New records of exotic crickets in Europe: *Homoeogryllus* species (Orthoptera: Gryllidea: Phalangopsidae)

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Abstract

This short note lists new records of exotic crickets belonging to the genus *Homoeogryllus* (Orthoptera: Gryllidea: Phalangopsidae) in Europe (Poland and Belgium) and discusses the most probable scenarios of their arrival from tropical regions. Photographs and stridulation spectrograms of these crickets are provided. The report concludes that handling terminals and warehouses with tropical plants are the most common sites in Europe where exotic species of different taxa are recorded. The species *Homoeogryllus longicornis* (Walker, 1869) is also reclassified to the genus *Meloimorpha* Walker, 1870.

Keywords

Belgium, identification, Poland, species introductions, spectrogram, tropical plants

Introduction

International trade, with its multiple means and routes, may not only speed up the movements of animals, but also allow the spread of non-native animals far beyond their home ranges. Among anthropogenic vectors of nonindigenous species, rising sea transport is now considered to account for the bulk of introduced species (Sardain et al. 2019). Shipping containers, hull fouling, and ballast waters help small animals, like insects, to reach distant places. Coupled with global warming, introducing non-native species to new habitats as a result of human activities may be a significant source of biological invasions and can cause severe harm to native species communities (Wheeler and Hoebeke 2017).

However, many adventive or exotic species are introduced to new habitats accidentally and do not establish populations. Crickets within the genus *Homoeogryllus* Guérin-Méneville, 1847 are one example of this phenomenon. Out of 16 species within the *Homoeogryllus* genus, 15 can be found in Africa: *H. adunctus* Gorochov, 1988, *H. ambo* Gorochov, 2018, *H. cavicola* Chopard, 1950, *H. deviatus* Desutter-Grandcolas, 1985, *H. gabonensis* Desutter-Grandcolas, 1985, *H. lyristes* Gorochov, 1988, *H. maroccanus* Desutter-Grandcolas, 1985, *H. nigresculus* Desutter-Grandcolas, 1985, *H. nigripennis* Chopard, 1942, *H. orientalis* Desutter-Grandcolas, 1985, *H. parvus* Chopard, 1936, *H. reticulatus* (Fabricius, 1781), *H. tessellatus* (Serville, 1838), *H. venosus* Saussure, 1878, and *H. xanthographus* Guérin-Méneville, 1847. The last species, *Homoeogryllus longicornis* (Walker, 1869) from the Malay Penninsula (Desutter 1985, Gorochov 2018, Cigliano et al. 2020), actually belongs to the genus *Meloimorpha* Walker, 1870, according to the number of spurs on its hind tibiae (Desutter-Grandcolas and Jaiswara 2012), and, consequently, we propose here the new combination *Meloimorpha longicornis* (Walker, 1869), **comb. nov.** Here, we show data on new records of *Homoeogryllus* crickets in Europe and provide photos and call spectrograms.

Materials

Specimens were found in various situations as described in the Results. They were collected when possible, recorded, and identified by one of us (LDG), except *H. xanthographus* (Guérin-Méneville, 1847) (see Żurawlew 2009).

Recordings of spontaneously stridulating crickets were made using Canon Power Shot A570 IS (*H. xanthographus*), MINT Olympus Digital Dm-1 (*H.* cf. *reticulatus*) and a dictaphone (*H. tessellatus*). Analog recordings were digitized at a sampling rate of 44.1 kHz/16 bits and visualized using *seewave* package (Sueur et al. 2008) implemented in R (R Core Team 2013) with the following settings: FFT length: 1024, window type: Hann, temporal overlap: 90%. The audio files were uploaded to the Orthoptera Species File Online (Cigliano et al. 2020) and the MNHN Sound Library.

Results

Homoeogryllus cf. *reticulatus* (Fabricius, 1781)

Figs 1, 2

Observed material.—Belgium, Gent, 8 VIII 2010, 1♂, D. B. Herman leg., specimen not collected, identified based on its calling song.

