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Short scientific note

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Expanding the European distribution limits of *Bruchidius raddianae*. First record in Portugal from Vachellia karroo's infested seeds (Coleoptera: Bruchidae; Fabales: Fabaceae)

Francisco A. LÓPEZ-NÚÑEZ [1,*], Liliana NETO DUARTE [2], Rafael YUS RAMOS [3], Elizabete MARCHANTE [1], Hélia MARCHANTE [1,2]

[1] *CFE-Centre for Functional Ecology-Science for People & the Planet, Department of Life Sciences, University of Coimbra - Calçada Martim de Freitas, 3000-456, Coimbra, Portugal* - lnfran85@gmail.com; emarchante@uc.pt
[2] *Instituto Politécnico de Coimbra, Escola Superior Agrária de Coimbra, Centre for Functional Ecology - Coimbra, 3045-601 Bencanta, Portugal* - lilianand@gmail.com; hmarchante@gmail.com
[3] *c/Urb. El Jardín 22, E-29700 Vélez-Málaga, Spain* - rafayus@telefonica.net
* Corresponding author

Abstract
Several Australian and African *Acacia* shrubs and trees have been intentionally introduced into the Mediterranean basin for different purposes, but some species become invasive, such as *Vachellia karroo* (Hayne) Banfi & Galasso (syn. *Acacia karroo*) (Fabales: Fabaceae). The seed beetles, belonging to family Bruchidae, have a significant ecological and economic importance, either because they can be plant pests or, on the other hand, be used as biocontrol agents against invasive plant species. *Bruchidius raddianae* (Anton & Delobel, 2003) (Coleoptera: Bruchidae) is native to tropical and subtropical areas, but it has been recently reported from Cádiz and Málaga (southern Spain, 2007) and in the Lampedusa Island (Italy, 2015) from seeds of pods collected from *V. karroo*. This paper reports 104 specimens reared from seeds collected from *V. karroo* in Faro (southern Portugal) from August to October 2019, expanding the *B. raddianae'* European distribution limits. This is also the first report of its presence in Portugal and the third in Europe.

Keywords: Portugal, alien seed beetle, Karroo thorn, biocontrol, Acacia.

Although the Mediterranean basin is considered one of the world's biodiversity hotspots, it is continuously threatened by anthropogenic activities, habitat fragmentation and introduction of invasive alien species (IAS) (Brunel et al. 2010; Cuttelod et al. 2008). It is broadly accepted that invasive species have environmental (such as biodiversity homogenization, changes on water, nutrient and fire cycles) and socio-economical (allergies, new emergent diseases, management and control costs) negative impacts (Gaertner et al. 2011; Marchante et al. 2008; Mazza et al. 2014; Pimentel et al. 2000). An example of widespread IAS are *Acacia* species (Fabaceae: Mimosoideae), a genus of Australian and African shrubs and trees. They were intentionally introduced in the Mediterranean basin for forestry, food, sand stabilization or industrial purposes, and can be considered as one of the most widespread invasive genus (Al-Assaf et al. 2005; Griffin et al. 2011; Maslin & McDonald 2004). There are many different ways to manage the invaded areas by acacias, with mechanical and chemical methods being the most commonly used in Europe. However, such methods have a high long-term cost/efficiency ratio. The use of biocontrol agents is a promising tool, used for a long-time in other Continents, and that is slowly beginning to be implemented in Europe to fight invasive alien plants (Marchante et al. 2017; Shaw et al. 2018; Shaw et al. 2016).

Vachellia karroo (Hayne) Banfi & Galasso (syn. of *Acacia karroo*) is a South African small tree or shrub, can be used in its native range as a valuable resource for cattle feeding and to maintain several ecological services (Idamokoro et al. 2016). It was introduced in the Mediterranean basin for multiple purposes (such as ornamental and to form hedges) and distributed through the Mediterranean coast (Dufour-Dror 2013). Although the literature about their behaviour in Mediterranean basin is anecdotical, there are evidences of its invasive potential on other regions such Australia or Israel. For example, can cause diverse negative impacts, reduce diversity of the native grass communities and, with its sharped stipules can also cause injuries to animals and people and can hamper diverse forestry management operations (CRC 2003; Dufour-Dror 2013).

The seed beetles' family (Bruchidae) is worldwide spread, with about 2000 species distributed in 56 genera. With an unsolved taxonomical status inside the Chrysomeloidea, some authors claimed that this group should be included as a Chrysomelidae's subfamily due to its paraphyletic profile; other authors argue that it should be a family by itself since it forms a monophyletic group inside

Chrysomeloidea. In order to be conservative, this note followed Yus Ramos, et al. (2007) considering the seed beetles group as a separate family.

Bruchids have a significant economic importance, either by being plant pests or by being used as biocontrol agents against invasive plant species. For example, several species are considered important pests over the world, attacking and damaging both leguminous plants and fruits, such as *Bruchus pisorum* Linnaeus, 1758. This pea weevil is the most important threat for production of *Pisum sativum* L. worldwide (Clement et al. 2009), feeding on cotyledon contents of field pea seeds, reducing the yield, quality and marketability of the product. Nevertheless, due to their characteristic life cycle (as endophytic spermophagous species during pre-imaginal life), other bruchids are often used as biocontrol agents to control invasive plant species with a great seed production, such *Algarobius prosopis* (J.L. LeConte, 1858), introduced in South Africa to control *Prosopis* spp. (Fabaceae: Mimosoideae) (Hoffmann et al. 1993) or *Bruchidius centromaculatus* (Allard, 1868) released in Australia to control *Acacia nilotica* (L.) Willd. ex Delile (Fabaceae: Mimosoideae) (Radford et al. 2001).

