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THE FIRST RECORD OF *PURPURICENUS DESFONTAINII* (FABRICIUS, 1793) (COLEOPTERA: CERAMBYCIDAE) FROM NORTHWESTERN ALGERIA AND ITS SEXUAL DIMORPHISM

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Abstract

Although the cerambycid fauna of Algeria has received a great deal of attention so far, additional collecting has produced one species that was not previously recorded in northwestern Algeria. *Purpuricenus desfontainii* (Fabricius, 1793) is recorded for the first time in northwestern Algeria from the Msila Forest. In May 2019, 50 males and 50 females of *P. desfontainii* were collected by hand on the flowers and stems of milk thistle. External morphological measurements were made to find possible sexual dimorphism in *P. desfontainii*. Results indicated that there are significant differences between males and females in the lengths of antennae and of flagellomeres. Moreover, males and females significantly differ in total body length and width, head width, ratio of antennal length to total body length, and elytral length and width.

KEY WORDS: biodiversity, flagellomeres, forest entomology, Purpuricenini, xylophagous

Introduction

Longhorn beetles are species of the genus *Purpuricenus* Dejean, 1821, and are remarkable for their advantageous size and their brightly colored bodies, more or less stained with black (Trócoli, 2019). The genus has a wide Holarctic distribution and the life cycle of its taxa lasts about 2-3 years. Adults are 10-20 mm in length and fly from May to July (Hanks *et al.*, 2014). The longhorn beetle *Purpuricenus desfontainii* (Fabricius, 1793) is a cerambycid with velvet, red-black appearance, extremely long antennae and prothorax with two anterior black spots. This beetle is found in Morocco, Tunisia, Algeria, Libya and Greece in its typical form [*P. desfontainii desfontainii* (Fabricius, 1793)], unlike the subspecies *P. desfontainii inhumeralis* Pic, 1891, which is distributed more orientally (Danilevsky, 2019; Trócoli, 2019). Villiers (1978) cited this species

as common in Morocco, Algeria and Tunisia, from the coast to high mountains, but he did not list the localities from where the species was reported. It is a polyphagous species, feeding on deciduous trees and shrubs, and it is frequently found from April to July on the flowers of milk thistle (MacRae, 2009; Trócoli, 2019). Kocher (1958) reported it for the whole of mountainous Morocco, with the exception of the south of the Grand Atlas Mountains, sometimes above 2,500 m a.s.l., exceptionally in the plains. It was also reported in Libya, Greece, Turkey, Syria, Jordan, Lebanon and Palestine (Özdikmen & Demir, 2006). In Algeria, this beetle was first found around 1790 in northeastern Barbaria by the French botanist René Louiche Desfontaines, and it was soon after described as *Cerambyx desfontainii* Fabricius, 1793 (Cocquempot *et al.*, 2016). According to Abdelhamid *et al*. (2017), *P. desfontainii* was recorded on the Atlas cedar in the Theniet El Had National Park (northern Algeria).

There is a lack of knowledge about the sexual dimorphism of this beetle and there are no research papers in which its males and females are distinguished based on their external morphology. The ability to more easily distinguish genders in beetles is important in their studying and management, as well as in studies on their reproductive habits (Weber, 1976).

The aims of this study were to: (i) report the first occurrence of *P. desfontainii* from northwestern Algeria; (ii) conduct morphometric analysis of sexual dimorphism of *P. desfontainii*.

Materials and Methods

Adult couples of *P. desfontainii* (50 males and 50 females) were hand-collected, conserved as dry specimens and deposited in the collection of the Department of Ecology and Environment, Faculty of Natural and Life Sciences, University of Batna 2, Batna, Algeria. Samples were photographed using a Nikon Coolpix P610 camera (16 megapixels) (Figs. 1 and 2) and measured using Digimizer Image Analysis Software (Version 5.4.3, MedCalc, Ostend, Belgium). Specimens were measured by analyzing 18 morphometric variables (body length and width, elytral length and width, head length and width, antennal length and length of each of antennomeres 1-11).

Figure 1. A female of *P. desfontainii* found on a flower of milk thistle.

