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CONTENTS

PRACTICAL SECTION FOR GROWERS

Commercial benefits of the project

It has been said that new cultivars of woody plants are the life-blood of the HNS industry. Novelties can command a premium price, attract the attention of the buying public and stimulate sales in general. In addition, selection for ease of propagation or disease resistance could reduce direct costs, but is outside the scope of the current project.

Background and objectives

The HDC project has sought to exploit the variation that exists in several subjects, including *Sambucus* and *Buddleia* – making various crosses and selecting seedlings with novel combinations of characters that promise to be commercially useful. In the case of *Sambucus*, especially in *S. nigra*, we are trying to combine various leaf forms, leaf colours and growth habits. In the case of *Buddleia*, especially *B. davidii*, the emphasis is on combining compact growth habit with a range of flower colours, including yellow, good scent and foliage.

With the exception of such subjects as Rose and Camellia, little systematic improvement work had previously been undertaken. In many subjects, a range of variants exist in collections or the trade, thanks to sharp-eyed botanists and gardeners selecting interesting forms from the wild or from open-pollinated seedling progenies and such variants provide the raw material for our breeding programmes.

The project was, in effect, a combination of the HDC-funded project HNS 18a and inherited a wealth of promising material from advanced selections to potential parents. The work benefits from complementary genetic research funded by the Ministry of Agriculture, Fisheries and Food (HH1012SHN). Part of this is concerned with resolving genetics of horticulturally important characters, such as leaf form, leaf colour and growth habit, so that the breeding programme can be planned rationally to maximise the chances of combining interesting characters. Another part is concerned with the use of colchicine to double chromosome number, either with a view to

restoring fertility to sterile inter-specific hybrids, thus allowing further crossing, or to equalising chromosome numbers prior to crossing.

Summary of results and conclusions

Release of *Sambucus* 'Black Beauty'

- *Sambucus nigra* 520-80, which has very dark purple foliage and striking pink flowers, was released in 1999. HDC members had placed order for 60,000 plants and these were distributed in March 1999. The launch to the public took place in August. Considerable interest has now been expressed overseas and licensing agreements promise to secure royalty income of more than £50,000 p.a. to be shared between HDC and HRI.

Selections in advanced trial in HNS18b on which decisions are pending (nicknames in double quotes " " are not cultivar names):

- *Sambucus nigra* 389-33 ("Golden Lace"). Perhaps the best selection with golden laciniate foliage. However, can scorch somewhat and maybe needs direct comparison with *S. racemosa* 'Sutherland'. At Sub-Committee's request, HRI-East Malling have undertaken initial propagation, perhaps 20 plants, in case we recommend release as a companion for "Black Lace". The foliage colour of the two contrast strongly and photograph well.

- *Sambucus nigra* 390a-45 ("Tawny Lace"). Perhaps the best selection with tawny (i.e. purple and gold) laciniate foliage, an unusual colour and very bright in early summer. At Sub-Committee's request, HRI-East Malling has initial propagation in hand; around 20 plants in case we decide to release, may be in association with 'Black Lace' and 'Golden Lace'.

- *Sambucus nigra* 595-35 ("Black Lace"). This has been agreed to be, on balance, the best selection with laciniate dark purple leaves. The flowers are a paler pink than some of the siblings also considered, but the foliage is very dark, almost

black, and more finely cut. At Sub-Committee's request, HRI-East Malling has rooted 100 or more softwood cuttings as a basis for launch in 2002.

- *Sambucus racemosa* 327-9 ("Dumpy"). This is very distinctive, forming low mounds about 1 foot high of cut green foliage. The Sub-Committee has agreed it could be released for a 'niche' market, but no further propagation has yet been undertaken.

- *Sambucus racemosa* 327-41 ("Tenuifolia Improvement"). This has finely dissected pale green leaves, but is not as slow growing as 'Tenuifolia'. The Sub Committee has agreed it could be appropriate for a 'niche' market, but no further propagation has yet been undertaken

- *Sambucus nigra* 525-54, 525-56. These selections have mottled, variegated, laciniate leaves. It is debatable whether the variegation is attractive or looks unhealthy. No decision has been reached on which, if either, should be released. They can be reviewed in 2001.

