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The distribution and history in the British Isles of some alien species of *Polygonum* and *Reynoutria*

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ABSTRACT

An account is given of the escape from garden cultivation of four members of the Polygonaceae introduced from Eastern Asia: *Reynoutria japonica* Houtt., including the dwarf var. *compacta* (Hooker fil.) Buchheim, *R. sachalinensis* (Friedrich Schmidt Petrop.) Nakai, *Polygonum polystachyum* Wall. ex Meissner and *P. campanulatum* Hooker fil., and of their establishment in a variety of habitats, which is illustrated by a series of maps for each species showing their distribution in the British Isles at successive time periods since introduction. Introduction ranges from 1825 for *R. japonica* to *c* 1910 for *P. campanulatum*. The former alone is widely naturalized, and like *P. polystachyum* is commoner in western Britain. *R. sachalinensis* is now most frequent in south-eastern England. A hairy variant of *P. polystachyum* is considered and is distinguished from *P. molle* D. Don. In the usually functionally dioecious *Reynoutria*, the occurrence of male-fertile plants is indicated and, in *R. sachalinensis*, the rare polygamous condition is confirmed.

INTRODUCTION

The escape of European plants when introduced into distant countries—*Hypericum perforatum* L. in North America, for example—has led on occasion to a weedy invasion of agriculturally serious or even dramatic proportions. The corresponding escape and spread of so-called alien plants introduced into the British Isles from outside Europe has not led to devastation of such magnitude. Nevertheless, there have been rapid, even explosive, invasions and spread through the country in suitable, usually man-made habitats. The importance of following the chronological sequence and pattern of spread of newly introduced species was first established by Salisbury (1932) using maps based on the vice-comital annual extension; *Matricaria matricarioides* (Less.) Porter and *Veronica persica* Poir. were shown to have spread throughout the country within a hundred years or less. Davey (1953, 1961) has mapped the infiltration into 'natural' vegetation of *Epilobium brunnescens* (Cockayne) Raven & Engelhorn, a native of New Zealand. Detailed, fully documented accounts of the spread of *Senecio squalidus* L. have been given by Kent (1956b–1964c) and of *Veronica filiformis* Sm. by Bangerter & Kent (1957, 1962, 1965), the latter illustrated by dot and grid-square maps for two successive periods. Alien species of *Polygonum* and *Reynoutria* occurring in the London area were described by Bangerter & Welch (1955). The late J. E. Lousley had studied the alien species of these genera for a number of years and had collected a wide range of specimens (RNG).

The large, perennial species of *Polygonum* and the species of *Reynoutria*, introduced mainly as decorative horticultural plants from Eastern Asia and the Himalayas, show varying degrees of ability not only to persist 'out of cultivation' but also to naturalize and to compete with natural vegetation by means of vegetative spread. The species considered here are *Reynoutria japonica* Houtt. (*Polygonum cuspidatum* Siebold & Zucc.), *Reynoutria sachalinensis* (Friedrich Schmidt Petrop.) Nakai (*Polygonum sachalinense* Friedrich Schmidt Petrop.), *Polygonum polystachyum* Wall. ex Meissner, and *P. campanulatum* Hooker fil. Of these four, *R. japonica* alone has, to date, effectively become part of the British scene. The two species of *Polygonum* belong to sect. *Aconogonon* Meissner. The only other species of this section which are naturalized in Britain are *P. molle* D. Don, which is discussed later, and *P. alpinum* All., but the latter is not covered here as it has been recently dealt with by Lousley (1976a).

The four species are discussed separately and their spread illustrated by 1 to 4 maps each. The

documentation is based on a variety of sources: the Biological Records Centre, Monks Wood; herbaria (**BIRM, BM, CGE, DBN, DHM, E, HLU, K, LANC, LDS, LIVU, LSR, LTR, MANCH, NMW, OXF, RNG, UCNW**); a wide range of local Floras and other literature sources; information supplied by vice-county recorders and others; and personal observation. For reasons of space, only a few of the records cited are fully documented here.

REYNOUTRIA JAPONICA HOUTT. (*POLYGONUM CUSPIDATUM* SIEBOLD & ZUCC.)

R. japonica, a native of Japan, Taiwan and northern China (Ohwi 1965), was first introduced to Britain in 1825 (Synge 1956). Hooker (1880a) was under the impression it had been sent to Kew from Holland about a 'quarter of a century' prior to 1880. Cultivated as an ornamental plant, and on the Continent apparently also for fodder since the 1840s (Hegi 1910, Lawalrée 1953), this large and vigorous perennial has frequently escaped, to become established in waste places, along railway and canal embankments and river and stream sides, and, especially in western Britain, has become increasingly common on roadsides, with all the appearance of being native.

The early history of the escape of this species from cultivation and its subsequent naturalization is not easy to ascertain, since all intermediate situations exist between a relic of cultivation at one extreme and a fully naturalized colony at the other. The earliest British herbarium specimens traced are labelled 'Little Chelsea, Middlesex, I. Irving, 1861' (**BM**) and 'near Little Chelsea, A. Irvine, 1863' (**MANCH**), but both are without indication of status and could be from plants in gardens. On the Continent it was noted by Schemmann (1884) as long since established as an escape near a coal-mine on the banks of the Ruhr in Westphalia, Germany.

Four phases of spread in the British Isles may be distinguished.

PHASE 1: UP TO 1919 (FIGURE 1)

In the British Isles the first report of certain naturalization appears to be that of Storrie (1886), who referred to its growing in abundance on cinder tips at Maesteg, Glam. Then, in 1887, in an account of the wild and cultivated flora of Alexandra Park, Oldham, S. Lancs., comes the comment that it 'turns up unexpectedly in nearly every piece of cultivated ground' (Walters 1887). Kidd (1956) said it is quite common in this area in recent years on waste ground and railway embankments.

Gardens must have provided the source of all the early, i.e. primary, records. Early herbarium specimens of known garden cultivation come from diverse, widely separated places, e.g. in and near Leicester, Leics., 1881, 1892 (**MANCH**); southern Kirkcudbright, 1889 (**MANCH**); Ledbury, Hereford, 1900 (**MANCH**); Southport, S. Lancs., 1907 (**MANCH**). It was also known to grow in a derelict garden in Swindon, N. Wilts, in *c* 1910 (J. D. Grose *in litt.* 1961), and must have been grown in the Oxford Botanic Garden around the turn of the century. These and other garden stations must have acted as centres from which later spread could occur.

Very early reports of escapes and naturalizations come from Scotland. Druce (1929, p. 71) gave his own record of 1894 as the first for W. Ross; this could refer to the Braemore site, but not certainly so. Then, in Aberdeen, Trail (1899), who had been keeping under observation a piece of waste ground formed by the filling in, in 1896, of an old channel of the River Dee and subsequently used for railway sidings, first noted 'three stems' of *R. japonica* in 1898, i.e. within two years.

At the turn of the century two further records, presumably of escapes, come from Glamorgan: Aberdare, 1900 (**BM**), and Llwdcoed, 1902 (**BM**). Druce (1926) reported it from rubbish heaps in Langley, Bucks., also in 1902. Between the years 1902 and 1904 there are several records from the vicinity of Edinburgh, all from sites on waste-ground, by railways or nursery gardens (Evans & Evans 1904, Fraser 1905, Fraser & McAndrew 1904). In Ireland, again in 1902, Colgan (1904) commented on a stretch of *R. japonica* planted alongside the Rathmines waterworks south of Dublin as already looking wild there and 'not unlikely to become naturalized in this station'. In 1903 Melville (1904) had observed its spread near Church Stretton, Salop, into the roadside habitat 'mingling with the native vegetation ... abundantly in one place and sparingly in another'; and he further prophesied that 'twenty or thirty years hence it will have so largely increased as to have the semblance of a truly indigenous production'. There is a specimen dated 1907 (Bailey, **MANCH**)

from Cardingmill Valley (by Church Stretton); it persists there to this day (1962, **LTR**). However, a poor specimen of Melville's from Church Stretton is more probably *R. sachalinensis* (**BM**).

Up to about 1910 most occurrences are clearly either direct garden escapes by vigorous vegetative growth or are outcasts on rubbish heaps. For the most part, too, they come from south-western Britain: 1908, near Exeter, S. Devon (Druce 1910a); by 1909, already from five places in Cornwall, all 'perfectly naturalized' (Davey 1909); in 1907, listed for Glamorganshire (Riddelsdell 1907) as a 'frequent escape' and as occurring in all but one district; and in 1911 in Carmarthenshire it was deemed 'general' without mention of localities (Hamer 1911). In western Ireland, Druce (1907) reported it in 1906 between Sligo and Glencar, Sligo, as 'not near houses'. From Scotland, there is a record from Stranraer, Wigtown, in 1909 (Druce 1910b) and from Loch Earn, Mid Perth, 1906 (**MANCH**). From the Midlands there is a specimen from near Leicester, Leics. in 1908 (**LSR**), but apparently little at this time (*c* 1910) in eastern England apart from London.

The earliest record as an established escape in London (apart from Little Chelsea) is uncertain, but it was listed in 1911 from a Bloomsbury, Middlesex, building site which had been cleared the previous year (Shenstone 1912) and by about 1914 it was certainly established on the embankment of the District Railway between Gunnersbury and Turnham Green, Middlesex (T. G. Tutin pers. comm. 1961). There are specimens from Yiewsley, Middlesex, for 1913 (**BM**) and from Finchley, Middlesex, for 1915 (**BM**). By 1913 too it was frequent near Liverpool, S. Lancs. (Wheldon 1914). From then up to 1919 an increasing but random scatter of localities are recorded ranging from the south coast (W. Sussex, 1914) to S. Aberdeen (1918), with rather many from Wales and Scotland.

