FINAL REPORT APRIL 1991

HDC Project No. HNS.18

Plant Breeding: Improved Shrubs and Trees

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Project Leader	:	**K R Tobutt**
Location	:	**Horticulture Research International East Malling**
Project Coordinator	:	**John Hillier**
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Breeding Woody Ornamentals

Ken Tobutt and Jacqui Prevette write about their work at East Malling

For many years East Malling has conducted breeding programmes for various fruit crops, and several of its cultivars, such as the cherry rootstock Colt and the apple rootstock MM106, have proved valuable to the hardy nursery stock industry. In the early 1980s East Malling specifically broadened its interests to include the breeding of woody ornamentals – exploring the natural variation available and recombining it to create new plants.

We wished to cover a range of subjects – shrubs and trees, evergreen and deciduous, flowering and foliage – but wanted to work within our capabilities and to leave alone such genera as *Rosa* and *Camellia* which have already received considerable attention from commercial or private breeders. The principal genera we have worked on are *Buddleia, Malus* (crab apple), *Pieris, Sambucus* (elderberry), and *Syringa* (lilac), and we have also made some crosses with *Berberis, Ceanothus, Corylus* (hazel), *Mahonia* and *Prunus* (peach and cherry).

Objectives vary with the subject. Nurserymen are particularly concerned with ease of propagation, resistance to pests and diseases, and point-of-sale appeal. Customers, less concerned with ease of propagation, welcome compact habit and adaptability. Novelty itself is a useful character, helping to maintain public interest and enhance sales.

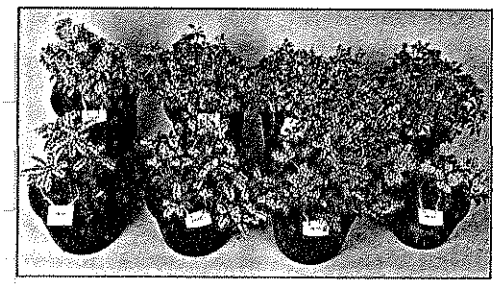
The HDC agreed to fund the project for three years from May 1988, government funding having lapsed the year before. John Hillier, the HDC contact, sought the views of nurserymen on the priorities of various possible lines of research, and the resulting shopping list was very helpful in planning the subsequent work. HDC's support enabled the appointment of Jacqui Prevette to assist Ken Tobutt with the evaluation and propagation of existing material and, where appropriate, with making further crosses and raising seedlings. Now at the end of the three years it is useful to consider what has been achieved.

Pieris

In *Pieris* we have been selecting for resistance to lime.

Before the HDC funding we had sown open pollinated seed from various cultivars in compost supplemented with lime, had potted up the greenest seedlings, again into lime supplemented compost, and had planted out the healthiest, into soil of pH 6.9 to 7.2.

In the last three years we have propagated the best of these and grown them again in lime supplemented compost. We now have a dozen or so promising selections that need final evaluation in the field including 19-65 and 19-72, both derived from the open pollination of Debutante.



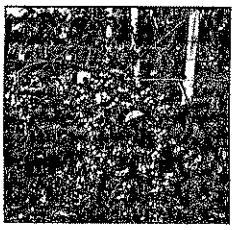
Pieris *selected for resistance to Chlorosis in lime supplemented compost*

Malus

In *Malus* our aim has been to combine disease resistance and weeping habit with a range of other ornamental attributes.

From crosses made before the HDC support, we have selected SA573-14 and have distributed it for off-station trial. It is derived from Red Jade (weeping), Baskatong (red leaves), and SA18-83 (resistant to scab and mildew) and it combines all these characters.

Over the last three years we have crossed it with *M. transitoria* (cut leaves), *M. florentina* (hawthorn-like leaves, very late flowering), Aurea 99116 (yellow leaves), Dorothea (semi-double deep pink flowers) and Red Sentinel (persistent decorative red fruit). Seedlings are screened for scab resistance in the greenhouse, soon after germination, by spraying with a suspension of spores in a humid atmosphere. The resistant seedlings are planted in the field and assessed for mildew resistance, growth habit, and leaf, flower and fruit characters.



Weeping* Malus *selected for disease resistance on unsprayed plot

Buddleia

In *Buddleia* we have concentrated on combining dwarf habit with large inflorescences and bold colours.

Before the HDC support it had been feasible only to raise open pollinated progenies from popular cultivars, select the dwarfest, showiest seedlings for trial, and then raise and select more seedlings from the best of these. Selections 80-45 and 81-9, both derived from Nanhoensis, have now proved to be genuinely dwarf, with violet red and purple red flowers respectively, and are being distributed for outside trial.