- *Sambucus nigra* 528-4, 528-15, 528-27, 528-75, 528-84, 528a-16. These selections all have purple leaves and a fastigiate growth habit. The inflorescences tend to be congested and are not as showy as in 'Black Beauty', a sibling. The growth habit would be suitable for an informal hedge. No decision has been reached on which, if any, merit release. They can be reviewed in 2001.

- *Buddleia davidii* 364-4 ("White Rocket"). Has narrow, white inflorescences and a compact erect growth habit maybe suiting it for a herbaceous border. No decision has been reached; can review in 2001.

- *Buddleia davidii* 150-65 ("Big Boy"). Has enormous panicles of typical colour, outstanding in 2000. No decision has been reached; can review in 2001.

- *Buddleia davidii* 91-43, 360-32, 362-16, 363-18, 363-43. These all have blue flowers and healthy foliage and in many ways are better than 'Empire Blue'. No decision has been reached; can review in 2001

- *Pieris* 19-A, -29, -37, -38, -51, -55, -60, -64. These have all been selected for resistance to lime-induced chlorosis and for attractive flowers; all are slow growing. No decision has been reached on which, if any, should be released; can review in 2001.

- *Syringa* 219-2, 413-1. These both have golden leaves, and in the case of 413-1 these are pinnatifid. The foliage is very bright in early summer but eventually scorches. No decision reached; can review in 2001.

Less advanced material of *Sambucus, Buddleia*, *Physocarpus*, *Prunus*, *Ribes* and *Syringa*:

- This material is described in the Science Section. Promising selections should be trialled for 2 or 3 years before a decision to release can be made.

Action points for growers

- *Sambucus nigra* 'Black Beauty' (= 'Gerda') was released in 1999. Details had been circulated to all HDC members with an invitation to register interest and then confirm orders. Approximately 60,000 plants were sold in the first year. Any further enquiries should be directed to Margaret Scott, HRI-Efford, Lymington, Hampshire SO41 0LZ (telephone: 01590 673341).

- HDC members are welcome to inspect advanced selections of *Sambucus*, *Buddleia*, *Pieris* and *Syringa* in trial at East Malling that may be worth commercialising. To arrange a viewing, they should contact Ken Tobutt, HRI-East Malling, West Malling, Kent ME19 6BJ (telephone: 01732 843833). They should inform Margaret Scott (see above) of their interest, and also the Chairman of the Plant Breeding Sub-Committee – Chris Saunders, Bridgemere Nurseries Ltd, Nantwich, Cheshire CW5 7QB (telephone: 01270 521125).

- Aspects of the work were reported to growers in HDC's *Project News* No. 36, pp 1-2, No. 57, p. 17, No. 58, p. 6, No. 65, p. 12 and No. 66, pp 16-17, and in *Profit*

from Research – Nursery Stock, September 1998, pp 24-25. In addition, the work was presented to growers at the HDC conference in July 1997 and at the IPPS conference in August 1997.

Practical and Financial Benefits

The work reported is of direct use to nurserymen interested in stocking new lines of hardy nursery stock. As mentioned above, novel items can command a premium, attract the attention of the public and stimulate sales. So far, this is illustrated by the successful uptake of *Sambucus nigra* 'Black Beauty'. In the near future, it is hoped that one or more additional *Sambucus* and *Buddleia* selections, provisionally earmarked for release, will build on the 'Black Beauty' success to the benefit of individual growers taking part in their commercialisation.

In addition, sales overseas, e.g. America, Canada, Scandinavia, Germany, Australia and maybe Japan, are expected to earn substantial royalties for HDC and HRI, which may be used to fund future breeding programmes. Careful thought should be given to the scheduling of overseas markets to avoid damaging the sales of HDC members. To the extent that the royalties exceed the costs of the 'current' programme focused principally on *Sambucus* and *Buddleia*, there will be an opportunity to undertake additional breeding or genetic work aimed at improving the industry's competitiveness.

SCIENCE SECTION

Introduction

Although there is a diverse range of trees and shrubs already available in the trade, the plant breeder, by judicious crossing and selection, can put this existing variation into novel, commercially useful combinations. New cultivars stimulate public interest and boost sales and produce opportunities for exports or for earning royalties from overseas.

