



The Chinese weed *Corydalis linstowiana* (Papaveraceae) recorded for the first time in Belgium

Filip VERLOOVE^{1*} and Luc DEVOS²

¹ Meise Botanic Garden, Nieuwelaan 38, B-1860 Meise, Belgium

² Zwaluwenstraat 21 bus 301, B-8400 Oostende, Belgium

* filip.verloove@plantentuinmeise.be

Photographs: Luc Devos.

ABSTRACT. – *Corydalis linstowiana* Fedde is a Chinese species with a rather limited natural distribution (the western part of Sichuan). It is cultivated, although probably very rarely, as an ornamental plant and – thanks to its ‘explosive’ fruits – is sometimes observed in a subsponaneous or even locally naturalized state. It is often considered an undesirable xenophyte rather than an ornamental plant. An apparently well-established population has been observed for some time now in Bruges (province of West Flanders), in and around a garden centre. A closely related and ecologically similar species, *C. incisa* (Thunb.) Pers., has become invasive in North America in a short period of time.

RÉSUMÉ. – Une première trouvaille en Belgique de l’adventice chinoise *Corydalis linstowiana* (Papaveraceae). *Corydalis linstowiana* Fedde est une espèce chinoise à distribution naturelle assez limitée (la partie occidentale de Sichuan). Elle est cultivée, bien que probablement très rarement, comme plante ornementale et – grâce à ses fruits ‘explosifs’ – s’observe parfois à l’état subsponané, voire naturalisé localement. Elle est souvent considérée comme une xénophyte indésirable plutôt qu’une plante ornementale. Une population apparemment bien établie s’observe depuis quelque temps déjà à Bruges (province de Flandre occidentale), dans une jardinerie et dans ses environs immédiats. Une espèce très proche et écologiquement similaire, *C. incisa* (Thunb.) Pers., est devenue, en peu de temps, envahissante en Amérique du Nord.

SAMENVATTING. – Een eerste vondst van de Chinese soort *Corydalis linstowiana* (Papaveraceae) als onkruid in België. *Corydalis linstowiana* Fedde is een Chinese soort met een vrij beperkte natuurlijke verspreiding (het westelijke deel van Sichuan). Ze wordt, zij het wellicht zeer zelden, gekweekt als sierplant en verwildert gemakkelijk dankzij haar ‘explosieve’ vruchten. Ze heeft zich hier en daar buiten China gevestigd en wordt vaak eerder beschouwd als een onkruid dan als een sierplant. In Brugge (provincie West-Vlaanderen) houdt al geruime tijd een ogenschijnlijk goed ingeburgerde populatie stand in een tuincentrum en in de onmiddellijke omgeving ervan. Een nauw verwante en ecologisch vergelijkbare soort, *C. incisa* (Thunb.) Pers., is in korte tijd een vervelend onkruid geworden in Noord-Amerika.

Introduction

Corydalis linstowiana Fedde has a relatively small natural distribution. It is confined to the western part of Sichuan (China) where it can be found in forest margins, channel sides and roadsides, at altitudes ranging between 1,300 and 3,400 m (Zhang *et al.* 2008). Elsewhere in the world, in climatologically suitable areas, it is grown as an ornamental although probably not widely so. It is not mentioned in standard garden floras such as *The European Garden Flora* (Cullen 2011), *The New Royal Horticultural Society Dictionary of Gardening* (Huxley 1999) or Jäger *et al.* (2008), nor is it mentioned in overviews of the

genus in cultivation by Rydberg (1955) or Lidén & Zetterlund (1988). This supports the idea that this species is not commonly cultivated. It is very rarely offered for sale. In Belgium and the Netherlands there currently is, according to www.plantago.nl, only a single provider. *Corydalis linstowiana* is also absent from the main Belgian living collections in public gardens and parks (www.plantcol.be).

Despite being a local Chinese endemic and very rarely grown for ornament, *C. linstowiana* has been recorded as a weed by Randall (2017), based on information from the European Botanic Gardens Consortium. It is considered to be an invasive weed in the botanic garden in München



Fig. 1. *Corydalis linstowiana* as a weed in a garden center in Bruges.

(Germany). Botanic gardens are known to have played a significant role in the processes of biological invasions. A consequence of the introduction of many thousands of plant species into cultivation has been the escape of considerable numbers of them (Heywood & Sharrock 2013).



Fig. 2. *Corydalis linstowiana*. Flowers are pinkish-blue with a spur that is bent at the apex.