Compact* Buddleia *seedling

With the HDC funding we have been able to make various controlled crosses, for example of Nanhoensis Alba (compact habit, white flowers) with Pink Delight (clear pink flowers), Royal Red (reddish purple), Black Knight (deep violet) and *B. fallowiana* Alba (white flowers, grey foliage). *Buddleia* seedlings flower within a year or two of germination and so results are rapid. Not only have we identified a number of promising dwarf selections but we have learnt a lot about the inheritance of flower colour and growth habit.

Sambucus

In *Sambucus* we have been trying to combine some of the variant forms of foliage that occur in various cultivars, to produce a range of subjects with attractive foliage, more resilient than the Japanese maples.

In *S. racemosa*, the European red berried elder, we crossed Sutherland (yellow, cut leaves) with Tenuifolia (finely dissected green foliage, dwarf) in 1989. The resulting seedlings segregated for yellow versus green, but had leaves that were cut rather than finely dissected. So we took two of the yellow seedlings, kept them growing in the glasshouse for as long as possible, gave them an artificial winter in the coldstore, and were able to intercross them in 1990. Now in 1991, the resulting progeny is segregating for very pale versus yellow versus green, and also for cut leaves and vigorous growth versus finely dissected leaves and slower growth. In fact, the leaf type can be predicted accurately on the basis of the shape and colour of the cotyledons. The breeding of woody plants is sometimes thought of as excessively long term but in this case, just two years after the initial cross, we have the second generation from which we can choose, in effect, a golden version of Tenuifolia.

In *S. nigra*, the native black berried elder, we have, at various stages of selection, interesting progenies from crosses between Guincho Purple (purple leaves), Aurea (yellow leaves), Pulverulenta (green and white mottled leaves) and Laciniata (parsley like leaves).

Sambucus *seedlings, from Sutherland x Tenuifolia segregating for leaf colour*

Syringa

In *Syringa* our aim is the improvement of the foliage of the garden lilacs.

Before the HDC funding we had crossed Souvenir de Louis Spaeth and Vestale with *S. pinnatifolia*, a low growing species with pinnate leaves rather like a mountain ash. In the first year from germination the seedlings showed little influence of *S. pinnatifolia*, but in subsequent years the foliage was piannatifid to a greater or lesser extent.

During the HDC contract these progenies have flowered, and we have been able to select four of each and have propagated them for trialling. Not unexpectedly, these interspecific hybrids are sterile and we have treated several with colchicine in an attempt to double the chromosome number and restore fertility, and thus permit further breeding.

Others

We have not neglected the other genera in the HDC contract.

For example, we have crossed *Ceanothus* Snow Flurries (white flowers, evergreen) x *Ceanothus* Marie Simon (pink flowered but deciduous), *Corylus avellana* Contorta (twisted shoots) x *C. maxima* Purpurea (purple leaves), *Berberis linearifolia* Jewel (orange flowers) x *Mahonia japonica* (scented flowers, pinnate leaves), *Prunus* x *Amygdalo-persica* Pollardii (showy flowers) x *P. persica* PC408 (reportedly resistant to leaf curl), and *P. padus* Watereri (exceptionally long racemes) x *P. padus* Colorata (red leaves and pink flowers).

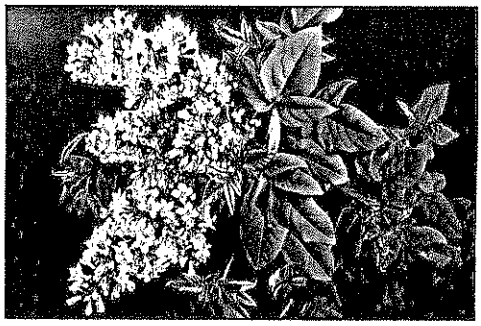
With the exception of the *Ceanothus* we have seedlings from all these crosses.

The future

Limitations of space permit only this brief selective account of some of our promising lines of work. We hope it shows how the plant breeder by choosing parents, making controlled crosses, devising appropriate screening techniques, and selecting the best seedlings for trial can put together useful combinations that otherwise would not exist.

The HDC contract has enabled us to identify various exciting selections with commercial potential, and several thousand seedlings are at less advanced stages of assessment. It has also allowed us to develop a reasonably clear, though still only partial, understanding of the genetic control of such characters as flower colour in *Buddleia* and leaf colour in *Sambucus*, as well as disease resistance in *Malus*. Such genetic information is of great help in planning further crosses.

We are hoping that MAFF will support the strategic, genetic, aspects of this work and that the industry can finance the near market development needed to turn interesting selections into commercial cultivars.



Syringa *hybrid with pinnate leaves*