The HDC funding supported the genetic improvement of several hardy nursery stock subjects over the five years of the current project, which capitalised on the achievements of its predecessor HNS 18a. Choice of subject and breeding objectives has been discussed periodically with the HDC's Plant Breeding Sub-Committee. Particular progress has been made with ornamental *Sambucus*, in which one selection has now been released commercially and others earmarked for release, and in *Buddleia,* where several interesting selections have entered trial. In addition, work on *Pieris* continued and work on *Ribes, Physocarpus* and *Lonicera* was initiated. The original plan to include *Clematis* was shelved after discussion with the Plant Breeding Sub-Committee in April 1995.

The HDC's project is underpinned by strategic work on the genetics and on the biotechnological improvement of these subjects, funded by MAFF. Genetic interpretation helps with the planning of crosses, e.g. identifying the need to raise a second generation to re-express recessive characters. The biotechnological work helps overcome the blocks in certain breeding lines, e.g. by using colchicine to double chromosome number and restore fertility to sterile hybrids.

Materials and Methods

The following is a slightly idealised account of the materials and methods leading from the parent cultivars to the new release. Actual practice may deviate somewhat from this account.

Parent collection

Cultivars chosen as likely parents are maintained, by the glasshouse staff, as potted plants on gravel beds repotted each year. Some selections are also used in the crossing programme. These selections are usually growing in rows on the seedling plots but, once used for crossing, they are propagated and added to the field genebank. Lists of the cultivars and selections are maintained in a simple database.

Crossing

Crossing, for *Sambucus*, *Buddleia*, *Physocarpus* and *Ribes*, is an intricate process needing careful planning, good eyesight, manual dexterity and patience. From the plant chosen as the pollen parent, flowers about to open are collected and, with fine forceps, the anthers are extracted into a small petri dish. The petri dish is placed in an incubator at 20° for one day for the anthers to dehisce and then stored in a desiccator in a refrigerator until needed. The plant to be used as the female is moved to an insect-proof glasshouse, open flowers having been removed, or else unopened inflorescences are enclosed in insect-proof bags. As flowers approach opening, they are carefully emasculated with forceps and, in some cases, with the aid of magnifying glasses. The pollen from the petri dish is dabbed on to the receptive styles and, in the case of crosses made outdoors, the flowers are re-bagged. On occasions, flowers may be repollinated after about 2 days. A label giving details of the cross is attached. The ripe berries or capsules are collected and brought to the workroom.

Table 1, at the end of Materials and Methods, lists a sample of crosses made during the project. Pedigrees and salient features are given on first mentioning a parent.

Raising seedlings

Seeds are extracted from berries by squashing the fruit in a sieve and washing off the debris and dried. In the case of capsules, the infructescences can be left to dehisce in a paper bag. The seeds are packeted and labelled. Seed sowing, in the case of *Sambucus*, is typically scheduled for winter. The seeds are sown in seed trays of compost, allowed to after-ripen at ambient temperature for one month and then

stratified in a coldstore for three months at 4°C, before being brought to the glasshouse. In the case of *Buddleia*, seed sowing is scheduled for the spring and the stratification period is omitted. When sufficient seedlings have germinated, typically 50 or 100 per family are potted up and grown on. In the case of progenies segregating for leaf colour, seedlings with green leaves may be discarded before potting. Seedlings are planted out in the field in the summer or autumn, with ~1 metre between plants and ~3 metres between rows.

Field assessment

Preliminary records may be taken in the second year. Further records of, e.g., colour and leaf shape, plant habit and flower colour is taken in the third and fourth years and seedlings that may merit trial are noted. Members of the HDC HONS Plant Breeding Sub-Committee may view the seedling plots and help us short-list these for trial. Seedlings meriting trial may be photographed for the record.

Trialling

Seedlings meriting trial are propagated, typically by softwood cuttings in June in the case of *Sambucus* and *Pieris,* by hardwood cuttings in winter for *Buddleia* and by bench grafting in March for *Syringa.* Typically ten cuttings are taken. Those rooting are potted up and, in due course, about three plants per selection are planted in a trial. Until recently, these have been formal replicated trials with the plants set out in rows. More recently, the trials comprise informal 'garden' arrangements of three plants per selection. The trials are monitored year by year. Members of the HDC HONS Plant Breeding Sub-Committee are invited to view the plants and the merits of the various selections are discussed. When a selection is earmarked for possible commercial release, cuttings are taken to establish stock plants; an effort is made to take photographs.