PHASE 2: 1920 TO 1939 (FIGURE 2)

By 1939 *R. japonica* had established itself in many places in and around London, including several of the vast refuse-dumps used by the then London County Council, i.e. Dagenham, Tilbury, Hackney Marshes (Melville & Smith 1928). In Wales it had been recorded from all but two vice-counties. In Cardiganshire, as for Glamorganshire and Carmarthenshire at an earlier date, localities were too numerous to warrant detailed listing (Salter 1935), and from Monmouthshire there were already many records by 1935 (A. E. Wade *in litt.* 1961).

Scotland too was showing a mounting number of scattered records in a random pattern, from Westerness (1921) to Caithness (1926) and Kincardine (1926) to the Inner Hebrides (1937). There were, presumably, well-established though undocumented centres in the cities of Edinburgh and Aberdeen. From the latter it had spread to a few places in the immediate district (Trail 1923), and in the neighbourhood of Glasgow and the Clyde it was regarded as a 'common garden outcast' sometime within the period 1916 to 1928 (Grierson 1931).

Apart from the two early sites already mentioned, there is little documentation of naturalization in Ireland before 1939. Praeger (1934) did not refer to it, although judging by its later distribution it seems unlikely not to have escaped fairly frequently in this period.

In south-western England, Cornwall had another six published records by 1922 to add to the earlier ones (Thurston & Vigurs 1922); even so under-recording is suggested by the note on a specimen from Par, E. Cornwall, dated 1925 (**K**) 'a frequent hedge plant in West England spreading rapidly'. And in the mid-thirties, in a locality between Plymouth and Looe, E. Cornwall, it was known as 'Hancock's Curse'—having originally spread from a garden belonging to someone of that name; moreover a house thereabouts had a £100 reduction in price because the garden was overrun with it (Daniels pers. comm. 1972).

In southern England, vice-comital additions in this period include Surrey (1930), E. Kent (1931) and E. Sussex (1921), S. Wilts. (1937); and, in the Midlands, Staffs. (1923), Derbys. (1928) and Cheshire (1932). For Leicestershire, Horwood & Noel (1933) commented 'waste places becoming established, and spreading, a pest in gardens'. The first East Anglian occurrence was from Diss, E. Norfolk, in 1927, and it was also known from Colchester, N. Essex, sometime in the twelve years up to 1927 (Brown 1927). A notable addition in 1935 were two records from E. Yorks (Wilson 1938). Other additions at about that date include Jersey, Channel Islands, in 1925; Spalding, S. Lincs., in 1939; Isle of Wight in 1936; and the Isles of Scilly in 1939.

By 1939, the rest of the Midlands, the remainder of southern and eastern England, apparently almost all the rest of Yorkshire, the Lake District, and north-eastern England still had no or few records. Maybe this reflects in part the absence of botanists who thought it worth recording rather than a genuine absence. On the other hand G. C. Druce, who had been recording this species since

