

HISTORY AND ANALYSIS OF THE ALIEN FLORA

Records for approximately 920 alien plant species and hybrids found in Ireland mainly between the beginning of the 19th century and 2001 are presented in the Catalogue. By comparison, there are approximately 900 native vascular plant species, nearly 200 hybrids and a further 80 or so species whose status is uncertain (Scannell & Synnott 1987). The aliens are predominantly flowering plants, some conifers and ferns, and one clubmoss. Over half the total number are casuals, and over a quarter were recorded only once or at one site.

The composition of the alien floras in the 19th century and 20th century, and the main changes between that of the 19th century and end of the 20th century are summarized below. Following this, the emphasis is on alien plants recorded since 1987 including their native range, means of introduction and impact on natural, semi-natural and other habitats. The Catalogue entries for the examples given below contain more information and published references. Numbers of taxa are for those now considered alien, and in most cases are approximate.

HISTORICAL OVERVIEW

Alien flora in the 19th century

The first edition of *Cybele Hibernica* (Moore & More 1866) is used as a baseline for the Catalogue because it contains records of both native and alien plants found in Ireland in the mid-19th century as well as records extracted from earlier 19th century and 18th century works. Nearly 200 alien plants were included, and the number rose to over 250 in the second edition (Colgan & Scully 1898). The authors of both editions of *Cybele Hibernica* were far-seeing for the number and variety of non-native plants which they included. However, in *Irish topographical botany* Praeger (1901a) included only about 110 alien taxa which he considered more or less established, or to be spreading at that time. With other published records (including regional Floras) and herbarium records, there are entries in this Catalogue for some 370 taxa found in the 19th century, only about 50 of which have not been found since then.

Just over half (c.54%) of the alien plants recorded in the 19th century were escapes from, or relics of, cultivation; there were many more escapes than relics. By the mid-19th century, for example, *Cymbalaria muralis* was already well established on walls, although never far from gardens and houses. Similarly, *Petasites fragrans* was beginning to spread away from where it was originally grown, and *Mimulus guttatus* was established along at least one river; all three species were widespread by the end of the century.

Other garden plants such as *Antirrhinum majus*, *Clematis vitalba* and *Ribes* spp., which were not or only rarely found in the wild, were also included in the first edition of *Cybele Hibernica*. Better established were the relics of ancient cultivation such as the potherbs *Chenopodium bonus-henricus* and *Smyrniolum olusatrum*, and the medicinal plants *Sambucus ebulus* and *Inula helenium*.

Apart from plants of cultivated origin, other alien plants (c.46%) recorded in the 19th century were long-established arable weeds typified by *Urtica urens*, *Fumaria* spp. and *Papaver* spp., or more recently arrived weeds such as *Veronica persica* and *Geranium pyrenaicum*, as well as species accidentally introduced with agricultural seed and a variety of casuals including grain aliens. *Orobancha minor* was introduced with clover seed, while *Cuscuta epilinum*, *Camelina sativa* and *Lolium remotum* came in with flax. It is probable that *Veronica peregrina* arrived with imported garden plants, and then became a garden weed found particularly in the north.

An interest in casual aliens increased towards the end of the 19th century and in the early 20th century. Alien plants were recorded where foreign grain had been fed to poultry, for example, *Conringia orientalis* and *Thlaspi arvense* at Greenisland, Co. Antrim. On a rubbish heap near a distillery in Cork City, *Erysimum repandum*, *Sisymbrium altissimum* and *Anisantha tectorum* occurred in abundance, while the docks area in Limerick yielded such casuals as *Cannabis sativa*, *Securigera varia*, *Centaurea calcitrapa* and *Panicum capillare*. Stewart and Praeger (1894-95) published a list of nearly 50 species found on waste ground adjoining the Belfast Distillery and/or near a flour mill, including *Vaccaria hispanica*, *Echinochloa crus-galli* and an early record of *Setaria viridis*. The most comprehensive list (some 85 taxa) was made at a hen run on the banks of the Grand Canal near Straffan, Co. Kildare in 1904-05 where grain screenings had been brought from a nearby flour mill (Knowles 1906). Among the many interesting records were ones for *Malva parviflora*, *Brassica juncea*, *Oenothera laciniata* and *Hemizonia kelloggii*. A smaller group of casuals were those arising from discarded birdseed, for example, *Lathyrus aphaca*, *L. inconspicuus* and *Asperula arvensis* in a North Kerry garden. Not all voucher specimens were correctly identified; redeterminations have invalidated some records and produced quite a number of first or early Irish records of grain aliens, for example, *Chenopodium berlandieri*, *Rumex dentatus*, *Camelina rumelica*, *Madia sativa* and *Aegilops speltoides* subsp. *ligustica*.

