

Establishment after transport adds *Mimela junii* (Duftschmid, 1805) to the Belgian fauna (Coleoptera: Rutelidae)

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Abstract

We report the first records of *Mimela junii* (Duftschmid, 1805) in Belgium. As the records go back to 2012, we interpret that the species has established at least at one location and possibly already about a decade ago. In Sint-Niklaas a population has established in a residential area and adjacent park while other records from 2021 are located in different city centers. The species habitus superficially resembles that of *Anomala dubia* (Scopoli, 1763) for which it was mistaken till recently. The species prefers sandy dry grasslands. We provide details on the Belgian records of *M. junii* and map the distribution of this species along with that of *A. dubia*. The species is likely introduced with the transport of large potted plants from its original range in southern Europe. The northward colonisation of this species in Europe likely needs to be interpreted as an adaptation to climate change.

Keywords: anthropogenic transport, climate change, introduction, first record

Samenvatting

Wij rapporteren de eerste vondsten van *Mimela junii* (Duftschmid, 1805) in België. Omdat deze teruggaan tot 2012, kunnen we hieruit afleiden dat de soort zich gevestigd heeft op minstens één plaats en dit mogelijks al ongeveer een tiental jaar geleden. In Sint-Niklaas heeft de soort zich gevestigd in een residentiële buurt en een nabijgelegen park terwijl andere meldingen van 2021 zich voornamelijk in stadscentra situeren. De habitus van de soort lijkt op het eerste zicht op die van *Anomala dubia* (Scopoli, 1763) waarmee ze voorheen verward werd. De soort heeft een voorkeur voor droge graslanden op zandgrond. We geven details over de Belgische records van *M. junii* en haar verspreidingskaart samen met die van *A. dubia*. De soort werd waarschijnlijk ingevoerd met het transport van grote potplanten uit haar natuurlijk verspreidingsgebied in Zuid-Europa. De noordelijke uitbreiding van deze soort in Europa moet wellicht gezien worden als een adaptatie aan de klimaatverandering.

Résumé

Nous rapportons l'espèce *Mimela junii* (Duftschmid, 1805) pour la première fois de Belgique. Cependant, les observations remontant à 2012, nous supposons que l'espèce pourrait s'être établie il y a déjà une dizaine d'années au moins à un endroit. À Sint-Niklaas, une population réside dans une zone d'habitats et un parc adjacent, tandis que d'autres signalements, datant de 2021 sont situés dans différents centres-villes. L'habitus de l'espèce ressemble superficiellement à celui d'*Anomala dubia* (Scopoli, 1763), espèce avec laquelle elle était confondue jusqu'à récemment. *M. junii* préfère les prairies sablonneuses et sèches. Nous fournissons des détails sur les données belges de *M. junii* ainsi qu'une carte de distribution des deux espèces. L'espèce est probablement introduite lors du transport de grandes plantes en pot

depuis son aire de répartition d'origine dans le sud de l'Europe. La colonisation de cette espèce vers le nord de l'Europe doit probablement être interprétée comme une adaptation au changement climatique.

Introduction

Mimela junii (Duftschmid, 1805) is a scarab beetle belonging to the Rutelidae. This family included up to now only three Belgian species: *Anomala dubia* (Scopoli, 1763), *Chaetopteropia segetum* (Herbst, 1783) and *Phyllopertha horticola* (Linnaeus, 1758). *A. dubia* is a rather common species in Belgium on sandy soils. The habitus of *M. junii* resembles superficially that of *A. dubia* and the species was therefore mistaken for the latter for many years in Belgium and Germany (URBAN *et al.*, 2020). *M. junii* originates from Italy, Ticino (Switzerland), French Riviera, Sicily, Sardinia, Corsica, south Carinthia and Tyrol (Austria) and Slovenia (MIKSIC, 1953; HORION, 1971; CARPANETO, 1983; BARAUD, 1992; BRELIH *et al.*, 2010; COSANDEY *et al.*, 2017). In Slovenia, the species went extinct in the early 20th century (BRELIH *et al.*, 2010).