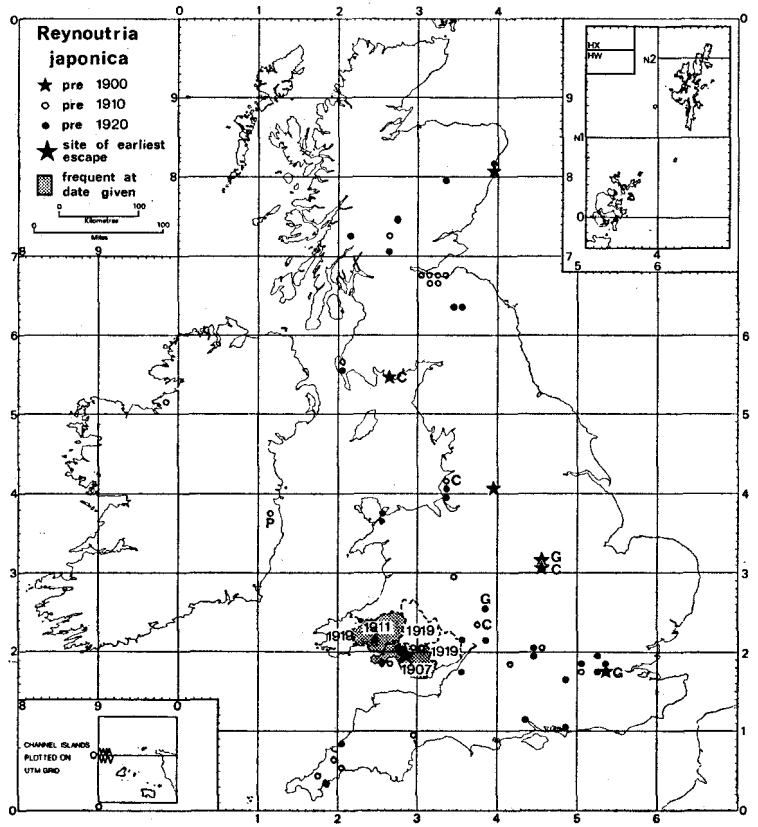

FIGURE 1

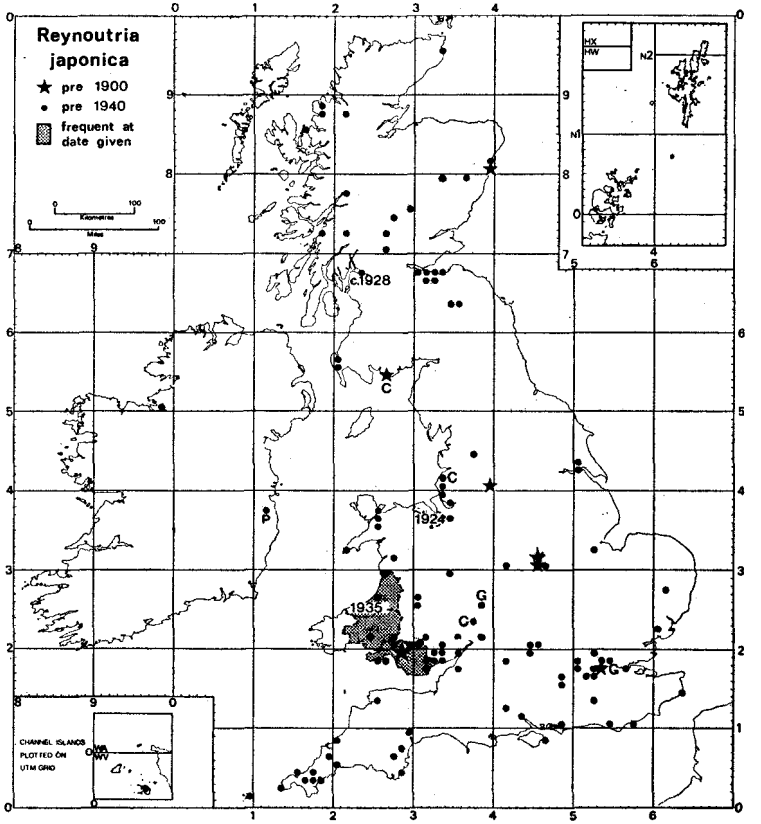

FIGURE 2

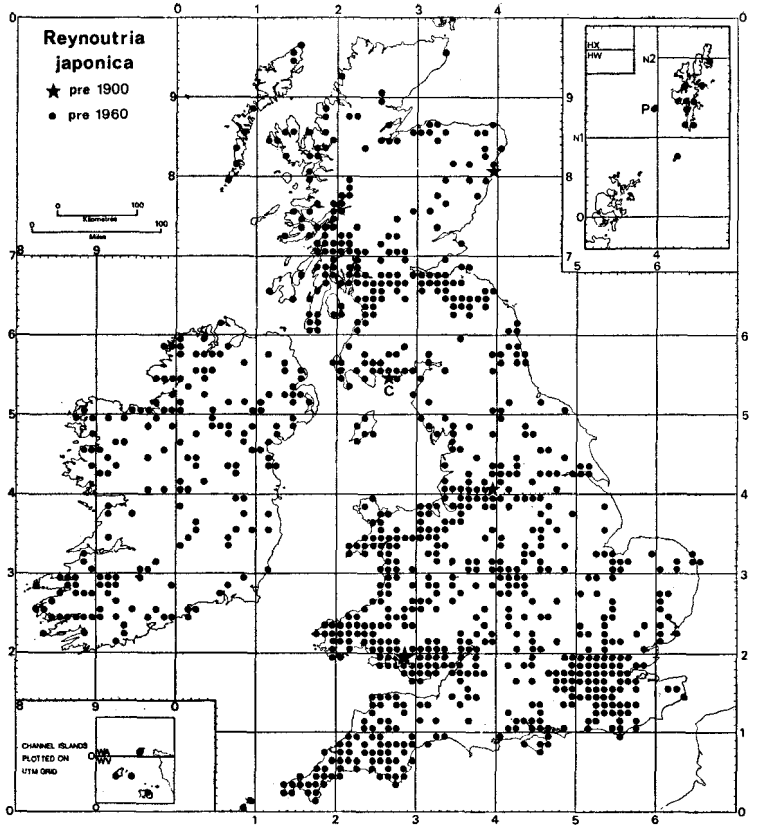

FIGURE 3

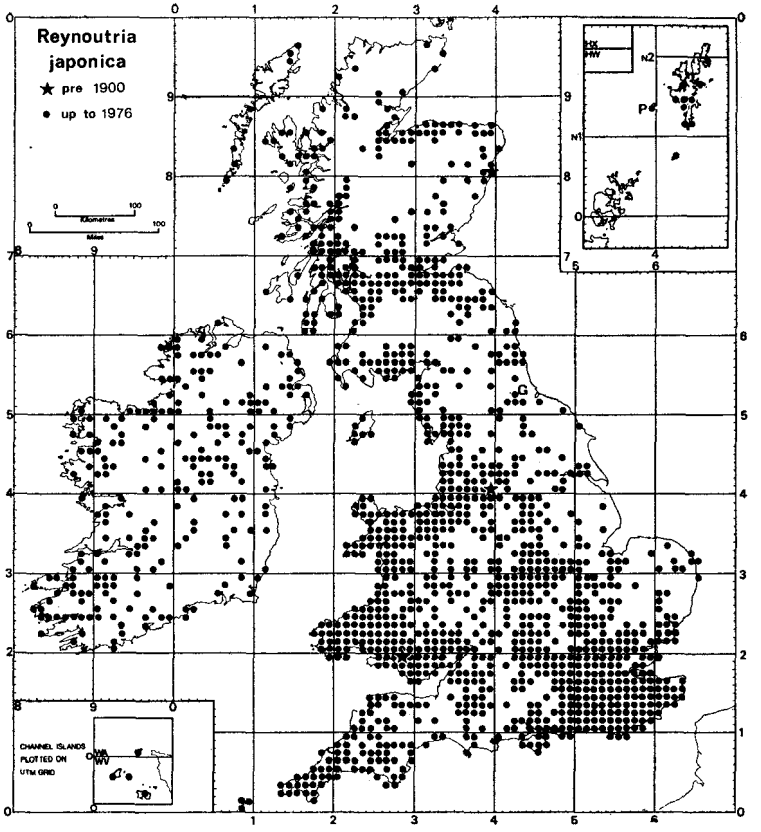

FIGURE 4

FIGURES 1–4. Distribution in the British Isles of *Reynoutria japonica* Houtt. for the four phases described in the text. Records are cumulative: older ones are repeated on later maps. Records known to be of garden origin are marked with G, those planted with P, and those marked C refer to early cultivated plants. Compiled from various sources, including the Biological Records Centre.

On Figs. 1 & 2 vice-counties for which records were too numerous for citation by the original author are shaded and the appropriate date given. Dates for unshaded vice-counties refer to unlocalised earliest dates.

1902 or earlier, certainly covered much of those parts of the Midlands for which there were still no published records at that time.

PHASE 3: 1940 TO 1959 (FIGURE 3)

Up to the start of the B.S.B.I. Maps Scheme in 1954 additional records showed little change in the above pattern. Denbighshire (1943) and Montgomeryshire (1939/41) completed the vice-county tally for Wales. Notable eastern records were from Cambridge, Cambs. (1946) and Hull, S.E. Yorks. (1950). In 1947 it was first recorded from Guernsey, Channel Islands. Comparison with the subsequent part of this phase, however, indicates considerable under-recording up to 1954.

The intense recording for the Maps Scheme culminated in the publication of the *Atlas of the British flora* (Perring & Walters 1962), and Fig. 3 is based on the map in that publication with a few additions and corrections.

Details of establishment in Ireland in the 1950s are still meagre. Webb (1953) referred to the several coarse perennial species of *Polygonum* (incl. *Reynoutria*) of which some were established as escapes. There is a specimen from Clare (1954) and in 1957 McClintock (1960) listed 12 localities from six vice-counties ranging from W. Galway and W. Donegal to Louth and Meath. The evenness of spread in Ireland shown in Fig. 3 contrasts with the concentration in Britain in the west and around major conurbations elsewhere.

In Scotland, the 1950s show an extension of range to more remote areas: Jura, S. Ebudes; Mull, Mid Ebudes; Skye, N. Ebudes; Shetland; and Moray. For some of these, the records refer to little more than rampant relics of derelict cottage gardens (Haa, Fair Isle; Skye). Why it should be absent from Orkney whilst relatively common in Shetland is not known, but could merely reflect the haphazardness of island colonization by plants.

The lateness of records for eastern England is marked by the first for N. Lincs. in 1950 followed by others in the late 1950s for both N. and S. Lincs. (Gibbons 1975), the second for E. Norfolk in 1958 (Swann *in litt.* 1976), and seemingly the earliest for Hunts. in 1950. Evidence of naturalization in Cambridgeshire is sparse; it was already known from a Cambridge roadside in 1946 (**LTR**) and from Cottenham in 1956 (Perring & Sell 1959), but it had been known locally in Ely for some ten years prior to 1961 (S. Bishop pers. comm. 1961) and it was reported as 'widespread' in the Wisbech area in 1959 (Perring 1961). In Bedfordshire, Dony (1953) commented 'increasing in waste places and recorded for all districts except [three]'. In north-eastern England additions at this time include Durham (1954), S. Northumb. (1958) and N.W. Yorks. (1959).

The data incorporated into Fig. 3 indicate a number of vice-counties not previously mentioned and for which locality details have not been sought or traced, viz— Cheviot, Cumberland, Westmorland, W. Lancs. and N.E., S.W. and Mid-W. Yorks. in northern England, and a long list in Scotland including almost all vice-counties in southern Scotland and several vice-counties from Kintyre and Clyde Is. to N. Aberdeen, Outer Hebrides and E. Sutherland. Elsewhere notable additions are the Isle of Man, S. Somerset and the last English midland counties. In Ireland in this period records covered all vice-counties except, apparently, Dublin.

Compared with the earlier phases, the pre-1960 position indicates the incentive the *Atlas* gave recorders to notice these alien plants, with the resultant great increase in the number of 10km grid-squares added to the map.

PHASE 4: 1960 TO 1976 (FIGURE 4)

In the most recent period, the 1960s and 1970s, changes have been mostly those of consolidation. The addition of records for Dublin and Peebles (1976) has left only Orkney remaining without a record. Elsewhere a large number of records for extra grid-squares have filled in many areas, especially in the south-east and where Floras have recently been published or are in an advanced state of preparation. Despite this spurious concentration there does nevertheless seem to be a marked increase in records during the last few years, especially in the south-east and in Cumberland (Haworth 1976). Could it be that the recent run of mild winters has been a genuine contributing factor?

DISCUSSION

The sequence of stages in the spread of this vigorous weed follows the generalized pattern seen in many other alien plants: a pioneer phase of scattered primary occurrences; a rapid extension with

secondary spread from the primary foci; and a final era of consolidation. But the pattern of this spread for *R. japonica* differs regionally. In the west, early spread was rapid and secondary spread must have quickly followed with the colonization of river and railway embankments and establishment on roadside sites with a merging of stands so that any original locus was obscured. In South Wales it was already common almost throughout Glamorgan by 1907; common through three or four Welsh vice-counties by 1918; and known from almost all of Wales by the 1930s. Observations in South Wales in recent years demonstrate the abundance of this plant in many areas, for example the derelict sites and waste ground in the Swansea–Neath, Glam. area, already noted as abundant here in 1930 (A. E. Wade *in litt.* 1961), around Cwmbran, Mon. (D. I. Morgan-Huws *in litt.* 1964), or the streambanks of Porth Talbot and Bridgend, Glam. In North Wales too, roadside colonies away from habitation abound south of Machynllech, Montgomery and about Portmadoc, Caerns.

In contrast to the west, spread in the east and north-east has been both tardy and slow, and more restricted in the habitats invaded. The lack of spread from Aberdeen, one of the earliest sites of establishment, contrasts sharply with the rapid engulfment of the South Wales derelict areas. It was barely recorded in East Anglia or in the Durham–Northumberland region till the 1950s. In the east too, in contrast to the west, roadside stands away from centres of population are infrequent. Up to the 1960s only around Metropolitan London was there any concentration of localities. Here, along the railway embankments, there has been an abundance of stands not adjacent to stations within the densely built-up area, at least since the early 1960s, but further out of London these become restricted to the immediate vicinity of stations or goods-yards. Thus on the old L.M.S. railway line out of St Pancras, inter-station stands are common as far as Elstree, but further north they are conspicuous only at stations: St Albans, Luton, Bedford and then Leicester. And the same can be seen on the Southern lines out of Victoria and Waterloo, with the change at about East Croydon and Weybridge respectively.

These contrasts between the performance in the east and west of Britain suggest some climatic control restraining its spread in the east and north-east and encouraging its aggressiveness in the west; not, perhaps, surprising for a species coming from an oceanic area. Comparison with rainfall maps does show a correlation between high precipitation and greater frequency of sites, but does not account for the high incidence in and around London so prominent in the earlier phases. *R. japonica* is cut back by the first sharp frost in autumn, often before there would have been time for fruit to form. Field observations of the dramatic effect of the late spring frost of May 1961, when severe damage was widespread over Carmarthenshire, for example, and on the Argyll coast (C. A. Sinker pers. comm. 1962), point to a possible factor which would normally be of much more frequent occurrence in the east and on high ground than in the west. It would also account for the conurbation effect, for the amelioration of centres of population on the incidence and severity of frost is well known. The results of the severe late frosts of 1965 were studied in western Wales by Savage (1965), who included *R. japonica* in his 'most severely damaged' category. That the apparent great increase in frequency in south-eastern England in recent years is connected with the recent run of mild winters is a further possibility. During the drought and hot sunny weather of the 1976 summer, scorching and withering of leaves was noticed in August—again suggesting an inimical influence of a more continental climate. Whether repetitive cut-back by frost leads to reduction of 'growth-potential' sufficient to reduce the vigour of the extending rhizomes is an open question. Komarov (1936) noted that *R. japonica* was very hardy, even in Leningrad, although he recommended the plant for regions where the soil does not freeze in winter. The resilience of the rhizomes is such that they have been seen growing up through asphalt, and their resistance to a variety of weed-killer chemicals has been shown by Fuchs (1957). The readiness to colonize cinder-tips, railway ballast and similar well-drained pioneer habitats is not surprising for a species which in its native Japan is characteristically an early colonist of volcanic soils and occurs even on the sulphurous soils of fumaroles with a pH below 4 (Yoshioka 1974).