Alien flora in the 20th century

A useful summary (with many examples) of the origins of alien plants and their impact on native vegetation from the latter part of the 19th century up to

the 1930s is provided by Praeger (1934b) in *The botanist in Ireland*. He noted that casuals were found as obvious introductions at docks, railway yards, factories etc., and most were of fleeting occurrence. Although a few were becoming more permanent, for example, *Coronopus didymus*, *Malva neglecta* and *Poa compressa*, they required the conditions presented in artificial habitats and seldom penetrated into native vegetation on wild ground. A large group of aliens arrived with agricultural and garden seed, or with soil on imported plants. Some of these, such as *Draba muralis*, were spreading rapidly, but most, particularly the arable weeds, were dependent on the ground being turned over regularly and again usually did not mix with undisturbed native flora. Another group were ornamental plants or species formerly used as potherbs or for medicinal purposes. They were sometimes aggressive or persistent perennials, but mostly remained near houses or grew on old walls and in disturbed ground. Examples were ‘kitchen-garden’ plants such as *Chelidonium majus* and *Tanacetum vulgare*, and garden plants such as *Erysimum cheiri* and *Centranthus ruber*. A number of them, however, had also become integrated among native plants and were establishing themselves as members of the permanent flora, for example, *Mimulus guttatus*, *Elodea canadensis* and *Impatiens glandulifera*. Many other species, including *Cruciata laevipes*, *Mercurialis annua* and *Hordeum murinum*, were described as “followers of man”, and how they arrived was not clear. No alien species were singled out by Praeger as causing particular problems at that time.

Throughout the 20th century, many more alien plants which had originated in cultivation were first recorded as escaping, for example, *Rubus spectabilis* spread by suckering and *Leycesteria formosa* was bird-sown. By the middle of the century, plants such as *Prunus laurocerasus* were establishing themselves, and recording in the 1950s for the *Atlas of the British flora* (Perring & Walters 1962) showed just how widespread some, such as *Fallopia japonica* and *Symphoricarpos albus*, had become. There was an early record for *Calystegia pulchra* in Co. Down in 1885, but most records of it date from the second half of the 20th century. Similarly, *Veronica crista-galli* apparently escaped from the Cork Botanic Garden in the early 1900s, but seems to have become more common only since the 1970s. It can be difficult to distinguish between real increases and increased recording activity by botanists. However, the spread of *Soleirolia soleirolii* and *Veronica filiformis*, first noticed as potential escapees in the 1930s, and of *Epilobium brunnescens* was undoubtedly real.

The most recent countrywide recording scheme, carried out between 1987 and 1999, was for the *New atlas of the British and Irish flora* (Preston *et al.* 2002). It included systematic recording of many alien plants for the first time – the established garden escapes and weed species as well as casuals on

roadsides, waste ground and rubbish dumps. Also included were conifers, some escaping from plantations, such as *Picea sitchensis* and *Abies alba*, hedgerow shrubs such as *Ligustrum ovalifolium* and *Spiraea* × *pseudosalicifolia*, and relics of cultivation found in abandoned gardens and near houses such as *Vinca minor*. Sometimes a particular species turned up in great numbers in a limited area, often without a clear explanation. In Co. Cork, some 10,000 plants of *Datura stramonium* shaded out a fodder beet crop in the late 1970s, and about 3000 *Verbascum nigrum* appeared in an old disturbed meadow in 1991. Many of these may seem like unimportant records, but they provide a baseline against which future trends can be compared. Of more concern are the small number of aquatic plants, now commonly available in garden centres, which are escaping into the wild, for example, *Lagarosiphon major*, *Myriophyllum aquaticum* and *Crassula helmsii*.

With regard to the casuals, ports are an obvious point of entry for exotic plants, but there are few existing records for the first half of the 20th century. At Dublin Port, the flora was recorded over four years by H.J. Hudson in the 1930s, including grain aliens such as *Consolida ajacis* and the first report of *Conyza canadensis*. A further list of grain aliens, as yet unpublished, was made by J.P. Brunner at Guinness Brewery in Dublin City. This is supported by a collection of voucher specimens (some redetermined) which include the earliest specimen of *C. canadensis* as well as specimens of *Hemizonia pungens*, *Centaurea melitensis*, *Asphodelus fistulosus* and *Phalaris paradoxa*, all rare casuals. Since the late 1980s, my personal interest in alien plants which arrived through the ports added or updated records for at least 40 taxa mainly introduced with animal feed or grain, for example, *Bassia scoparia*, *Salsola kali* subsp. *ruthenica*, *Brassica fruticulosa*, *Artemisia biennis* and *Triticum spelta*.

Main changes between 19th century and late 20th century

Approximately 370 alien taxa were recorded in the 19th century. In round figures, 255 new taxa were added between 1900 and 1970, 110 taxa between 1970 and 1987, and a further 185 between 1987 and 2001, totalling 920 taxa. About 645 taxa make up the current list (recorded since 1987), only about 275 more than were recorded in the 19th century. This indicates that a relatively high proportion of new arrivals subsequently disappeared during the course of the 20th century, borne out by the fact that over half the total number are casuals.