In recent years the species was reported from northern Europe including northern France, the UK, The Netherlands and Germany. In France, it was found in Verrières-le-Buisson (department Essonne, region Île-de-France) on 29.VII.2021 (www.inaturalist.org/observations/89166076) and in the UK in London on 9.VII.2021 (www.inaturalist.org/observations/86336649). Records from the Netherlands originate from all over the country (www.inaturalist.org; www.waarneming.nl) with multiple records from Rotterdam and surroundings, Nieuwegein-Utrecht, Alphen aan den Rijn, Groningen and Weert. The oldest record dates from 2011 but the majority is from 2021 and most of them have been reported in urban or suburban areas. Also in Germany records were done all over the country with a majority in urban areas. Multiple records are from the centers of Bremen, Hamburg, Berlin and Frankfurt am Main (URBAN *et al.*, 2020; ESSER & MAINDA, in prep.; www.inaturalist.org; www.colkat.de). These records date between 2019 (one) and 2021 (majority).

The ecology of *M. junii* seems to be rather similar to that of *A. dubia*. In their original region, adults are mainly found in June and July and feed on leaves of various wild shrubs and grasses. Larvae prefer sandy soils and are rhizophagous, feeding primarily on roots of grasses and herbs, but likely also of trees and shrubs.

The head, pronotum and the suture of the elytra of *M. junii* are metallic-green while the rest of the elytra are coppery-brown (Fig. 1). A similar colour morph exists for *A. dubia*. Distinguishing both species is easiest by the larger claw of the front and middle tarsi which are simple in both sexes of *M. junii* while *A. dubia* has incised or split claws at least at the front legs (clearer for females). The pronotum of *M. junii* has an indentation in front of the posterior angles which is absent in *A. dubia* (Fig. 2). The elytra have longitudinal darker and lighter yellow stripes and typical wrinkled lines in *M. junii* and the antennae are more reddish. In both species the base is the broadest part of the pronotum but in *M. junii* sides are nearly parallel up to the middle. The males have slightly longer lamella on the antennal club than the females. *M. junii* can be distinguished from *M. aurata* (Fabricius, 1801) as the posterior angles of the pronotum are not sinuated and the pronotal base is not interrupted in the middle (at the scutellum). However, *M. junii* can best be distinguished from other *Mimela* spp. based on the aedeagus (especially as we are looking at specimens outside their original range). Five subspecies have been accepted with the mainland form being *M. junii junii* and other subspecies originating from Calabria, Sicily, Sardinia, Corsica and Giglio Island (Giuseppe Carpaneto, pers. comm.; Baraud, 1992; www.coleonet.de/coleo/index.htm).

