May		June	
Oued Agouf	1	2	3	1	1	0
Ain Fegoum	0	1	2	2	2	5
El Maktoua	1	1	1	5	1	1
Taxa_S	2	3	3	3	3	2
Individuals	2	4	6	8	4	6
Shannon_H’	0.30	0.45	0.39	0.18	0.45	0.20
Shannon_H'max.	0.30	0.48	0.48	0.48	0.48	0.30
Equitability_J	1.00	0.94	0.82	0.38	0.94	0.66

The Table 3 reveals that the diversity and equitability of *Triplax melanocephala* fluctuates little between sites, months and years, but remains generally low, which is characteristic of a species adapted to a specialised microhabitat such as that provided by *Fomes fomentarius*. The differences observed between 2015 and 2016 (for example, a greater number of individuals in 2016) may reflect environmental variations, such as temperature or humidity, which influence either the fungus or the beetle. Sites such as Ain Fegoum, with a peak of five individuals in June 2016, appear to be more favourable at certain times, potentially due to a local abundance of tinder fungus. The variations in species richness, diversity, and dominance between years and months could be influenced by environmental changes, the species' biological cycles, or alterations in resources associated with Fomes in the cork oak forests.

4.1. Diagnosis by species **Triplax melanocephala**

Scientific name**: Triplax** *melanocephala* (Latreille, 1804);
parentname**:** Latreille, 1804;
Kingdom: Animalia; phylum: Arthropoda;
class: Insecta; order: Coleoptera;
family: Erotylidae;
taxon Rank: species; genus: *Triplax*;
specific epithet: melanocephala;
location id: Massif de collo (Skikda);
higher geography id: Algeria;
higher geography: North Africa;
continent: Africa; country: Algeria; municipality: Skikda;
minimum elevation in meters: 0m; maximum elevation in meters: 1412 m.

verbatim Coordinates: 36°52′34″ N, 6°54′33″ E; Altitude above sea level: 24m; verbatim Latitude: 36°52′34″N; verbatim Longitude: 6°54′33″E; decimal Latitude: 36.5234; decimal Longitude: 6.5433; sampling protocol: Pitfall traps; induvidual Count: 71; recorded by: Sabrina Laouira; identified by: Faiza Marniche; date Identified: 2015.

Triplax melanocephala (Latreille, 1804) is characterised by a dark head, pronotum, antennae and legs. The rest of the body is black. The antennae are relatively short with narrow segments and the tibiae, especially the anterior tibiae, are conspicuously enlarged at the tips. The metatibia is less enlarged, and the species is between 3.5 and 4.9 mm long (Dajoz, 1985; Merkl, 2004; Hackston, 2009; Ruta et al., 2011; Dodelin & Saurat, 2014) (Figure 3). This species is found in central and southern Europe (Calmont, 2011), and Kocher confirmed its existence in Morocco near Guenfouda (Chavanon, 2018). Synonyms for this species, as noted by Wegrzynowicz (2007), include *Triplax ruficollis* Stephens, 1830, *Tritoma collaris* Fabricius, 1801, *Tritoma melanocephala* Latreille, 1804, *Triplax nigriceps* Lacordaire, 1842, *Platichna collaris*, *Platichna melanocephala, Platichna nigriceps, Platichna ruficollis*, and *Triplax cyanescens* Bedel, 1868, which is synonymous with *Triplax melanocephala* Lacordaire, 1842.

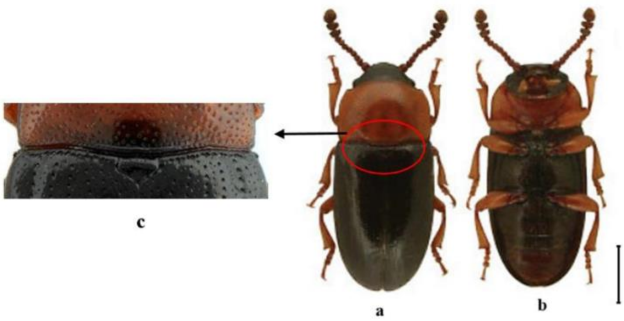

Figure 3. Triplax melanocephala (Latreille, 1804) a: dorsal side; b: ventral side; c: base of the elytra Bars :1.0mm.