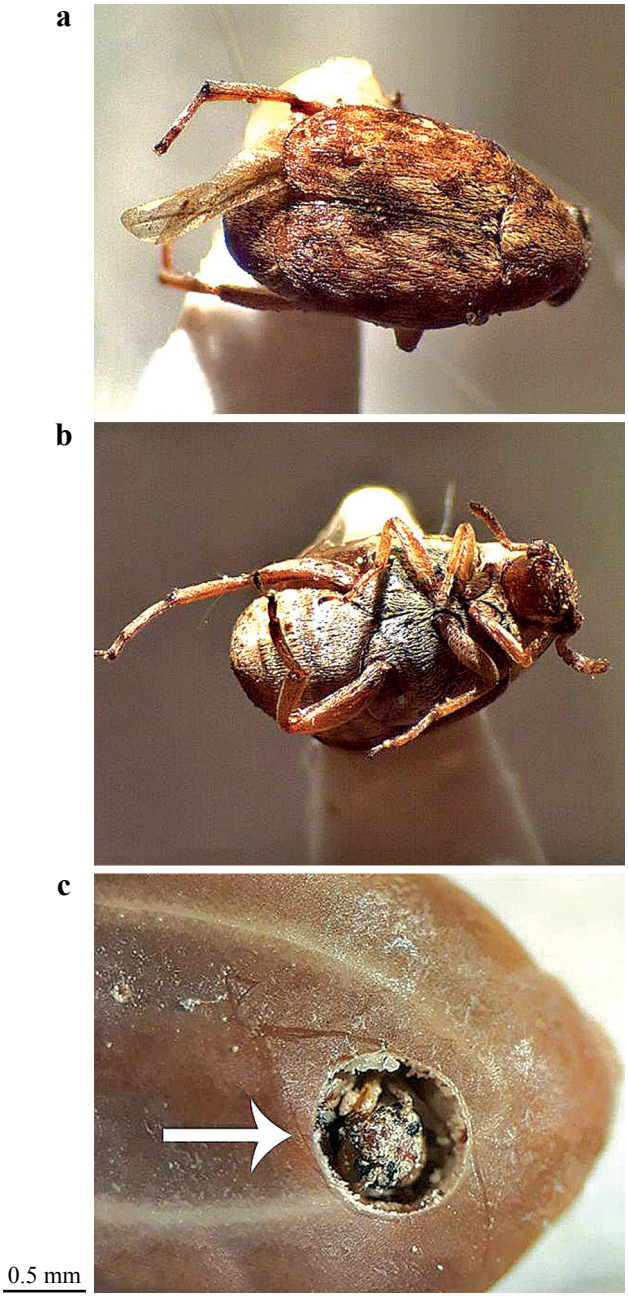

Fig. 1 – Male of *Bruchidius raddianae* (Anton & Delobel 2003); **a,** dorsal view; **b**, ventral view; **c**, emerging from a *Vachellia karroo* seed. Scale bar: 0.5 mm.

Bruchidius raddianae (Anton & Delobel, 2003) is a facultative multivoltine bruchid (Yus Ramos & Coello García 2008a, 2008b), native from tropical and subtropical areas of North Africa, Near and Middle East, India and Sri-Lanka. Pre-imaginal phases feed on seeds of different *Acacia* species (*sensu lato*), showing preference for the Mimosoideae subfamily. In North Africa it usually feeds on *Acacia tortilis* (Savi) Brenan *subsp. raddiana* while in Europe it has been recorded as using only *V. karroo* as vicarious host plant. It prefers immature pods with developing seeds still hanging on *Acacia* trees in contrast to *Caryedon acacia* (Gyllenhal, 1833) which prefers dry and mature seeds on soil (Derbel et al. 2007; Yus Ramos & Coello García 2008a). *Bruchidius raddianae* was recorded by the first time in Europe in August and September 2007 in Cádiz and Málaga (Southern Spain) from *V. karroo* collected material (Yus Ramos & Coello García 2008b). Later, Toma et al. (2017) reported the presence of *B. raddianae* reared from collected *V. karroo* pods from Lampedusa Island (Italy) in October 2015, expanding its distribution in Europe. In May 2019 twenty mature pods from one isolated *V. karroo* shrub were collected in Faro (coordinates: 37.1.52.7448N, 7.58.37.6536W), Portugal. Pods with seeds were picked from the shrub and then kept in a sealed jar at room temperature. From August to the end of October 2019, 104 specimens (48 males, 56 females) of *B. raddianae* (Fig. 1) emerged from 97 seeds (of a total of 147 evaluated seeds). Specimens were identified and confirmed following (Yus Ramos et al. 2014) and vouchers were deposited between Rafael Yus Ramos, Francisco A. López-Núñez and Museu da Ciência–UC collections.

This new record for the alien Portuguese fauna represents the third one for Europe, increasing the reduced knowledge about this species in Europe, expanding its distribution range to the south of Portugal and to the southern end of Europe. Although this finding is restricted to Algarve (the most southern Portuguese region), it is possible that the area of distribution of this bruchid in Portugal extends to Alentejo coast and Estremadura (in the south-middle Portugal) or to Beira litoral (in the centre Portugal), overlapping with the distribution of the host-plant which starts to invaded in these areas (Marchante et al. 2014).

Feeding on seeds, *Bruchidius raddianae* may disrupt Acacias' life-cycle, decrease its seed banks and reduce the Acacia's population growth, showing its potential to be screened in the future as a biocontrol agent against *V. karroo* and related acacias in Portugal and Europe and complementing other biocontrol agents (Winston et al. 2014). However, its feeding behaviour in Europe should be confirmed with non-choice tests to avoid pervasive indirect effects on native species.

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