



New observations of garden escapes in Meise Botanic Garden (Belgium), part 1

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ABSTRACT. – As a continuation of previous investigations of the subsponaneous flora in the domain of Meise Botanic Garden (MBG), further fieldwork since 2011 yielded several interesting new records of vascular plants garden escapes. In this contribution, part of these new records for MBG are presented. In total 23 taxa not previously recorded are presented. Eight of these had not been recorded so far in the wild in Belgium. The status of naturalization of these taxa varies from mere ephemeral to naturalized and potentially invasive. For each taxon we provide information on its native distribution, degree of invasiveness, occurrence in MBG as part of the collection and as escapes from the collections, their status in Belgium and elsewhere, and references to the herbarium collections in BR. Where deemed useful, information on related species is given. A number of taxa are illustrated with pictures.

RÉSUMÉ. – **Nouvelles observations d'espèces échappées des collections au Jardin Botanique de Meise (Belgique) : première partie.** Plusieurs nouvelles observations intéressantes d'espèces de plantes vasculaires ont été faites dans le domaine du Jardin Botanique de Meise lors d'inventaires réalisés depuis 2011, en continuation d'études antérieures de la flore subsponanée. Cet article présente 23 nouveaux taxons, dont huit ont été observés pour la première fois en Belgique à l'état subsponané. Le degré de naturalisation de ces taxons varie d'éphémère à naturalisé, certaines espèces étant potentiellement envahissantes. Pour chaque taxon, nous mentionnons l'aire d'indigénat et le degré d'envahissement, leur présence au Jardin comme plante cultivée et échappée de culture, leur statut en Belgique et ailleurs, les collections conservées dans l'herbier du Jardin (BR) et, s'il y a lieu, des notes sur des espèces apparentées. Quelques taxons sont illustrés par des photos.

SAMENVATTING. – **Nieuwe waarnemingen van collectievlieders in het domein van Plantentuin Meise (België): deel 1.** Als een vervolg op eerdere studies over de subsponane flora van het domein van Plantentuin Meise werden meerdere nieuwe interessante vaatplanten waargenomen tijdens veldwerk sinds 2011. In deze bijdrage worden 23 nieuwe taxa voorgesteld, waarvan acht die nog niet eerder in België in het wild werden aangetroffen. De inburgeringsstatus van de waargenomen taxa varieert van efemeer tot ingeburgerd en potentieel invasief. Van elk taxon wordt informatie gegeven over het herkomstgebied, hun al dan niet invasief karakter, hun aanwezigheid in de Plantentuin als gekweekte en ontsnapte soort, hun status in België en daarbuiten, herbariumspecimens bewaard in BR en, waar relevant, notities over nauw verwante soorten. Enkele taxa zijn geïllustreerd met foto's.

Introduction

Garden escapes are defined as plants that have originated from cultivated plants in gardens and that grow or spread outside their planting area in gardens. As with other neophytes, some can become invasive. As a matter of fact, within the list of the one hundred worst invasive organisms of the world, more than half of the plant species are

garden escapes (Lowe *et al.* 2000). Moreover, in Australia, New Zealand and the US, over 50% of the naturalized plants and weeds are garden escapes, and this group of neophytes has been identified as a major source of weed introductions worldwide with a considerable impact on the biodiversity (Downey & Glanznig 2006). Garden escapes can spread from private gardens but also from botanical gardens where often vast and varied plant col-

lections are present (Galera & Sudnik-Wojcikowska 2010).

Botanic gardens have been found to be the source of introduction or dissemination of more than half of the 34 plants on the list of the 100 world's worst invasive species (Hulme 2011). Therefore, codes of conduct or guidelines have been developed by botanic gardens in order to diminish this risk, e.g. by Kiehn *et al.* (2007) and by the European Botanic Gardens Consortium (<https://www.bgci.org/our-work/where-we-work/europe/european-botanic-gardens-consortium/>; accessed on 15.05.2020). Several action points concern the gathering of information on the 'weediness' of plants in botanic gardens, so as to evaluate their potential risk in terms of invasiveness and identify emerging problem taxa, especially in an era of climate change.

A first status report on the 'garden escapes' of MBG, covering the period 2002-2010, appeared in Hoste (2011). In this publication, the first author presented an introduction to the wild flora of MBG (Ronse 2011a), its truly indigenous flora (Ronse 2011b) and four categories of neophytes: stinsen plants and other deliberate introductions in the (semi-)natural zones (Ronse 2011c), external neophytes which also occur in the surrounding area (Ronse 2011d), botanic garden escapes (Ronse 2011e) and wood-lawn neophytes (Ronse & Leten 2011).

This paper shortly describes a selection of new garden escapes in the domain of Meise Botanic Garden, not mentioned by Ronse (2011d). We briefly describe their occurrence in MBG and whether their probable source population was from the collections of MBG. Furthermore, we review their native distribution, their current presence as garden escapes in Belgium and their potential invasiveness elsewhere in the world.

In a subsequent paper, more escapes encountered in the domain of MBG will be described in a similar way.

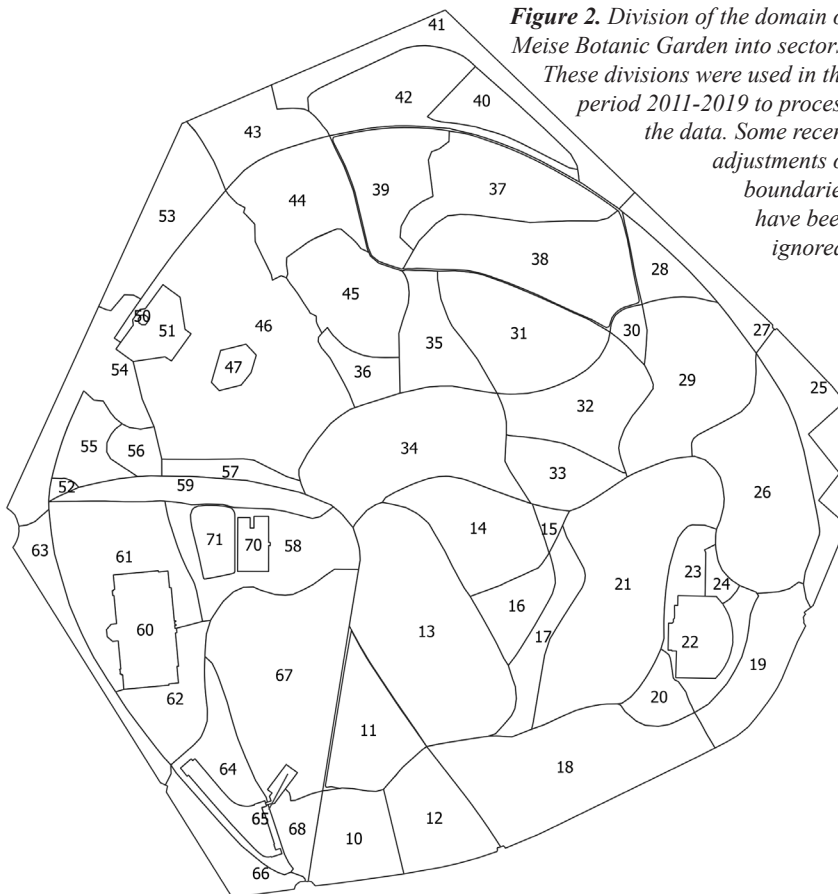
Material and methods

Meise Botanic Garden (MBG, formerly National Botanic Garden of Belgium) lies 15 km to the north of

Figure 1. An up-to-date map of the domain of Meise Botanic Garden in Meise (province of Flemish Brabant).