A weedy *Corydalis* in Bruges

In April 2019 one of us (LD) found a small population of an unknown species of *Corydalis* alongside a former railway track (now a cycling track) in Bruges (province of West Flanders). The plants were found right next to a garden, about 100 m from a nearby garden center. In the spring of 2020, its presence was confirmed, although the plants were clearly considered weeds and soon afterwards removed. Closer to the garden center, however, more plants were discovered and the species apparently was a pernicious weed inside the garden center as well. Upon inquiry, it turned out that this *Corydalis* has been present there since about five years at least. It was inadvertently introduced, probably as a contaminant in other pot plants. It is not really controlled but where it sows and hinders other plants, it is removed (Fig. 1).

The plants were initially thought to be an aberrant form or cultivar of our native species *Corydalis solida* (L.) Clairv., which indeed is superficially similar in habit, flower color and leaf shape. However, on closer examination the weedy plants differ in a number of characters (see Fig. 2-4). They are tap-rooted annuals (or biennials?) (vs. a tuberous perennial), the floral bracts are more deeply incised (although this is a variable character in *C. solida* as well; cf. Lidén 2001) and – most importantly – fruits are ‘explosive’, i.e. the seeds are explosively dispersed.

Naming a non-native weed

The quest for an appropriate name for the weedy plants found in Bruges was not straightforward, the genus *Corydalis* being known to be taxonomically complex. The aforementioned garden floras yielded no results as did Eu-



Fig. 3. *Corydalis linstowiana*. Fruits are pendent on patent pedicels.

ropean and North American accounts (Mowat & Chater 1993; Stern 1997). However, the genus is most diverse in China where 357 species are found (more than 75% of all known species), 262 of them endemic (Zhang *et al.* 2008). Based on the life form, flower color, floral bract shape and pendent fruits on patent pedicels, the plants from Bruges proved to belong to section *Incisae* Fedde, a small section



Fig. 4. *Corydalis linstowiana*. Plants are annuals or biennials with a taproot.

with nine East Asian species, eight of them endemic to China (Zhang *et al.* 2008). The deeply laciniate stipules of the upper (!) leaves then led to *C. linstowiana* and this identity was subsequently confirmed by Henrik Zetterlund from the Goteborg Botanic Garden (pers. comm. 14 May 2020).

A characteristic feature of *Corydalis* sect. *Incisae* are the capsules that are explosively dehiscent. This particular dispersal mechanism is observed in other ‘successful’ weeds and invasive plants, e.g. in species of *Impatiens* and *Oxalis* (e.g. Lovett-Doust *et al.* 1985; Chapman & Gray 2012). Judging from the weediness of *C. linstowiana* in and near the garden center in Bruges it indeed very easily reproduces from seed and doubtlessly must have been dispersed to private gardens, as a stowaway in sold garden plants. It is therefore likely to be present in other localities (gardens in the first place) in the wider surroundings of the garden center where it may have been overlooked, neglected or confused with native *C. solida*.

A potential problematic environmental weed?

From the same section, an in all respects very similar species was recently discovered in North America, *C. incisa* (Thunb.) Pers. It is the most widespread species of the section and also occurs in Japan and Korea (Zhang *et al.* 2008). Compared with *C. linstowiana* it has stipules of the upper leaves merely erose-dentate (vs. deeply lacinate), longer fruits (12-18 mm vs. 10 mm) with larger seeds (1.8-2.1 vs. 1-1.5 mm) and pinkish-purple rather than purplish-blue to pink flowers with a more or less straight spur (vs. bent spur) (see also Zhang *et al.* 2008). It was first detected in New York in 2005 (Atha *et al.* 2014) and since then also in Washington DC and a further six U.S. states (U.S.D.A. 2017). In a few years’ time this species has become a problematic environmental weed that also penetrates nature reserves.

Even though it is unknown how *C. incisa* was introduced to the United States, it was most likely imported as an ornamental although it is only offered for sale by a very limited number of nurseries in the U.S.A. (U.S.D.A. 2017). According to Lidén & Zetterlund (1988) it is “too insignificant to be of interest” as an ornamental. Rydberg (1955) noted that it is sometimes included in seed catalogues, mainly distributed from Asiatic gardens and institutions. Like *C. linstowiana*, it is of limited ornamental value and probably mostly confined to botanic gardens, either as a cultivated curiosity or, increasingly, as a pernicious weed. In the New York Botanical Garden, it is actively managed (Atha *et al.* 2016).