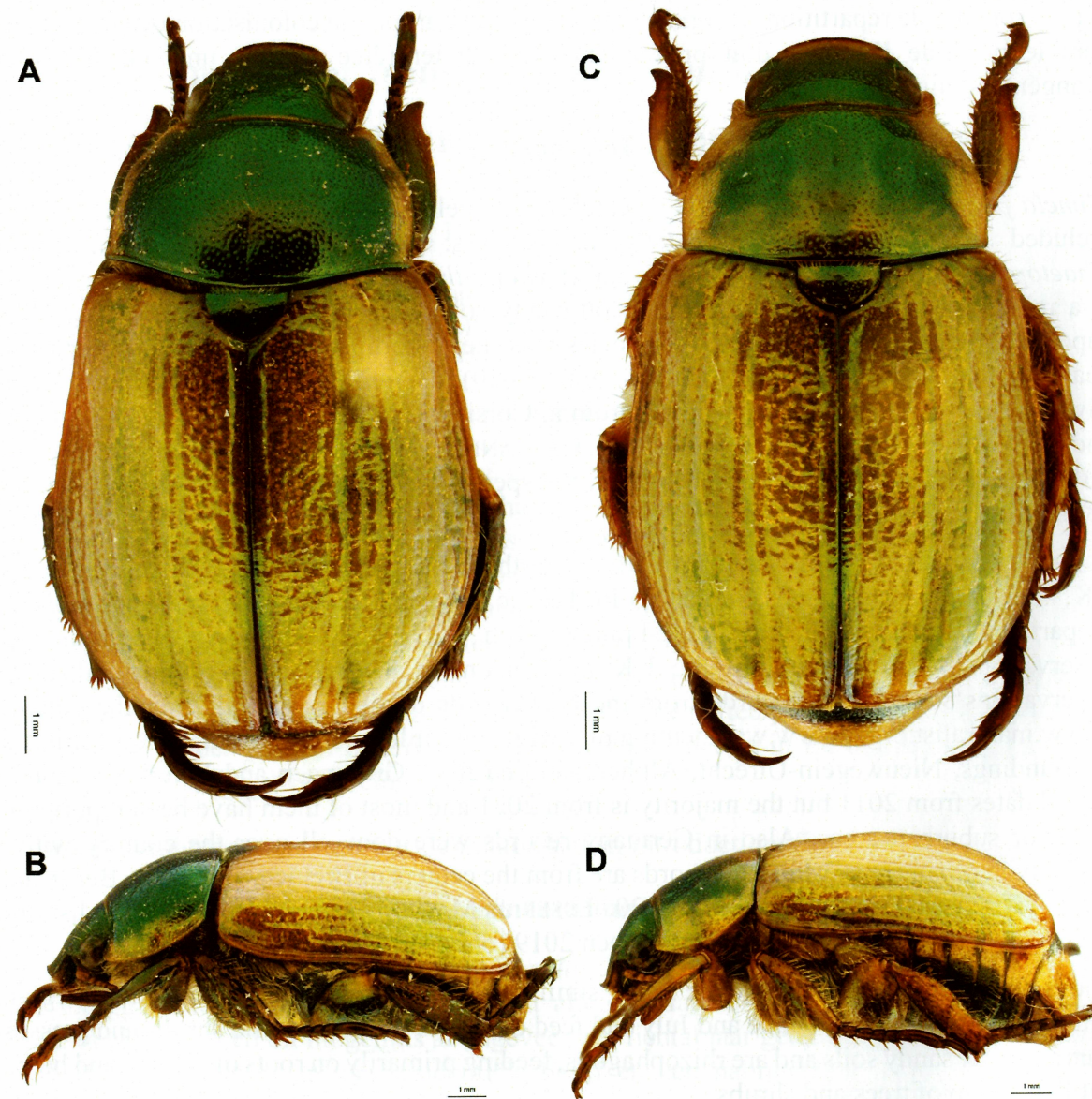


Fig. 1. Habitus of *Mimela junii*, Sint-Niklaas, Raap (51.1789°N, 4.1817°E), 31.VII.2021, found in copula, leg. A. Thomaes, coll. RBINS (I.G.34464). A, ♂ dorsal view. B, ♂ lateral view. C, ♀ dorsal view. D, ♀ lateral view. © Julien Lalanne.

Triggered by the recent findings in neighbouring countries and based on an older record that was interpreted as imported, the authors aimed to check records of *A. dubia* on www.waarnemingen.be and executed some field visits in order to report this species from Belgium.

Material and methods

All pictures of records of *A. dubia* on the citizen science data portals waarnemingen.be and inaturalist.org were rechecked and identification was changed to *M. junii* if needed. Based on the records found of *M. junii*, the authors carried out the following field trips:

*30.VII.2021: Raap; east parking of 'Provinciaal domein De Ster' and parking of plant shop Wase Vijverwinkel (all in Sint-Niklaas) by Arno Thomaes.

