



A revision of the British elms (*Ulmus* L., Ulmaceae): the historical background

J. V. ARMSTRONG, F.L.S.

*Division of Environmental & Evolutionary Biology, Zoology Building, University of Glasgow,
University Avenue, Glasgow, G12 8QQ*

AND

P. D. SELL, F.L.S.

Herbarium, Department of Plant Sciences, University of Cambridge, CB2 3EA

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The British elms have historically proven to be recalcitrant taxonomically, with at least six different levels of treatment being applied. The taxonomic history of the group and the nomenclature is outlined from the ancient authors up until the present day. This paper is the foundation for future articles in which a novel taxonomic treatment is introduced.

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INTRODUCTION

Ulmus remains one of the most critical genera within the British flora. It exhibits a complex pattern of variation, characterized by the existence of a large number of distinctive forms most of which have proved difficult to classify into biological or Linnean species. As a result, at least six different levels of taxonomic treatment have been applied ranging from the recognition of one species to a multispecies approach, with infraspecific variation being recognized either formally at the varietal or

subspecies level, or in terms of mathematical descriptors. Such diversity of treatment stems from both the immense diversity of form expressed by the British elms, many of which are the putative products of multiple hybridizations, events facilitated by a long history of importation (Richens, 1967, 1983), the lack of internal sterility barriers and the coexistence of sexual and asexual strategies (suckering), and differences in taxonomic procedure. The latter arise from the recognition of taxa based on small subsets of characters (principally vegetative), disagreements over the so-called important taxonomic characters, the imposition of a pre-conceived notion on how the variation should be partitioned, and the premature erection of taxa. All this has left a legacy of taxonomic incalcitrance exacerbated by the vociferous disagreements of the two former elm specialists, R. Melville and R.H. Richens, so that elms are usually overlooked or regarded with despair.

In preparation for the introduction of a novel taxonomic treatment of the genus, the history of the group is reviewed with the aim of unravelling some of the past taxonomic complexities. For such purposes two major groups are recognized, those with large leaves, flower-clusters and fruits, which include *Ulmus glabra*, *vegeta* and *hollandica*, and those with small leaves, flower-clusters and fruits, which include *U. minor*, *coritana* and *plotii*. It is also useful to subdivide the small-leaved trees into those in which the leaves are narrow, *U. minor* and *plotii* and those which are broad, *U. coritana* and *procera*.

THE ANCIENT AUTHORS

The history of elm classification effectively started with the Greek author Theophrastus (1916). He recognized two elms, *πτελεα* [*ptelea*] and *ορειπτελεα* [*oroptelea*], literally elm and mountain elm. From his descriptions and from what is known of Greek elms, it is possible they were both species of small-leaved elms.

The next descriptions of elm species come from the Roman agricultural author Columella. He also described two elms, a native species *umus vernacular* or *ulmus nostras*, propagated by seed and a species from Cisalpine Gaul which he called *ulmus gallica* or *ulmus atinia*, propagated vegetatively. Both these elms are almost certainly small-leaved species. The first confusion was created by Plinius Secundus (Pliny) (1966) who turned Columella's two species into four by treating his alternative names as different elms. For *ulmus vernacular* he substituted *Ulmus sylvestris*. He also mentions the two elms of Theophrastus, designating *πτελεα* as *Ulmus campestris* and *ορειπτελεα* as *Ulmus montana*. Nothing more was done until the Renaissance.

Theodore of Gaza, who translated Theophrastus' botanical works into Latin during the sixteenth century, rendered *πτελεα* as simply *ulmus* and *ορειπτελεα* as *montiulmus*. The Renaissance translators usually referred to *πτελεα* as *ulmus*, but sometimes used Pliny's *ulmus campestris* for *ορειπτελεα*. *Montiulmus* was not accepted and, whereas Pliny's *ulmus montana* was used by some, the name which became most popular was the *ulmus montana* of Ruellius (1536).

THE HERBALISTS

The early herbalists' principal aims seemed to be to identify the elms of the ancient authors rather than actually look at the elms growing around them.

The German botanist Hieronymus Bock (1552) distinguished an elm with a spreading habit, *Ulmus lata*, from one with an erect habit, *Ulmus procera* (not to be confused with *U. procera* Salisb.), but these names soon disappeared from the botanical literature. Nobody has been able to identify these two elms with trees known in the field.