Stridulation description.—Only two stridulation series were recorded (Fig. 2a). Each consisted of two fast introductory creaks separated by 30 ms pause and a number of chatter syllables with fundamental frequency ca. 4 kHz and harmonics (Fig. 2c). Duration of the first stridulation with 8 syllables (Fig. 2b) was 4.1 s and that with 5 syllables was 2.2 s. Both stridulations were separated by a 7.6 s pause.

Fig. 1. *Homoeogryllus* cf. *reticulatus* (Fabricius, 1781). Male found in a crack of a wall near the port of Gent (Belgium) in which wood of tropical trees is stored.

Remark.—The specimen was found in a crack of a wall near a port where the wood of tropical trees is stored. The species has been recorded in Egypt, Chad, Senegal, Guinea, Ivory Coast, Benin, Cameroon, Central African Republic, Equatorial Guinea, Gabon, Republic of the Congo, and Democratic Republic of Congo (= Zaire) (Desutter 1985, Gorochov 2018).

Homoeogryllus tessellatus (Serville, 1838)

Figs 3, 4

Observed material.—Poland, Warsaw, Łowicka Street, 17–23 VIII 2016, 1♂, M. J. Gorazdowski leg., L. Desutter-Grandcolas det., MNHN.

Remark.—The male was found in a snake terrarium. Presumably, the vector was a bromeliad *Neoregelia carolinae* (Beer) L.B. Smith bought in a garden center. The species is native to Ivory Coast, Guinea, and Sierra Leone (Desutter 1985).

Stridulation description.—The stridulation was mostly continuous with repeated creaks of roughly the same length of 0.3 s (Fig. 4a). The beginning of each series consisted of only 3–5 creaks increasing in length (Fig. 4c). The fundamental frequency of stridulation was around 5 kHz (Fig. 4b). The shortest recorded stridulation was 9.3 s and the longest 35.3 s.