Release

The decision to release is taken by the HDC HONS Plant Breeding Sub-Committee. When the decision to release is taken, propagation proceeds as rapidly as practicable, a

stock plant is chosen for virus testing and an application drawn up for submission for Plant Breeders' Rights. At this stage, the breeders step back and allow colleagues at HRI and HDC to take over, but remain available for providing technical information.

Table 1. A sample of crosses made during the project, including those mentioned in annual reports (descriptions and pedigrees of parents are given when first mentioned)

Sambucus	
611	*S. nigra* 'Plena' (double flower) x 294-3 ('Plena' x 100-7 ['Aurea' x 'Purpurea']) (slightly tawny leaves, heterozygous for double flowers)
604	*S. nigra* 'Fastigiata' (fastigiate habit) x 'Pulverulenta' (variegated leaf)
605	*S. nigra* 390-7 (149-13 ['Laciniata' x 'Aurea'] x 148-2 ['Laciniata' x 'Purpurea']) (tawny laciniate leaves) x 'Fastigiata'
596	*S. nigra* 391-27 (148-31 ['Laciniata' x 'Purpurea'] x 149-13 ['Laciniata' x 'Aurea']) (purple laciniate leaves) x 391-2 (purple laciniate leaves)
736	*S. nigra* 'Linearis' (thread-like foliage) x 326-18 (100-1 ['Aurea' x 'Purpurea'] x 'Guincho Purple') (dark purple foliage on yellow background)
738	*S. nigra* 326-18 x 'Linearis'
735	*S. canadensis* 'York' (large inflorescences, later flowering) x 594-7 (391a-17 [148-31 x 149-13] x 391-27) very dark purple laciniate foliage
792	*S. canadensis* 'York' x 294-12 (*S. nigra* 'Plena' x 100-7) ['Aurea' x *S. nigra* Guincho Purple']) (tawny leaf and heterozygous for double flowers)
804	*S. nigra* 604-14 (heterozygous for fastigiate habit and pulverulent foliage) x 604-10 (ditto)
793	*S. nigra* 605-32 (tawny foliage, heterozygous for laciniate leaf and for fastigiate habit) x 605-47 (ditto)
798	*S. canadensis* 'Aurea' (late flowering, golden leaf) x 310-16 (*S. canadensis* 'Aurea' x *S. nigra* 'Guincho Purple' (tawny)
800	*S. canadensis* 'Aurea' x 310-30
805	*S.* hybrid 209-71 (*S. nigra* 'Guincho Purple' x *S. racemosa* 'Tenuifolia') (purple leaf, heterozygous for dissected foliage) x 294-3
934	*S. nigra* 528-150 (303-4 ['Fastigiata' x 'Guincho Purple'] x 303-21) (purple leaves, dwarf) x 528-156 (ditto)
Buddleia	
639	*B. davidii* 'Dartmoor' (multi-headed, mauve inflorescences) x 'Nanhoensis Alba' (white flowers, compact habit)
635	*B. davidii* 'Dartmoor' x 'Pink Delight' (pink flowers, compact habit)
644	*B. davidii* 'Dartmoor' x 'Black Knight' (dark violet flowers)
637	*B. davidii* 150-361 ('Pink Delight' x 'Nanhoensis Alba') (exceptionally broad inflorescences) x 150-418 (exceptionally broad inflorescences)
641	*B. davidii* 150-65 (exceptionally broad inflorescences) x 150-418
746	*B. davidii* 'Black Knight' x 'Dartmoor'
755	*B. davidii* 'Royal Red' (purple-red flowers) x 'Dartmoor'
751	*B. davidii* 'Pink Delight' x 'Dartmoor'
750	*B. davidii* 'Pink Delight' x *B. heliophila* (fragrant flowers, good foliage)