Of more significance than the come and go of most casuals was the continuing spread and establishment of alien plants, particularly garden

escapes. Some examples are given above; others are *Mycelis muralis*, now part of the permanent flora on limestone pavement in the Burren and in a variety of habitats elsewhere, and *Buddleja davidii*, thoroughly established in urban areas on walls, roofs and waste ground. It appears that the proportion of alien plants of cultivated origin increased from approximately 54% of all aliens found in the 19th century to some 70% at the end of the 20th century. Somewhat less numerous than garden escapes, many relics of cultivation are still found persisting on roadsides and near dwellings and ruins, such as *Althaea officinalis* and *Petroselinum crispum*, whereas others have become less common such as *Persicaria bistorta* and *Artemisia absinthium*, or apparently extinct such as *Marrubium vulgare* and *Leonurus cardiaca*. A few are now a real nuisance in gardens, for example, *Aegopodium podagraria* and *Saponaria officinalis*.

One of the notable changes during the 20th century has been the decline in frequency of arable weeds, no doubt due to better seed-cleaning methods and changes in agricultural practices including the widespread use of herbicides. It is now hard to find species such as *Valerianella dentata*, *Lolium temulentum* and *Avena strigosa*. On the other hand, *Thlaspi arvense*, formerly a rare arable weed, was common at the end of the 20th century and was probably reintroduced with animal feed or grain, and *Avena fatua* was a frequent casual on roadsides and disturbed ground. Although never widely recorded, it is likely that species introduced with grain – arable weeds in their country of origin – have also become less diverse and less numerous due to seed-cleaning methods. Recently, rare arable weeds have also been turning up in a variety of places, introduced in wild flower seed mixtures which often contain a high proportion of *Agrostemma githago*, *Centaurea cyanus*, *Anthemis arvensis* and the more common *Chrysanthemum segetum*. Another group of plants, in particular *Diploaxis muralis*, *Minuartia hybrida* and *Chaenorhinum minus*, which initially spread rapidly along the railways in the 19th century, has declined because of weedkiller sprayed on the tracks. In contrast, the spread of *Senecio viscosus* has been associated with the railway network in modern times.

CURRENT ALIEN FLORA, 1987-2001

The following discussion on the current situation (essentially the end of the 20th century) is based on records made since 1987, but the generalizations seem to apply equally to the broader date class of post-1970 records (i.e. all records since 1970). Of the approximate total of 920 alien taxa recorded, some 645 have been found between 1987 and 2001, and some 710 between 1970 and 2001 (most of those not refound since 1987 were casuals). The dates post-1987 and post-1970 were chosen to allow records presented in this

Catalogue to be compared with map records in the Botanical Society of the British Isles *New atlas of the British and Irish flora* (Preston *et al.* 2002).

Native ranges

Information (not included in the Catalogue) on the countries, regions or continents where the plants are native was extracted from Clement & Foster (1994) and Ryves *et al.* (1996) and, for taxa considered native in Britain, from Clapham *et al.* (1989). In broad terms, at least 50% are from the region encompassing continental Europe, Eurasia, south-west Asia and the Mediterranean, and include about 20% considered native in Britain. Of the taxa native in Britain (nearly 200 of the total of 920), some are quite uncommon there, so it is possible that they were introduced into Ireland from elsewhere. A further approximately 10% come from North America (about half of those from western North America), about 8% from Asia (mainly China and Himalayas, a few from Japan), and smaller proportions from South America, South Africa, New Zealand and Australasia. As noted in the above reference works, not all the aliens would have arrived directly from their native range; over 10% (about 100 taxa altogether) have become widely distributed across the world. Some 6% originated in cultivation and for a few the origin is not known. These proportions were quite similar for the total number of aliens and the date classes post-1987 and post-1970.

The names sometimes give a clue as to where a particular taxon is native, such as *Eschscholzia californica* (Californian Poppy) and *Valeriana pyrenaica* (Pyrenean Valerian). The native range can be quite restricted (e.g. *Echium pininana* from the Canary Islands), or encompass a specific region (e.g. *Persicaria campanulata* from the Himalayas and West China), or several large regions (e.g. *Chenopodium glaucum* from Europe, Asia and America). Others such as *Galinsoga quadriradiata*, originally from Tropical America, have now spread well beyond their native range. The following are examples of alien plants native in various parts of the world.

Britain (and usually elsewhere): *Clematis vitalba*, *Bryonia dioica*, *Viscum album*, *Cruciata laevipes*, *Mycelis muralis*, *Spartina anglica*.

Continental Europe: *Abies alba*, *Erucastrum gallicum*, *Laburnum anagyroides*, *Geranium phaeum*, *Erinus alpinus*, *Pilosella aurantiaca*.

Mediterranean: *Soleirolia soleirolii*, *Tamarix gallica*, *Hirschfeldia incana*, *Linaria purpurea*, *Centranthus ruber*, *Petasites fragrans*.

Eurasia: *Hesperis matronalis*, *Melilotus officinalis*, *Aegopodium podagraria*, *Inula helenium*, *Tanacetum parthenium*.