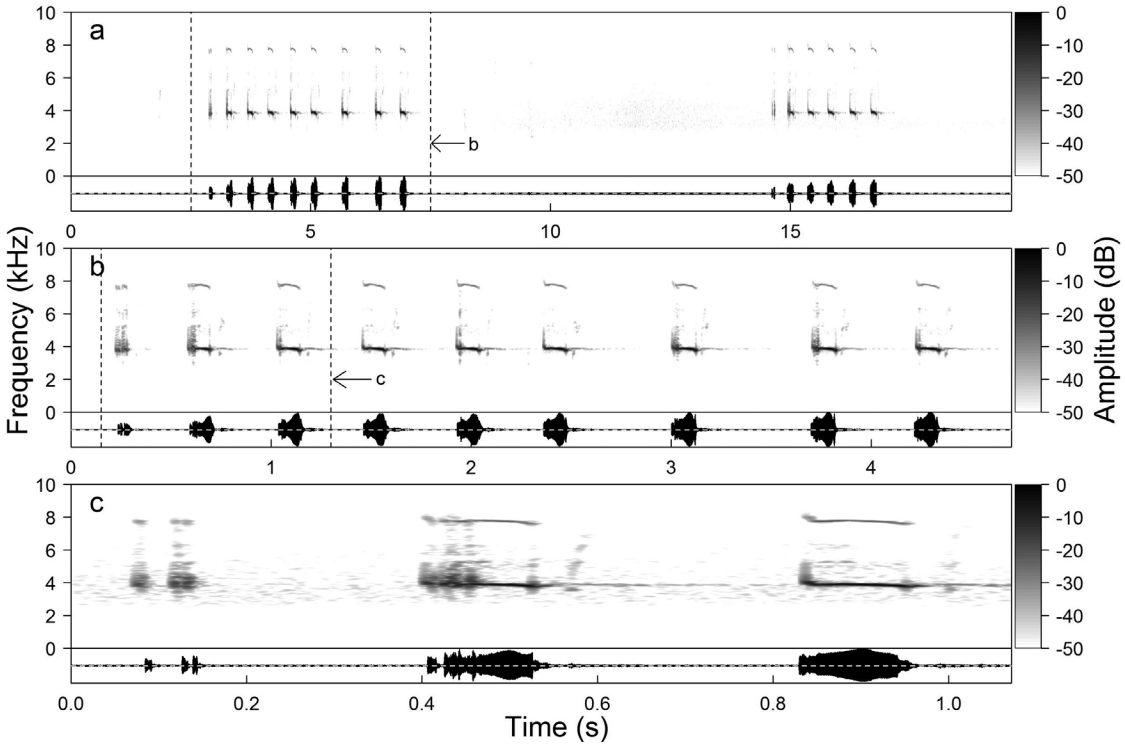

Fig. 2. Stridulation of *Homoeogryllus* cf. *reticulatus* (Fabricius, 1781) male from Gent (Belgium): **a.** spectrogram of two recorded stridulation series; **b.** spectrogram of one stridulation series in higher resolution of time domain; **c.** spectrogram of the beginning of stridulation series with three units (syllables) shown. The oscillograms are shown below and the relative amplitude scales (in dB) on the right of the spectrograms. Abbreviations: dB, decibel; s, second; kHz, kilohertz.

Fig. 3. *Homoeogryllus tessellatus* (Serville, 1838) male observed in Warsaw (Poland).

***Homoeogryllus xanthographus* (Guérin-Méneville, 1847)**
Figs 5, 6

Observed material.—Poland, Gołuchów, Pleszew District, 20 I–10 III 2009, 1♂, A. Biernat leg., S. W. Heads det. (see Żurawlew 2009).

Remark.—The male was found in a wicker basket with potted plants inside a residential building. It had probably been transported, as an egg or a nymph, with the coconut bedding into which the plants were potted.

Stridulation description.—Recorded stridulations (n = 9) consisted of 4 to 9 elements (Fig. 6a). Two types of elements could be distinguished: shorter creaks repeated 3 to 8 times and a longer, terminating creak (Fig. 6c). One series had two terminating elements (Fig. 2b). The fundamental frequency of stridulation was around 4 kHz.

Discussion

In this short note, we report new records of two species of *Homoeogryllus* genus, *H.* cf. *reticulatus* and *H. tessellatus*, in Belgium and Poland, respectively. In addition, we newly describe the stridulations of *H. xanthographus*, another *Homoeogryllus* species which, as an egg or nymph transported in soil substratum, was previously introduced in Poland (Fig. 5; Żurawlew 2009). So far, of the species of *Homeogryllus*, only the stridulations of *H. tessellatus*, *H.* cf. *reticulatus*, *H. nigresculus*, and *H. xanthographus* have been described (Desutter 1985, Żurawlew 2009).

These tropical crickets were probably introduced into Europe by being shipped from Africa, which is a source of tropical plants for Europe. Shipping-mediated introductions of

