

Disease-resistant elm cultivars

Butterfly Conservation trials report, 4th revision

2014



Disease-resistant elm cultivars

Butterfly Conservation trials report, 3rd revision, 2013

Contents:

- 1. Abstract
- 2. Introduction
- 3. List of trees
- 4. Comparative phenology
- 5. Performance summary
- 6. The butterfly
- 7. The trees described
- 8. Recommended trees
- 9. Suppliers

1. Abstract

The Hampshire & Isle of Wight Branch of *Butterfly Conservation* (BC) initiated trials of elm cultivars highly resistant to Dutch Elm Disease (DED) in 2000. The trials are in fulfilment of Objective 5 for the White-letter Hairstreak (WLH) in BC's South Central Regional Action Plan: to evaluate their potential as host plants for the butterfly, now a DEFRA UK Biodiversity Action Plan 'Priority' species (no. 945) on account of its increasing scarcity as a consequence of DED pandemic. The trials are believed to be the most comprehensive of their kind in the world. This report, originally published in 2010, has been substantially revised in the light of the 'Princeton' fiasco. 'Princeton', an American Elm cultivar, was widely sold and promoted in the UK without having been tested for resistance to DED in Europe. The loss of many 'Princeton' to DED, notably at Highgrove House, has prompted the exclusion of other American cultivars until such time as their resistance can be proven. More recently, the loss of Morfeo nursery stock to elm yellows, has obliged its relegation, along with the Dutch clones, because of the susceptibility of *U. wallichiana*, their main source of DED resistance, to the same disease. In 2014 a clone, 'Ademuz', of a Spanish *U. minor* with a DED resistance greater than 'Sapporo Autumn Gold' was added to the trial.

2. Introduction

The elm trials are located at three sites in southern Hampshire. The sites feature very diverse ground conditions, from arid rendzinas atop an outlier of the South Downs to waterlogged Brickearths less than 1 m A S L along the shores of Portsmouth Harbour. This report describes 4 of the 9 cultivars with a scientifically proven resistance to DED and elm yellows, and are available in Europe. The resistance of the trees to DED has been determined by the *Institut Nationale pour la Recherche Agronomique* (INRA) in France, and the *Istituto per la Protezione delle Piante* (IPP) in Italy; testing in both instances was by inoculation with unnaturally high doses (inoculum strength 10^6 spores / ml) of the pathogen *Ophiostoma novo-ulmi*.

The BC trials in Hampshire have therefore focussed on:

- Appearance (form / structure, leaf size and shape)
- Phenology
- Rate of growth

and susceptibility to:

- Exposure (wind scorch, branch breakage)
- Drought
- Waterlogging (anoxic soils)

3. List of trees

CULTIVAR ORIGIN

'New Horizon' WARF, Wisconsin, USA 'Plinio' IPP, Florence, Italy 'San Zanobi' IPP, Florence, Italy 'Sapporo Autumn Gold' WARF, Wisconsin, USA

Other cultivars and exotic species were planted, but are not described here on account of their resistance to DED or Elm Yellows in Europe being either sub-standard or, as with most of the American cvs, simply unknown. It is hoped that tests to be conducted by Noordplant, Netherlands, and IRSTEA, France, in 2014 will determine the resistance of the American cultivars, notably the promising 'Patriot'.

CULTIVAR ORIGIN

'Arno' IPP, Florence, Italy

'Columella' Dorschkamp, Wageningen, Netherlands 'Dodoens' Dorschkamp, Wageningen, Netherlands

'Fiorente' IPP, Florence, Italy

'Lewis & Clark' = PRAIRIE EXPED. North Dakota State University, USA

'Morfeo' IPP, Florence, Italy

'Morton' = ACCOLADE Morton Arboretum, Illinois, USA 'Morton Glossy' = TRIUMPH Morton Arboretum, Illinois, USA

'Nanguen' = LUTECE * Dorschkamp, Wageningen, Netherlands

'Patriot' USDA National Arboretum, USA

'Princeton' Princeton Nursery, Princeton, Mass. USA

'Prospector' USDA National Arboretum, USA 'Valley Forge' USDA National Arboretum, USA

'Wanoux' = VADA Dorschkamp, Wageningen, Netherlands

EXOTIC SPECIES ORIGIN

Ulmus davidiana Liaoning Province, China

Ulmus laciniata Sapporo, Japan Sapporo, Japan Ulmus laevis Sapporo, Japan Val d'Allier, France

Ulmus macrocarpa Beijing Botanic Garden, China

^{*}NB Names in capitals are the selling names used in commerce, as opposed to the registered cultivar names which are always written within single inverted commas. Unlike cultivar names, selling names may vary from country to country.