752	*B. davidii* 'Pink Delight' x *B. lindleyana* (large flowers, late flowering, neat foliage)
759	*B. davidii* 'Nanhoensis Alba' x *B. heliophila*
749	*B. davidii* 'Nanhoensis Alba' x *B. lindleyana*
816	*B. globosa* 2B5C (yellow flowers, tetraploid after colcichine treatment) x *B. davidii* 'Nanhoensis Alba'
Other	
727	*Ribes odoratum* 3272 (yellow, sweetly scented flowers) x *R. sanguineum* 'White Icicle' (long white runners)
733	*R. sanguineum* 'Brocklebankii' (yellow leaves, pink flowers) x 'White Icicle' (long white racemes, green leaves)
730	*R. sanguineum* 'White Icicle' x 'Brocklebankii'
781	*R. rubrum* 'Red Poll' (long strigs) x *R. sanguineum* 'White Icicle'
814	*R. sanguineum* 'White Icicle' x 'Flore Pleno' (double flowers)
928	*R. odoratum* 'Crandall' (yellow flowers) x *R. sanguineum* 'Flore Pleno'
764	*Physocarpus opulifolius* 'Diabolo' (purple foliage) x 'Golden' (yellow leaves)
917	*Lonicera periclymenum* 'Honeybush' (non-climbing) x 'Graham Thomas' (cream flowers)

Results and Discussion

In this section, it is appropriate to focus on selections of interest within the genera *Sambucus, Buddleia* and others.

Sambucus

The selection *S. nigra* 520-180 was earmarked for commercialisation in summer 1996. Coming from the cross 303-4 ('Fastigiata' x 'Guincho Purple') x 303-21 (ditto), it has exceptionally dark purple leaves, presumably because of homozygosity for this character, and pink flowers, but normal growth habit. A few cuttings were rooted and then intensive multiplication started in early 1997 in the Propagation Unit at HRI-East Malling, continuing in 1998 at HRI-East Malling and Efford. Members of HDC were advised by HRI-Efford and HDC for expressions of interest and responses amounted to some 60,000 plants. An application was made for European Union Plant Breeders' Rights by HRI-East Malling with the PBR name 'Gerda'. For commercial purposes, the trademark 'Black Beauty' was adopted. In spring 1999, approximately 60,000 liners were distributed by HRI-Efford to growers. HRI and HDC worked jointly on the marketing, e.g. the former organising labels and point-of-sale boards and the latter the placement of plants with garden journalists. 'Black Beauty' was launched to the UK public in August 1999 and has been well received. Further propagation can be

undertaken directly by growers, subject to payment of a royalty under the scheme operated by BARB. Considerable interest has been expressed from overseas and HRI, acting jointly for HDC and HRI, has begun to set up licensing agreements with reliable propagators. Resulting royalties will be shared between HDC and HRI.

The first garden trial of *Sambucus* selections, planted in January 1997 close to the East Malling staff restaurant, contained 32 selections of *S. nigra*; there are three plants of each, of which two are stooled annually. The selections are: 100-5 ('Aurea' x 'Guincho Purple'), tawny leaves; 312-12 (supposedly *S. canadensis* 'Aurea' x self), tawny leaves; 326-1 (100-1 x 'Guincho Purple'), dark purple leaves; 326-14, dark purple leaves; 389-3 (148-2 ['Laciniata' x 'Guincho Purple'] x 149-13 ['Laciniata' x 'Aurea'], golden laciniate leaves; 389-16, tawny leaves; 389a-18, tawny laciniate leaves; 389a-33, golden laciniate leaves; 390-2 (149-13 x 148-2), golden laciniate leaves; 390-7, tawny laciniate leaves; 390a-15, purple leaves; 390a-45, tawny laciniate leaves; 391-2 (148-31 x 149-13), purple laciniate leaves; 391-20, tawny laciniate leaves; 391-27, dark purple laciniate leaves; 391a-17, tawny laciniate leaves; 391a-32, tawny laciniate leaves; 391a-39, golden laciniate leaves; 427-2 (147-27 ['Aurea' x 'Guincho Purple'] x 100-7), dark purple leaves; 427-4, dark purple leaves; 525-48 (393-4 ['Pulverulenta' x 'Laciniata'] x 393-5); 525-54, variegated laciniate leaves; 525-56, variegated laciniate leaves; 528-4 (303-4 ['Fastigiata' x 'Guincho Purple'] x 303-21), dark purple leaves, fastigiate; 528-15, dark purple leaves, fastigiate; 528-7, dark purple leaves, fastigiate; 528-75, purple leaves, fastigiate; 528-84, purple leaves, fastigiate; 528-180, dark purple leaves, pink flowers; 528-181, dark purple leaves and 528a-16, dark purple leaves, fastigiate.