Figure 2. Division of the domain of Meise Botanic Garden into sectors. These divisions were used in the period 2011-2019 to process the data. Some recent adjustments of boundaries have been ignored.



Brussels (Belgium). It is housed in a domain of 92 ha, which harbors various habitats, mainly grasslands or lawns and woodlands (Fig. 1). As it consists of two old castle domains, it also contains historical buildings, besides more recent ones built for botanic garden purposes. Moreover, it lodges large botanical collections, in greenhouses as well as outdoors.

From 2011 to 2019, the first author regularly inventoried the alien flora of MBG. The records of our observations include references to subdivisions of the domain; these sectors were initially defined for management purposes (Fig. 2). The observations were entered in an Access database, also comprising the number and size or age of the plants. Herbarium vouchers were taken in many cases, and sometimes photographs as well. All cited herbarium specimens are present in BR.

We looked up the locations of the plants in the living collections of MBG in the collections database with the management software BG-BASE (version 9.0, www.bg-base.com). The distance of the escapes to the nearest cultivated location of that species was then measured.

We looked up their presence as garden escapes in Belgium in the *Manual of the Alien Plants of Belgium* (<http://alienplantsbelgium.be>). Furthermore, we searched for mentions of their occurrence as neophytes or invasive behaviour on a global level in the specialized literature.

The garden escapes are mentioned in alphabetical order, followed by the name of the plant family to which they belong.

Results

- *Adiantum capillus-veneris* L. (Pteridaceae)

This fern was originally described from southern Europe but occurs throughout the warm-temperate and subtropi-

cal regions of the world. At MBG, it is cultivated in a nursery greenhouse, from material with unrecorded provenance. It is also grown in the display greenhouses of the Plant Palace, where it sows itself freely as a weed in the plant beds and pots. Plants of this species have established themselves on the outside walls of the nursery greenhouses since decades (Fig. 3), as well as on the outer walls of the display greenhouses. More recently, in October 2019, several small seedlings of this fern were found on the walls of an old small building within the domain of the Garden, at a distance of approximately 500 m from the greenhouses (<https://waarnemingen.be/observation/181334481/>).

A population of *A. capillus-veneris* is known to persist in Antwerp at least since 2007. It grows there on exposed, unprotected walls as well. Since then, the species has also been observed in a few other localities in Flanders, for instance in Bruges and Ghent. In Belgium, it is rarely seen outdoors (as an escape). The related species *A. raddianum* is found more often as an escape (Verloove *et al.* 2007).

Herbarium (BR): A. Ronse 2285, Meise, Domain of National Botanic Garden, on wall of greenhouse, cultivated in 'kweekkassen', 29.08.2011.

- *Ageratum houstonianum* Mill. (Asteraceae)

This species is native to Central America but is now a naturalized garden escape throughout the tropical regions of the earth. It is often considered to be weedy (e.g. Sharma 1987) and was given a medium risk score by Randall (2017). It has been planted in flower beds in the vicinity of the castle. Many young escapes were found growing in front of the castle in 2013, in the vicinity of flowerbeds where the species was planted.

Elsewhere in Belgium, this species is often cultivated



Figure 3. *Adiantum capillus-veneris* growing on the outside walls of the nursery greenhouses. Its ultimate segments are large, usually over 15 mm wide, as opposed to those of the related *A. raddianum*, which are more narrow and usually less than 10 mm wide.



Figure 4. *Allium siculum* subsp. *dioscoridis* flowers every year in a wood edge since 2011. The flowers of this subspecies are suffused with red, unlike the flowers of subsp. *siculum*, which are greenish white.

as an annual in flower beds because of its blue flowers, and it is a regular escape from cultivation in Belgium, known at least since 1908 (Verloove 2006). It is, however, always ephemeral.

Herbarium (BR): A. Ronse 2949, Meise, domain of botanic garden sector 13, near flowerbeds before castle, many seedlings, 24.09.2013.

- *Akebia quinata* (Houtt.) Decne. (Lardizabalaceae)

This species is native to China, Korea and Japan but widely cultivated elsewhere in the world as an ornamental vine. The exact identity of plants in cultivation is not always obvious. *Akebia ×pentaphylla* (Makino) Makino, a hybrid of *A. quinata* and *A. trifoliata* (Thunb.) Koidzumi, is sometimes difficult to distinguish from genuine *A. quinata*. According to Christenhusz (2012) it has leaf margins that are sinuate-dentate while they are entire (often undulate) in *A. quinata*. Plants in cultivation (as well as in the wild) might also, at least in part, represent this hybrid although all Belgian plant material seen (collected in the wild) seems to belong to *A. quinata* (Verloove 2019a). This is also the case for the escape in Meise.

Akebia quinata has been included in the EPPO Observation List of invasive alien plants (https://www.eppo.int/ACTIVITIES/invasive_alien_plants/iap_lists#observ; accessed on 26.05.2020). It is considered to be an invasive species in many countries throughout the world and was given a medium risk score by Randall (2017).

The species is cultivated on three locations in the Garden, among which the Fruticetum, all with plants from cultivated origin. The Fruticetum might well be the source location from where it has spread, as it is the closest to the

place where the escape was found, at a distance of some 200 m. It was planted in the Fruticetum in 2008. It has been found in woodland close to the border of the domain with a neighbouring private garden.

Akebia quinata is an exceptional escape elsewhere in Belgium. It is only known since 2009 from Mol (persisting in an abandoned garden center) and Lommel (spreading in an abandoned arboretum) (Verloove 2019a).

Herbarium (BR): A. Ronse 2670, Meise, domain of botanic garden sector 53, edge of woodland with neighbouring garden, 31.08.2012.

- *Allium siculum* Ucria subsp. *dioscoridis* (Sm.) K. Richt. (Amaryllidaceae)

This species with rather large flowers is also known as *Nectaroscordum siculum* (Ucria) Lindl. The plants found in MBG belong to subsp. *dioscoridis* (Sm.) K. Richt. [syn. subsp. *bulgaricum* (Janka) Stearn]. This subspecies is native to eastern Romania, Bulgaria, the Crimea and western Turkey. Randall (2017) reports it as a weed, mostly from Europe and New Zealand. In the British Isles it is naturalized in a few places in southern England (Frost *et al.* 1991; Clement & Foster 1994).

This species has been present in the collections in the walled garden since 1983, but had died by 2005. In 2017 it was introduced in three other sectors. One flowering plant of this species has been found in the edge of a (semi-) natural woody area in MBG in 2011. It has subsisted there up to now and has flowered every year with several inflorescences, though the plant is partly overgrown with nettles (Fig 4). In 2020 fourteen inflorescences were counted, much more than the previous years.

The source of this escape might be the plants from the walled garden, at a distance of more than 700 m. These plants had disappeared six years before the discovery of the escapes, however. On the other hand, it is possible that a small non-flowering plant would have gone unnoticed in the forest edge that is overgrown by nettles. Another possibility might be the three-day annual garden fair that was held close to the location of the escapes from 2005 to 2011. During these fairs several commercial growers exhibited and sold a range of garden plants.

Allium siculum has been recorded on three locations in the wild in Belgium since 2017 (<https://waarnemingen.be/species/144786/>).