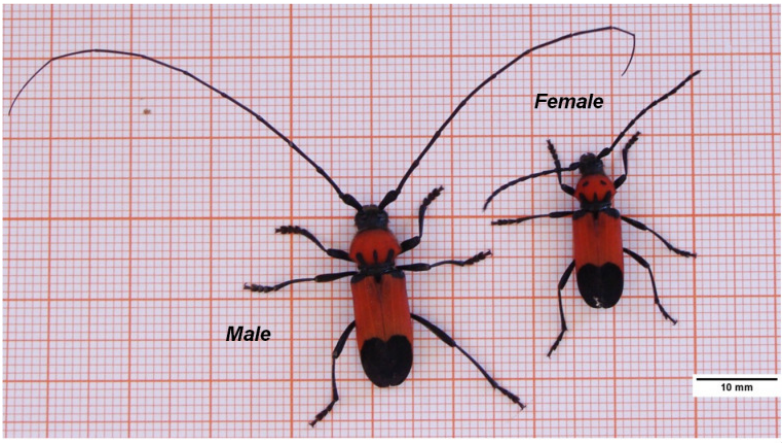

Figure 2. Habitus of a male and a female of *P. desfontainii* (dorsal view).

Measurements included the length (from the front of the head to the distal end of the elytra) and the greatest width of the body (at the base of the elytra), the greatest width and length of the head, the greatest length and width of the elytra, the length of the scape and pedicel, the length of each of the nine flagellomeres and the length of the antennae (from the front of the scape to the distal end of the flagellum).

The measurements obtained for males and females were compared by Mann-Whitney U-test at a probability of 1% using Statistical Analysis System (SAS) software (Version 9.0).

Results

During routine surveys in order to establish a complete inventory on the distribution of the species of Asteraceae of northwestern Algeria, I came across an interesting species of the genus *Purpuricenus* in May 2019. Indeed, numerous adult individuals (>250) were observed on the flowers of milk thistle [*Silybum marianum* (L.) Gaertn.] (Asteraceae). The adult specimens (50 males and 50 females) of *P. desfontainii* used in this study were collected on May 30, 2019 at the edge of the Msila Forest, Oran, Algeria (35°38'N 0°52'W; altitude of 488 m a.s.l.). The sampling location only had milk thistle plants at flowering stage (Fig. 1). Beetle specimens were collected on the flowers and stems of milk thistle in the afternoon. In this period, during mating, it was easy to recognize males and females.

Body length, length and width of elytra, width of head, and length of antennae have different dimensions in the males and females of *P. desfontainii* (Table I). The average length of the antennae in males is 3.72 times as long as the average length of their elytra, whereas the average length of the antennae in females is 1.44 times as long as the average length of their elytra. The ratio of the length of antennae to body length was measured to be on average 2.36 in males and only 0.93 in females. However, both genders of *P. desfontainii* seem to have nearly the same head length according to the Mann-Whitney test at a probability of 1%, while the head width is greater in males than in females (Table I).

Table I. Morphometric analysis of the adult body of *P. desfontainii*.
* – significant at a probability of 1%; Min-Max – range of lengths; ns – not significant; SD – standard deviation; Z – Mann-Whitney U-test value.

Characters	Males (mm)		Females (mm)		Z
	Min-Max	Average±SD	Min-Max	Average±SD	
Body length	22.45-23.10	22.70±0.22	18.60-19.41	19.10±0.29	3.30*
Body width	6.02-6.70	6.35±0.24	5.50-6.20	5.85±0.25	2.84*
Elytral length	14.04-15.68	14.40±0.53	11.94-12.64	12.30±0.21	3.30*
Elytral width	6.53-7.33	6.93±0.29	5.60-6.40	6.05±0.29	3.30*
Head length	2.30-2.90	2.58±0.19	2.19-2.87	2.52±0.23	0.52ns
Head width	3.89-4.50	4.19±0.27	2.29-3.19	2.91±0.35	3.31*
Antennal length	53.30-54.02	53.60±0.23	16.88-17.50	17.70±0.22	3.30*

Table II. The range of antennomeral lengths and average length of antennomeres of *P. desfontainii* adults.
F – flagellomere; Min-Max – range of lengths; SD – standard deviation.