*31.VII.2021: West parking of De Ster; Raap and bike path along the railroad between Nieuwkerken-Waas and Sint-Niklaas (all in Sint-Niklaas) by Arno Thomaes and Kevin Scheers

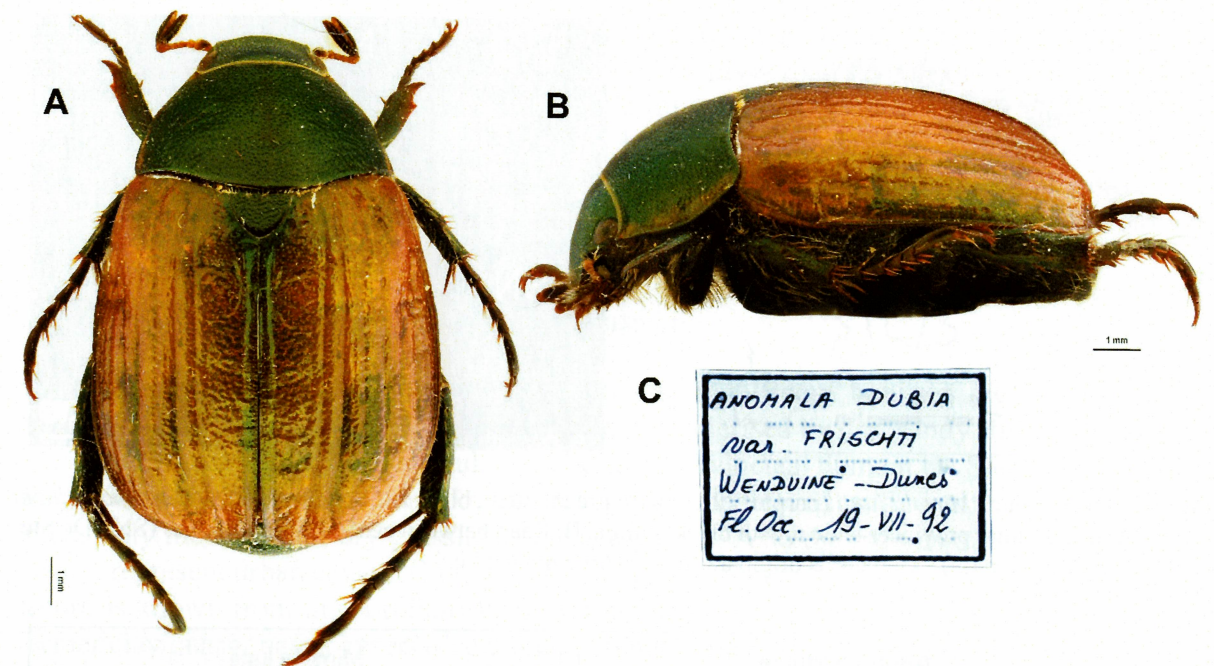


Fig. 2. Habitus of *Anomala dubia*, Wenduine, duinen, 19.VII.1992, coll. RBINS. A, dorsal view. B, lateral view. C, label. © Julien Lalanne.

Maps were made with ArcGIS 10.4.1, phenology graphs with R.4.1.1. Stacking pictures were taken by Julien Lalanne at RBINS.

ACRONYMS.

RBINS: Royal Belgian Institute for Natural Sciences, Brussels Belgium

Results

In 2020, the second author already found one *M. junii* at the plant shop Wase Vijverwinkel (Sint-Niklaas) but it was then interpreted as an imported individual and not given any further attention. A total of 1683 records from www.waarnemingen.be and 42 from www.inaturalist.org with photographic evidence (on 24.XII.2021) classified as *A. dubia* were revised with the aim of checking for the presence of records referring to *M. junii*. Among these records we found 47 records on www.waarnemingen.be (none at www.inaturalist.org) which could be identified as *M. junii* with certainty (including the older record and records of the field visits by the authors). The oldest record is from 2012 and regards two individuals from De Ster (Sint-Niklaas). In the years 2015, 2016 and 2019 there are single records from Raap, De Ster and Sint-Pauwels respectively. There are seven records from 2020 and no less than 36 records from 2021. The majority of the records are from Sint-Niklaas (35) and other areas in the province of East-Flanders (5). Other records come from Antwerp (4) and two records from Flemish Brabant and one from Hainaut (Fig. 3). Nearly all records are from residential or urban areas. The majority of the records (34) have been done in July, while the rest comes from June and August (Fig. 4).