Also in the garden trial were planted five selections of *S. racemosa*, one to three plants of each. These were: 327-9 (205-1 ['Sutherland' x 'Tenuifolia'] x 205-2), cut leaves, dwarf habit; 327-35, very compact, stiff leaves; 327-41 dissected leaves; 327-87, dissected leaves and 328-1 (205-2 x 205-1), dissected leaves. Three other selections of 327, with golden leaves, provided difficult to propagate.

As already described, selection 528-180 has been successfully released, under the trade name 'Black Beauty'. Repeated observations identified the best golden laciniate selection as 389a-33 and the best tawny laciniate as 390a-45. Soon after the end of

the project, these two were propagated in case the Plant Breeding Sub-Committee should decide to release them, along with a dark purple laciniate selection described later. For the other types of *S. nigra*, such as variegated laciniate and purple fastigiate, no selection was earmarked for possible release and no propagation was undertaken.

Of the *S. racemosa* selections, 327-9, which forms dumpy green cushions of cut leaves, but has not flowered, was identified for possible release as a 'niche' cultivar, but has not yet been propagated. And 327-41, with dissected pale green foliage and slow growing, appeared to be an improvement on 'Tenuifolia'.

The second garden trial, planted in spring 1999, comprised five selections with dark purple laciniate leaves and pinkish flowers from family 595, which resulted from the cross of 391a-32 (148-31['Laciniata' x 'Guincho Purple'] x 149-13 ['Laciniata' x 'Aurea']) x 391a-17. The selections are -2, -8, -13, -23 and -35. Considerable effort went into assessing their relative merits, not only in the trial but also in the original seedling plot. The eventual decision, taken just after the end of the project, in June 2000, was to proceed with 595-35 which, though having rather pallid flowers, has the best foliage, finely laciniate and almost black; the fruits are dark red, not black. Since then, several hundred cuttings have been rooted at HRI-East Malling with a view to 595-35 being launched, with the provisional trade name of "Black Lace" in 2002. It has yet to be decided if it will be launched on its own, or with the golden laciniate and the tawny laciniate selections mentioned earlier.

In the seedling plots there is a range of progenies with further combinations of interesting characters. For example, progeny 804 from the cross of 604-14 x 604-10 (both 'Fastigiata' x 'Pulverulenta') has some seedlings combining fastigiate habit and variegated foliage. However, various progenies were not ready for assessment until after the project finished and received only cursory observation in summer 2000.

Buddleia

The garden trial of *Buddleia* selections, planted in summer 1998, comprised eleven selections, with three plants of each. They are: 91-43 (30-105 ['Royal Red' o.p.] o.p.), powder blue flowers, weeping habit, willow-like foliage; 150-65 ('Pink Delight'

x Nanhoensis Alba), exceptionally broad lilac panicles; 150-361, exceptionally broad lilac panicles; 150-418, exceptionally broad lilac panicles; 250-23 (129-35 [*B. fallowiana* 'Alba' x 'Nanhoensis Alba'] x 'Nanhoensis Alba), broad white panicles and silvery leaves; 262-6 (80-45 [32-13 {Nanhoensis' o.p.} o.p.] x 81-9 [32-16 o.p.]), two-tone purple-red panicles; 360-32 (185 several [31-7 {'Black Knight' o.p.} x *B. fallowiana* 'Alba'] intercross), large blue panicles and healthy foliage; 362-16 (as 360), late flowering with large blue panicles and upright habit; 363-18 (as 360), large blue panicles and healthy, deeply-veined leaves; 363-43, large blue drooping panicles and healthy foliage; and 364-4 (129-19 x 'Nanhoensis Alba'), white flowers and compact, very erect growth.

Little assessment could be undertaken in 1999 as that was the establishment year. The plants flowered well in 2000, after the end of the project. In late July, 150-65, with enormous lilac flowered panicles, was very impressive, and 364-4, with inflorescences resembling white rockets, looked good as a potential border plant.

Selections for a second garden trial were propagated. They comprise 11 multi-headed selections derived from 'Dartmoor', of which the most promising may be 639-24 ('Dartmoor' x 'Nanhoensis Alba'), which has white multi-headed infloresences and compact growth, and two other selections, 637-52 (150-361 ['Pink Delight' x 'Nanhoensis Alba'] x 150-418), with exceptionally broad panicles, and 637-43. The trial was not planted by the end of the project and the plants have remained in pots!