Based on the experiences with *C. incisa* in the U.S.A., it is not unlikely that the ecologically, biologically and morphologically similar *C. linstowiana* might naturalize and spread in Belgium and other West European countries as well. Indeed, on the occasion of the preparation of this article, we also verified recent observations of *Corydalis* in The Netherlands (<https://waarneming.nl>). In Zutphen (province of Gelderland) a small naturalized population

of a species called “*Corydalis elata* Bureau & Franch.” and known from an urban habitat since at least 2017, clearly also refers to *C. linstowiana*. Plants of this population are depicted in Denters (2020).

Acknowledgements – Dr. Henrik Zetterlund from the Goteborg Botanic Garden (Sweden) is sincerely acknowledged for confirming the identity of our plant material from Bruges. Mrs. Daniëlle Monbaliu from the ‘Epimedium’ garden center is thanked for providing useful details about the introduction and status of *Corydalis linstowiana* in Bruges.

References

- Atha D.E., Forrest T., Naczi R.F.C., Pace M.C., Rubin M., Schuler J.A. & Nee M. (2016) – The historic and extant spontaneous vascular flora of The New York Botanical Garden. *Brittonia* 68(3): 245-277.
- Atha D., Schuler J.A. & Tobing S.L. (2014) – *Corydalis incisa* (Fumariaceae) in Bronx and Westchester counties, New York. *Phytoneuron* 96: 1-6.
- Chapman D.S. & Gray A. (2012) – Complex interactions between the wind and ballistic seed dispersal in *Impatiens glandulifera* (Royle). *Journal of Ecology* 100(4): 874-883.
- Cullen J. (2011) [edited by Knees S.G.] – *Corydalis*. In: Cullen J. *et al.* (eds.), *The European Garden Flora*, vol. 2 (2nd ed.): 537-544. Cambridge, Cambridge University Press.
- Denters T. (2020) – *Stadsflora van de Lage Landen*. Amsterdam, Fontaine Uitgevers.
- Heywood V.H. & Sharrock S. (2013) – *European Code of Conduct for Botanic Gardens on Invasive Alien Species*. Strasbourg, Council of Europe / Richmond, Botanic Gardens Conservation International.
- Huxley A.J. (1999) – *The new Royal Horticultural Society dictionary of gardening*. London, Macmillan.
- Jäger E.J., Ebel F., Hanelt P. & Müller G. (eds.) (2008) – *Rothmaler Band 5. Exkursionsflora von Deutschland. Krautige Zier- und Nutzpflanzen*. Berlin, Springer Verlag.
- Lidén M. (2001) – *Corydalis*. In: Jonsell B. (ed.), *Flora Nordica*, vol. 2: 371-377. Stockholm, The Bergius Foundation.
- Lidén M. & Zetterlund H. (1988) – Notes on the genus *Corydalis*. *Bulletin of the Alpine Garden Society* 56: 146-169.
- Lovett-Doust L., Mackinnon A. & Lovett-Doust J. (1985) – Biology of Canadian weeds. 71. *Oxalis stricta* L., *O. corniculata* L., *O. dillenii* Jacq. ssp. *dillenii* and *O. dillenii* Jacq. ssp. *filipes* (Small) Eiten. *Canadian Journal of Plant Science* 65: 691-709.
- Mowat A.B. & Chater A.O. (1993) – *Corydalis*. In: Tutin T.G. *et al.* (eds.), *Flora Europaea*, vol. 1 (2nd ed.): 303-305. Cambridge, Cambridge University Press.
- Randall R.P. (2017) – *A Global Compendium of Weeds*, 3rd ed. Perth (Western Australia), R.P. Randall.
- Ryberg M. (1955) – A taxonomic survey of the genus *Corydalis* Ventenat, with reference to cultivated species. *Acta Horti Bergiani* 17(5): 115-175.
- Stern K.R. (1997) – *Corydalis*. In: *Flora of North America* Editorial Committee (eds.), *Flora of North America*, vol. 3: 348-355. New York & Oxford, Oxford University Press.
- U.S.D.A. (2017) – *Weed Risk Assessment for Corydalis incisa* (Thunb.) Pers. (Papaveraceae) – Incised fumewort. United States Department of Agriculture, Animal and Plant Health Inspection Service. [https://www.aphis.usda.gov/plant_health/plant_pest_info/weeds/downloads/wra/corydalis-incisa.pdf]
- Zhang M., Zhiyun S. & Lidén M. (2008) – *Corydalis*. In: *Flora of China*, vol. 7: 295-428. Beijing (China), Science Press / Saint Louis (U.S.A.), Missouri Botanical Garden Press.