- South-east Europe/south-west Asia: *Erysimum cheiri*, *Rhododendron ponticum*, *Prunus laurocerasus*, *Heracleum mantegazzianum*, *Vinca major*, *Veronica filiformis*.
- Himalayas: *Persicaria amplexicaulis*, *P. wallichii*, *Impatiens glandulifera*, *Leycesteria formosa*.
- China: *Cotoneaster horizontalis*, *Lycium barbarum*/L. *chinense*, *Buddleja davidii*, *Lonicera nitida*.
- Japan: *Fallopia japonica*, *F. sachalinensis*, *Ligustrum ovalifolium*, *Sasa palmata*.
- North America: *Epilobium ciliatum*, *Symphoricarpos albus*, *Solidago canadensis*, *Aster novi-belgii*.
- North America, west coast: *Picea sitchensis*, *Pinus contorta*, *Claytonia perfoliata*, *Ribes sanguineum*, *Rubus spectabilis*, *Lupinus arboreus*, *Mimulus guttatus*.
- North and South America: *Lemna minuta*, *Cyperus eragrostis*.
- South America: *Escallonia macrantha*, *Acaena ovalifolia*, *Gunnera tinctoria*, *Fuchsia magellanica*, *Libertia formosa*.
- South Africa: *Carpobrotus edulis*, *Lobelia erinus*, *Lagarosiphon major*, *Crocoshmia paniculata*, *C. pottsii*.
- Australia: *Helichrysum bracteatum*, *Dicksonia antarctica*.
- Australasia: *Crassula helmsii*, *Acaena novae-zelandiae*, *Haloragis micrantha*, *Juncus planifolius*.
- New Zealand: *Epilobium brunnescens*, *E. pedunculare*, *Hebe salicifolia*, *Hydrocotyle moschata*, *Cordyline australis*, *Phormium tenax*.
- Widespread: *Azolla filiculoides*, *Amaranthus retroflexus*, *Thlaspi arvense*, *Chrysanthemum segetum*, *Avena fatua*, *Setaria viridis*.
- Widespread, but origin obscure: *Chenopodium capitatum*, *Vicia faba*, *Vitis vinifera*.
- Cultivated origin: *Saxifraga* × *urbium*, *Malus domestica*, *Hebe* × *franciscana*, *Crocoshmia* × *crocoshmiflora*.

Means of introduction

The majority, about 70%, of alien plants currently encountered are of cultivated origin. They were initially deliberate introductions into Ireland for horticulture or as crop plants, including forestry species. The remaining 30% come from a variety of other sources, and initially were usually not deliberate introductions. They include species originating as impurities in agricultural seed and weed species with horticultural imports. The other

main source is foodstuffs and impurities arriving with them. However, categories overlap and species can arrive by more than one means. *Crepis tectorum* was probably introduced (at different sites) both with animal feed and in a grass seed mixture, and *Echinochloa colona* both with grain and birdseed. In a number of cases, the source is not known.

Cultivated origin The largest group (nearly 80%) of alien plants of cultivated origin are garden plants. They can escape into the wild either by self-seeding (e.g. wind-blown, bird-sown), or by being actively discarded, or perhaps transported with soil. Plants which grow vigorously in gardens and are discarded often continue to thrive in their new habitats, particularly by spreading vegetatively, e.g. *Fallopia japonica* and *Crocosmia* × *crocosmiiflora*, whereas other garden escapes or discards may appear only fleetingly on disturbed and waste ground, and on rubbish dumps, e.g. *Calendula officinalis* and *Clarkia amoena*. Some plants still found are those which were introduced in medieval times or earlier for culinary and medicinal use, and these are often referred to as relics of ancient cultivation.

Crop plants form another group, most noticeably growing on roadsides from spilt seed, for example, *Hordeum distichon*, *Brassica napus* and *B. rapa*, although the last species is not considered a certain introduction in Ireland. Tree species grown for forestry, including several conifers, are also a crop which can self-seed into the wild.

A final group of cultivated origin are those species which were initially planted into natural or semi-natural habitats and which have since become established, for example, *Spartina anglica* on intertidal mud and *Sarracenia purpurea* on bogs. Plants of reseeded agricultural land, amenity grassland and roadsides may also be grouped here, although the Catalogue lists records for only a few obvious aliens in these habitats, for example, *Lotus corniculatus* var. *sativus*.

Other sources Whereas cultivated plants were originally deliberately introduced, aliens from other sources were often accidental introductions. An important group are those which are thought to have arrived with Neolithic crops and which are still found as weeds in arable and other disturbed ground. Similarly, impurities continue to arrive in imported seed mixtures for agricultural and amenity purposes, for example, *Plantago media* and possibly *Gaudinia fragilis* with grass seed. Foreign weed species are also inadvertently introduced with imported plants, for example, *Spergula morisonii* with Blueberry plants from Germany, *Cardamine corymbosa* with nursery stock and *Lemna minuta* with aquatic plants.