The Flemish herbalist Rembert Dodoens (1554) equated Theophrastus' *πτελεα* with Columella's *ulmus gallica* and said it was the common elm of the Brabant. Later in 1557 he decided Theophrastus' *ορειπτελεα* was in western Flanders. He also recognized a third elm which he thought might be Pliny's *ulmus sylvestris*, and which was known as *herseleer* or *heranteer*, but it was probably either *Carpinus betulus* or confused with it. However, in different editions of his work, his opinions oscillated widely.

Another Flemish herbalist, Mathias de L'Obel (1576) distinguished two elms, the common elm and the broad-leaved elm of western Flanders, probably the same as Dodoens' elm of western Flanders. Whereas Dodoens confused elm and hornbeam, L'Obel seems to have confused elm and lime as the tree he called *Tilia mas* is probably an elm. It was known by the Flemish name *ypeline*, which possibly means elm-lime.

The early English herbalists largely copied Dodoens. Henry Lyte (1578) based his accounts on Dodoens' herbal, but added some fresh details. He concluded that Theophrastus' *ορειπτελεα* also occurred in Picardy where it was known as *ypreau*. Richens (1983: 54) believed the Picardy tree was *Ulmus hollandica*. Lyte said Theophrastus' *πτελεα* was frequent in England, by which he may have meant *Ulmus procera*. Lyte thought Dodoens' third elm was what was known in England as *wych* or *wych hazel*. It could mean Lyte was familiar with *Ulmus glabra* or *U. scabra*.

John Gerard (1597) also based his *Herball* on Dodoens' work. *Ulmus procera* he called simply *Ulmus*, which like Lyte's elm was Theophrastus' *πτελεα*. The *herseleer*, which he said grew in Theobalds Park and Southfleet, he called *Ulmus latifoli*. His description does not allow it to be identified, especially as he too confuses elm and hornbeam.

The central European botanist Caspar Bauhin (1632) made some attempt to clear up the developing nomenclatural confusion by classifying all the European elms into two species, *Ulmus campestris* & *Theophrasti* and *Ulmus montana*. Superficially this seems to divide them into the two major groups we now recognize, but the synonyms suggest each of Bauhin's species is a mixture and probably still includes hornbeam.

The second edition of Gerard's *Herball* (1633) provided for the first time four clearly recognizable elms occurring in England, contributed by Thomas Johnson: (1) *Ulmus vulgatissima folio lato scabro*, which is *U. procera* Salisb.; (2) *Ulmus folio latissimo scabro*, which has received two names, *U. campestris* L. and *U. scabra* Miller; (3) *Ulmus minor folio angusto scabro*, which grew and still grows between Lymington and Christchurch in Hampshire (it has received four names: *U. sativa* Miller, *U. angustifolia* (Weston) Weston, *U. campestris* var. *stricta* Aiton and *U. stricta* var. *goodyeri* Melville); (4) *Ulmus folio glabro*, which grew and still grows to the north-west of North Ockendon. Miller named this tree *U. glabra*, but it is a later homonym of *U. glabra* Huds. It is a distinct species of small-leaved elm.

John Parkinson (1640) took up Johnson's elm names, but renamed the first three *Ulmus vulgaris*, *Ulmus latiore folio* and *Ulmus minor*.

Robert Plot (1677), an Oxford antiquarian, discovered an elm at Hanwell,

Oxfordshire which he named *Ulmus folio angusto glabro*. A specimen collected by Plot is in the British Museum and shows that it is a distinct species of small-leaved elm still found in northern Oxfordshire today. G.C. Druce searched for this species, but the tree he described as *U. plotii* is a different small-leaved species.

Leonard Plukenet (1696), botanist to Queen Mary II, described two new elms. One he called *Ulmus pumila foliis parvis cortice fungosa*, which is probably a small-leaved elm. The other, *Ulmus major hollandica angustis & acuminatis samarris folio latissimo scabro* was later called by Miller, *U. hollandica*.

The French botanist Joseph P. de Tournefort (1700) did not publish any fresh names or observations. He accepted Johnson's four elm species and Johnson's names for three of them, but called *Ulmus vulgatissima folio lato scabro* by Bauhin's name *Ulmus campestris* & *Theophrasti*.

