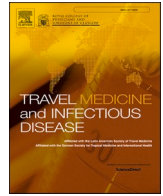




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First report of a traveller myiasis caused by *Cordylobia rodhaini* (Diptera, Calliphoridae) in Spain

Myiasis due to flies of genus *Cordylobia* Grünberg, 1903 (Diptera, Calliphoridae) are classified as obligatory and external, because larvae feed exclusively on living tissues, without a pre-existing lesion. Taxonomically *Cordylobia* belongs to the redefining subfamily Bengaliinae Brauer & Bergenstamm, 1889, and currently includes four species, *Cordylobia anthropophaga* (Blanchard & Bérenger-Feraud, 1872), *Cordylobia rodhaini* Gedoelst, 1910 (= *Cordylobia ebadiana*), *Cordylobia roubaudi* Villeneuve, 1929 and *Cordylobia ruandae* Fain, 1953. *Cordylobia* is an endemic genus in the Afrotropical region and three species are known to cause dermal myiasis, but most cases reported are associated to *C. anthropophaga* (tumbu fly), and less frequently to *C. rodhaini* (Lund's fly), and *C. ruandae* [1]. The tumbu fly is throughout Africa, the Lund's fly is more common in rainforests areas, and *C. ruandae* has been cited only in Zaire and Rwanda [1]. Adults of all species closely resemble each other, and larvae can be distinguished due the body size, spines, shape of the posterior spiracles, and mouth-hooks. Updated diagnostic keys are not available [1], but some studies about morphology of third instar using both optical microscopy and scanning electron microscopy (SEM) had been previously performed [2,3]. The widespread international travel to and from tropical countries, can expose travellers to local pathogens. In Spain, some cases of "travelling" myiasis related with *C. anthropophaga* have been previously reported [4]. Also, potential cases of "local" acquisitions have also been cited in the Iberian Peninsula [5]; however they could be explained if the host was in contact with eggs or small larvae carried by another person from Africa.

A 55-year-old male flew from Alicante (SE Spain) to Bo (Sierra Leone), from the 17th to 24th September 2016. He visited the surroundings of Lakka beach, the chimpanzee sanctuary of Tacugama (rainforest), the campus of University of Njala, and several agricultural fields. When he returned to Spain, he found a boil-like lesions with a small central punctum on his hand, and another in the back, developed as an abscess. Larvae were extracted and introduced in 70% ethanol (Fig. 1). Morphology was analysed using a stereomicroscope an adapted camera (Leica M205C; Leica DFC450). Larvae were measured (1.5–3.5 mm) and identified as *C. rodhaini*, in second instar [1–3]. The identification was confirmed based on a combination of characters (Table 1). The sample was deposited in the Entomological Collection of the University of Alicante and it is public available.

The human myiasis by the Lund's fly is far less common than the one caused by tumbu fly. Since 1902 until 2015, 30 cases of human furuncular myiasis by Lund's fly have been reported in the world, related with travellers infested in tropical sub-Saharan Africa (Ghana, Cameroon, Congo, Ethiopia, Kenya, Uganda, Tanzania, Zimbabwe) [2]. The present case is the first one from Sierra Leone, being the most eastern record, in the endemic area. The usual hosts of *C. rodhaini* are several types of mammals as monkeys, rats, and occasionally humans. The number of body lesions is variable, but it is normally one or two [1].

The life cycle of *C. rodhaini* occurs over 55–67 days. Females lay eggs in wet soil, damp clothes, and humans are infested when contacting these substrates. In about 2–4 days, the newly hatched larvae are activated by the warm body of the host and penetrate skin. In 12–15 days, the larva exits the skin and falls to the ground to pupate. The adult emerges in 23–26 days [2]. In base to the life cycle and the habitats in which it is frequent, the infestation could have taken place probably in the chimpanzee sanctuary of Tacugama. However, it is not excluded the possibility that eggs could have been laid on the on the bed linen. Geray et al. [6] indicated that a L-2 of 1.5 mm was 8–9 days old. However, the second instar can be very variable in size and, in late second instar it could be proximately 6.5 mm, as young larvae of the third instar [2].

This report presents the first case of furuncular myiasis due to *C. rodhaini* diagnosed in Spain. In Europe, 12 cases have been described by this myiasis agent, and Spain only cases of furuncular myiasis by *C. anthropophaga* are known [4]. Considering the increasing number of people, animals, and assets moving across countries, myiasis case reports could be useful to achieve a correct identification of the species causing myiasis. Between 1997 and 2017, 54 cases of autochthonous myiasis were published from Europe, and about 57% come from Southern Europe, with Italy and Spain as the main areas of focus [7]. The rise of temperatures, but also the shortening and softening of winters in the temperate regions could increase the myiasis problem. In conclusion, although *C. rodhaini* is only found in Africa in wild stage, myiasis is continuously recorded throughout the world due to travellers returning from endemic myiasis areas. This report may help to identify the larval species which caused myiasis, to provide the appropriate treatment.