The other main group are foodstuffs, in particular imported grain and animal feed. Spilt grain itself germinates and grows, and a variety of casuals introduced with grain or animal feed can be found at ports as well as along roadsides where there has been spillage from lorries. However, few such casuals persist for any length of time by self-seeding, e.g. *Amaranthus retroflexus* and *Setaria viridis*. Less frequent are alien plants arising from discarded birdseed (a source which has hardly been investigated in Ireland), and vegetable and fruit species mainly found on rubbish dumps from discarded food refuse. *Lycopersicon esculentum* sometimes occurs in large numbers on shores near sewage works. More unusually, *Sisymbrium altissimum* was thought to have been introduced with fodder for army horses during the 1916 Easter Week insurrection.

Further possible sources were with soil attached to shipping containers (e.g. *Calamagrostis epigejos*) and with ferry traffic (e.g. *Lagurus ovatus*, and perhaps *Poa bulbosa*). Plants were presumably also introduced regularly with ballast at ports, but there are very few records (e.g. *Lepidium draba*). Unlike Britain, wool was not imported and so was not a means of introduction. There remain many species for which the means of their original introduction is not known, for example, *Senecio squalidus* first found in Cork City in the early 1800s, *Juncus planifolius* in peaty and damp ground in Connemara in 1971, and *Prunella laciniata* on a hill in Co. Kilkenny in 1999.

Of the additional 44 taxa in the Catalogue which are considered 'probably introduced' (Scannell & Synnott 1987), all but a few (e.g. *Scandix pecten-veneris*) have been recorded since 1987. Most are found in cultivated and disturbed ground (e.g. *Papaver rhoeas*, *Aethusa cynapium*, *Euphorbia helioscopia*) or as casuals (e.g. *Descurainia sophia*, *Melilotus altissimus*), and the remainder are of cultivated origin (e.g. *Salix triandra*, *Foeniculum vulgare*).

Establishment of alien plants

Of the approximately 645 alien plants recorded since 1987, it appears that up to 30% (about 200 taxa) are currently established, a further 25% are relics of cultivation or just persisting, and some 45% occur as casuals. Over two thirds of the alien plants now considered established are of cultivated origin and the remainder include many arable and other weeds (Tables 1 and 2). A few established alien species have even hybridized with native species, for example, *Heracleum mantegazzianum*, *Calystegia silvatica*, *Senecio cineraria*, *Epilobium brunnescens* and *E. ciliatum*.

Including all the 645 taxa on the current list, whether established, persistent or casual, over half (c.55%) are rare or only found at one site, just over a

quarter (c.27%) are found occasionally, and less than 20% are common and widespread. However, the situation is continually changing with the arrival and disappearance of alien taxa, and ongoing spread of some already here. Any plant producing spores or seeds, or reproducing effectively by vegetative means can disperse, but for it to thrive there also has to be a suitable ecological niche for it and it has to find the climate compatible. Conifers such as *Picea sitchensis* and *Pinus contorta* are now self-seeding onto bogs away from plantations, bird-sown *Cotoneaster* is appearing in rocky places, and aquatic species such as *Elodea nuttallii* are competing successfully with native plants in still and flowing water. Meanwhile, there are cultivated plants such as *Acacia melanoxylon* and some Bamboos, and forestry trees such as *Larix* spp. which are regenerating well and have the potential to escape.

A few examples will illustrate the variety within the **established alien flora**. Two species which are considered truly naturalized because they are well established among native vegetation in natural and semi-natural habitats are *Elodea canadensis* and *Acer pseudoplatanus*. Introduced around 1836, the rapid spread of *E. canadensis* caused concern in the 19th century, but by the end of that century it appeared to have already reached a balance with the native aquatic flora. *Acer pseudoplatanus* was planted in Ireland in the 17th century, only rarely found self-sown in the wild at the end of the 19th century, and is now one of the most common large deciduous trees in the country. Towards the end of the 19th century, *Matricaria discoidea* was accidentally introduced in many places, almost certainly with American corn fed to hens, and within a few decades became a fully established weed in both rural and urban areas. These three species are common and widespread, whereas some other established alien plants are more localized. *Bryonia dioica* has long been known on Howth in Co. Dublin, *Tamus communis* in woods, thickets and hedgerows around Lough Gill, and *Senecio cineraria* has been a feature on the cliffs at Killiney Bay for more than a century. *Matteuccia struthiopteris* is established in damp woodland by Lough Neagh and *Cirsium oleraceum* in marshy ground near the confluence of the Rivers Barrow and Nore. So far, *Haloragis micrantha* is restricted to one site on peat in West Galway.