4. Comparative phenology

Another factor of significance is the synchrony of the trees' phenology with the life-cycle of the WLH. The larva emerges from its ovum in mid March in Hampshire, and immediately feeds on the elm flowers, progressing to the seeds, ultimately the leaves. Thus it is of critical importance that the cultivars are in flower at the same time as the native hostplants, such as the Wych Elm *Ulmus glabra*. Below is a simplified plot of the phenology of the cultivars relative to that of the Wych Elm.

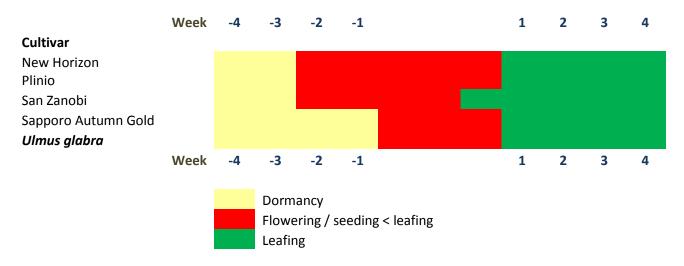


Fig. 1 Elm cultivar phenology compared with Wych Elm Ulmus glabra

As can be appreciated from the table, half the trees begin flowering up to two weeks before *U. glabra* but, significantly, are still in flower when the flowers of *glabra* emerge. The Dutch clones LUTÈCE and VADA flower / seed at the same time as *glabra*, but the leaves do not flush until nearly a month later, although the seeds are retained until that time, and after. It is hoped the significance of these phenological discrepancies to the butterfly can be evaluated in the next stage of the trial. It is worth mentioning however, that the butterfly was successfully, if inadvertently, reared on an exclusive diet of *U. laevis* seeds at an IRSTEA research station in France after young larvae were unwittingly gathered with seed which then was partially dried and placed in storage for several months (E. Collin, pers. comm.).

5. Performance

Only one of the trees died in the trials, for reasons unknown, and one cultivar initially exhibited poor stability and required stake support for several years, while several others grew very slowly and / or exhibited poor structure. All four are hybrid cultivars, with the Asiatic parent *U. pumila* from whom they have inherited their resistance to DED and Elm Yellows. However, environmental conditions in the Far East are, with few exceptions, very different from those experienced in southern England. Typically, winters in the mountains of Asia, where most of the elm species are found, are dry and very cold, whilst summers are short, hot, but wet. A critical aspect of the trials was therefore the assessment of the cultivars' adaptation to a temperate maritime climate. Many of the cultivars also differ in appearance from the European species, often being significantly smaller with uncharacteristic foliage. Ergo: some would not, for all their virtues, look at home in the wider English countryside, and are better retained as ornamentals in the urban environment.

6. The butterfly

The White-letter Hairstreak *Satyrium w-album* is a monophagic species entirely reliant on Elm. Larvae have been very occasionally been found feeding on oak and bird cherry in continental Europe, but these occurrences are regarded as random. Moreover, it is sexually mature elm which is required, as the larvae hatch in mid-March, a number of weeks before the leaves flush, and immediately feed on the elm flowers, progressing to the seeds.

Much encouragement can be found in the fact that the White-letter Hairstreak is endemic to much of the Far East, including Japan, where it thrives on several of the elms used in hybridization in Europe and the USA; the insect is not found in North America however. Although the WLH has yet to colonize the trials trees, as most have only attained sexual maturity since 2008, larvae of other elm-feeding Lepidoptera, notably the Comma butterfly and Buff-Tip moth, have been observed on the trees.



Fig. 2 White-letter Hairstreak larva on elm flower. Photo: Peter Eeles

7. The trees described

The following pages offer illustrated descriptions of the cultivars in alphabetical order. A performance checklist is offered at the end of each page:

'New Horizon'

Hybrid cultivar: *Ulmus davidiana* var. *japonica* × *U. pumila*

Origin: Wisconsin Alumni Research Foundation (WARF); released 1995.