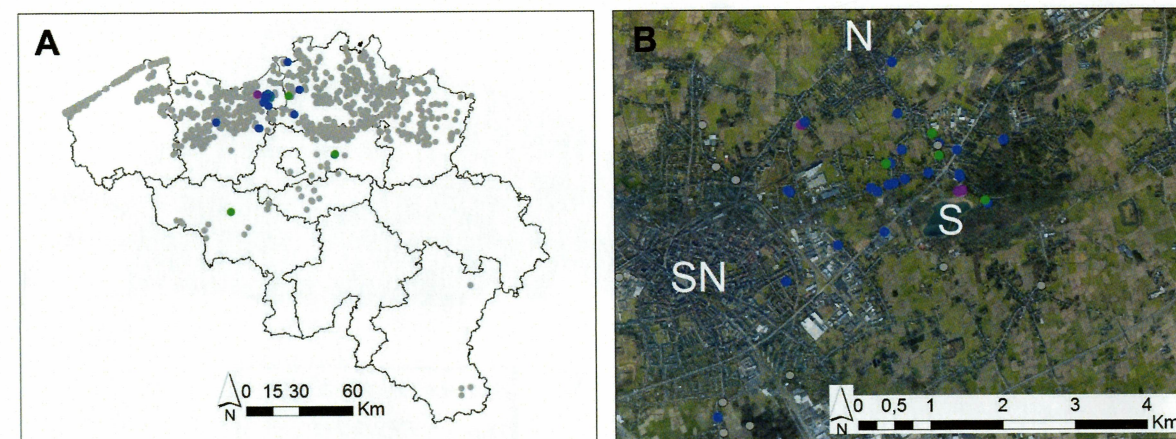


Fig. 3. Distribution of *Mimela junii* (purple: 2012-2019, green: 2020, blue: 2021) with records of *Anomala dubia* (grey). A, in Belgium, provinces shown with black outline. B, Raap between center of Sint-Niklaas (SN), De Ster (S) and Nieuwkerken (N). All records originate from waarnemingen.be.