Senecio squalidus has established itself mainly in artificial habitats – in Cork City for nearly two centuries, in Dublin City for a century and more recently in Belfast. First found in 1958, *Epilobium ciliatum* has become a widespread weed since the early 1980s. An example of a more recent arrival is *Conyza bilbaoana*. It is not known how it was originally introduced nor where it came from, but examination of herbarium specimens showed that it was already in Dublin in the mid-1980s. Since 1996 it has been establishing itself

in Dublin City, producing numerous plumed seeds and overwintering rosettes of leaves, and growing on waste ground, railway tracks, at pavement edges and in cracks. Based on its present performance, it is likely to become a prominent member of the permanent urban weed flora.

As mentioned above, about a quarter of the current alien flora are **relics of cultivation or just persisting**. The very term ‘relic of cultivation’ implies that a species remains near where it was originally planted, for example, *Lonicera nitida* and *Vinca major* found near houses or in abandoned gardens. Even if discarded, some such species tend not to spread further because they do not reproduce effectively either vegetatively or by seed, for example, *Armoracia rusticana*. Trees and shrubs in hedgerows are often also relics of cultivation; examples are *Ulmus minor*, *Syringa vulgaris*, *Ribes sanguineum*, and *Salix* hybrids formerly used in basket-making.

Not spreading far from where originally planted are some ornamental and forestry tree species. They are capable of regeneration, but the self-sown saplings are usually only found near the parent trees, for example, *Carpinus betulus*, *Acer campestre*, *Aesculus hippocastanum* and *Abies alba*.

Impact of alien plants

The understandable concern is whether alien plants are having an impact on the natural or semi-natural vegetation, or otherwise causing problems. Overall, many more alien plants are casual and/or rare than are established and common, and it would appear that the majority have little or no demonstrable impact. The relics of cultivation are usually found near houses and ruins, on roadsides and in hedgerows. Most casual aliens grow in artificial and disturbed habitats – in urban areas, at ports, on waste ground and rubbish dumps, as well as on roadsides. Many of the established aliens are also found in built-up areas and in cultivated and waste ground, leaving a relatively small proportion, about 94 species and hybrids, which have become integrated among native vegetation (Table 1). Only a small number of alien plants are invasive and may cause real problems, and they are discussed in the next section.

Invasive alien plants Most of the changes resulting in the loss and degradation of natural habitats, and in the decline of native species have been because of human activities – clearing of woodland, use of land for agricultural purposes, drainage of wetlands, land reclamation in coastal areas, gardening and the continuing spread of urban areas and roadways. In contrast, it appears that the majority of alien plants have little or no adverse impact. However, a small number of escapes from cultivation, mainly ornamental plants, are invasive among natural vegetation where they compete

with native species and may prevent regeneration. One of the best known examples is *Rhododendron ponticum* in oak woods, particularly in the south-west and north-west. Much time, energy and money has been spent trying to eradicate it. *Fagus sylvatica* is also considered a threat to oak woods, and to the yew woods in Killarney. Particularly in demesne woodlands, evergreen *Prunus laurocerasus* allows little else to grow beneath it. To a lesser extent, the shrub *Cornus sericea* is a threat to native vegetation in open and wooded wetland habitats. Although not usually mentioned as a problem, *Acer pseudoplatanus* can produce such dense stands of saplings that it must affect the ground flora in some deciduous woods.

Heracleum mantegazzianum, which causes skin problems in people after contact, forms dense stands mainly along rivers as does *Impatiens glandulifera*, an annual which grows up to 2 m high. *Fallopia japonica* also forms dense stands, but in a wider variety of habitats, both urban and rural. These three large herbaceous plants, originally introduced as garden plants, are difficult to eliminate by either physical or chemical means. In addition, *H. mantegazzianum* hybridizes with native *H. sphondylium*, but the impact remains to be assessed. Other invasive species are *Gunnera tinctoria* in boggy ground in West Mayo and West Galway, and the less common *Lysichiton americanus* in a wet woodland site in North Kerry, and *Acaena novae-zelandiae* by a lake in the Ox Mountains in Co. Sligo.

In coastal habitats, *Hippophae rhamnoides* and *Spartina anglica* were initially introduced to bind sand and estuarine mud respectively. *H. rhamnoides* has become invasive on sand dunes in the north-east and elsewhere, and there has been concern that *S. anglica* was affecting the intertidal feeding ground for waders and other birds. The garden escape *Carpobrotus edulis* is locally dominant on cliffs and rocks where it can outcompete other plants.

A number of species are the bane of gardeners' lives because they spread vigorously and vegetatively, and broken-off pieces grow readily. Such invasive plants are *Petasites fragrans*, *Aegopodium podagraria*, *Calystegia silvatica*, *Oxalis* spp., *Soleirolia soleirolii* (also discarded from greenhouses) and *Veronica filiformis*, the last originally introduced as a rockery plant. In agricultural land, arable weeds are usually controlled by herbicides and so are scarce. However, weeds such as *Chrysanthemum segetum* and *Avena fatua* are still fairly common, and *Phalaris minor* is a recent arrival which could become a problem.