Herbarium (BR): A. Ronse 2266, Meise, Domain of National Botanic Garden, 13.05.2011.

- *Asclepias incarnata* L. (Asclepiadaceae)

This species is native to North America. Randall (2017) assigned a medium risk score to this species; it is particularly weedy in North America in areas where it does not occur naturally. Although frequently cultivated as an ornamental, there are hardly any records of escaped plants in Europe.

Asclepias incarnata shows invasive behaviour in the Herbetum, a garden with herbaceous plants arranged according to systematics. It grows in other flowerbeds and on paths up to a distance of 10 m. Three accessions of this species are grown in different locations of the outdoor collections since 2008, all wild collected in North America (USA and Canada). The plants grown in the Herbetum originate from Michigan.

This species was recorded only twice before in Belgium (Verloove 2019b). It superficially looks like *Asclepias syriaca*, a locally naturalized and increasing neophyte, found in Belgium since 1987 (Verloove 2006).

Herbarium (BR): A. Ronse 2631, Meise, domain of botanic garden, Herbetum, in flower bed of *Potentilla*, 27.08.2012.

- *Atropa belladonna* L. (Solanaceae)

This species has its natural distribution in large parts of Eurasia and North Africa and it is native to Belgium as well. It is a well-known medicinal plant; its berries contain many different alkaloids. According to Randall (2017), *Atropa belladonna* has a low risk as a weed. The species has also reportedly been growing (sub)spontaneously in one botanic garden in Poland (Galera 2003).

One large flowering and fruiting plant was found in the enclosed courtyard of the herbarium building of MBG in 2018 and 2019 (Fig. 5). In the courtyard the vegetation had not been cut for approximately 20 years. In 2017, however, most trees were felled, creating open ground. The species appeared there the next year, probably by ornithochory. It still subsisted there in 2020, and was accompanied by a second flowering plant, despite the fact that all weedy vegetation had been cut to the ground in April of that year. Plants of this species are grown in the

Garden on three locations. First of all in the medicinal garden with an accession which goes back to the former MBG location in Brussels before 1930. More recently, two wild collected accessions have been introduced in 2002, one in the Herbetum (coming from Baden-Württemberg, Germany) and one in sector 39 (from Salzburg, Austria). This means that the closest possible source lies at a distance of between 600 and 800 m.

In Belgium, *Atropa belladonna* naturally occurs in clearings and woodlands, mostly in the southern part of the country (Wallonia). In Flanders, it is very rare and often confined to urban habitats (Van Landuyt 2006).

Herbarium (BR): A. Ronse 4350, Meise, domain of botanic garden sector 65, 31.05.2018.

- *Bulbine semibarbata* (R. Br.) Haw. (Asphodelaceae)

This annual herb grows up to 45 cm tall and has yellow flowers. It is native to Western Australia (<https://florabase.dpaw.wa.gov.au/browse/profile/1366>; accessed on 21.04.2020). It is known to be weedy and easily self-sowing. Shaw (2002) reported about this species as a new alien species in the British Isles. Randall (2017) reports this species as a weed from New Zealand and the USA.



Figure 5. Subspontaneous *Atropa belladonna* in the enclosed courtyard of the herbarium building.

Several seedlings of *B. semibarbata* grow between the pavements of the paths in the Herbetum, where the species is cultivated, with plants from unknown provenance. Another accession of the same species is cultivated in a greenhouse of the Plant Palace since 1976. The escaped plants spread on a distance of up to 10 m from the cultivated plants, and some of them flower. They have been present every year since 2015, the year of discovery. It has not been recorded before in Belgium (Verloove 2006).

Herbarium (BR): A. Ronse 3707, Meise, domain of botanic garden sector 51, uitgezaaid op paden, 23.06.2015.

- *Cedronella canariensis* (L.) Webb & Berthel. (Lamiaceae)

This species is endemic to Macaronesia (the Canary Islands, Madeira and the Azores). Outside of Europe, *C. canariensis* has been reported from Australia, New Zealand, South Africa and the USA, though with a low weed risk score (Randall 2017). In the British Isles it is an exceptional and casual horticultural seed impurity (Clement & Foster 1994).

A single seedling of this species with very aromatic leaves was found in open air between the greenhouses of the Plant Palace. It is cultivated in greenhouse I, from cultivated material obtained from a botanic garden in Germany.

This species has not been recorded before in the wild in Belgium (Verloove 2006).

Herbarium (BR): A. Ronse 2282, Meise, domain of botanic garden sector 51, 29.08.2011.

- *Cistus parviflorus* Lam. (Cistaceae)

This small shrub is native to the Mediterranean area from Sicily to Turkey and Libya (<http://www.plantsoftheworldonline.org/taxon/urn:lsid:ipni.org:names:168409-1>). It

has pink flowers of approximately 3 cm diameter and grey velvety foliage. To our knowledge, this species has never before been reported as an escape from cultivation (see e.g. Randall 2017).

This species is cultivated since 1988 in the walled Orangery garden, and was raised from seeds obtained in 1982 from nurseries in the Netherlands (herb. AR 3589). One seedling of this species has been found in 2015 at about ten meters distance from the cultivated plants.

Herbarium (BR): A. Ronse 3586, Meise, domain of botanic garden sector 22, seedling, 10 m away, 8.05.2015.

- *Cotoneaster dielsianus* E. Pritzel ex Diels (Rosaceae)

This *Cotoneaster* originates from China and is spread by birds that eat the berries. It is reportedly known from rather numerous countries as an escape, especially in Europe, but was assigned low weed risk score by Randall (2017).

Several plants are growing, flowering and fruiting in the inner courtyard of the herbarium building (Fig. 6). Five accessions of this species have been introduced in five different sectors between 1950 and 1985, all from cultivated origin. The escapes occur at a distance of approximately 100 m from where the cultivated plants were introduced in 1950 from a Dutch botanic garden (HB Utrecht).

The species is one of the Asian species of *Cotoneaster* most frequently seen in the wild in Belgium (Verloove 2013).

Herbarium (BR): A. Ronse 2403, Meise, domain of botanic garden sector 65, 19.04.2012; A. Ronse 4368, Meise, domain of botanic garden sector 65, 31.05.2018; A. Ronse 4384, Meise, domain of botanic garden sector 65, 6.06.2018; A. Ronse 4801, Meise, domain of botanic garden sector 65, 27.09.2019.

Figure 6. *Cotoneaster dielsianus* fruiting in the inner courtyard of the herbarium building. This species has deciduous leaves that are shortly acuminate at the apex and tomentose on their lower surface; it has inflorescences with 3 to 7 flowers.



Figure 7. Escaped *Euphorbia characias* subsp. *wulfenii* flowering in edge of a flower bed, May 2020. This is a perennial spurge with alternate leaves and large inflorescences containing 10 to 20 rays with fused bracts.



- *Epimedium pinnatum* Fisch. ex DC. subsp. *colchicum* (Boiss.) N. Busch (Berberidaceae)

This species inhabits two widely separated areas in the Caucasus, and the plants from each area are recognized as belonging to different subspecies. The eastern populations near the Caspian Sea belong to subsp. *pinnatum*, whereas the western populations near the Black Sea belong to subsp. *colchicum* (Boiss.) N. Busch (Stearn *et al.* 2002). This species is sometimes reported as an escape from (or more often relic of) cultivation, for instance in the British Isles (Clement & Foster 1994). It has a low weed risk score (Randall 2017).