Antennomeres	Males (mm)		Females (mm)	
	Min-Max	Average±SD	Min-Max	Average±SD
Scape	2.47-3.01	2.79±0.20	1.79-2.31	2.01±0.19
Pedicel	0.45-0.59	0.52±0.05	0.33-0.47	0.40±0.05
F1	4.09-4.31	4.21±0.09	2.21-2.35	2.28±0.05
F2	4.67-4.81	4.74±0.05	1.89-2.02	1.96±0.05
F3	5.03-5.16	5.10±0.04	1.86-1.99	1.92±0.05
F4	2.28-5.36	4.92±1.07	1.65-1.77	1.71±0.04
F5	5.34-5.46	5.40±0.04	1.53-1.67	1.60±0.05
F6	5.40-5.55	5.48±0.05	1.31-1.43	1.37±0.04
F7	5.82-5.97	5.90±0.05	1.36-1.49	1.43±0.05
F8	5.16-5.31	5.24±0.05	1.14-1.23	1.18±0.03
F9	8.90-9.90	9.33±0.35	1.00-1.90	1.39±0.31

There were significant differences between males and females in the length of flagellomeres 1-9: all flagellomeres are longer in males (Fig. 3). In male specimens, the angle between the two distalmost flagellomeres is right (Fig. 2). The ninth flagellomere in males looks quite long and thin. It is on average 9.33 mm in length, 6.71 times as long as the same flagellomere in females (Table II; Figs. 2 and 3).

In males, flagellomeres 6, 7 and 8 are on average 4.00, 4.13 and 4.44 times as long as the same flagellomeres in females, respectively. However, the lengths of scape and pedicel differ slightly between genders: in males they are on average 1.39 and 1.30 times as long as the same antennomeres in females, respectively (Table II). The lengths of flagellomeres in females decrease progressively from flagellomeres 1 to 6 (Table II).

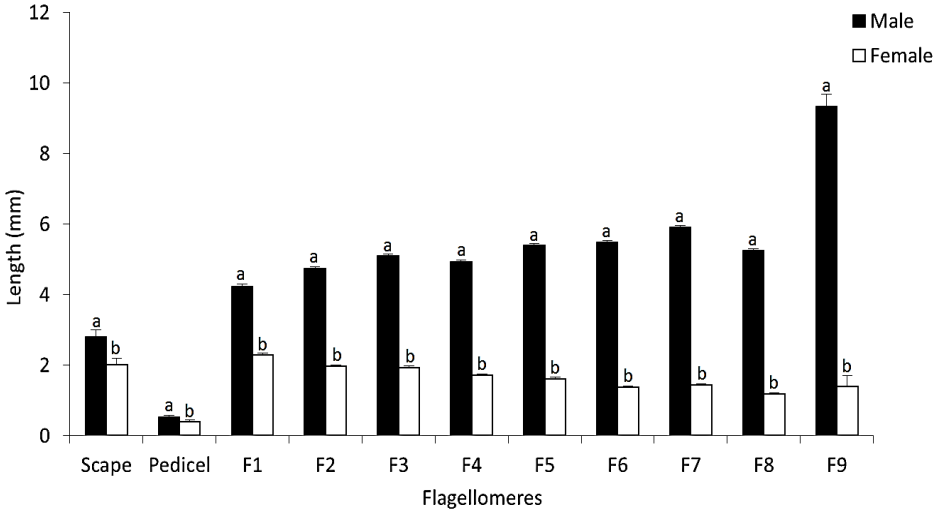

Figure 3. The average length of antennomeres in *P. desfontainii*. Means for the same flagellomere, followed by the same letter, do not differ by Mann-Whitney U-test at a probability of 1%. a – means of 50 male individuals; b – means of 50 female individuals; F – flagellomere.

Discussion

Purpuricenus desfontainii was detected for the first time in northwestern Algeria (Msila Forest, Oran) during the spring of 2019. Further surveys in the spring of 2020 (Kheloufi, pers. obs.) yielded its presence near to the initial detection point (<500 m away), indicating that *P. desfontainii* most probably completes its annual life cycle around this area.