Prohibited alien species There are several alien species prohibited by law both in the Republic and Northern Ireland. In the Republic, *Berberis vulgaris*

has been classified as a “noxious weed” since 1958 because it is the alternate host for the wheat rust fungus. It has been systematically eliminated and is now rare. The male plant of *Humulus lupulus* was legislated against in 1965 even though hops have never been a common crop. In contrast, *Avena fatua* is widespread despite legislation in 1973. In Northern Ireland, the 1985 Wildlife Order makes it an offence to plant or cause to grow in the wild *Heracleum mantegazzianum* and *Fallopia japonica* (both now common and widespread) and all species of *Spartina* (*S. anglica* is abundant, for example, in Strangford Lough). Also prohibited there are all species of *Acaena* as well as *Fallopia sachalinensis*, which is apparently less invasive than *F. japonica*.

Alien plants to monitor In Britain, apart from *Heracleum mantegazzianum*, *Impatiens glandulifera*, *Fallopia japonica* and *Rhododendron ponticum* (and *Acaena* in places), a major concern as a threat to native vegetation are several aquatic species, namely *Crassula helmsii*, *Myriophyllum aquaticum* and *Azolla filiculoides*. The fern *A. filiculoides* has been in Ireland for nearly a century and is now becoming more widespread – it grows rapidly to cover water surfaces. The other two species, as well as *Lagarosiphon major* used as an oxygenating plant, are more recent arrivals, commonly for sale in garden centres. As they will undoubtedly escape or be discarded from ornamental ponds and aquaria, their progress in the wild should be monitored. *Hydrocotyle ranunculoides*, also an invasive aquatic species in Britain, was found in Ireland for the first time in Co. Down in 2002 (G. Day, pers. comm.).

Another group of plants to monitor are introduced variants of native species used to reseed grassland and road verges. The Appendix to the main Catalogue lists some native species which may be grown in cultivation from foreign sources. In theory, members of both groups could interbreed with native plants and modify the native gene pool. Wild flower mixtures of unknown origin are increasingly being used, but they are probably not a threat as they need open ground to persist. When recording or monitoring plants it is therefore worth noting their possible source, the size of populations and any apparent impact they are having on their habitat.

Finally, although conifer plantations are a widespread and conspicuous feature of the landscape, conifer species have been variably recorded. These species merit a systematic approach to the study of their spread into the wild.

SUMMARY

In round numbers, 920 alien plant taxa have been recorded in Ireland, mainly in the 19th and 20th centuries. Over half are casuals, and over one quarter were recorded only once or at one site.

In the 19th century, 370 taxa were recorded, 50 of which have not been found since.

The current list (1987-2001) contains 645 alien plant taxa, of which

- 70% are of cultivated origin (compared with 54% in 19th century);
- 55% are rare or found at only one site, 27% are occasional and 18% common;
- 45% are casuals, 25% persisting and 30% established.

Of the 30% established (c. 200 taxa)

- two thirds are of cultivated origin, the remainder include many arable and other weeds;
- c.94 taxa are considered established in natural or semi-natural habitats, of which only a small number are invasive.

Table 1

Alien plants considered established in natural and semi-natural habitats in Ireland.

Some of the alien plants listed below and opposite are quite localized or rare, and many are also established in artificial habitats. Semi-natural habitats include hedgerows, but not road verges.

<i>Acaena novae-zelandiae</i>	<i>Aster</i> spp. and hybrids
<i>Acaena ovalifolia</i>	<i>Azolla filiculoides</i>
<i>Acer pseudoplatanus</i>	<i>Berberis vulgaris</i>
<i>Acorus calamus</i>	<i>Bryonia dioica</i>
<i>Adoxa moschatellina</i>	<i>Calystegia pulchra</i>
<i>Allium carinatum</i>	<i>Calystegia silvatica</i>
<i>Allium triquetrum</i>	<i>Carpobrotus edulis</i>
<i>Alnus incana</i>	<i>Chenopodium murale</i>
<i>Anisantha diandra</i>	<i>Chenopodium polyspermum</i>

Cirsium oleraceum
Claytonia sibirica
Clematis vitalba
Cornus sericea
Cotoneaster franchetii
Cotoneaster horizontalis
Cotoneaster integrifolius
Cotoneaster simonsii
Crepis vesicaria
Crocoshia × crocosmiiflora
Cymbalaria muralis
Elodea canadensis
Elodea nuttallii
Epilobium brunnescens
Erica ciliaris
Erica terminalis
Fagus sylvatica
Fallopia japonica
Fuchsia magellanica
Gaultheria mucronata
Geranium pyrenaicum
Gunnera tinctoria
Haloragis micrantha
Hebe × franciscana
Heracleum mantegazzianum
Hippophae rhamnoides
Impatiens glandulifera
Juncus planifolius
Lagurus ovatus
Leycesteria formosa
Libertia formosa
Lolium multiflorum
Lupinus arboreus
Lysichiton americanus
Malus domestica
Matricaria discoidea
Matteuccia struthiopteris
Mentha × gracilis