The plants of subsp. *colchicum* are slowly-spreading evergreen perennials with bright yellow spurred flowers (Brickell 2008). Stearn *et al.* (2002) write that it is common in gardens, and that it differs from subsp. *pinnatum* in its longer petal-spurs, ovate inner sepals, usually 3- or 5-foliolate leaves with larger and less spinous-, or even entire-margined leaflets. According to van de Laar (1981), all plants of *E. pinnatum* in cultivation in the Netherlands belong to subsp. *colchicum*, which can also be distinguished from subspecies *pinnatum* because it flowers earlier in the year.

In MBG, some plants were found growing in the undergrowth of a woody area in 2014, where it has flowered every year since then. It is a vigorous grower which has slowly expanded and is now about 0.5 m high. The spontaneous plants in Meise belong to subsp. *colchicum* (some leaves trifoliolate, leaflets with entire margins); they flower in the second half of March. This species has been planted in MBG from four sources, two of them labelled as subsp. *colchicum*. They all come from cultivated origin and have been planted in seven sectors between 1968 and 2015. The most probable source for the escapes is from a

sector at a distance of approximately 250 m uphill from the location; these are plants without known wild origin obtained in 1968 as *E. pinnatum*.

This species is only known from one other naturalized locality in Belgium, where it was identified as subsp. *colchicum* (Verloove 2019c).

Herbarium (BR): A. Ronse 3053, Meise, domain of botanic garden sector 61, near hangar, escaped, 31.01.2014; A. Ronse 3083, Meise, domain of botanic garden sector 61, forest edge, flowering, 20.03.2014.

- *Euphorbia characias* L. subsp. *wulfenii* (Hoppe ex W.D.J. Koch) Radcl.-Sm. (Euphorbiaceae)

This subspecies naturally occurs in the northern Mediterranean area. In Western Europe, the species is locally more or less established and increasing as an escape, in particular in coastal dunes, for instance in the British Isles (Clement & Foster 1994). Subspecies *wulfenii* as well as several cultivars of *E. characias* have been reported as escapes or weeds (Randall 2017).

In 2016 young seedlings were found growing in the vicinity of cultivated plants in MBG. The mother plants were obtained from HB Paris in 2009, raised from wild plants collected in Ioannina (Greece) and planted in 2012 in the new Peony garden in raised beds with stone walls. In 2020, one seedling had grown into a large flowering plant, and moreover more than 20 seedlings were found at distances of up to 5 m from the flower beds (Fig. 7).

Euphorbia characias (both subsp. *characias* and subsp. *wulfenii*) is known as an escape from cultivation in Belgium since 2001, mostly in coastal dunes (Verloove 2006).

Herbarium (BR): A. Ronse 3865, Meise, domain of botanic garden sector 20, seedlings from cultivated plants, 29.02.2016.

- *Euphorbia dulcis* L. cf. ‘Chameleon’ (Euphorbiaceae)
Euphorbia dulcis is a perennial from Central and Western Europe. It is native to the south of Belgium, where the subspecies *incompta* (Cesati) Nyman [syn.: subsp. *purpurata* (Thuill.) Rothm.; Lambinon & Verloove 2012] occurs. In Flanders, only a few populations occur at locations where the species was probably introduced as a stinsen plant (see below). The species easily establishes itself wherever cultivated, for instance in the British Isles, where it is naturalized on roadsides and riverbanks, especially in Scotland and Wales (Clement & Foster 1994). It is also sometimes reported as an escape in other parts of Europe, but also for instance in New Zealand (Randall 2017).

In 2010, one flowering plant was encountered in a forest edge in MBG. The plants have done well on this location: they have propagated so that in 2014 already 70 plants were recorded, including many young ones. In 2020, 140 plants were counted, of which more than half were flowering. No representatives of this species are grown in the collections in Meise. Belgium lies outside its main distribution area and in Flanders it is very rare. Since two out of the three populations in Flanders occur in old castle domains, it is regarded as a so-called *stinsen plant*, a plant that was intentionally introduced in old parks and castle domains (Allemeersch 2006). Some other species of stinsen plants have been found in the domain of Meise Botanic Garden, which consists of parts of two old castle domains (Ronse 2011c). However, this species has never been recorded from MBG before 2010, despite intensive floristic inventories since 2002, so we do not regard it as a stinsen plant in Meise. The plants have purple leaves and bracts (Fig. 8), which does not occur in plants in the

wild that belong to subsp. *incompta*. This colour is typical for the cultivar ‘Chameleon’ that is generally cultivated as a garden plant (Jäger *et al.* 2008); the population in the Garden probably belongs to that cultivar. As these spurges occur in a zone where garden plants have been sold during several years during a garden fair (see also *Allium siculum*), we regard them as garden escapes, that probably were unintentionally introduced during these garden fairs.

This is the first observation of this cultivar as an escape in Belgium.

Herbarium (BR): A. Ronse 2058, Meise, domain of botanic garden sector 64, 1 plant in wood edge, 3.05.2010; A. Ronse 3097, Meise, domain of botanic garden sector 64, in wood edge, ca. 70 plants, many seedlings, 4.04.2014.

- *Hypericum androsaemum* L. (Hypericaceae)

This species’ native distribution extends from western and southern Europe and North Africa to Iran. According to the Invasive Species Compendium (<https://www.cabi.org/isc/datasheet/114901>) and Weber (2017) this species occurs in several countries in Europe, Asia, Africa and Oceania. In Australia and New Zealand it is considered an invasive species as it has formed dense thickets and displaced native plants, probably spreading by ornithochory from plants cultivated in private gardens. Its black berries contain numerous seeds (Trueblood *et al.* 2010).

The species has increasingly been recorded in the domain of MBG since 2014. Observations were made on more than ten locations and herbarium vouchers were collected. In the beginning there were only young seedlings (as in Fig. 9 left), but soon more and more flowering and seed producing bushes were recorded. This species has



Figure 8. *Euphorbia dulcis* proliferates in a forest edge, where one plant was first spotted in 2010. These plants probably belong to the cultivar ‘Chameleon’, since they possess purple leaves and bracts.



Figure 9. Young seedlings (left) and flowers (right) of *Hypericum androsaemum*.

been grown in the Botanic Garden for a long time, at least from before the 1970s. It is now cultivated in three sectors, mainly with plants from unknown provenance, and one more recent accession from wild origin (collected in France, D ep. Loire-Atlantique, in 2009). In Belgium, it is extremely rare as a native species and is only known from a small, rather disjunct area in Wallonia. It is much more frequent in cultivation and increasingly occurs as a garden escape or throw-out on refuse tips, in wood margins, etc., as stated in the *Manual of the Alien Plants of Belgium* (<http://alienplantsbelgium.be/content/hypericum>; accessed on 16.04.2020).

Herbarium (BR): A. Ronse 3022, Meise, domain of botanic garden sector 36, along Maalbeek near bridge, 13.01.2014; A. Ronse 3259, Meise, domain of botanic garden sector 29, wood edge, 10.06.2014; A. Ronse 3712, Meise, domain of botanic garden sector 61, 26.06.2015; A. Ronse 3934, Meise, domain of botanic garden sector 64, wood edge, 3.06.2016; A. Ronse 4584, Meise, domain of botanic garden sector 36, on Maalbeek bridge, 20.02.2019.

