



## *Cardamine graeca* (Brassicaceae), an unexpected new weed in Western Europe?

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**Photos** by the authors (Fig. 1-2: RB; Fig. 3: FV).

**ABSTRACT.** – *Cardamine graeca* L. (Brassicaceae), a non-weedy species from rather natural habitats in Southeastern and Eastern Europe, was recently found in two cemeteries in Belgium (Genk and Gent). It is suggested that this species most likely has been introduced via the container nursery industry although it is not officially known as such.

**RÉSUMÉ.** – *Cardamine graeca* (Brassicaceae), une nouvelle mauvaise herbe inattendue en Europe occidentale ? *Cardamine graeca* L., une espèce poussant principalement dans des habitats plutôt naturels du sud-est et de l'est de l'Europe et connue nulle part ailleurs comme mauvaise herbe, a été trouvé récemment dans deux cimetières en Belgique (Genk et Gent). Il est suggéré que cette espèce a été très probablement introduite dans des conteneurs à plantes méditerranéennes, bien qu'elle ne soit pas officiellement recensée dans des jardineries.

**SAMENVATTING.** – *Cardamine graeca* (Brassicaceae), een verrassend nieuw onkruid in West-Europa? *Cardamine graeca* L., een soort uit vrij natuurlijke habitats in Zuidoost- en Oost-Europa en nergens gekend als onkruidsoort, werd recent gevonden op twee begraafplaatsen in België (Genk en Gent). Er wordt aangenomen dat deze soort hoogstwaarschijnlijk ongewild is geïntroduceerd via de sierteeltsector, hoewel ze officieel niet als zodanig bekend is.

### ***Cardamine*: weeds of the container nursery industry**

*Cardamine* L. is a genus from temperate areas across the globe and counts around 200 species. Only six species are native in Belgium (Lambinon & Verloove 2012). The genus comprises some prolific and costly weeds of the container nursery industry. In addition to the native species *C. hirsuta* L. (and to a lesser extent *C. flexuosa* With.) two further, alien weeds are naturalized in Belgium. *C. corymbosa* Hook.f., a New Zealand endemic species, is known since at least 1999 (Hoste *et al.* 2008). Since its first discovery it has been recorded in rather numerous additional localities but it is still relatively rare and appears to be confined to the northern part of the country (Flanders). The identity of a second alien species long remained unknown. It was first provisionally called 'Asian *Cardamine flexuosa*' (Bleeker *et al.* 2008), subsequently *C. hamiltonii* G. Don (Dirkse *et al.* 2015). Only relatively recently its correct name was finally established: *C. occulta* Hornem. (Marhold *et al.* 2016). This species has a similar distribution as *C. corymbosa* in Belgium. However, it is morphologically much less easily distinguished and probably still often confused with either *C. hirsuta* or *C. flexuosa*. It may be much more widespread.

All the above-mentioned species are found in the same type of habitats: mostly in plant nurseries and cemeteries, but also in urban habitats, vegetable gardens, etc.

### **Records of *Cardamine graeca* from cemeteries**

In early April 2019 one of us (RB) found an unusual species of *Cardamine* in two places in a cemetery in Genk (province of Limburg). He identified it as *C. graeca* L., a rather unexpected finding (Fig. 1). This species apparently had not been reported before as an adventive species from outside its native area in southeastern and eastern Europe. Two months later, on June 9<sup>th</sup>, the second author found identical plants, again in a cemetery, this time in Gent (Gentbrugge) (province of East-Flanders). On this occasion the specimens could be compared with material of *C. graeca* preserved in the herbarium of Meise Botanic Garden and found to be identical. Also, the plants were easily identified as this species with Schulz' monographic work on the genus (Schulz 1903).