Submission declaration

The work described has not been published previously, and this is not under consideration for publication elsewhere, and its publication is approved by all authors. If the manuscript is accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder.

Author contributions

Anabel Martínez-Sánchez: conceptualization; data curation; formal analysis; investigation; methodology; resources; supervision; original draft; review and editing.

German López-Iborra: conceptualization; data curation; investigation; resources; supervision; review and editing.

Santos Rojo: conceptualization; funding acquisition; investigation; project administration; resources; supervision; review and editing.

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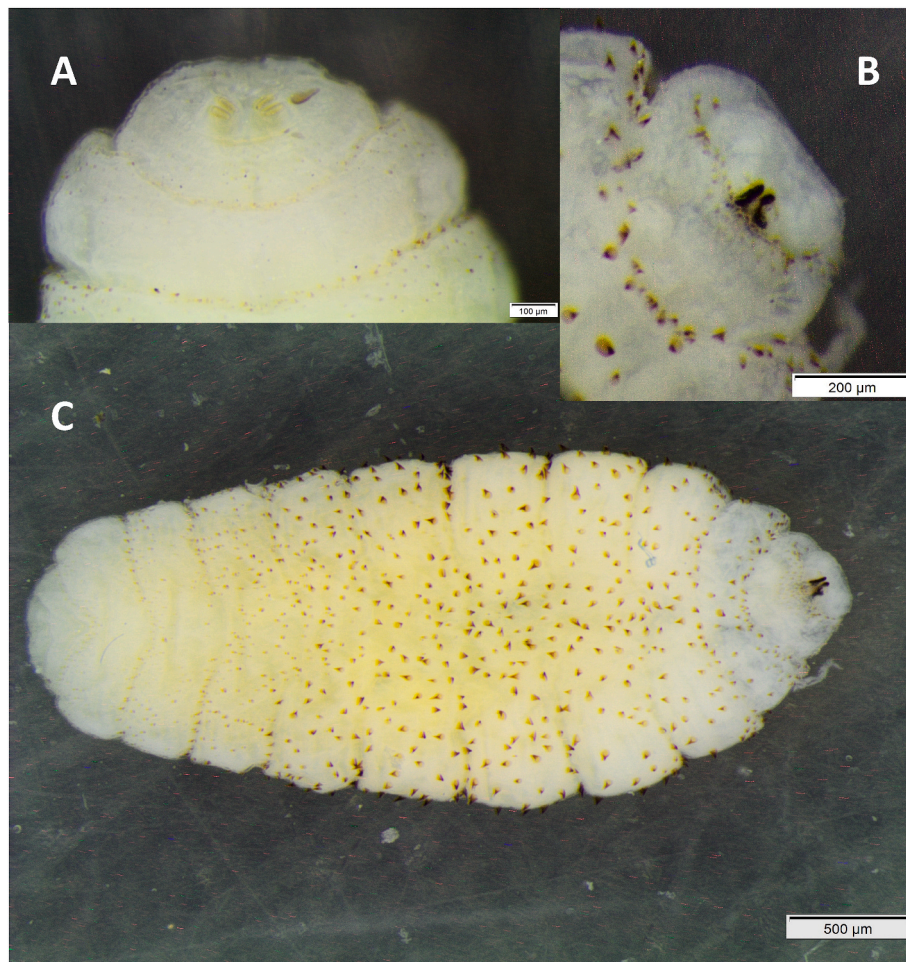


Fig. 1. Morphology of *Cordylobia rodhaini* in second instar. Dorsal view of the posterior spiracle with two slits each one (A); anterior end with the two black mouth hooks (B); ventral general view (C).

Table 1

Diagnostic characters used to differentiate the second instar of *C. rodhaini* to *C. anthropophaga*.

Larva II	<i>C. anthropophaga</i>	<i>C. rodhaini</i>
Segments III to VIII	Large and black cuticular spines irregularly distributed. Directed backwards	Relatively larger and fewer in number. Mainly directed backwards, but not all
Segments IX to XI	Almost bared when compared with the preceding segments. However, with a few rows of small pale spines posteriorly	Almost bared when compared with the preceding ones. However, with a few rows of small pale spines posteriorly, but also laterally
Segment XII	Densely covered with pale spines	Not densely covered with pale spines
Anal segment	Provided with two pairs of short processes	Lack the soft digital processes
Posterior spiracles	Two slightly bent slits	Two straight slits
Cephalo-skeleton	Strongly sclerotized, with two hook-shaped mouth hooks	Strongly sclerotized, with mouth hooks more rounded

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Declaration of competing interest

On behalf of all authors, the corresponding author states that there is no conflict of interest. Patient consents have been obtained to include case details.

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