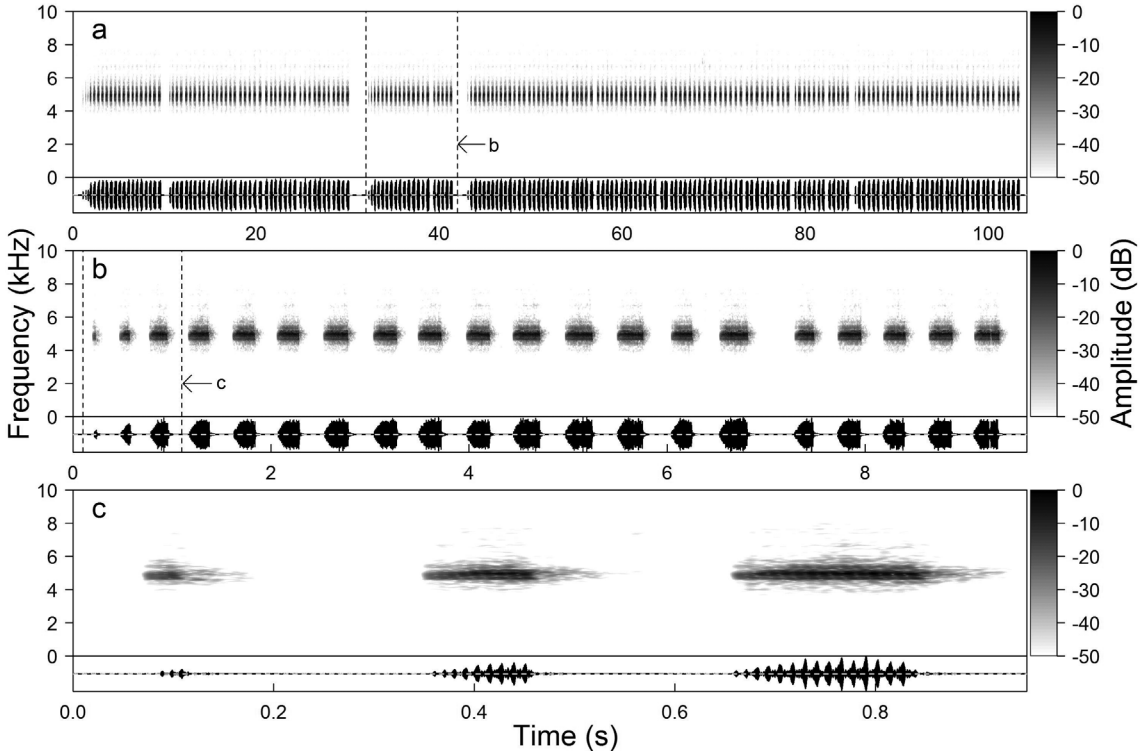

Fig. 4. Stridulation of *Homoeogryllus tessellatus* (Serville, 1838) male from Warsaw (Poland): **a.** spectrogram of recorded stridulation; **b.** spectrogram of one stridulation series in higher resolution of time domain; **c.** spectrogram of the beginning of stridulation series with three units (syllables) shown. The oscillograms are shown below and the relative amplitude scales (in dB) on the right of the spectrograms. Abbreviations: dB, decibel; s, second; kHz, kilohertz.

Fig. 5. *Homoeogryllus xanthographus* (Guérin-Méneville, 1847) male observed in Gołuchów, Pleszew District (Poland).

Eugaster spinulosa (Johansson, 1763) (Bazyluk and Liana 2000) from Africa, *Amphiacusta nauta* (Desutter-Grandcolas, 1997) from the Caribbean, and that of *H. xanthographus* support this scenario. In fact, studies show that ports and garden centers in Europe are places where many species of tropical insects and spiders have been recorded (Rozwałka et al. 2016). Apart from the accidental introduction of species associated with woody plants, another pathway that largely contributes to the spread of non-native species is trade and breeding as pets (owing to their pleasant songs) or as food for vertebrate and invertebrate pets. Indeed, some *Homoeogryllus* species are reported to be kept in terrariums, but their true origin and identification have not been confirmed.

As a consequence of accidental introductions, some species may start new populations, which is a threat to local biodiversity (Hulme 2009). They could also invade hot, human-made places, such as bakeries, houses, or underground electric railroad, as is the case of *Acheta domesticus* (Linnaeus, 1758), known as the "grillon du métro" in Paris. Examples of tropical Orthoptera species that were introduced to Europe or North America that can now be found in palm houses, greenhouses, and houses include *Tachycines asynamorus* Adelung, 1902, and *Diestrammena japanica* Blatchley, 1920, (Głowaciński et al. 2012, Epps et al. 2014). These species have also been found in Cuba where they are believed to have established new populations (https://www.saltatoria.info/arten%C3%BCbersicht-a-z-species-a-z/homoeogryllus-sp-kuba/), even though they are not listed among the Orthoptera of Cuba (Yong and Perez-Gelabert 2014).