- *Malus kansuensis* (Batalin) C.K. Schneid. (Rosaceae)

This wild apple reaches a height of up to 5 m and has white flowers and small yellowish red fruits. It grows in mixed forests at an altitude of 1500-3300 m in Central China (Gu & Spongberg 2003). There are no known records of it as an escape from cultivation (Randall 2017).

Approximately ten small seedlings of this species have been found in MBG in 2014, close to the parent tree. The seedlings have not subsisted there as they were weeded out. This species has been introduced in the collections in 2004 from cultivated material obtained from a Belgian nursery.

Malus kansuensis has not been recorded before as an escape in Belgium (Verloove 2006).

Herbarium (BR): A. Ronse 3093, Meise, domain of botanic garden sector 62, young seedling, 31.03.2014.

- *Mazus miquelii* Makino (Mazaceae; formerly Scrophulariaceae)

Originally native to East Asia, *Mazus miquelii* has become naturalized in many northern states of the USA, where this trailing perennial is most often encountered as a weed in lawns (Keener 2019; Pringle 2018). It is also increasingly recorded elsewhere, mostly in lawns or cracks of concrete, for instance in Italy (Banfi & Galasso 2010). It was assigned low weed risk score by Randall (2017).

Mazus miquelii was found in a lawn of MBG in 2013 and subsequent years, occupying an area of ca 1 m² (Fig. 10). This low creeping species thrived there despite, or maybe thanks to, the frequent mowing regime of the lawn. However, this part of the lawn was dug out in 2018 for the construction of a new rose garden at this location, and so the species has disappeared there. It has been introduced on three spots in the collections in Meise, with an accession obtained from cultivated source in 1984. It subsists in two sectors, that are both situated at a distance of more than 500 m.

This species was recently recorded for the first time from Belgium (Verloove 2019d).

Herbarium (BR): A. Ronse 2822, Meise, domain of botanic garden sector 38, in the lawn, ca 1 m², 21.06.2013.

- *Muehlenbeckia axillaris* (Hook.f.) Walp. (Polygonaceae)

This low-growing species from New Zealand can carpet rocky or gravelly habitats. It has only been reported before as an escape from Australia and the USA and was given a low weed risk score (Randall 2017). The very similar species *M. complexa* (A. Cunn.) Meissn. is larger and more vigorous than *M. axillaris* and can be quite overwhelming, sometimes overrunning shrubs or small trees in its native habitats in New-Zealand (<https://www.o2landscapes.com/plants/muehlenbeckia/>; accessed on 14.04.2020). It is frequently grown as an ornamental.



Figure 10. *Mazus miquelii* flowering freely in a lawn. This perennial species has leafy stolons rooting at the nodes; the corolla is 13-26 mm long.

In MBG, one bush of *M. axillaris* was found growing within a *Buxus* hedge some 15 m away of the mother plants in the walled Orangery garden in 2015. The species is cultivated there as well as in the Fruticetum with an accession from unknown provenance and introduction date. In the Orangery garden, it has probably been grown for more than 50 years, but the oldest record in the database is from 2005. Seedlings of this species may well have occurred and been weeded more often in this well maintained garden.

Muehlenbeckia axillaris has not been observed as an escape before in Belgium, but *M. complexa* recently started escaping in Belgium (Verloove 2019e).

Herbarium (BR): A. Ronse 3590, Meise, domain of botanic garden sector 22, within *Buxus* hedge, 8.05.2015.

- *Oenothera rosea* L'Hér. ex Aiton (Onagraceae)

A native to southern North America and northern South America, this species is frequently cultivated and naturalized in southwestern Asia, Australia, southwestern Europe and South America. It is known from very numerous countries but its weed risk score is low (Randall 2017). In Braunschweig (Germany) *O. rosea* has also been found as an escape from the botanic garden by Brandes & Nitzsche (2013).

One flowering plant of this species was found as an escape in MBG in the Herbetum in 2014, growing at a distance of some 30 m from cultivated plants. Three years later, a flowering plant was present in a plant border at a distance of nearly 800 m. The source population in the Herbetum is cultivated since 2009 from material received from Lyon Botanic Garden; it was originally collected in the wild in the Pyrénées-Atlantiques (France).

This species was recorded on a few occasions in Belgium in the 19th century (Verloove 2006); it never managed to naturalize.

Herbarium (BR): A. Ronse 3352, Meise, domain of botanic garden sector 51, near Balat greenhouse, one

plant, 22.08.2014; A. Ronse 4284, Meise, domain of botanic garden sector 61, around plant border, 22.06.2017.

- *Pelargonium grossularioides* (L.) L'Hér. (Geraniaceae)

This species is a very low-growing ground cover, with stems that may grow as long as 0.5 m and with small pink to purple flowers. It has its native distribution in South Africa from the southwestern Cape northeastward up into Mozambique. In Kenya, California and India it is recorded as an alien species (<http://pza.sanbi.org/pelargonium-grossularioides>; accessed on 21.04.2020) whereas Randall (2017) reports it as a weed in parts of the USA and India.

It has been found in MBG on the backside south of the greenhouses of the Plant Palace in 2015. Several flowering plants occur between the pavements and on the edge of the adjacent lawn. The species has persisted to this day, despite weed control on this spot (Fig. 11). *Pelargonium grossularioides* has been grown in a nursery greenhouse since 2004, at a distance of nearly 200 m. However, some containers with flowering *Pelargonium* plants have been exhibited for some years in the summer months at the eastern side of the Plant Palace, and these may have included *P. grossularioides*.

This species has not been recorded before as an escape in Belgium (Verloove 2006).

Herbarium (BR): A. Ronse 3711, Meise, domain of botanic garden sector 61, 26.06.2015; A. Ronse 4842, Meise, domain of botanic garden sector 61, 6.05.2020.

- *Phyla nodiflora* (L.) Greene (Verbenaceae)

This is a low spreading plant, which is often sold as a garden plant under synonyms such as *Lippia repens* or *Lippia nodiflora*. It is one of the few species in the family Verbenaceae to have a pan-tropical native distribution, probably resulting from natural dispersal from America to Africa then to Australasia (Gross *et al.* 2017). It can display invasive behaviour, and its rapid growth and ability



Figure 11. The low-growing *Pelargonium grossularioides* subsists on pavements near the Plant Palace. It shows rather small pink to purple flowers.

to adapt to a variety of soils make it difficult to control if it becomes invasive; moreover, it reproduces both by seed or vegetatively, with new growth sprouting from broken stolons (<https://homeguides.sfgate.com/control-phyllanthus-nodiflora-46653.html>).

Phyllanthus nodiflorus is known as invasive in many parts of the world (e.g. Xu *et al.* 2010, Price *et al.* 2011) and was assigned an extremely high weed score by Randall (2017).

In MBG, plants of this species were found flowering in the lawns surrounding the greenhouses of the Plant Palace. The species is grown in the Herbetum from cultivated material introduced in 1978. The escaped plants were found at a distance of 500 m from the mother plants, but they have disappeared after a few years.

This species has been recorded twice in Belgium since 2010 (Verloove 2019f). On a talus slope in Essen it is more or less naturalized since 2011.

Herbarium (BR): A. Ronse 3757, Meise, domain of botanic garden sector 62, 17.08.2015.

- *Sinocalycanthus chinensis* W.C. Cheng & S.Y. Chang (Calycanthaceae)

Synonym: *Calycanthus chinensis*.