Vegetative spread to new sites, either by direct extension of the aggressive rhizomes or indirectly by the removal and cartage of earth, is the usual means of dispersal. Floating cut stems have been seen throwing up new shoots, so that water-transport could be an additional means of dispersal. Whether establishment in the British Isles ever occurs from fruit is doubtful. Fruit is set apparently only very occasionally and then only after a 'hot dry summer' (note on a fruiting specimen from Richmond, Surrey, B. Welch, 1955, **BM**). However, a specimen from Cambridge (1946, **LTR**) must have another explanation. Fruiting following the 1976 hot summer has been observed in

western London (D. H. Kent pers. comm. 1976) and in N. Hants., but here, as for the previous records, there is no evidence that these fruits are viable. Seedlings or observations of germination have not been reported, at least not in the wild. Moreover, as the majority of plants in this country are male-sterile, it is more likely, as D. McClintock (pers. comm. 1961) has pointed out, that the rare occurrence of fruit coincides with the rare availability of effective pollen.

The flowers of *R. japonica* are functionally dioecious (Hooker 1880a). In the commoner plant, functionally female, the stamens are included within the perianth and the small, rusty-pink anthers are either empty or have aborted pollen. The ovary enlarges and nuts may develop enclosed in the winged fruiting-perianth. In the far less common male-fertile plants, the long stamens are exserted and the large, cream anthers have good pollen (up to 80% or more stainable); the ovary remains small and aborts.

Dwarf variants have long been sold by nurseries; they were described by Hooker (1880b) as *Polygonum compactum* Hooker fil., although in Japan it is not considered a distinct species (Ohwi 1965). Under *Reynoutria* the combination is *R. japonica* var. *compacta* (Hooker fil.) Buchheim. Not more than one metre (and sometimes only 30cm or so) tall, it has small, thick-textured leaves which are characteristically as broad as long with an abruptly cuspidate apex, very truncate base and undulate margins. The inflorescence is said to be erect and scarcely branched. This dwarf variety is likewise functionally dioecious, and both male and female plants are cultivated. A red coloration on the stems and petioles extending to the perianth adds to the decorative appearance, and can in the female give striking, red-winged fruiting perianths; male plants are less often so red. Specimens have been seen from N. Devon, N. Somerset, E. Gloucs., S. Lancs., Main Argyll and Roxburgh (male plants), and from Surrey, Herts., Cambs., Glam., W. Lancs., Easterness and Shetland (female plants).

Some plants collected from coastal sites in western Ireland and south-western Scotland show undulate leaves and hence resemble var. *compacta*, but this is probably only the result of the saline environment. Herbarium sheets rarely give details of plant height, and it is possible that the very few British male-fertile specimens seen of *R. japonica* are in fact the var. *compacta*. Where both sexes of var. *compacta* are cultivated together, D. McClintock (pers. comm. 1976) has observed that viable seed is set and that seedlings arise; these are all dwarf and of both sexes. This gives weight to the idea that in var. *japonica* also good seed is produced only on the rare occasions of pollen availability.

REYNOUTRIA SACHALINENSIS (FRIEDRICH SCHMIDT PETROP.) NAKAI (*POLYGONUM SACHALINENSE* FRIEDRICH SCHMIDT PETROP.)

A native of southern Sakhalin and of northern Japan (Ohwi 1965), *R. sachalinensis* is generally assumed to have been introduced in 1869 (Synge 1956). However, Hooker (1881) commented that, although the first notice of its being cultivated was in the Moscow Zoological Garden, where it was seen in 1869, it was in fact apparently known in England before that date, and he recollected it in cultivation at Kew 'at least 20 years ago', i.e. about 1861. Moreover Regel (1864) had already referred to the succeessful cultivation of this species overwintering in the open without cover in St Petersburg. It was apparently introduced in the first place for forage and only subsequently grown as a decorative horticultural plant. In 1896 W. Foggitt of Yorkshire, writing to J. H. Davies in Northern Ireland, told of its being brought to England and grown for forage, and that it was said to produce 80–120 tons of green fodder per acre, and that horses were especially fond of it (*fide* Davies 1896). Foggitt further told Davies that the farmers of Wensleydale were planting it 'at the base of oozy hillsides' and added 'its beauty seems to have recommended it to horticulturists, and it is now to be seen in many gardens in Yorkshire'. More recently Komarov (1936) also referred to its economic importance and its successful cultivation in the Leningrad area, and said that the young shoots are readily eaten by horses and cows. Four phases of spread may again be recognized.

PHASE 1: UP TO 1929 (FIGURE 5)

It was Davies (1896) who first published an account of this species growing outside cultivated areas in the British Isles. He described an extensive and longstanding growth on waste ground by the Lagan Canal at Lisburn, Antrim, where it was considered locally as 'growing wild' and not to

have been planted. Davies surmised that it had been brought by lighters, which were repaired in a nearby dry dock and which had carried coal, shipped from northern England, from Belfast to Lisburn. It does not seem to be there now. It must be stated that Druce (1929, p. 72) in fact gave 1894 as the date for his record from Braemore, W. Ross., but, as elsewhere in this Flora (p. xviii) he mentioned adding *R. sachalinensis* in 1923, there must (in the absence of specimens or other evidence) be some uncertainty about the earlier (1894) date. It still grows near Braemore.

Persistence of stands spreading from gardens or naturalizing from cast-out plants were only rarely published early this century. In 1901/2 a single plant was reported (Colgan 1904) naturalizing beneath the cliffs of Howth, near Dublin, and evidently derived from a garden above, and, in 1903, the alien Reynoutrias collected by J. C. Melville from Church Stretton, Salop, included a specimen of *R. sachalinensis* (**BM**), though there has previously been doubt as to its determination. Several of G. C. Druce's early collections have been renamed at various times from inadequate herbarium specimens. His specimen from Par, E. Cornwall (**OXF**, 1908) was labelled '*Polygonum cuspidatum*' but it has been correctly renamed '*P. sachalinense*' by H. J. M. Bowen. Between 1917 and 1926 Druce noted and collected both species from Marston Brickyard, near Oxford (**CGE, E, NMW, OXF**), evidently derived from the Oxford Botanic Garden; some were correctly but others incorrectly determined. His collection of *R. sachalinensis* from Dagenham, S. Essex (**OXF**), probably dates from before 1930 (Brown 1940). Known since 1925 near Forres, Moray, it was originally determined as *R. japonica* and only recently has it been recognized as *R. sachalinensis* (det. R. M. Harley; M. McC. Webster pers. comm. 1976). There are reports or specimens from Renfrew (Giffnock, 1926), S. Devon (Countess Weir, 1929), and W. Gloucs. (Blaize Castle, 1929, **NMW**).

PHASE 2: 1930 TO 1949 (FIGURE 6)

Records are still sparse in this phase outside Devon. They doubtless reflect the whereabouts of disillusioned gardeners or those unable to restrain their decorative plantings. Published records or specimens come from Surrey (Weybridge, 1934 and Holmbury St Mary, 1938), and S. Hants. (Milford-on-Sea, 1935). Several localities were listed by Martin & Fraser (1939) from Devon, of which that at Plymouth Hoe, S. Devon, can be dated 1937. In 1938 it was collected from Amroth, near Saundersfoot, Pembs. (**NMW**) and it still grows there on the coast at the old county boundary with Carmarthenshire. In this period two sites were recorded in Londonderry: by the R. Bann at Coleraine, and by the R. Foyle at Londonderry (Praeger 1938), both apparently between 1934 and 1938. It was collected from Phoenix Park, Dublin, in 1937 (**herb. V. Gordon**).

J. E. Lousley collected it from Chewton Glen, S. Hants., in 1945 (**RNG**). There are records from Down in 1942; Merioneth (near Brithdir) in 1941, though here merely spreading in a garden where it had been introduced *c* 1919; Westerness (near Fort William) in 1947; Outer Hebrides in 1946; and Middlesex (Brent Reservoir) in 1944 (Kent 1975).

PHASE 3: 1950 TO 1959 (FIGURE 7)

In the 1950s records were added for the following vice-counties: E. Gloucs. (1955), Radnor (1956), Cheshire (1952) and S. Lancs. (1953) in the west and north-west; N.W. Yorks (1959) and N.E. Yorks. in the north; E. Norfolk (1959), Cambs. (1959), E. Suffolk (1957) and W. Suffolk (1958) in East Anglia; Notts. (1952) in the Midlands; N. Somerset (1956), Wight (1956), E. Sussex (1952), W. Kent (1956/7) and Bucks. (1958) in the south.

In Scotland, vice-counties added in the 1950s were: Main Argyll (1958) and Shetland (1958) in the north, and Ayr (1956), Dumfries (1957), Wigtown (1956) and Berwick (1960) in the south. The last, from Dun's Castle, had, however, been known locally 'for many years before this' (A. G. Long *in litt.* 1976). In Ireland, vice-county additions in this period were mostly in the north and north-west, but also from W. Cork and Wexford.

Further records from vice-counties already covered range from Cornwall and E. Sussex in the south to Ayr and Main Argyll in the north. Others come from northern Ireland; there were several from Greater London in Surrey and W. Kent as well as from the City of London.