DESCRIPTION

The tree has a compact pyramidal form, with comparatively dense foliage comprising glabrous, dark-green, elliptical leaves < 12 cm long by 7 cm broad, occasionally without the asymmetric bases typical of the genus. The tree increases in height only slowly, while its trunk thickens comparatively quickly. Like its Siberian Elm parent, the crown of 'New Horizon' can suffer <25 % natural twig dieback over winter, seriously disfiguring the tree. Moreover, 'NH' is the most sensitive of all the trees on test to ground conditions, demanding a fertile and free draining soil.

PERFORMANCE

- +++ Stability (resistance to wind rock)
 - + Resistance to exposure (leaf scorch, branch breakage)
 - + Resemblance to native elm
- +++ Suitability for street planting
 - + Rate of growth (ht. max.: 0.13 m p. a., d.b.h.: 0.85 cm p. a.)
- +++ Tolerance of waterlogging (>3 months' inundation over winter)
- +++ Tolerance of drought
- ++ Flowering, fruiting, synchrony with Wych Elm *U. glabra*
- +++ Leafing synchrony with Wych Elm *U. glabra*

Wikipedia: http://en.wikipedia.org/wiki/Ulmus%27New Horizon%27 **ResistantElms:** http://www.resistantelms.co.uk/elms/the-best-of-the-rest/

'Plinio'

Hybrid cultivar: 'Plantyn' × U. pumila

Origin: Istituto per la Protezione delle Piante, Italy; released 2004





'Plinio' on chalk downland



'Plinio' on moist, fertile soil

DESCRIPTION

A Jekyll and Hyde character, forming an ungainly, unsteady tree with splaying branches and an often inadequate root system where grown on fertile soils, whereas on thin, arid chalk soils more substantial roots are stimulated, whilst wind exposure produces a sturdier, bushy tree. The leaves are < 6.5 cm long by 3 cm broad and glabrous on both sides, but devoid of autumn colour.

PERFORMANCE

- ++ Stability (resistance to wind rock)
- +++ Resistance to exposure (leaf scorch, branch breakage)
 - ++ Resemblance to native elm
 - + Suitability for street planting
 - ++ Rate of growth (ht. max.: 0.60 m p. a., d.b.h.: 1.35 cm p. a.)
 - ++ Tolerance of waterlogging (>3 months' inundation over winter)
- +++ Tolerance of drought
 - ++ Flowering, fruiting, synchrony with Wych Elm *U. glabra*.
- +++ Leafing synchrony with Wych Elm *U. glabra*.

Wikipedia: http://en.wikipedia.org/wiki/Ulmus_%27Plinio%27

ResistantElms: http://www.resistantelms.co.uk/plinio/

'San Zanobi'

Hybrid cultivar: 'Plantyn' × *U. pumila*

Origin: Istituto per la Protezione delle Piante, Italy; released 2003.





DESCRIPTION

'San Zanobi' is a moderately fastigiate, tree, the branches gradually becoming pendulous with age. The glabrous, bright green leaves are < 15 cm long $\times < 6$ cm broad. Like its compatriot 'Plinio', the tree lacks striking autumn colours. Widely planted as a street tree in Italy, notably in and around the Villa Medici in Rome.

PERFORMANCE

- ++ Stability (resistance to wind rock)
- +++ Resistance to exposure (leaf scorch, branch breakage)
 - ++ Resemblance to native elm
- +++ Suitability for street planting
- +++ Rate of growth (ht. max.: 0.87 m p. a., d.b.h.: 1.45 cm p. a.)
 - + Tolerance of waterlogging (>3 months' inundation over winter)
- +++ Tolerance of drought
 - ++ Flowering, fruiting, synchrony with Wych Elm *U. glabra*.
 - ++ Leafing synchrony with Wych Elm *U. glabra*.

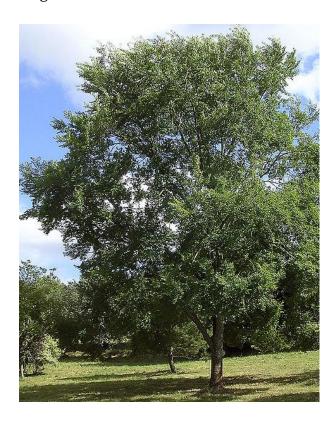
Wikipedia: http://en.wikipedia.org/wiki/Ulmus %27San Zanobi%27

ResistantElms: http://www.resistantelms.co.uk/elms/the-best-of-the-rest/

'Sapporo Autumn Gold'

Hybrid cultivar: *Ulmus davidiana* var. *japonica* × *U. pumila*

Origin: Wisconsin Alumni Research Foundation (WARF); released 1975.