This species is called Chinese wax shrub because of its large white flowers with waxy appearance. It has broadly ovate, tapered leaves with a rough upper surface. Its buds are not visible. In the wild, the plant is known to survive on only a few wooded mountain slopes at 600 to 900 meters in Zhejiang Province in Eastern China, where it grows up to 3 m tall (Straley 1991). It is listed as a protected plant

in China, owing to habitat deterioration caused by tourism development and overexploitation due to its value as a garden ornamental [(Hu (2002) and Zhang (2007), cited in Li *et al.* (2020)]. This species is grown rather exceptionally in private gardens. As far as we know, this species has never before been recorded as an escape.

In MBG, we found one young plant of this species growing under a *Ligustrum* bush in 2012, at a distance of approximately 10 m from a cultivated shrub of this taxon. In total, three other plants from the same source are grown in other locations in MBG, all flowering and producing seeds. The species was introduced in 2001 as seeds obtained from a German botanic garden (Dresden), coming from a tree with known wild origin in China.

Herbarium (BR): A. Ronse 2699, Meise, domain of botanic garden sector 63, one bush under *Ligustrum*, 19.10.2012.

- *Sisymbrium strictissimum* L.

This species grows up to 2 m tall and is called Perennial Rocket. It is native to Central Europe. In the UK it has become naturalized in several places, and in the Netherlands it is increasingly found as a casual escape (Tijssma & Dijkhuis 2018). This species has also been reported to escape within the territory of the Moscow University Botanic Garden (Vinogradova *et al.* 2015), as well as in a Polish botanic garden (Galera 2003). It is known as a weed in various European countries (Randall 2017).

In MBG, a few plants of *S. strictissimum* have been found on the parking lot for the Garden staff in 2017. They were flowering in 2018 but have been removed during the maintenance of the parking lot later that year. The species is cultivated in two sectors of the domain, the closest location being the Herbetum, at a distance of about 700 m from the parking. It has been introduced there in 2002 from seeds collected in the wild in Hungary.

In Belgium, *S. strictissimum* has been collected as a casual alien between 1857 and 1924 (Verloove 2006), but it has not been found since that time.

Herbarium (BR): A. Ronse 4397, Meise, domain of botanic garden sector 64, several plants, 12.06.2018.

- *Viola riviniana* ‘Purpurea’

This is a purple-leaved form of the European dog-violet, that is often sold by nurseries as *Viola labradorica*. The true *Viola labradorica* Schrank is almost never sold (<https://www.houzz.com/discussions/2209751/viola-labradorica-purpurea-v-riviniana-what-s-the-story>; accessed on 15.05.2020). *Viola riviniana* ‘Purpurea’ is readily distinguished from *V. labradorica*: it has densely hairy stems (vs. glabrous stems) and sepal auricles are 1.8-2.5 mm long and enlarged in fruit (vs. auricles not enlarged in fruit and 1-1.5 mm long).

The native range of *Viola riviniana* extends from Eurasia to North Africa, and includes Belgium. Its purple form is known as a local weed in New Zealand (Randall 2017) and on the above mentioned webforum, there is a testi-

mony of the invasiveness of these plants in an Australian garden. Galera (2003) also reports this taxon as an escape in four of the nine Polish botanic gardens that she investigated. In the Netherlands it recently naturalized in urban habitats (Denters 2020).

In 2018, one flowering plant of a purple-leaved violet was found in MBG along the eastern wall of the walled garden near the Orangery. In 2020, we found similar violets as a weed among *Sempervivum* plants in the neighbouring Peony garden. Upon research, it turned out that an accession of such violets had been introduced on another location in the walled garden under the name of *Viola labradorica*. The cultivated plants were originally obtained from a commercial grower in Belgium.

In Belgium there are numerous recent records of this taxon in urban habitats on <https://waarnemingen.be>.

Herbarium (BR): A. Ronse 4328, Meise, domain of botanic garden sector 22, 30.03.2018; A. Ronse 4843, Meise, domain of botanic garden sector 23, 14.05.2020.

Discussion

This paper deals with 23 taxa of flowering plants that have been found as escapes from cultivation in the domain of Meise Botanic Garden. They are listed in Table 1, with indication of their occurrence as garden escapes and whether or not they are native to Belgium.

Most of the taxa are herbaceous, a few are small shrubs and only two are trees. Eight are reported here for the first time in Belgium, namely *Bulbine semibarbata*, *Cedronella canariensis*, *Cistus parviflorus*, *Euphorbia dulcis* (purple form, probably cv ‘Chameleon’), *Malus kansuensis*, *Muehlenbeckia axillaris*, *Pelargonium grossularioides* and *Sinocalycanthus chinensis*. Nine other taxa are exceptional or rare escapes in Belgium, while the remaining five taxa are regularly found and increasingly establish as neophytes, especially *Cotoneaster dielsianus*, *Euphorbia characias* subsp. *wulfenii* and *Viola riviniana* ‘Purpurea’. *Hypericum androsaemum* is a remarkable case of an exceedingly rare and local native species that is very commonly grown as an ornamental throughout the country and now increasingly naturalizes as an escape from cultivation.

More than half of the discussed taxa show persistent behaviour in Meise, unless they are weeded or their habitat destroyed. However, the majority of the taxa with first records for Belgium either occur in limited numbers or as ephemerals. One species, *Sinocalycanthus chinensis*, is known as endangered in its home country (China), where it occurs in a restricted area. On the other hand, some of the taxa in this group, such as *Bulbine semibarbata* and *Euphorbia dulcis* cf. ‘Chameleon’, appear to be well-established; both have also elsewhere been recorded as established outside their native range. *Pelargonium grossularioides* has also subsisted for more than five years, albeit with a small number of individuals. This species has been recorded as an alien in several countries with a (sub)tropical climate; in Meise, it is restricted to the ther-

Table 1. Taxa found as escapes from cultivation in MBG. – First mention: ‘B’, first mention for Belgium as garden escape; ‘W’, first mention worldwide as garden escape.

Taxon	First mention	Native to Belgium?
<i>Adiantum capillus-veneris</i>	–	No
<i>Ageratum houstonianum</i>	–	No
<i>Akebia quinata</i>	–	No
<i>Allium siculum</i>	–	No
<i>Asclepias incarnata</i>	–	No
<i>Atropa belladonna</i>	–	Yes
<i>Bulbine semibarbata</i>	B	No
<i>Cedronella canariensis</i>	B	No
<i>Cistus parviflorus</i>	B + W	No
<i>Cotoneaster dielsianus</i>	–	No
<i>Epimedium pinnatum</i> subsp. <i>colchicum</i>	–	No
<i>Euphorbia characias</i> subsp. <i>wulfenii</i>	–	No
<i>Euphorbia dulcis</i> cf. ‘Chameleon’	B	Yes *
<i>Hypericum androsaemum</i>	–	Yes
<i>Malus kansuensis</i>	B + W	No
<i>Mazus miquelii</i>	–	No
<i>Muehlenbeckia axillaris</i>	B	No
<i>Oenothera rosea</i>	–	No
<i>Pelargonium grossularioides</i>	B	No
<i>Phyla nodiflora</i>	–	No
<i>Sinocalycanthus chinensis</i>	B + W	No
<i>Sisymbrium strictissimum</i>	–	No
<i>Viola riviniana</i> ‘Purpurea’	–	Yes *

* Although the species is native to Belgium, the cultivar is not.

mophilic environment of pavements at the southern edge of greenhouses.