PHASE 4: 1960 TO 1976 (FIGURE 8)

In the 1960s and 1970s a number of new vice-counties gave important extensions in the north of England: Mid-W. Yorks. in 1967, Westmorland in 1961, Cumberland in *c* 1965, Durham in

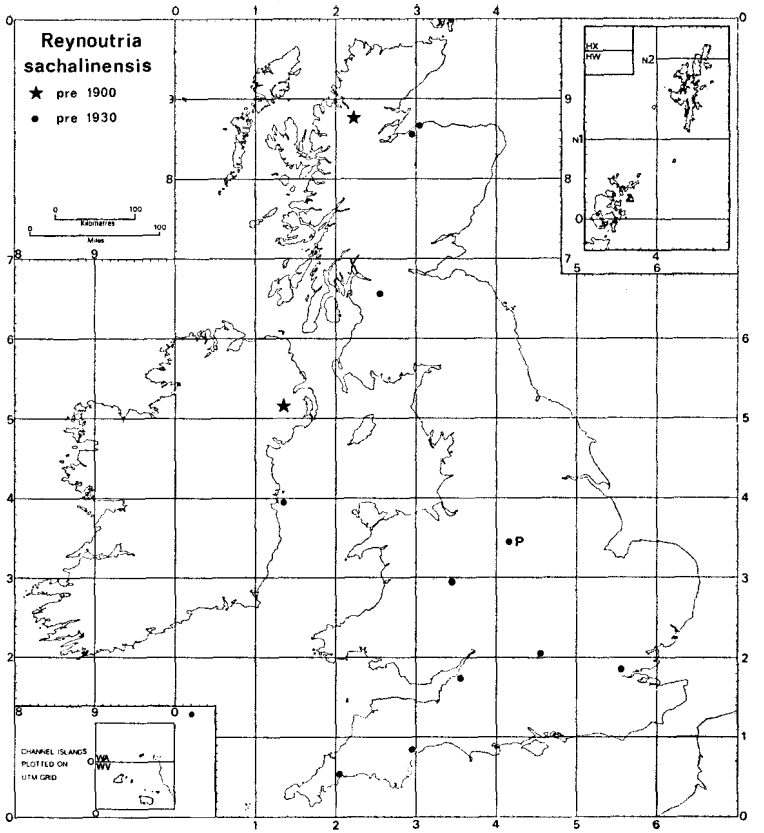

FIGURE 5

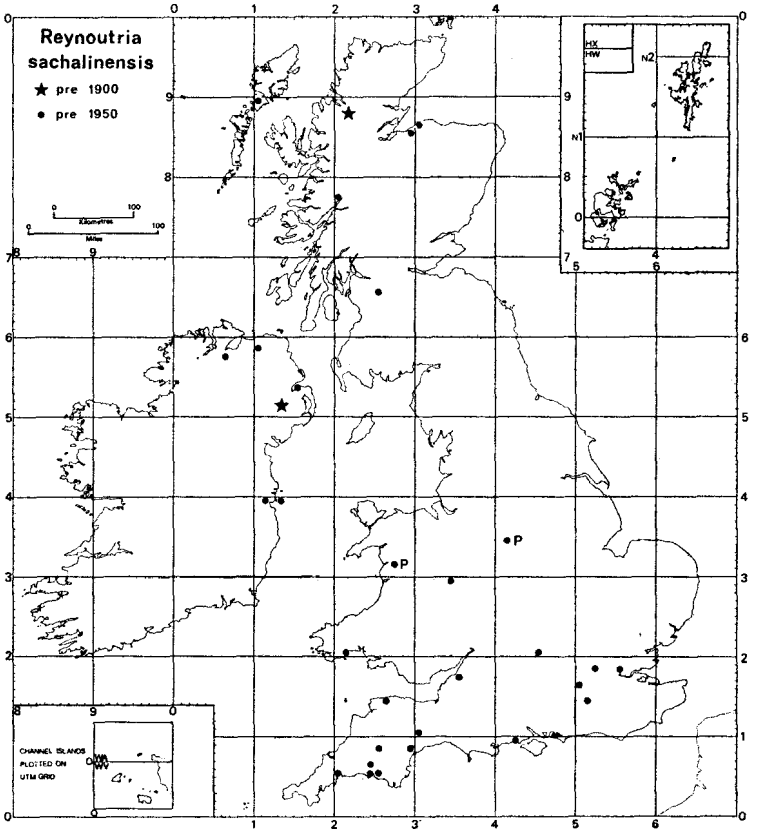

FIGURE 6

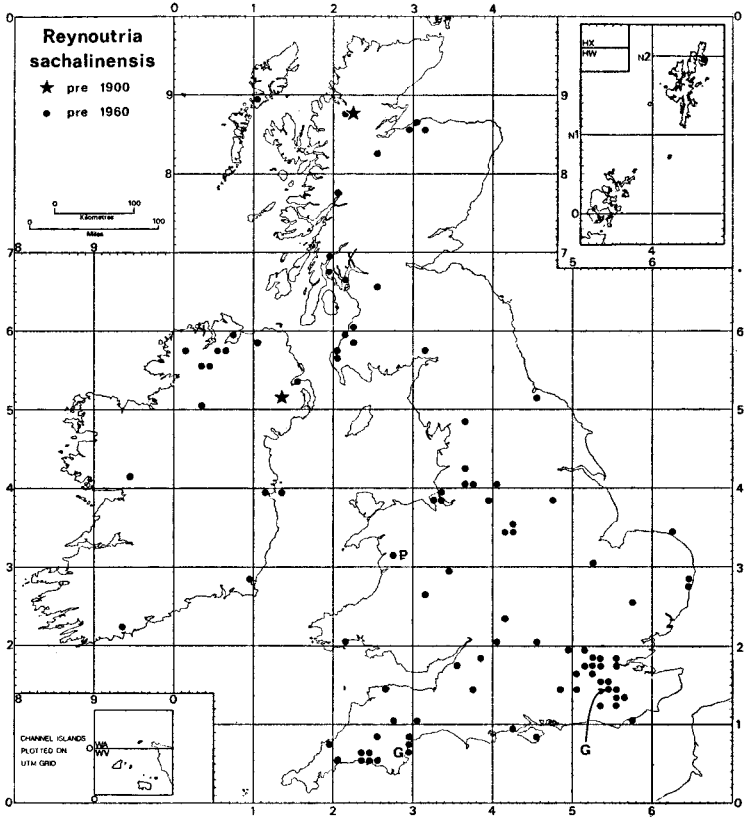

FIGURE 7

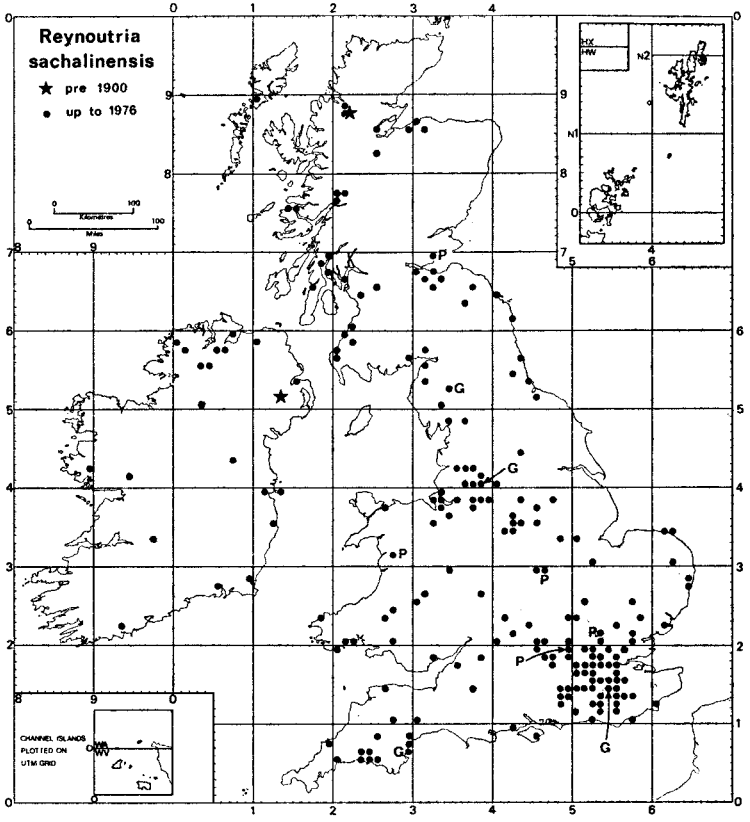

FIGURE 8

FIGURES 5–8. Distribution in the British Isles of *Reynoutria sachalinensis* (Friedrich Schmidt Petrop.) Nakai for the four phases described in the text. Records are cumulative. Those known to be of garden origin are marked with G, and those planted with P. Compiled from various sources, including the Biological Records Centre.

1960 and Cheviot in 1966. In Scotland notable additions were Edinburgh (1960), Fife (1962) and the Isle of Mull (Mid Ebudes, 1967), and in Ireland, W. Galway in 1965 and Wicklow in 1971. In Wales, five new vice-counties were recorded: Glam. (1963), Mon. (1969) and Carms. (1957–67) in the south and Caerns. (1965) and Flint (1961) in the north. Other new vice-counties range from Worcs. and E. Kent to S. Lincs. and Leics. in England, and Kintyre to E. Ross in Scotland. Other records in this period add stations to vice-counties already recorded; in particular to the London area, to Surrey and to Herts.; to Cheshire (Newton 1971) and S. Lancs.; and to Oxon. (S. R. J. Woodell pers. comm. 1976). Elsewhere a scatter of such records come from central and south-eastern England, from Wales, from Scotland and from W. Donegal in Ireland. Eleven new localities from Essex (Jermyn 1975), as well as some from other areas, could date from an earlier decade.