DESCRIPTION

'Sapporo Autumn Gold' forms a densely foliated vase-shaped crown, the structure similar to that of the Field Elm *U. minor*. The leaves are narrowly-elliptical, < 9 cm long by < 4.5 cm wide; as the name implies, the leaves turn pale yellow in autumn. Flowering usually begins when the tree is aged six years. Although the oldest cultivar on trial, it remains one of the most resistant to DED, exhibiting just 2.8% defoliation and 1.2 % dieback after inoculation, and has become the yard-stick by which others are judged. The tree is known to host the White-letter Hairstreak.

PERFORMANCE

- +++ Stability (resistance to wind rock)
- +++ Resistance to exposure (leaf scorch, branch breakage)
- +++ Resemblance to native elm
- ++ Suitability for street planting
- ++ Rate of growth (ht. max.: 0.53 m p. a., d.b.h.: 0.62 cm p. a.)
 - + Tolerance of waterlogging (>3 months' inundation over winter)
- +++ Tolerance of drought
- +++ Flowering, fruiting, synchrony with Wych Elm *U. glabra*.
- +++ Leafing synchrony with Wych Elm *U. glabra*.

Wikipedia: http://en.wikipedia.org/wiki/Ulmus%27SapporoAutumnGold%27

ResistantElms: http://www.resistantelms.co.uk/sapporo-autumn-gold/

8. Recommended trees

Countryside

Sheltered sites with moist, well drained soils: Sapporo Autumn Gold

Exposed sites with arid, chalk soils:

Plinio

Sapporo Autumn Gold

Waterlogged sites with heavy clay soils:

Ulmus laevis

Town

Parks:

San Zanobi

Sapporo Autumn Gold

Streets:

San Zanobi

New Horizon (on fertile, free draining soils only)

9. Bibliography

Brookes, A. (2013). *Great Fontley Elm Trial, 2013 Report.* Butterfly Conservation, Lulworth. Emmet, A. M, & Heath, J. (1989). *The Moths and Butterflies of Great Britain and Ireland, vol. 7.* Harley Books, Colchester, UK

Santamour, F. S., & Bentz, S. E. (1995). Updated checklist of elm (Ulmus) cultivars for use in North America. *Journal of Arboriculture*, 21(3): May, 1995

Santini, A. et al. (2008). Euphytica 163: 45-56. 2008

Santini, A. et al. (2002). HortScience 37(7): 1139-1141. 2002

10. Disease-Resistant Elm Cultivars: Suppliers in or to the UK

'New Horizon'

Hillier Nurseries, Ampfield, Hants Standards www.hilliertrees.co.uk tel. 01794 368733

'Plinio'

Umbraflor, Spello, Italy All sizes www.umbraflor.it

email: umbraflor@pec.it, tel. 00 39 742 315007

'Rebona' (a sister of 'New Horizon' not included in BC trials)

Hillier Nurseries, Ampfield, Hants Standards

www.hilliertrees.co.uk tel. 01794 368733

'San Zanobi'

Umbraflor, Spello, Italy All sizes

www.umbraflor.it

email: umbraflor@pec.it tel. 00 39 742 315007

'Sapporo Autumn Gold'

Ashridge Nurseries, Castle Cary, Somerset Standards

www.ashridgetrees.co.uk/allprods.php

email: info@ashridgetrees.co.uk tel. 01963 359444

Buckingham Nurseries, Buckingham

Bare-rooted whips

www.buckingham-nurseries.co.uk

email: web-enquiries@buckingham-nurseries.co.uk tel. 01280 822133

Chew Valley Trees, Chew Magna, Bristol

30-litre potted trees

http://www.chewvalleytrees.co.uk

email: info@chewvalleytrees.co.uk tel. 01275 333752

Golden Hill Plants, Marden, Kent

20-litre potted trees

www.goldenhillplants.com

email: goldenhillplants@hotmail.com tel. 01622 833218