On the whole, the taxa reported here are also known as weeds or escapes in other parts of the world, resulting in a variable degree of invasiveness or risk as a weed. About half of them have a low risk as a weed, but some are known as invasive in some parts of the world, such as *Phyla nodiflora* and *Akebia quinata*. On the other hand, for three of the species (*Cistus parviflorus*, *Malus kansuensis* and *Sinocalycanthus chinensis*) we have found no mentions as escapes. The latter three species have been found in very low numbers and at a short distance (within 25 m distance) from the mother plants.

Among the reported escapes, four are native to Belgium, at least in part of the country. In the case of *Atropa belladonna*, this species is mainly native to the southernmost part of the country, and possibly also in areas within 50 km from Meise. Similarly, *Euphorbia dulcis* is native to the south of Belgium, where the subspecies *incompta* occurs. In Flanders, the northern part of the country, only a few populations occur where the species was introduced as a stinsen plant. On the other hand, the plants in Meise belong to a purple cultivar, probably ‘Chameleon’. *Viola riviniana* occurs naturally in the woody areas in Meise, but in this case also a purple cultivar, erroneously sold under the name of *V. labradorica*, escaped from the collections. The fourth species is *Hypericum androsaemum*,

which is extremely rare as a native species in Belgium and only in a small area in the southern part of the country.

Cultivated native species can rather easily escape from cultivation, as they are adapted to the local climate. Ronse (2011d) has dealt with that issue in a paper on garden escapes in the domain of Meise Botanic Garden; she found that one quarter of the escapes were species that are native to Flanders, but obviously had propagated locally, because they only occurred close to the cultivated plants in Meise.

Overall, the escapes mentioned here have very likely originated from the botanical collections in the Garden, but two taxa might have been introduced unintentionally during an annual garden fair in the domain. Some of the taxa remained in the close vicinity (within 10 m) of the cultivated mother plants, but others were found at distances of up to 1 km, which approximates the maximum distance within the Garden.

The dispersal of the escapes outside the boundaries of the Garden has not been recorded yet. This is difficult to assess, however, as the domain of MBG is surrounded by numerous private gardens, which cannot readily be accessed.

Conclusion

As in other botanic gardens (e.g. Galera 2003; Galera & Sudnik-Wojcikowska 2010; Vinogradova *et al.* 2015; Weber *et al.* 2018), we have found a series of taxa escaping from the botanical collections in MBG. This paper describes 23 new taxa of escapes, in addition to the 156 taxa already reported by Ronse (2011d).

The results of this study have added a series of newly recorded taxa of escapes. One third of these are new for Belgium, while 13% have not been reported before as escapes anywhere in the world (compared to 4% in 2011). In combination with the formerly reported taxa, this brings the total number of escapes found in MBG that are new to Belgium to 46 (which represents 26% of all reported escapes); nine of these concern new mentions on the global scale.

Although these figures may appear fairly spectacular, they must be put into perspective. In recent years there is an increasing interest in alien plants in general and escapes from cultivation in particular. It is very likely that similar research in large, species-rich public and private gardens, parks, estates, etc. will yield numerous additional records. Many of these will prove to be merely anecdotal but some, however, may prelude incipient invasion events.

The escaped taxa display varying degrees of persistence and of invasiveness: the majority of taxa presented here persisted for more than two years, as opposed to those reported in 2011, of which many survived for less than two years. More than 80% of the escapes concern herbaceous plants. The escapes originate from various collections, including greenhouse collections for three of them; up to now, these have only been found growing in the immediate vicinity of the greenhouses, in locations with a mild microclimate. The proportion of taxa that

have escaped from the Herbetum, the main collection of herbaceous plants in Meise, is 22%; in 2011, it amounted to 67%, and then nearly all the herbaceous plants originated from the Herbetum. Among the presently described taxa, only four of the escapes are native species, yet for two of these it is a purple coloured cultivar that shows invasive behaviour.

New escapes keep turning up in Meise Botanic Garden. We intend to discuss them in subsequent papers.

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References

- Allemeersch L. (2006) – *Euphorbia dulcis*. In: Van Landuyt W. *et al.*, (eds.), Atlas van de flora van Vlaanderen en het Brussels Gewest: 391-392. Brussel & Meise, INBO, Nationale Plantentuin van België & Flo.Wer.
- Banfi E. & Galasso G. (eds.) (2010) – *La flora esotica lombarda*. Milano, Museo di Storia Naturale di Milano.
- Brandes D. & Nitzsche J. (2013) – Verwilderungen von kultivierten Arten im Freiland des Botanischen Gartens Braunschweig. *Braunschweiger Geobotanische Arbeiten* 10: 1-27. [https://publikationsserver.tu-braunschweig.de/receive/dbbs_mods_00051756]
- Brickell C. (ed.) (2008) – *The Royal Horticultural Society A-Z Encyclopedia of Garden Plants*. London, Dorling Kindersley.
- Christenhusz (2012) – An overview of Lardizabalaceae. *Curtis's Botanical Magazine* 29(3): 235-276.
- Clement E.J. & Foster M.C. (1994) – *Alien plants of the British Isles*. London, Botanical Society of the British Isles.
- Denters T. (2020) – *Stadsflora van de Lage Landen*. Amsterdam, Fontaine Uitgevers.
- Downey P.O. & Glanznig A. (2006) – Understanding and managing the risk of garden escapes to Australia's native flora: which future weed candidates are already here? In: C. Preston, J.H. Watts and N.D. Crossman (eds.), *Managing Weeds in a Changing Climate*. Proceedings of the 15th Australian Weeds Conference, Adelaide: 723-726. Adelaide (Australia), Weed Management Society of South Australia.
- Frost L.C., Houston L., Lovatt C.M. & Beckett A. (1991) – *Alilium sphaerocephalon* L. and introduced *A. carinatum* L., *A. roseum* L. and *Nectaroscordum siculum* (Veria) Lindley on St Vincents Rocks, Avon George, Bristol. *Watsonia* 18: 381-385.
- Galera H. (2003) – The spontaneous flora of Botanical Gardens in Poland: a review. *Biuletyn Ogródów Botanicznych* 12 (1): 31-82.
- Galera H. & Sudnik-Wojcikowska B. (2010) – Central European botanic gardens as centres of dispersal of alien plants. *Acta Societatis Botanicorum Poloniae* 79 (2): 147-156.
- Gross C., Fatemi M., Julien M., McPherson H. & Van Klinken R. (2017) – The phylogeny and biogeography of Phyla nodiflora (Verbenaceae) reveals native and invasive lineages throughout the world. *Diversity* 9 (2): 20-33. [<https://doi.org/10.3390/d9020020>]