DISCUSSION

The pattern of spread in the early stages shows most sites were in southern and western Britain, with a few in northern Ireland and northern and western Scotland. The later position shows a marked increase in Surrey and elsewhere around London, but still mostly south-west of a line from the Ribble to the Wash. In the last phase the main increase is not only in the south-east but also in Cheshire, S. Lancs., Derbys. and in western and south-western Scotland. In view of all the hillside and garden plantings last century, the lack of records and especially the late date of those from Yorkshire and north-eastern England suggests some climatic restraint to spread. In this *R. sachalinensis* parallels *R. japonica*. On the other hand, in contrast to the latter, sites are sparse in Wales and very sparse in Ireland except the north. Nor is there much sign of spread or extension from the early sites in Devon and Cornwall. *R. sachalinensis*, in comparison with *R. japonica*, has not spread to anything like the same extent: the maps reflect mainly the incidence of many independent primary escapes and/or establishments; indeed a number are no more than vigorous garden plantings that have become well established and extensive over the years but can barely carry the status of 'naturalized'. The rest are almost all primary escapes, or cast-outs at the site of deposition that have taken hold on waste-ground, embankments and so on. There is nothing comparable with the innumerable secondary sites of *R. japonica* seen in so many London, Welsh and western Scottish areas, with the merging of stands into vast stretches. Only around greater London can *R. sachalinensis* now be considered at all common. The *Flora of Surrey* (Lousley 1976b) is alone among recent Floras in not citing individual records; the relevant map gives 34 tetrads in sixteen 10km grid-squares, but even here individual stands are often far apart. The most extensive stands noted are along 30 yards of a river bank at Penicuick, Edinburgh (Beattie 1962, Biological Records Centre card), a large clump extending 'some 20 yards . . . in a moorland field' at Saddleworth, S.W. Yorks. (Kidd 1956), and for a quarter of a mile along the R. Foyle, Londonderry (Praeger 1938). Far less a menace to gardeners than *R. japonica*, *R. sachalinensis* hence gets thrown out far less often, has therefore far fewer opportunities to become established on waste-ground, and, being so much less aggressive, stays more restricted to primary sites. In Japan, characteristic habitats include unstable, moist soils on volcanic detritus and basaltic lava flows, and somewhat stabilized scree below coastal cliffs (Ishizuka 1974, Yoshioka 1974).

Although mature-looking fruits do occur on occasion, there are no reports of seedlings; spread is invariably by vegetative means.

On occasion there has been some confusion between *R. japonica* and *R. sachalinensis*, herbarium specimens with atypical leaves having been variously determined as one or the other. Such specimens are inadequate, for they do not have the essential basal leaves which could assure correct identification. These two species are known to be much more variable in their native areas than in the British Isles, and introductions on different occasions may well have been of different variants. But the question remains as to the constancy of the characters separating the two species; some herbarium specimens probably of *R. sachalinensis* lack one or more of the characteristic features of that species, so that their identity remains uncertain. It also raises doubts as to the authenticity of certain early records not supported by voucher material, particularly some of G. C. Druce.

As in *R. japonica* the flowers of *R. sachalinensis* are functionally dioecious. The male plants have exserted stamens, large anthers with good pollen, and vestigial ovaries. Examples are from Chewton Glen, S. Hants., 1945 (**RNG**); Nant-y-Frith, near Wrexham, Flint, 1961 (**LIVU**); and Dingwall, E. Ross, 1971 (**E**). Female plants have included stamens, small, empty anthers and nuts enclosed

in well-developed winged fruiting perianths. Many examples have been seen. Other specimens point to a more complex condition; some from the Edinburgh region (E) with predominantly male flowers show a few nuts developing as well, and a plant from Ware, Herts (LTR, RNG), bears not only male and female flowers with nuts containing seeds, but also apparently hermaphrodite flowers having nuts and exserted stamens, although the seed is ill-formed. Material from Amroth, Pembs. (NMW), shows a similar range in a single inflorescence. A polygamous condition is, therefore, indicated, as had been suspected by Hooker (1881), and not a dioecious one as stated by Webb (1964). It is not known whether even the best-formed nuts contain viable seed in this country.

POLYGONUM POLYSTACHYUM WALL. EX MEISSNER

Introduced as a horticultural plant from the Himalayas, *P. polystachyum* has only occasionally established itself as a naturalized garden escape, for most reports refer either to garden plantings that have persisted in abandoned or neglected areas, or to stands still remaining at the site of dumping from nearby gardens. Natural extension by vegetative growth beyond the confines of a garden or estate, or the invasion of surrounding vegetation from dumped material, has been less common. But such sites may well act at some future time as centres of spread, as has happened with some many other alien invaders. For this species five phases of spread may be delimited.

PHASE 1: UP TO 1929 (FIGURE 9)

Early records for *P. polystachyum* are sparse. A reference to cultivation in 1904 comes from Lyss, N. Hants. (K), and it was in cultivation in the Royal Botanic Garden, Edinburgh, by 1900 (E), and in Trinity College Dublin Botanic Gardens by 1911 (K). The Royal Botanic Gardens, Kew, received a garden specimen from Salop in 1914 (K), and in 1917 it was grown at Welbeck, Notts. (OXF), but the precise date of introduction into Britain does not seem to be known.

The earliest authentic evidence of escape seems to be in 1917, when a Miss Cobbe from Lynton, N. Devon, reported it 'almost naturalized in these parts' (*in sched.*, OXF). Subsequently, further reports indicate its frequency and establishment in that district; Druce (1929) recorded it 'in great abundance near Woody Bay and along the railway from Barnstaple to Lynton' (OXF). There are further reports there in 1933, 1960 and 1961, and extending east to Luccombe, S. Somerset, in 1961 and west to Combe Martin, N. Devon., in 1970 or before. As with *Reynoutria japonica*, many others of these earliest records come from the west country: S. Devon in 1920 (OXF) and W. Cornwall in 1925. Others come from Ireland (W. Donegal in 1928), from Scotland (Moray in 1925, Caithness in 1927 and two places in W. Ross in 1926), and from Wales (nr Bala, Merioneth, 1921, LANC; Bettws-y-Coed, Caerns., 1928). The first from the home counties is from Herts. in 1927. In 1917 and 1921 an interesting hairy variant was collected from a sandpit near Woodhall Spa Golf Links, N. Lincs. (BM, OXF).

PHASE 2: 1930 TO 1949 (FIGURE 9)

In the next two decades the predominance of western records is shown by the number from Wales: Cards. (1936, 1941, 1942), Merioneth (two in 1941), Denbigh (1943), Flint (1942) and Monmouth (1942). Most of these were noted by J. A. Webb, who was perhaps less cautious than some in recording garden plants scarcely then naturalized. From Ireland, W. Galway (1935), W. Cork (1936) and Fermanagh (1947) were added, as well as Fife (1934) in Scotland and N. Somerset (1943) in England. There was also a group of new vice-county records from metropolitan London and the home counties: Surrey in 1930, Bucks. in 1913, N. Hants. in 1933 and Middlesex in 1948. It appeared on a bombed site in Coventry, Warks., in 1943, on waste-ground near the Lickeys, Worcs. in 1945, and in E. Sussex around 1946.

PHASE 3: 1950 TO 1959 (FIGURE 10)

The western emphasis is continued in the 1950s with over 30 Irish records: at least five from Galway (1955–57), and several from Donegal (1953–57), especially from south of Glenties. Others range from Waterford and Clare to Antrim, including seven new vice-county records. This marked increase in Irish records partly reflects renewed activity in recording and of taking note of aliens.