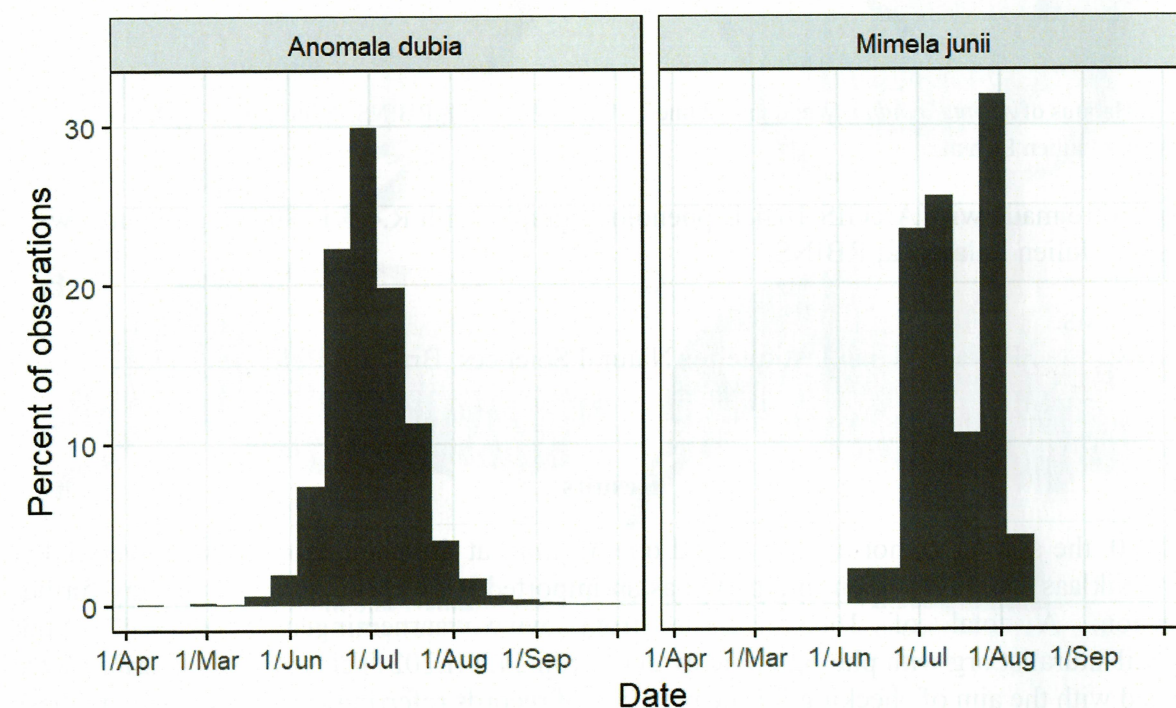


Fig. 4. Histogram of *Anomala dubia* (n: 1831) and *Mimela junii* (n: 47) in Belgium based on records from waarnemingen.be. Binwidth of 10 days.

During the field trips the following specimen of *M. junii* were collected.

East-Flanders: Sint-Niklaas, Raap, Wase Vijverwinkel (51.1798°N, 4.1913°E): 1 ex., 11.VI.2020, leg. et coll. K. Scheers; Sint-Niklaas, Raap (51.1762°N, 4.1814°E): 1♂ and 2♀♀, 30.VII.2021, leg. et coll. A. Thomaes; Sint-Niklaas, Raap (51.1789°N, 4.1817°E): 1♂ and 1♀, 31.VII.2021, in copula, leg. A. Thomaes, coll. RBINS (I.G.34464) (Fig. 1); Sint-Niklaas, Raap (51.1769°N, 4.1846°E): 2 ex., 31.VII.2021, leg. et coll. K. Scheers.

During the field trips other individuals were found at the same location (Zonneken, Uilenstraat, Slagmolenstraat and Bellestraat in Sint-Niklaas) but not collected (4 on 30.vii.2021 and 4 on 31.VII.2021). Most individuals were seen flying at low height (1-3m) crossing the street or

open areas or flying above the top of shrubs or hedges. The flight is very similar to *A. dubia* or *Amphimallon solstitiale* (Linnaeus, 1758) but for the authors the bright metallic colour distinguished them. Some individuals were found in grassy road verges, on bare soil or on the road. Two individuals were collected in copula after seen in flight grasping each other and falling to the ground which is a typical mating behaviour for Rutelidae. At the other locations visited (De Ster, Wase Vijverwinkel and bike path along the railroad between Nieuwkerken-Waas and Sint-Niklaas) no individuals were found and at none of the locations *A. dubia* was found during these field visits.

Discussion

M. junii is clearly established in the area surrounding 'Raap' between the center of Sint-Niklaas, Nieuwkerken and De Ster. This area is characterised by dry, sandy soils and is mainly a residential area with sparse agriculture. The site 'Provinciaal domein De Ster' is a recreation area (since 1965) with a parklike habitat with broadleaved and coniferous forests and intensively mowed semi-dry grasslands on sandy soils. Also the records outside Sint-Niklaas mainly represent urban centers (Leuven, Ghent, Dendermonde, Hoboken and Borgerhout). One record is known from the zoo Pairi Daiza (Brugellette) on loamy soils, one from a sand filled former clay quarry nature reserve Terhagen (Rumst), one from a sandy grassland in Kalmthout (near gardens) and one final record is situated in a garden in Sint-Pauwels on loamy sand. As these all represent single recent observations, established populations need confirmation at these locations. *M. junii* is mainly observed in July and seems to be a bit later than observations of *A. dubia* in Belgium.