THE EIGHTEENTH CENTURY TAXONOMISTS

Carl Linnaeus first tackled the elms in 1737 when he reduced all of them to one species, with Johnson's four elms as varieties. In his *Species Plantarum* of 1753, where he first used binomials, he had three species. Two of them, *U. pumila* from central Asia and *U. americana* of North America, do not concern us here. All the European elms were lumped under one species for which he used the first part of Bauhin's name *U. campestris*. Melville (1938b) set out all the taxa which at some time or other had been called *U. campestris*, and correctly rejected it as a *nomen ambiguum*. Now that this term is no longer allowed, we have lectotypified *U. campestris* by the specimen in the Linnean herbarium, *Savage Catalogue* 321/1, which is identical with *U. scabra* Miller, and put the name forward for rejection.

The first post-Linnean English botanist to use binomials for elms was William Hudson (1762). He had two species, each with an additional variety. His *U. campestris* is *U. procera* Salisb. and its variety is *U. sativa* Miller. His *U. glabra* is the first name for what we know as the Wych Elm and is clearly the northern tree which is usually known as *U. glabra* subsp. *montana*. The *Ulmus folio glabro*, made a variety of it, was named *U. glabra* Miller which is a later homonym of *U. glabra* Huds. It is a distinct small-leaved species.

The account by Philip Miller (1768) is a most important one and will be dealt with in a separate paper. It is sufficient to say here that *U. scabra*, *sativa*, *minor* and *hollandica* are regarded as the correct names for distinct species, that his *U. campestris* is *U. procera* Salisb. and that his *U. glabra* is a distinct small-leaved species, but is an illegitimate homonym.

The next author to describe new English elms was Richard Weston. His *U. campestris* var. *cornubiensis* (1770) is a distinct small-leaved species. His *U. campestris* var. *angustifolia* (1770), *U. angustifolia* (1775) is identical with *U. sativa* Miller, *U. campestris* var. *stricta* Aiton and *U. stricta* var. *goodyeri* Melville.

William Aiton (1789) has *U. campestris* with five varieties: var. *vulgaris* is *U. procera* Salisb., var. *stricta* is *U. sativa* Miller, var. *latifolia* is *U. scabra* Miller, var. *glabra* is *U. glabra* Huds. and var. *fungosa* is *U. hollandica* Miller.

Richard A. Salisbury (1796) gave us the first name for the English Elm, *U. procera*, a species which was commonly planted in Britain until its untimely demise from Dutch Elm disease.

The German botanist Conrad Moench (1758) described *U. nitens* and *U. suberosa*,

both of which have been recorded as British trees, but these names cannot be used unless they can be typified either by a specimen or by searching in the area from which they were described to see if any trees can be found to fit the descriptions. Certainly, elms having shiny upper surfaces have been found in Britain and identified as such.

Jonathan Stokes (1787) created the name *U. montana*, but it is the same taxon as, and the name is superfluous to, *U. glabra* Huds. *U. glabra* Huds. is usually called *U. glabra* subsp. *montana*; the tree usually regarded as *U. glabra* subsp. *glabra* is *U. scabra* Miller.

THE NINETEENTH CENTURY TAXONOMISTS

John Lindley (1829) made a valuable contribution to the study of the British elms, describing four new taxa. His *U. stricta* is a distinct small-leaved species of Cornwall and Devon allied to *U. campestris* var. *cornubiensis*. *U. stricta* is usually regarded as being based on *U. campestris* var. *stricta* Aiton, but no mention of Aiton's plant (*U. sativa* Miller) is made; its distribution, given as Devon and Cornwall, excludes that of *U. campestris* var. *stricta* Aiton which is confined to Hampshire. The holotype of Lindley's *U. stricta* var. *parvifolia* is identical with *U. campestris* var. *cornubiensis* Weston. The type of *U. glabra* var. *glandulosa* Lindl. is *U. minor* Miller. It is out of its main range, but could have been planted. *U. glabra* var. *latifolia* Lindl. is *U. scabra* Miller. *U. carpiniifolia*, often given as Gleditsch (1773), but correctly as Suckow (1777), appears in the British literature for the first time. It is obviously a small-leaved elm but it needs to be more precisely typified than it was by Melville (1956), before it can be taken up for any particular species.

U. major, named by James E. Smith (1813–14), is identical with, and the name superfluous to, *U. hollandica* Miller. The illustration is an excellent one of this taxon.