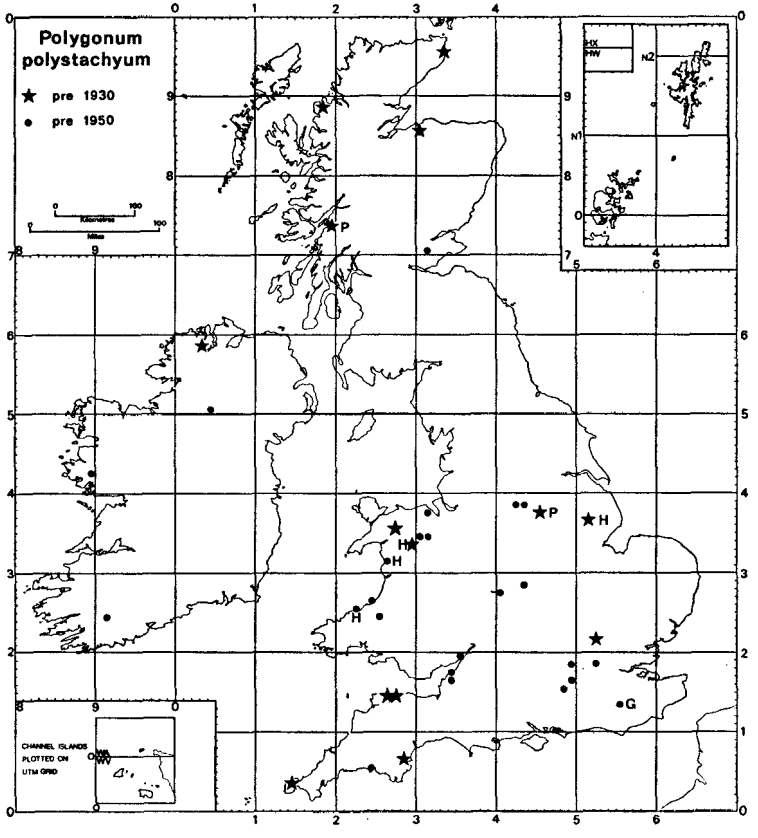

FIGURE 9

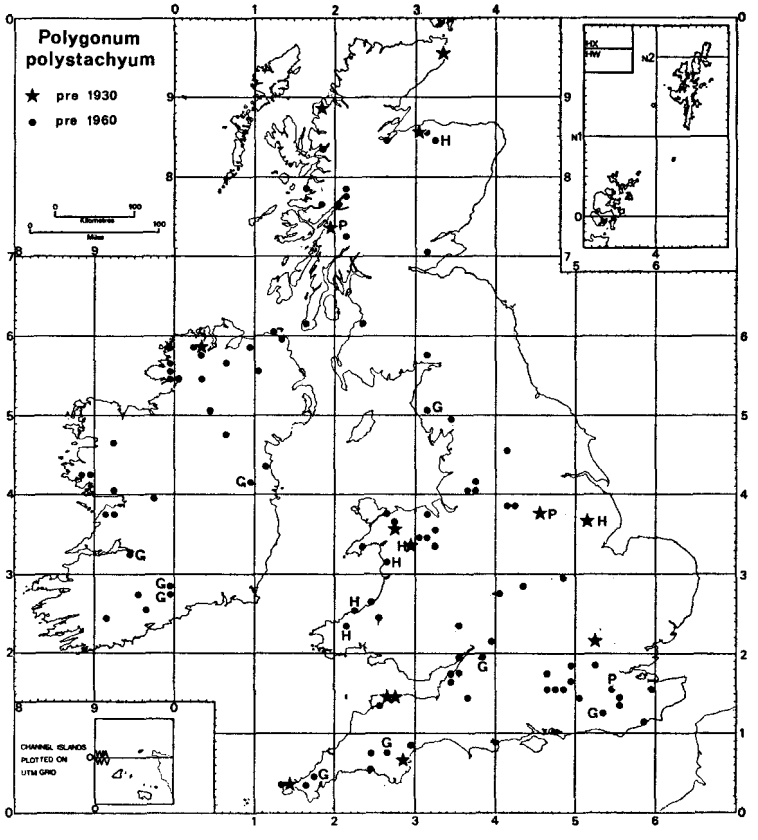

FIGURE 10

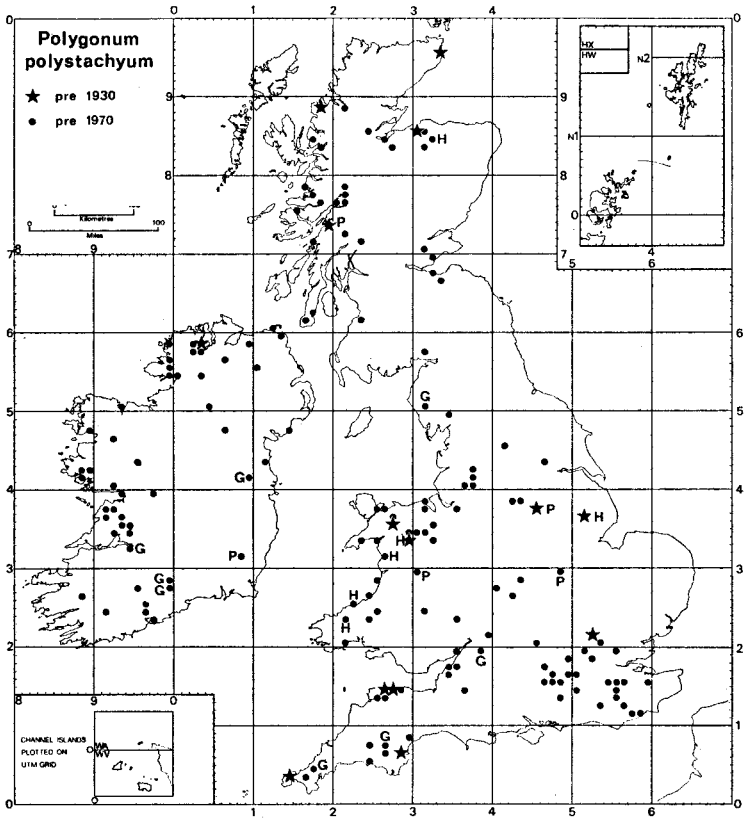

FIGURE 11

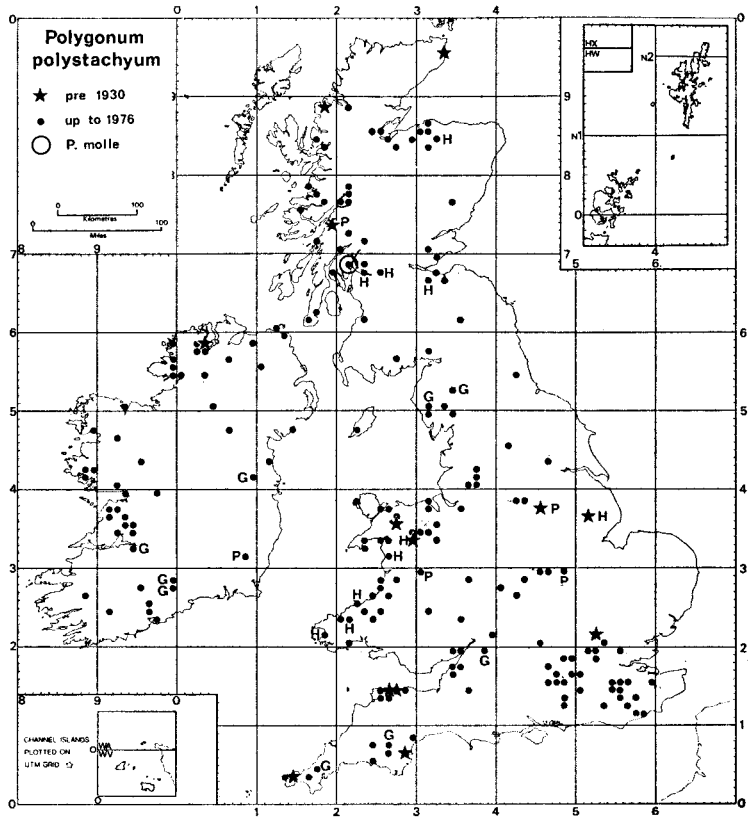

FIGURE 12

FIGURES 9–12. Distribution in the British Isles of *Polygonum polystachyum* Wall. ex Meissner for the five phases described in the text. Records are cumulative. Those known to be of garden origin are marked with G, those planted with P, and those referring to hairy-stemmed plants with H. The location of *P. molle* D. Don is shown in Fig. 12. Compiled from various sources, including the Biological Records Centre.

In England newly recorded vice-counties range from Hereford (1950) to W. Kent (1957) and northwards to Mid-W. Yorks. (1959) and Cumberland (1958). It had, however, been noted from Eskdale, Cumberland in the 1930s (V. Gordon *in litt.* 1976). In Scotland, Banff (1956), Easterness (1952), Westerness (1950), Main Argyll (1959) and Kintyre (1956) were added in the north and west, and Dumfries (1957) and Ayr (1957) in the south. Additional localities come from W. Cornwall, S. and N. Devon, and elsewhere in southern England, Wales and Scotland.

PHASE 4: 1960 TO 1969 (FIGURE 11)

The relatively high number of western records continues in the 1960s with the addition, in Ireland, of N.E. Galway (1960), Carlow, E. Donegal and W. Mayo (all 1961). For Scotland, new vice-county records are from Edinburgh (1965), W. Perth (1966), E. Ross (1966) and Mid Ebudes (1967). In Wales, Carms. (1961), Radnor (1963), Pembs. (1964), Anglesey (1966) and Montgomery (1968) were added. And for England, where perhaps less interest was focused, new records added S. Somerset (1961), S. Essex (1964) and S.E. Yorks. (1961). Further sites from previously recorded vice-counties came from Clare and W. Galway in Ireland, from three vice-counties in Scotland and from seven vice-counties in Wales; there were others from southern England and the Midlands.

PHASE 5: 1970 TO 1976 (FIGURE 12)

Even within the last few years there has been an apparent extension and increase in frequency of records in western Wales and in Scotland, in part because of concentration of interest there. Additional records of special note are those from Durham (1971), Leics. (1976), Forfar (1971), Roxburgh (1973) and Dunbarton (1975). The first record from the Isle of Man was reported in the last four years (D. E. Allen pers. comm. 1977).

DISCUSSION

P. polystachyum is best established in the west; the finest stands of naturalized plants must be along the old railway from Barnstaple to Lynton, around Woody Bay and by the R. Heddon at Parracombe, N. Devon. It has frequently been reported too from the Glenties region in W. Donegal. Reports of abandoned gardens where hundreds or even thousands of square yards have been engulfed come from Harlech, Merioneth and also from Craigend Castle, Mugdock, Stirling (A. J. Silverside *in litt.* 1976).

Plants of *P. polystachyum* are normally sparsely hairy with stems and ochreae glabrous and the leaves only lightly hairy on the veins beneath and on the margin. Plants with very hairy stems and leaves, and inflorescence rachides with long hairs, have been recently discussed in relation to *P. molle* D. Don (McClintock 1975, Lousley 1976a). A naturalized stand of *P. molle* D. Don (in the sense used by Lousley (1976a), i.e. including *P. rude* Meissner and *P. paniculatum* Blume) grows by L. Eck, at Coylet, Main Argyll. Specimens from this site and cultivated material of *P. molle* can be distinguished from *P. polystachyum* by the much smaller perianths (*c* 1·5mm), the segments of which are all of equal size (cf. Meissner 1856, Hooker 1886, Steward 1930), by the very short styles, and by the fruiting perianths (observed only in the cultivated material), which are bacciform, becoming fleshy and dark in colour. In *P. polystachyum*, in contrast, the perianth is large (*c* 3mm or more), the segments are unequal in size, the two outer narrower than the inner ones, the styles are relatively long, and the fruits are not bacciform; the perianth withers and the nut becomes narrowly winged. All the hairy-stemmed naturalized plants examined so far, with the exception of that from Coylet, Main Argyll, agree precisely with *P. polystachyum* in these features and not with those of *P. molle*. They therefore represent a hairy variant of *P. polystachyum* (cf. Meissner's (1856), var. *pubescens*). Plants of this sort have been seen by me from Wales (Pembs., Cards. and Merioneth) and from Scotland (Banff), and are indicated along with others on Figs. 9–12. The plant from Woodhall Spa, N. Lincs. (Rev. F. Alston, 1917, **OXF**; 1921, **BM**) must also belong here and not to *P. molle* D. Don as Lousley (1976a) stated, despite the smallness of the perianth.