The habitat in which the species was found (semi-dry grassland and heathland on sandy soils) seems to be very similar to the habitat in its native range (disregarding the observations in city centers) and sandy, dry grasslands seem to be important for its development. Also in the Netherlands and Germany this species is mainly found in city centers (URBAN *et al.*, 2020; ESSER & MAINDA, in prep.). This could be qualified both as areas with repeated import and/or with a warm microclimate.

Furthermore, we can speculate on how this species came to northern Europe. Firstly, it seems to have crossed a large distance in a limited amount of time and in-between colonisations seem to be lacking or overlooked. Furthermore, the fact that most records are located in city centers can indicate that the species likely arrived here by anthropogenic transport. As the larvae live in the soil, soil transport seems likely and over these large distances transport of potted plants seems a likely introduction pathway. In recent years, the use of large Mediterranean plants such as olive trees, figs, grapes, evergreen oaks and palm trees in residential gardens became quite popular in Belgium. These trees are imported from southern Europe in very large pots of roughly 1m³ and it is plausible that larvae feeding on the roots of these plants or the roots of the herbaceous stowaways are present in these pots. Particularly, a large shop specialized in these Mediterranean plants is present at the center of the current population in Sint-Niklaas. The large Mediterranean plants sold in this shop are imported from Pistoia (Tuscany, Italy) which falls within the native range of *M. junii*. Also Pairi Daiza is known for its monumental garden with exotic and Mediterranean plants and thus it is not unlikely that many plants were imported from southern Europe. As mentioned in the introduction, there are several locations in the Netherlands (Rotterdam and surroundings, Nieuwegein-Utrecht, Alphen aan den Rijn, Groningen and Weert) with larger numbers of records where the species is likely established. If similar patterns could be found in the Netherlands and Germany, this could further confirm this hypothesis.

Most of the records date from 2021 (also in The Netherlands and Germany) but in Sint-Niklaas records date back to 2012. It is unclear how these old records need to be interpreted, do they already indicate an established population or do these records rather refer to stowaway individuals that were imported. As they were found at some distance from the plant shop and in suitable habitat like De Ster, it seems likely that a population already established about a decade ago. The recent increase in the number of records (from one in 2019 to six in 2020 and 36 in 2021) might be interpreted as a population increase after initial establishment, potentially stimulated by the three exceptionally warm and dry summers (2018-2020) resulting in many beetles emerging in 2021. Alternatively, the increase in records can also or partly be explained by the increased popularity of www.waarnemingen.be. Especially the release of the app ObsIdentify (November 2019), an app that identifies photographed species and stores records on www.waarnemingen.be, led to a strong increase in observations, especially of common insects in gardens. The number of records of *A. dubia* increased from 92 in 2019 to 265 in 2020 and 1125 in 2021, so roughly three and 12 times more than 2019 (compared to six and 36 times higher for *M. junii*).

Probably, this species benefits from the changing climate and the described import to enlarge its natural range. These northward range expansions have been documented for many species in Europe including several beetle species (e.g. DREES *et al.*, 2011; SCHEERS, 2014, 2017, 2020; THOMAS *et al.*, 2016; CERASOLI *et al.*, 2019; TROUKENS *et al.*, 2019). Anthropogenic vectors (e.g. GIPPET *et al.*, 2019; SHORT *et al.*, 2019) can furthermore help these species to expand their range northwards and in this way compensate for a possibly shrinking southern range due to climate change. Consequently, further research and understanding of the potential of anthropogenic vectors for the range expansion of species might help to perform assisted migration to overcome the negative impact of climate change on biodiversity.

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