J.C. Loudon (1838) published a full account of a whole range of elms, native and foreign. Its importance derives from his close contact with nurserymen such as Masters of Canterbury and Loddiges of Hackney, who were distributing cultivated elms. Although they gave lists of these in their catalogues they did not give descriptions and Loudon did not do much better. In fact, the most important tree he named, *U. campestris* var. *sarniensis*, had no description at all and was not validated until much later. *U. glabra* var. *vegeta* has just about enough description to make it validly published, and it is one of our commonest elms.

The arrangement of elms by Jules E. Planchon (1873) was not helpful, showing poorly defined taxa and much misplaced nomenclature.

George E. S. Boulger (1879) had two broad species groups: *U. montana*, having elliptical fruits with a central position of the seed cavity, and *U. campestris*, having curved-oblong or obovate samaras with an apical seed cavity. Under these species he listed a number of taxa of unknown rank. No further new taxa were reported before the end of the century.

THE TWENTIETH CENTURY TAXONOMISTS

George Claridge Druce set out to discover Plot's elm of 1677, and found instead another distinct elm which he called *U. sativa* var. *lockii* (1907). This he then

transferred to *U. glabra* Miller; and finally, in 1911 he called it *U. plotii* in the mistaken belief it was Plot's elm. He later (1931) published the name *U. anglica* for *U. procera*. Druce's elm taxonomy, like much of his other work on the British flora, was superficial and often unreliable.

In his publication *Notes on British Elms* (1910), Augustin Ley recognized five species plus a number of varieties. The recognition of three species was based principally on fruit characters and he was the last taxonomist to do so. Amongst his species was *U. vegeta*, the Huntingdon Elm, which he elevated to species from the rank of variety, distinguishing it from the Dutch Elm which he called *U. major* Sm. The small-leaved elms he called *U. glabra* Miller, to which he said many varieties could be attached.

In 1913, Henry J. Elwes and Augustine Henry recognized 15 species of elm in cultivation of which six were believed to be native. Important new taxa were two large-leaved trees, *U. mossii* A. Henry and *U. major* var. *daveyi* A. Henry, the former a widespread tree in East Anglia, the latter sporadic in southern England. Both of these are good large-leaved species.

Charles E. Moss (1914) described three new taxa, *U. nitens* var. *sowerbyi* is a rare, small-leaved species of Cambridgeshire. *U. nitens* var. *hunnybunii* is a small-leaved species found in Cambridgeshire, Bedfordshire, Huntingdonshire and Leicestershire. *U. nitens* var. *hunnybunii* subvar. *pseudostricta* has not yet been typified.

B. Lindquist (1930) distinguished two varieties of the suckerless *U. glabra*, var. *scabra* with hairy old twigs and broad, thin acutely serrate leaves, and var. *montana* with almost glabrous old twigs and narrow, thick, obtusely serrate leaves. Var. *montana* had a more northerly distribution than var. *scabra*. We regard these varieties as species, the former *U. glabra* Huds., the latter *U. scabra* Miller. The leaf shape is distinct, the hairiness not so. It is possible *U. glabra* is the most 'pure' of all the elms. *U. scabra* may well be a hybrid between *U. glabra* and one of the small-leaved elms. It is very close to *U. mossii*, which differs somewhat in leaf shape and in having suckers.

Edgar Thurston (1930) says that *U. campestris*, which is what he calls *U. procera*, the English Elm, is abundant in Cornwall. We consider that *U. procera* is rare in Cornwall and that Thurston's tree is another distinct elm.

Arthur R. Horwood (Horwood & Noel, 1933) described *U. elegantissima*. We regard this as a distinct small-leaved elm.

Helen Bancroft (1934, 1935, 1937) made an important contribution to the taxonomy of elms, which was conservative in outlook. *U. procera* Salisb. was used for the English Elm, but the illegitimate *U. montana* replaced *U. glabra*, which she considered to be ambiguous.

Alfred Rehder (1938) critically examined the nomenclature of the elms and proposed a number of new combinations, especially of cultivated varieties. He used the name *U. carpiniifolia* Gleditsch to cover all the suckering elms.