POLYGONUM CAMPANULATUM HOOKER FIL. (FIGURE 13)

P. campanulatum, a native of the Himalayas and western China (Stapf 1925, Stearn 1969), is the least commonly reported of the species here considered. Attention was drawn to the possibility

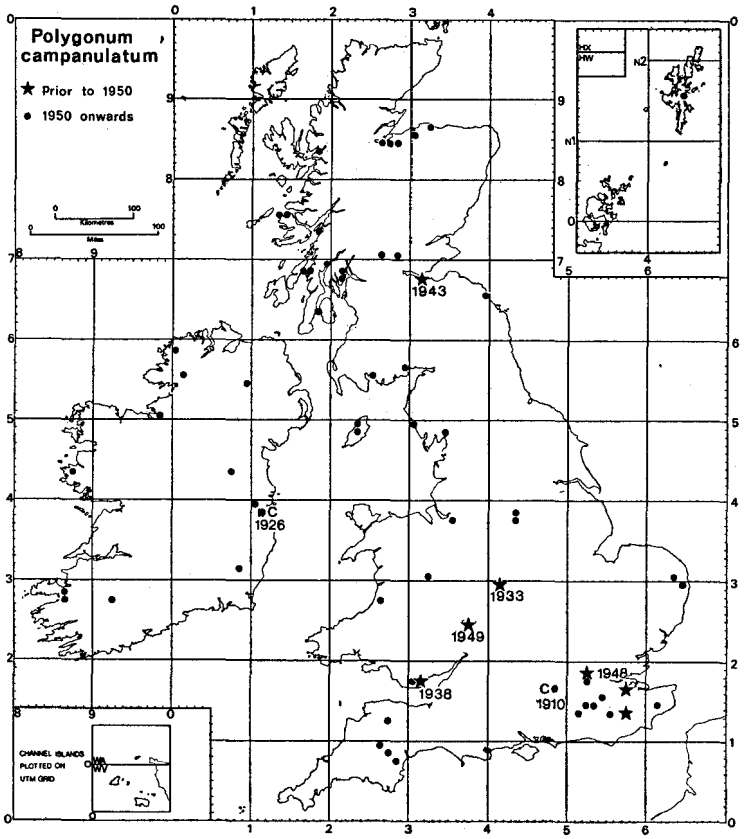

FIGURE 13. Distribution in the British Isles of *Polygonum campanulatum* Hooker fil. Records marked C refer to early cultivated plants. Dates are given for records prior to 1950. Compiled from various sources including the Biological Records Centre.

of this species escaping and becoming naturalized in Britain by Kent (1956a), who gave a short description and mentioned the four records then known to him. The earliest of these was dated 1949, and came from Herefordshire. Later records, like the first four, show randomly and widely separated sites for the incidence of escape or of establishment in wild places from garden outcasts. But doubtless this in part reflects merely the chance location of originally cultivated plants which have long persisted in or escaped from abandoned or untended estates, or else formed the source of jettisoned material, and, in part, the chance location of interested observers.

A specimen collected in 1938 from Maindy Pool, Cardiff, Glam. (**OXF, NMW**), which predates that of 1949 from Herefordshire, is thought by A. E. Wade (G. Ellis *in litt.* 1976) to have been only a casual—a garden throwout and unlikely to have got naturalized before the site was destroyed. This is itself predated, however, by a plant noted by the late R. C. L. Burges from Sutton Park, Warks. in 1933 (Cadbury *et al.* 1971). It has remained at this site. A much earlier record still, made by S. Andrews, comes from Walderslade, near Chatham, W. Kent. It is dated 1917, but there is no specimen (F. Rose pers. comm. 1976). Then in 1943 it was reported from a canal-side east of Ratho, Edinburgh, in 1946 from near Goudhurst, W. Kent (F. Rose pers. comm. 1976), and in 1948 from Kenwood, Middlesex, where it was originally planted but is now naturalized (Kent 1975).

Thereafter, between 1950 and 1959, recorded stands—in hedges, by streams, in fields, in plantations, by roads or lake-sides—are from Bovey-Tracey, S. Devon (1954), near Belstone, N. Devon (1957), Wimbledon Common, Surrey (1952, 1954, 1955, 1960), near Tunbridge Wells, W. Kent (1957) and Westerham, W. Kent (1958) in England. There are also records from Sligo (1952),

Tyrone (1959) and Mid Cork (1958) in Ireland; and from Easterness (1955), S. Ebudes (1957), W. Perth (1954), W. Ross (1953), Nairn (1954) and Moray (1956, 1959) in Scotland.

In the 1960s records came from S. Kerry (1960, 1964), Wexford (1961), Meath (1965), W. Donegal (1966) and W. Galway (two localities, 1966) in Ireland; and from Berwick (1960), Kirkcudbright (1969, but known for nearly 20 years before this), Kintyre (1961), W. Perth (1964), Main Argyll (1968) (Macpherson & Macpherson 1975) and Mull, Mid Ebudes (1968) in Scotland. There are reports too from Cumberland (1960), Westmorland (1965), Cheshire, E. Norfolk (1963) and W. Sussex (since 1966). It was seen in Wales (Cards.) in 1961, but is now lost at that locality (A. O. Chater pers. comm. 1976).

In the 1970s stands have been recorded from Shetland, in two places in the Isle of Man, Dublin (1973), Glam. (1972), Montgomery (1976), Derbys. (1972) and E. Kent. There were also additional localities in the 1960s and 1970s from Surrey, N. Devon, W. Donegal, Main Argyll, Kirkcudbright and Nairn.

The most extensive naturalized stand is that which stretches 'for at least half a mile on the bank of the Camp river', S. Kerry (M. Long *in sched.* 1969, **DBN**).

As yet the records are too few to discern a trend reliably, but the preponderance of western sites, and the scarcity from most of inland England, is perhaps significant. Indeed Synge (1956) said 'hardy or almost so', though others have considered it quite hardy (Irving 1912, Stapf 1925).

Hooker first found this plant (in 1848) and named it *P. campanulatum* in 1886 (Stapf 1925). The first introduction to England (and presumably to Europe) was of seed sent from Calcutta and grown to flower first in 1910 in a garden at Binfield, Berks. (Irving 1912). Jekyll was growing it by 1917 (**BM**) near Godalming, Surrey, and it was grown at Rathfarnham, Dublin, by 1925.

The flowers are dimorphic, as described by Stapf (1925), with long- and short-styled flowers on separate plants, which may account for the reported lack of seed-set. Spread is invariably vegetative, and there is in general little expansion at the site at which thrown-out plants are dumped.

CONCLUSIONS

Of the four aliens considered, two (*Reynoutria japonica* and *R. sachalinensis*) came from Japan, and two (*Polygonum polystachyum* and *P. campanulatum*) from the Himalayas. In the British Isles these species are all of garden origin and only occur outside of cultivation as the result of vigorous vegetative growth, the taking over of abandoned gardens, or after rhizomes have been dumped outside with subsequent establishment and spread. The earliest to be grown, *R. japonica*, introduced in 1825, was observed in London (Chelsea) some 30 years later in 1861, perhaps as an escape; it had begun its 'riotous career' in parks and gardens by 1887 and was already very abundant on waste-ground in southern Wales by 1886 (61 years after introduction). *R. sachalinensis*, first cultivated in Britain in the 1860s, was recorded in Scotland apparently in 1894 and as a long-standing escape in Ireland in 1896, not more than 35 years after introduction. *P. polystachyum* has no precise date of introduction, but it is likely to have been during the latter part of last century; it was in cultivation in 1900 in Edinburgh and in 1904 in N. Hants. Its first record as a well-established escape comes in 1917. *P. campanulatum*, not even described until 1886, was first grown just prior to 1910. The earliest field record is in 1917, less than ten years later. But these differing 'time-lags' may not be significant.

Comparison of present-day achievements by these species shows marked contrasts, but the differing dates of introduction account only in part for the differing present-day coverage. *R. japonica* is now well ahead of the others, and *P. campanulatum* is still only in the pioneer stage, but it is at least as widespread as were *R. japonica* or *R. sachalinensis* at a comparable time. *R. sachalinensis* and *P. polystachyum* are still expanding but are beginning to consolidate. The rate of spread of *R. sachalinensis* has been not unlike that of *R. japonica* but contrasts in the region of its greatest advance. *R. japonica* is much the most naturalized and alone can be said to have 'gone wild', especially in the west from Cornwall to Main Argyll. *P. polystachyum* was strongly established in N. Devon long ago, and is now increasing in western Wales and parts of Scotland. *R. sachalinensis*, though like *P. polystachyum* having begun mainly in the southern half of Britain, has latterly increased greatly in the south-east and is now, unlike *P. polystachyum*, not more prevalent in the west. The effect of a climatic deterrent may be emerging. For *R. japonica* and

P. polystachyum, in contrast, it would seem that the absence of severe frost has always been important to successful naturalization. Differing rates of spread and of frequency will naturally also depend on differing popularity with gardeners, their location and their subsequent desire to get rid of the plants.

Gaps and problems remain—it is hoped that the shortcomings of this compilation will act as an incentive and stimulus to the assembling of further data and, in particular, further investigation into the behaviour and incidence of the sexual variants in *R. sachalinensis* and of the occurrence of hairy-stemmed plants of *P. polystachyum*.

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