According to several authors, cerambycid beetles possess exaggerated antennas that are typically sexually dimorphic in size (Hughes, 1981; Goldsmith, 1985; Crook *et al*., 2003; Ghate *et al*., 2006; de Gasperis *et al*., 2018). Working on some morphological measurements of the pine sawyer *Monochamus saltuarius* (Gebler, 1830) (Cerambycidae), Han *et al.* (2007) showed that the determination of sex was based on the length of antennae. A more exact distinction between genders was observed in the body length and width, head width, antennal length, and ratio of antennal length to body length in *Monochamus alternatus* (Hope, 1843) (Cerambycidae) (Lee *et al*., 2004). Møller *et al*. (1997) also observed sexual size dimorphism in the antennae of many cerambycid species, with males typically having longer antennae.

The difference in antennal length between genders in Cerambycidae is related to their reproduction, because males use their antennae to find a female and mate, touching her body (Hanks *et al*., 1996; Fan *et al.*, 2014; de L. Nascimento *et al*., 2019). Generally, male beetles have more developed antennae than females to increase the surface area available for the detection of sex pheromones emanating from females (Price *et al*., 2011). Considering this as an evolutionary explanation for the existence of sexual dimorphism, the same may be applied for *P. desfontainii*. In the twig girdler *Oncideres ocularis* (Thomson, 1868) (Cerambycidae), the last antennal segment in males is almost seven times as long as the pedicel, while the last antennal segment in females is only about 2.50 times as long as the pedicel (Lemes *et al*., 2015).
Differences in antennal lengths between genders have also been observed in other Cerambycidae species: *Monochamus galloprovincialis* (Olivier, 1795) (Ibeas *et al*., 2008), *Plectrodera scalator* (Fabricius, 1793)

(Goldsmith *et al.,* 1996), *Phoracantha semipunctata* (Fabricius, 1775) (Faucheux, 2011) and *Aromia bungii* (Faldermann, 1835) (Di Palma *et al.*, 2019).

Although there is a difference between males and females in body length, it is not recommended to use these measurements to establish gender in Cerambycidae, since these measures can overlap in some cases (Arnett & Thomas, 2000). The males and females of *P. desfontainii* can easily be separated based on the length of the last antennal segment. These results are in agreement with the report of Lemes *et al.* (2015), who worked on sexual dimorphism in *O. ocularis*. The males of Cerambycidae often have longer antennae than females, but of a similar general structure, which indicates that selective factors other than pheromone sensitivity are at work (Allison *et al.*, 2004). Elongated antennae may benefit males by increasing their spread, with no such advantage for females, suggesting an evolutionary explanation for sexual dimorphism (Hanks *et al.*, 1996). It has also been suggested that sexual dimorphism in the antennal length in cerambycids is evidence that it plays a role in mate location. Antennal elongation in males can give a significant fitness benefit (Hanks *et al.*, 1996).

Conclusions

The present record of *P. desfontainii* is the first for northwestern Algeria. The longhorn beetle fauna of certain areas in Algeria is not sufficiently explored. Further interesting findings can be expected in the coming years.

This investigation revealed that there are great external morphological differences between the males and females of *P. desfontainii*. Its antennae are sexually size-dimorphic and exaggerated. The measurements of body size (both length and width), antennal length and length of certain flagellomeres are morphological data that can be considered efficient in the sexual selection of *P. desfontainii*.

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ПРВИ НАЛАЗ *PURPURICENUS DESFONTAINII* (FABRICIUS, 1793) (COLEOPTERA: CERAMBYCIDAE) ИЗ СЕВЕРОЗАПАДНОГ АЛЖИРА И ЊЕГОВ ПОЛНИ ДИМОРФИЗАМ

АБДЕНУР КЕЛУФИ

Извод

Иако је фауни стрижибуба Алжира до сада посвећена велика пажња, додатним сакупљањем откривена је једна врста, која раније није забележена у северозападном Алжиру. У питању је *Purpuricenus desfontainii* (Fabricius, 1793), који је регистрован у шуми Мсила. У мају 2019. године, са цветова и стабљика сикавице ручно је прикупљено 50 мужјака и 50 женки ове врсте. Мерења спољашње морфологије су извршена да би био утврђен могући полни диморфизам код *P. desfontainii*. Резултати су показали да постоје значајне разлике између полова ове врсте у дужини антена и дужини флагеломера. Осим тога, мужјаци и женке *P. desfontainii* се знатно разликују по укупној дужини и ширини тела, ширини главе, односу дужине антена према укупној дужини тела, као и по дужини и ширини покрилаца.

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