The seedling 649-1 (*B. lindleyana* x 'Nanhoensis Alba'), which resembles a white-flowered version of *B. lindleyana*, appears to be too vigorous for most gardens, but is fertile and could be a useful parent.

There is a range of younger progenies in the seedling plots that were not ready for assessment until summer 2000, after the project had finished.

Four seedlings of the interspecific family 654 (*B. madagascariensis,* yellow-flowered but tender, x *B. heliophila*, pleasant scented and hardy) were raised under glass in light of their possible tenderness. Seedling 65403 flowered, with yellow panicles, but was sterile and was passed to the allied MAFF project for treatment with colchicine. A tetraploid form has been successfully produced which, if it proves fertile, will facilitate introgression of yellow flower colour from a tender into a hardy species.

The tetraploid form 2B5C of the yellow-flowered *B. globosa* that had been raised in the allied MAFF project flowered in spring 1999. It was crossed with the naturally tetraploid *B. davidii* 'Nanhoensis Alba', which the MAFF project has shown is heterozygous for a gene to suppress anthocyanin, to give progeny 816. The resulting seedlings flowered in summer 2000, after the end of the project. Half had yellow-mauve flowers and half had yellow flowers and, excitingly, they were fertile and so can be backcrossed to *B. davidii* to improve panicle shape.

Other

Recording of a trial of various selections from progeny 104 of *Syringa vulgaris* 'Vestale' x *S. pinnatifolia* was concluded. Although the selections had attractive pinnatifid foliage, their inforescences were somewhat smaller and duller than those of garden lilacs and their growth habit tended to be leggy. Moreover, the seedlings of this interspecific cross are sterile and cannot be used directly for further crossing. Selections 104-18 and -25 were passed to the allied MAFF project for colchicine treatment. This successfully doubled the chromosome number, which is expected to restore fertility. The tetraploid forms were grafted on rootstocks in March 2000, but it will not be until they flower, perhaps in April 2001, that their fertility can be assessed.

A second small trial was planted of two more *Syringa* selections, 219-2 ('Aurea' x 'Massena'), which has bright golden leaves and 413-1 ('Aurea' x *S. pinnatifolia*), which has golden pinnatifid leaves.

Recording of a trial of several selections of *Pieris* that may be relatively lime tolerant was concluded. Eight selections, W19-29, -37, -38, -51, -55, -60, -64 and -A, all from 'Debutante' o.p., were shortlisted and propagated in 1997 and planted in a garden trial in spring 1999, along with 'Debutante', 'Forest Flame' and 'Mountain Fire' for comparison.

Prunus hybrid C292-2, from a cross of *P. padus* 'Colorata' (young leaves red) x *P. virginiana* 'Schubert' (old leaves purple), combined these two characteristics and could be worth trialling.

The *Betula pendula* progeny 613 from crossing 'Dalecarlica' (incised leaves) x 'Purpurea' (purple leaves) contained five purple seedlings, but none with incised leaves. The five were planted out so they can be intercrossed in due course with a view to combining incised leaf shape with purple colour.

Progeny 730, *Ribes sanguineum* 'White Icicle' (long white racemes, green leaves) x 'Brocklebankii' (yellow leaves, pink flowers), and 733, the reciprocal, segregated for green-leaved *versus* yellow seedlings, but the latter tended to scorch in the sun. Seedlings of progeny 727, from the cross of *R. odoratum* (yellow flowers) x *R. sanguineum* 'White Icicle' generally died before reaching 6" in height. Cuttings of *Ribes longeracemosum*, a rare species with exceptionally long racemes, were obtained and rooted, but the resulting plants did not flower before the end of the project.

The *Physocarpus opulifolius* progeny 764, 'Diabolo' (purple foliage) crossed with 'Golden' (yellow leaves), segregated into green, purple, yellow and purple-cum-yellow. It remains to be seen if seedlings in this last class are sufficiently distinct from 'Diabolo'.

Conclusions

Regarding the advanced selections, the highlight has been the successful launch of *Sambucus nigra* 'Black Beauty' (= 'Gerda'), selected from a second-generation progeny. This has been a testament to the efforts of the Plant Breeding Sub-Committee in planning the commercialisation and the skill of propagation staff at HRI-East Malling and Efford in raising the plants.