*Cardamine graeca* is a very characteristic species in the genus. In Schulz' monograph (Schulz 1903) it is easily distinguished based on the following consecutive steps in the identification key: leaves pinnatisect and clearly au-



**Figure 1.** *Cardamine graeca*, habit. Gent, April 2019.

riculate at base, petals white and 3-15 mm long, sepals 2-6 mm long and fruit 3-4 mm wide with winged beak. With its small amplexicaul auricles it only shows some resemblance with our native *C. impatiens*. However, the latter has much smaller petals that are only 2-3 mm long or sometimes even absent (vs. petals 4-6 mm long) and leaflets of upper leaves are much more numerous (5-9



**Figure 2.** *Cardamine graeca*, leaf. The leafbase is minutely auriculate-amplexicaul and the leaflets are deeply lobed-incised. Gent, April 2019.

pairs vs. 2-3 pairs). Also, the fruit in *C. impatiens* is very narrow (ca. 1 mm or only slightly more) and the beak un-winged. In fact, based on the leaf auricles and the distinctly flattened, very wide fruits with winged beak, the species is unmistakable (Fig. 2 and 3).

*Cardamine graeca* is native in Southern Europe, from Corsica eastwards to Turkey (with some scattered occurrences elsewhere in the Mediterranean area, for instance in Tunisia, Lebanon and Syria). It is by far most common in Greece and is usually found in woodland on rocky slopes and screes, on limestone, serpentine, marble and other alkaline substrates, from sea level to 1,700 m. It sometimes occurs in more (slightly) disturbed habitats but is not known at all as a weed (e.g. Randall 2017) nor has it been recorded as an alien outside of its native distribution range. It is not known to be cultivated as an ornamental (Jäger *et al.* 2008, Cullen *et al.* 2011). Interestingly, however,



**Figure 3.** *Cardamine graeca* at fruiting stage. The unusually wide and flattened fruits are very characteristic. Gent, June 2019.

it was apparently grown (as a curiosity?) in the Botanic Garden in Leuven in the 19<sup>th</sup> century, which appears from two specimens preserved in Meise Botanic Garden (herb. Martin Martens, 1845). Upon request it turned out that *C. graeca* is no longer cultivated there (comm. T. Gyselinck, June 2019), nor in any other of the main public gardens in Belgium (<http://www.plantcol.be>). It is therefore all the more remarkable that *C. graeca* was found as a weed in two cemeteries in Belgium in 2019. Moreover, during our research we came across a third recent (unpublished) record of this species in Western Europe: on May 2<sup>th</sup> 2014 it was found by Herke Fokkema in Dorpskerk on the island of Schiermonnikoog in the Netherlands, as a weed in ... a cemetery! (<https://www.verspreidingsatlas.nl>).

Cemeteries usually have a very characteristic weed flora that is found especially in the gravel between and along the grave tombs: the regular use of herbicides allows short-living and early-flowering species to complete their live cycle before or in between two treatments. Many of these weeds, especially the more remarkable ones like various species of *Euphorbia* subgenus *Chamaesyce*, *Cardamine corymbosa* and *C. occulta*, are obviously associated with the container nursery industry. They are inadvertently introduced with ornamental pot plants, set seed and find a suitable habitat in the bare, sun-exposed gravel that surrounds the graves. According to Kit Tan and Gabriele Galasso (respectively Copenhagen and Milan, comm. July 2019) *C. graeca* also occurs in olive groves in Greece as well as in the cooler parts of Italy and in Sicily. In the past 10-15 years huge numbers of mature olive trees have been imported to Western Europe, mostly from Italy, Spain and Greece, and these were accompanied by a rich alien weed flora (Hoste *et al.* 2009). It is likely that *C. graeca* arrived in an identical way in our area, first in the garden centres and/or nurseries and subsequently in the cemeteries where it was recently found in Belgium and the Netherlands. Yet, at least to our knowledge, it is not 'officially' known as a weed in this industry. A similar case was already described from the same two countries: the American grass species *Muhlenbergia mexicana* was also believed to be introduced through plant nurseries although the species was not known as a weed in the nursery trade (Verloove & Hoste 2010).

## Conclusion

It is unclear whether or not *Cardamine graeca* will be able to naturalize in Western Europe. However, as described

above, it is likely that the species is at least a local weed already in some plant nurseries and garden centres. In Genk the species is present in two small subpopulations that are c. 230 m apart, with c. 10 and 2-3 individuals respectively. In Gent the species is restricted to a single population that counts probably less than 20 individuals. This seems to point at a recent introduction. Since the species completes its life cycle well before the first herbicide treatments and/or weeding, it is likely to survive these actions.

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