In this study, *Triplax melanocephala* was observed to be present using both sampling methods. The presence of insects on polypore's can serve as an indicator of habitat condition. It is commonly acknowledged that insects, especially those in the Coleoptera order, are trustworthy reference standards for assessing the condition of ecosystems and the effects of management practices on forest habitats (Nageleisen & Bouget, 2009). They are xylomycophagous, meaning they feed on fungi that decompose wood throughout their life cycle and inhabit wood-decomposing fungi, with *T. melanocephala* specifically linked to the tinder fungus (Dajoz, 1985; Bekchiev et al., 2012).

The results of this study indicate that *T. melanocephala* is closely associated with the old fruiting bodies of *Fomes fomentarius*, as observed in the current research. This aligns with Dajoz (1985), who reported that the tinder fungus serves as a habitat for *Triplax* and *Mycetophagus* larvae. He also documented 142 specimens of *T. melanocephala* across three European study sites. Franc (2001) further noted that this species is sporadic and uncommon in the warm deciduous forests of southern and central Europe, with a preference for exothermal environments. In Spain, it has been documented in the provinces of La Rioja (Pérez-Moreno & Moreno Grijalba, 2009), Huelva, Orense (Diéguez Fernández, 2013), Tarragona, and Zaragoza (Viñolas et al., 2014). This species confirms the importance of freely evolving forests for the conservation of rare organisms. A large volume of dead wood, mixed plant species, advanced forest stages. All these factors, together with the absence of human intervention over the long term, contribute to the perpetuation of the micro-habitats that are essential for the *Triplax* we have just described and, more generally, for saproxylic organisms. Further discoveries would be interesting to better understand the degree of isolation of the populations described here. This species is closely associated with Fomes, a fungus that serves as a food source or habitat. Population fluctuations could be linked to the availability of Fomes (its quantity and distribution in the suberate's) and the health and growth of the fungus, which can vary according to environmental factors (temperature, humidity, and rainfall). The maturity of the fungus could also affect the ability of *Triplax melanocephala* to thrive. Other species of beetle or insect sharing the same habitat or feeding on *Fomes* could compete with *Triplax melanocephala.* If another species dominates in a given year, this could reduce *Triplax* populations. Predators such as birds, spiders and other predatory insects can affect *Triplax melanocephala* populations. An increase in predators could explain the drop in catches. Annual variations in temperature, rainfall, and humidity directly influence the growth of *Fomes*, as well as the biological cycles of *Triplax melanocephala* (reproduction and larval development). Frequent fires in cork oak forests can impact the habitats of both fungi and insects, while deforestation or human exploitation may disrupt local ecosystems and alter the availability of microhabitats.

Seasonal variations may be associated with the breeding season and larval development. If environmental conditions are unfavourable during a particular season, this could reduce the number of individuals in the following year. Additionally, individuals may migrate to other areas if resources become limited in a given suberate. This work provides of a new specific insect for the Collo Massif (Algeria) and is the first step towards compiling a catalogue of the family Erotylidae in the province, where there must undoubtedly be more species, as these species are generally indicators of environmental quality, and knowledge of them can serve as a tool to be taken into account in the management of natural areas.

5. Conclusion

This study highlights the ecological association between *T. melanocephala* and decaying cork oak trees, emphasising the importance of deadwood and fungal habitats for this species. Further research is recommended to explore the distribution, ecology, and conservation status of Erotylidae in North Africa. The identification and confirmation of *Triplax melanocephala* species completes the diversity of species of the Algerian entomfauna. Other investigations in various sites of the Algerian cork oak forests would be interesting to better analyze the distribution of the species in its potential environment.

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Author's declaration and contribution

The authors declare that they have no conflicts of interest. SL, a PhD student in agronomy, conducted the field sampling of arthropods, analysed the data, and drafted the manuscript. MF, a professor of agronomy, was responsible for data processing and manuscript revision, contributed to the identification of species. CG, a professor of agronomy, supervised the project and finalized the manuscript. All authors have read and approved the final version of the manuscript.

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