Regarding the youngest material, of particular interest has been the successful raising of a progeny from crossing the tetraploid form of the yellow flowered *Buddleia globosa*, produced in the allied MAFF-funded project, with the naturally tetraploid *B. davidii* 'Nanhoensis Alba', which MAFF-funded work has shown has a gene to suppress anthocyanin. This shows how the HDC and MAFF projects interact successfully, in this case with a view to producing a yellow-flowered *B. davidii* by backcrossing the best hybrids to 'Nanhoensis Alba'.

Between these two there is an extensive range of interesting material, from selections such as the *Sambucus nigra* selection likely to be called 'Black Lace' with dark purple laciniate foliage, and the *Buddleia davidii* selection that may be called 'White Rocket' with white flowers and dwarf, erect growth habit, to seedlings such as those of *Physocarpus opulifolius* combining purple and yellow foliage and those of *Betula pendula*, which, when intercrossed, should give seedlings with dissected purple leaves.

Thus, we are fortunate to have valuable breeding lines in the pipeline, royalty income to fund further breeding work and a complementary MAFF project. A meeting of the Plant Breeding Sub-Committee, planned for summer 2000, but postponed to December 2000, will discuss opportunities for future commercialisation and for continuing the breeding programme.

TECHNOLOGY TRANSFER

The HDC HNS Plant Breeding Sub-Committee met, at HRI-East Malling unless noted otherwise, on 14 April 1995, 10 May 1996, 28 January 1997, 5 June 1997, 1 October 1997, 19 December 1997, 21 April 1998, 28 October 1998 (HRI-Efford), 17 May 1999 and 18 October 1999 (and also on 13 June 2000, after the project had ended) to review progress and/or discuss plans for commercialisation. In addition, various, members of the Sub-Committee visited the plots in the summer months to advise on selections.

HDC reported aspects of the work to growers in *Project News* No. 36, pp 1-2, No. 57, p. 17, No. 58, p. 6, No. 65, p. 12, No. 66, pp 16-17 and in *Profit from Research – Nursery Stock* (September 1998) pp 24-25.

As already described, the release of 'Black Beauty' to the trade took place in 1999, *via* propagation at HRI-Efford and achieved extensive press coverage. Other selections have been short-listed for release and propagation of a *Sambucus* selection with very dark, laciniate leaves, has been initiated for likely release in 2002.

As itemised below, applications were made for EU Plant Breeders' Rights and for a US Plant Patent for 'Black Beauty'; some papers were published and several talks given.

Publications

Rose, J.B., Kubba, J. & Tobutt, K.R. (2000). Induction of tetraploidy in sterile *Syringa vulgaris* x *S. pinnatifolia* hybrids. *Plant, Cell, Tissue & Organ Culture* (in press).

Tobutt, K.R. & Prevette, J.Y. (1996). Breeding ornamental elderberries. *Project News* No. 36:1-2.

Tobutt, K.R. & Prevette, J.Y. (1998). Opportunities for breeding woody ornamentals, with particular reference to *Sambucus*. Combined proceedings of the International Plant Propagators' Society **47**:172-174.

Presentations

Tobutt, K.R. Breeding woody ornamentals, to HDC Committee, at East Malling, July 1995.

Tobutt, K.R. *Sambucus* breeding at East Malling, to East Malling Trustees, East Malling, June 1997.

Tobutt, K.R. Elders and betters – breeding ornamental *Sambucus* at East Malling, to HDC Hardy Nursery Stock Conference, Stoke-on-Trent, July 1997.

Tobutt, K.R. Opportunities for breeding woody ornamentals with particular reference to *Sambucus*, to IPPS Conference, Chichester, August 1997.

Tobutt, K.R. Breeding *Sambucus*, to MAFF staff, East Malling, July 1998.

Prevette, J.Y. Breeding *Sambucus* and other woody ornamentals, at HRI-East Malling Open Day, June 1998.

Tobutt, K.R. Plant Breeding, to students of Capel Manor, East Malling, June 1999.

Plant Breeders' Rights and Patent

K.R. Tobutt & J.Y. Prevette. *Sambucus* 582-180, 'Gerda'. European Community Plant Breeders' Rights application 98/1362.

K.R. Tobutt & J.Y. Prevette. *Sambucus* 582-180, 'Gerda'. US Plant Patent application.

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