Ronald Melville (1937, 1938a & b, 1939a–d, 1940, 1944, 1946, 1949, 1951, 1953, 1955, 1956, 1960, 1975, 1978 and 1984) contributed many papers on the study of British elms. In his early work he rejected as *nomina ambigua* *U. sativa* Miller, *U. campestris* L. and *U. minor* Miller. He described Goodyear's Elm as *U. stricta* var. *goodyeri*, but later replaced it with *U. angustifolia* var. *angustifolia*, both of which are our *U. sativa*. However, despite having collected the flowers and fruits, these were never described. He then described *U. diversifolia* which he later considered to be a hybrid, but what we regard as a good small-leaved species. Some confusion has been caused by the inadequacy of Melville's description and the selectivity of material for illustration, which has tended to mask the full range of variation within this taxon.

Finally, he described *U. coritana* with three varieties: var. *angustifolia*, var. *media* and var. *rotundifolia*. Var. *media* has to be replaced with var. *coritana* as it contains the type of the species. Melville took up the name *U. carpinifolia* for one of our small-leaved species, but we have rejected it (see p.43). Melville's taxonomic treatment was based firmly on the belief that elms hybridized freely in the British Isles, with past hybridization being responsible for much of the observed variation. He speculated that many taxa were the products of multiple hybrid origins. For example, *U. hollandica* was considered to be a triple hybrid between *U. glabra*, *U. carpinifolia* and *U. plotii*. Throughout the Midlands he considered there to be a nothocline of intergrading forms between *U. scabra* and *U. plotii*, with trees exhibiting a wide range of variation. A single cross between *U. scabra* and *U. plotii* was *U. elegantissima*. The Huntingdon elm, *U. vegeta*, was regarded as a single hybrid between *U. scabra* and *U. carpinifolia*, whilst the Jersey Elm, *U. sarniensis*, was considered to be *U. angustifolia* × *U. carpinifolia* × *U. scabra* × *U. plotii*. Although Melville was fairly consistent in his naming of the elms, he included very widely differing trees under the same name and the distribution and ecology of the taxa makes no sense at all. In addition, Melville's selection of only a few distinctive variants for taxonomic recognition from the many equally distinctive forms is surprising since he was undoubtedly aware of the sheer variety of forms as evidenced by his large collections at Kew, many of which remain undetermined. However, in his revision of the genus, he paid very little or no attention to past treatments. Melville (1937, 1939) also advocated the use of a rather time-consuming rectangular co-ordinate technique for the accurate description of leaf shape.

R.H. Richens (1955, 1956, 1958, 1959, 1960, 1961 a & b, 1965, 1967, 1968, 1976, 1977, 1980, 1981, 1983, 1984) published a long series of papers on the taxonomy of *Ulmus*. One of us, P.D.S., knew Richens throughout the period he was working on elms and frequently discussed their taxonomy with him. His work was almost entirely based on the morphometric study of the first pair of leaves on the short shoots using eight simple characters, although he knew much about the trees themselves in the field. He found that there were a large number of entities which he could distinguish morphometrically, and whenever elms were discussed he always referred to a particular entity growing in a particular area. For this reason P.D.S. discontinued his study of elms in the belief that Richens was on the right track and would eventually give his taxa names. However, despite initially adopting a multispecies treatment, in his monograph (1983) he ultimately recognized only two species, *U. glabra* and *U. minor*, with a hybrid between them, *U. × hollandica*. Under *U. minor* he had four varieties, var. *vulgaris*, var. *cornubiensis*, var. *sarniensis* and var. *lockii* as well as var. *minor*. We have no idea why he should pick out these varieties to give names and leave the many others which are equally or even more distinct. We regard his final treatment more the product of an inability to deal with the large number of distinctive variants based solely on the use of a small subset of characters rather than on taxonomic reality (for a character critique see Melville, 1978). He described one new taxon (1984), *U. × hollandica* var. *insularum*, a distinct large-leaved species.

Richens also wrote two papers with J.N.R. Jeffers (1978, 1985) and one with N.J. Pearce (1984). On his death his large collection of elm leaves, on which he based his statistics, was given by his wife to the Cambridge University Herbarium. Richens believed that *U. minor* (that is all the small-leaved species) was introduced by Man. Some of our species may have been, but many form such natural distributions that we think this is unlikely. Richens' studies should be regarded more as explorations

into population structure, with the aim of describing and mapping the variation encountered, and placing it in a historical and archaeological context.