Mentha × piperita
Mentha requienii
Mimulus guttatus
Mimulus × robertsii
Mycelis muralis
Nymphoides peltata
Oenothera glazioviana
Oenothera stricta
Orobanche minor
Pastinaca sativa
Petasites fragrans
Picea sitchensis
Pinus contorta
Pinus sylvestris
Poa palustris
Populus nigra
Rhododendron ponticum
Ribes nigrum
Ribes rubrum
Ribes uva-crispa
Rubus spectabilis
Rumex pulcher
Salix fragilis
Salix viminalis
Sarracenia purpurea
Saxifraga × urbium
Sedum album
Sedum dasyphyllum
Selaginella kraussiana
Senecio cineraria
Sisyrinchium californicum
Spartina anglica
Stratiotes aloides
Symphoricarpos albus
Tamus communis
Tellima grandiflora
Tolmiea menziesii
Verbena officinalis

Table 2**Alien plants considered established mainly in artificial habitats in Ireland.**

Artificial habitats include cultivated, managed and waste ground, walls, pavements, road verges and railways. Some of the alien plants listed below and opposite are rare, and some are also established in natural and semi-natural habitats, e.g. *Erysimum cheiri*, *Rosa rugosa* and *Veronica filiformis*.

<i>Aegopodium podagraria</i>	<i>Fumaria bastardii</i>
<i>Althaea officinalis</i>	<i>Fumaria muralis</i>
<i>Antirrhinum majus</i>	<i>Geranium phaeum</i>
<i>Armoracia rusticana</i>	<i>Hesperis matronalis</i>
<i>Avena fatua</i>	<i>Hieracium gougetianum</i>
<i>Avena strigosa</i>	<i>Hieracium grandidens</i>
<i>Barbarea intermedia</i>	<i>Hieracium maculatum</i>
<i>Brassica napus</i>	<i>Hirschfeldia incana</i>
<i>Buddleja davidii</i>	<i>Hordeum murinum</i>
<i>Centranthus ruber</i>	<i>Hyacinthoides hispanica</i>
<i>Chaenorhinum minus</i>	<i>Hyacinthoides non-scripta</i> ×
<i>Chelidonium majus</i>	<i>hispanica</i>
<i>Chenopodium bonus-henricus</i>	<i>Hydrocotyle moschata</i>
<i>Chrysanthemum segetum</i>	<i>Hypericum calycinum</i>
<i>Cicerbita macrophylla</i>	<i>Hypericum hircinum</i>
<i>Cichorium intybus</i>	<i>Inula helenium</i>
<i>Conyza bilbaoana</i>	<i>Juncus tenuis</i>
<i>Conyza canadensis</i>	<i>Kickxia elatine</i>
<i>Coronopus didymus</i>	<i>Lamiastrum galeobdolon</i> subsp.
<i>Cruciata laevipes</i>	<i>argentatum</i>
<i>Diplotaxis muralis</i>	<i>Lamium album</i>
<i>Draba muralis</i>	<i>Lepidium draba</i>
<i>Epilobium ciliatum</i>	<i>Linaria purpurea</i>
<i>Epilobium pedunculare</i>	<i>Malva neglecta</i>
<i>Epilobium tetragonum</i>	<i>Medicago arabica</i>
<i>Erigeron karvinskianus</i>	<i>Medicago sativa</i> subsp. <i>varia</i>
<i>Erinus alpinus</i>	<i>Melilotus albus</i>
<i>Erysimum cheiranthoides</i>	<i>Melilotus officinalis</i>
<i>Erysimum cheiri</i>	<i>Mentha spicata</i>
<i>Fallopia sachalinensis</i>	<i>Mentha suaveolens</i>
<i>Festuca heterophylla</i>	<i>Mentha</i> × <i>villosa</i>

Mercurialis annua
Misopates orontium
Myrrhis odorata
Papaver argemone
Papaver hybridum
Papaver somniferum
Pentaglottis sempervirens
Persicaria amplexicaulis
Persicaria bistorta
Persicaria campanulata
Persicaria wallichii
Petroselinum crispum
Peucedanum ostruthium
Pilosella aurantiaca
Plantago media
Poa compressa
Prunus domestica
Prunus laurocerasus
Raphanus raphanistrum subsp.
 raphanistrum
Rapistrum rugosum
Reseda alba
Rosa rugosa
Sambucus ebulus
Saponaria officinalis
Sedum forsterianum

Sedum rupestre
Senecio fluviatilis
Senecio squalidus
Senecio viscosus
Silybum marianum
Sinapis alba
Sisymbrium orientale
Smyrniolum olusatrum
Soleirolia soleirolii
Spartina pectinata
Stachys arvensis
Symphytum tuberosum
Symphytum × *uplandicum*
Tanacetum parthenium
Tanacetum vulgare
Thlaspi arvense
Trifolium hybridum
Urtica urens
Valerianella carinata
Verbascum virgatum
Veronica crista-galli
Veronica filiformis
Veronica peregrina
Veronica persica
Vicia sativa subsp. *segetalis*