- Gu C. & Spongberg S.A. (2003) – *Malus kansuensis*. In: Wu Z.Y., Raven P.H. & Hong D.Y. (eds.), Flora of China. Vol. 9 (Pittosporaceae through Connaraceae): 185-186. Beijing, Science Press / St. Louis, Missouri Botanical Garden Press.
- Hoste I. (ed.) (2011) – The spontaneous flora of the National Botanic Garden of Belgium (Domein van Bouchout, Meise). Meise, National Botanic Garden of Belgium. [*Scripta Botanica Belgica* 47.]
- Hulme P.E. (2011) – Addressing the threat to biodiversity from botanic gardens. *Trends in Ecology & Evolution* 26 (4): 168-174.
- Jäger E.J., Ebel F., Hanelt P. & Müller G. (eds.) (2008) – Rothmaler Band 5. Exkursionsflora von Deutschland. Krautige Zier- und Nutzpflanzen. Berlin, Springer Verlag.
- Keener B.R. (2019) – *Mazus pumilus*. In: Flora of North America Editorial Committee (eds.), Flora of North America, vol. 17: 364. Oxford University Press USA. [http://floranorthamerica.org/Mazus_pumilus]
- Kiehn M., Lauerer M., Lobin W., Schepker H. & Klingenstein F. (2007) – Grundsätzen im Umgang mit invasiven und potentiell invasiven Pflanzenarten in Botanischen Gärten des Verbandes Botanischer Gärten und der AG Österreichischer Botanischer Gärten. *Gärtnerisch-Botanischer Brief* 169 (4): 39-41.
- Lambinon J. & Verloove F. (2012) – Nouvelle Flore de la Belgique, du Grand-Duché de Luxembourg, du Nord de la France et des régions voisines. Sixième édition. Meise, Jardin botanique national de Belgique.
- Li J., Qi C., Gu J. & Jin Z. (2020) – Effect of sire population on the genetic diversity and fitness of F1 progeny in the endangered Chinese endemic *Sinocalycanthus chinensis*. *Ecology and Evolution* 10 (9): 4091-4103. [<https://doi.org/10.1002/ece3.6179>]
- Lowe S., Browne M., Boudjelas S. & De Poorter M. (2000) – 100 of the world's worst invasive alien species. A selection from the Global Invasive Species Database. Auckland (New Zealand), Invasive Species Speciality Group, a specialist group of the Species Survival Commission of the World Conservation Union. [http://www.issg.org/pdf/publications/worst_100/english_100_worst.pdf]
- Price J., Macdonald M., Gross C., Whalley R.D. & Simpson I. (2011) – Vegetative reproduction facilitates early expansion of *Phyla canescens* in a semi-arid floodplain. *Biological Invasions* 13: 285-289.
- Pringle J.S. (2018) – The Identification, Nomenclature, and Naturalized Distribution of *Mazus miquelii* (Mazaceae) in North America. *Castanea* 83(2): 216-223. [<https://doi.org/10.2179/17-154>]
- Randall R.P. (2017) – A Global Compendium of Weeds. 3rd Edition. Perth (Western Australia), R.P. Randall.
- Ronse A. 2011a. – The wild flora of the Botanic Garden: an introduction. In: Hoste I., *op. cit.*: 27-58.
- Ronse A. 2011b. – The ‘truly’ indigenous flora. In: Hoste I., *op. cit.*: 59-66.
- Ronse A. 2011c. – Stinsen plants and other deliberate introductions in the (semi-) natural zones of the Botanic Garden. In: Hoste I., *op. cit.*: 67-75.
- Ronse A. 2011d. – External neophytes. In: Hoste I., *op. cit.*: 77-88.
- Ronse A. 2011e. – ‘Botanic garden escapes’ from the living collections at the Botanic Garden. In: Hoste I., *op. cit.*: 89-111.
- Ronse A. & Leten M. 2011. – Wood lawn neophytes: historical park relics. In: Hoste I., *op. cit.*: 113-121.
- Sharma V.S. (1987) – Comments on the identity of *Ageratum conyzoides* L., and *A. houstonianum* Mill.: two naturalized weeds in India. *Feddes Repertorium* 98(11-12): 557-560.
- Shaw J.M.H. (2002) – Bulbine *semibarbata* (R.Br.) Haw., the leek lily as a new British alien. *Botanical Society of Britain & Ireland News* 91: 45-46.
- Stearn W.T., Shaw J.M.H., Green P.S. & Mathew B. (2002) – The genus *Epimedium* and other herbaceous Berberidaceae. Kew (UK), Royal Botanic Gardens.
- Straley G.B. (1991) – Presenting *Sinocalycanthus chinensis* - Chinese wax shrub. *Arnoldia* 51 (1): 18-22.
- Tijmsma L. & Dijkhuis E. (2018) – *Sisymbrium strictissimum*. In: Floron Verspreidingsatlas vaatplanten. [<https://www.verspreidingsatlas.nl/vaatplanten>; accessed on 22 April 2020.]
- Trueblood C.E., Ranney T.G, Neal J.C. & Olsen R.T. (2010) – Evaluating fertility of triploid clones of *Hypericum androsaemum* L. for use as non-invasive landscape plants. *HortScience* 45(7): 1026-1028. [<https://doi.org/10.21273/HORTSCI.45.7.1026>]
- Van de Laar H.J. (1981) – *Epimedium*: Keuringsrapport van de Koninklijke Vereniging voor Boskoopse culturen. *Dendroflora* 18: 5-13.
- Van Landuyt W. (2006) – *Atropa belladonna*. In: Van Landuyt W. *et al.*, (eds.), Atlas van de flora van Vlaanderen en het Brussels Gewest: 173. Brussel & Meise, INBO, Nationale Plantentuin van België & Flo.Wer.
- Verloove F. (2006) – Catalogue of neophytes in Belgium (1800-2005). Meise, National Botanic Garden. [*Scripta Botanica Belgica* 39.]
- Verloove F. (2013) – Het genus *Cotoneaster* (Rosaceae) in het wild in België: een voorlopig overzicht. *Dumortiera* 103: 3-29.
- Verloove F. (2019a) – *Akebia quinata*. In: Manual of the Alien Plants of Belgium. [<http://alienplantsbelgium.be/>; accessed 31.10.2019.]
- Verloove F. (2019b) – *Asclepias incarnata*. In: Manual of the Alien Plants of Belgium. [<http://alienplantsbelgium.be/>; accessed 14.11.2019.]
- Verloove F. (2019c) *Epimedium pinnatum*. In: Manual of the Alien Plants of Belgium. [<http://alienplantsbelgium.be/>; accessed 14.11.2019.]
- Verloove F. (2019d) Mazaceae. In: Manual of the Alien Plants of Belgium. [<http://alienplantsbelgium.be/>; accessed 14.11.2019.]
- Verloove F. (2019e) *Muehlenbeckia*. In: Manual of the Alien Plants of Belgium. [<http://alienplantsbelgium.be/>; accessed 14.11.2019.]
- Verloove F. (2019f) *Phyla*. In: Manual of the Alien Plants of Belgium. [<http://alienplantsbelgium.be/>; accessed 14.11.2019.]
- Verloove F., van der Ham R. & Denters T. (2007) – Exotische muurvarens in België en Nederland. *Dumortiera* 92: 1-16.
- Vinogradova Y.K., Mayorox S.R. & Bochkina V.D. (2015) – Changes in the spontaneous flora of the Main Botanic Garden, Moscow, over 65 years. *Skvortsovia* 2(1): 45-95.

- Weber E. (2017) – Invasive Plant Species of the World. A Reference Guide to Environmental Weeds, 2nd edition. Wallingford (UK), CABI Publishing.
- Weber E., Burkart M. & Joshi J. (2018) – Deutsche Botanische Gärten als künftige Quelle invasiver Pflanzenarten – eine Bewertung der Lebendsammlungen. *Natur und Landschaft* 93 (9): 423-427. [<https://doi.org/10.17433/9.2018.50153619.423-427>]
- Xu C.Y., Julien M.H., Fatemi M., Girod C., Van Klinken R.D., Gross C.L. & Novak S.J. (2010) – Phenotypic divergence during the invasion of *Phyla canescens* in Australia and France: Evidence for selection-driven evolution. *Ecology Letters* 13: 32-44.