Continuous monitoring of all the exotic species found in Europe can contribute greatly to correct identifications in the future, the collection of new information on their biology, and the identification of new potentially invasive species. For instance, in the Czech Republic, as many as 595 non-native species have been recorded (Šefrová and

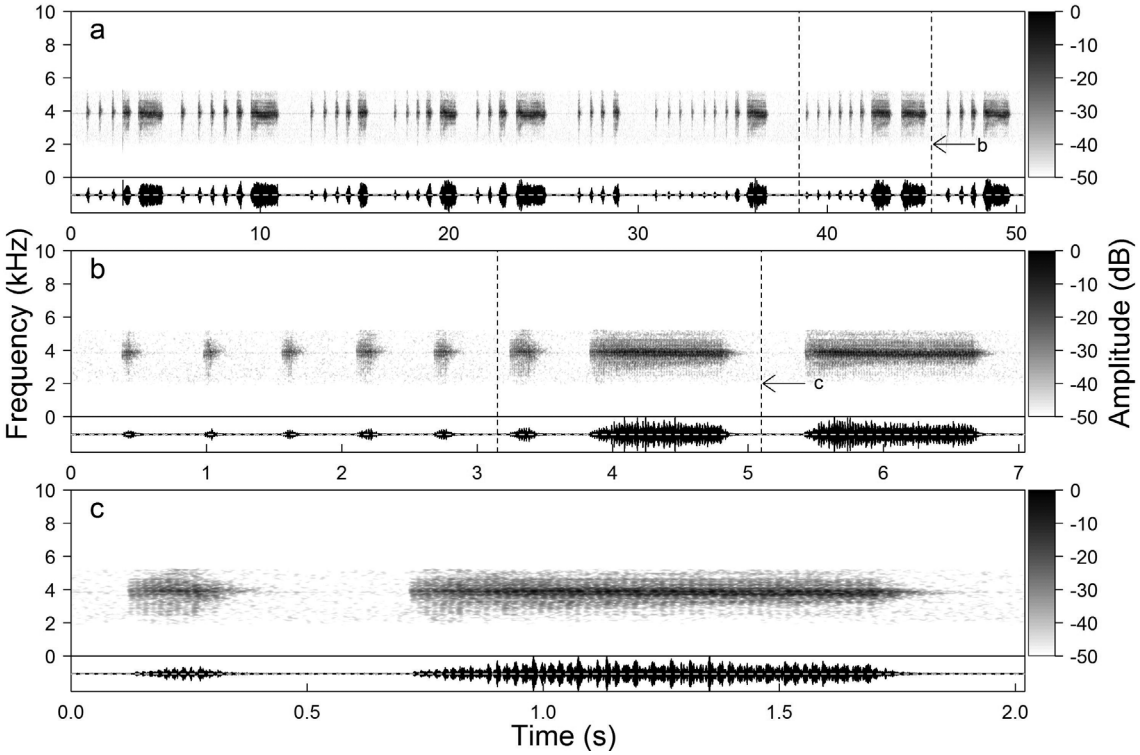

Fig. 6. Stridulation of *Homoeogryllus xanthographus* (Guérin–Méneville, 1847), male observed in Gołuchów, Pleszew District (Poland): **a.** spectrogram of recorded stridulation series; **b.** spectrogram of one stridulation series in higher resolution of time domain; **c.** spectrogram of two type units (syllables). The oscillograms are shown below and the relative amplitude scales (in dB) on the right of the spectrograms. Abbreviations: dB, decibel; s, second; kHz, kilohertz.

Laštůvka 2005). In Poland, 305 species are non-native with insects being most common, followed by molluscs, shellfishes, flatworms, nematodes, arachnids, cnidarians, and annelids (Głowaciński et al. 2012). The difficulty is in evaluating the potential of these tropical species to actually invade and settle, especially in terms of resistance to cold weather and changes in the available resources.

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