In the first edition of *Flora of the British Isles* (Clapham, Tutin & Warburg, 1952) seven species of elm — *U. glabra*, *U. procera*, *U. stricta*, *U. coritana*, *U. carpinifolia*, *U. plotii* and *U. diversifolia* — were recognized. *U. glabra* had two subspecies, subsp. *glabra* and subsp. *montana*, and also three varieties, var. *cornuta* (David) Rehder, var. *pendula* (Loudon) Rehder and var. *exoniensis* (C. Koch) Rehder. *U. stricta* had three varieties, var. *stricta*, var. *sarniensis* and var. *goodyeri*. Hybrids were noted between *U. glabra* and *U. carpinifolia*, including *U. × hollandica* var. *hollandica* and var. *vegeta.*, which was said to be a hybrid between *U. glabra* and *U. plotii*. This clearly followed Melville and in our opinion is the best classification of British elms so far published. In the second edition (1962) the species were reduced to three and in the third (1987) to two.

Oliver Rackham (1980), a Cambridge historical ecologist, divided the woodland elms into two broad ecological categories, invasive elms and non-invasive elms. The former category contained suckering elms belonging to both the broad-leaved and narrow-leaved groups of the small-leaved elms and occasionally intermediates between the two. The non-invasive elms contained *U. scabra* and a peculiar and hitherto undescribed group of woodland elms often mistaken for it! The latter elms were described as coppicing, non-suckering, gregarious elms, usually with a spreading habit and divergent twigs. Its leaves were described as smooth, with long petioles and an asymmetrical base. They were said to possess characteristics intermediate between *U. glabra* and *U. minor*, ranging from trees almost indistinguishable from *U. scabra* to those which would be regarded as *U. minor* had they the power of suckering. Rackham proposed the term Lineage elms to describe them. Several of our new species possess these characteristics.

In a later work, Rackham (1986) divided the elms into three historical categories: fashion elms (plantmen's varieties), traditional elms (with a definite, often complex, geographical distribution) and evolution elms (usually small, remarkable local elms different from the other two types). He further proposed a pragmatic taxonomic classification based upon Richens' scheme, in which seven broad groups were recognized, three of which were represented by hybrid groups: (1) the Wych Elm, *U. scabra* aggregate; (2) the English elm group, *U. procera*; (3) the East Anglian or smooth-leaved elms, *U. minor* aggregate; (4) the Cornish and Channel Island elms; (5) intermediates between *U. scabra* and *U. minor*; (6) *U. hollandica*, intermediate between *U. glabra* and *U. procera*; and (7) intermediates between *U. procera* and *U. minor*. Melville's *U. coritana* was placed as a smooth-leaved variant of *U. procera*. The East Anglian group encompassed the traditional and evolution elms of East Anglia, the north-east Midlands and east Kent, and incorporated a wide variety of species. The group was characterized by its narrow, smooth leaves with long petioles and markedly asymmetrical bases. Intermediates between *U. scabra* and *U. procera* were described as rare evolution elms. Intermediates of *U. minor* and *U. procera* were reported at the borders of *U. procera* and *U. minor* territory. They were exemplified by the Long Melford elms, evolution elms which combined the characteristics of the English Elm and East Anglian types.

K.G. Messenger (1990, pers. comm.), in recognition of both the extreme difficulties inherent in elm taxonomy and the devastation brought about by Dutch Elm disease, advocated the adoption of a novel treatment to deal with the variation expressed by British members of the genus. Treating individual variants as clones, and employing mainly juvenile material in his determinations, Messenger proposed

a new system of nomenclature. Seven major groups were initially recognized and each contained a number of subgroups. His material was collected in May or June, later collections being considered indeterminate. We consider this to be too early and that, in concurrence with other authors, material is better collected between mid-June and September. This method of rapid classification of immature hedgerow elms may give some idea of what exists in the English landscape, but scientifically it bears no resemblance to actual taxa and would not have made elm taxonomy easier than any of the previous classifications. At the time of Messenger's death in 1993, it was still in manuscript. Messenger visited a large part of England in his survey and he collected many (though often inadequate) specimens and took a large number of photographs. These have been presented to the Cambridge University Herbarium (CGE).

Clive A. Stace (1991) recognized only four species of elm and eight hybrids. One of the species, *U. minor*, has four subspecies. We believe that the taxa are of unequal composition and need to be subdivided as appropriate.

THE FUTURE

From the foregoing account, it is obvious that the most difficult and almost irresolvable problem which has faced all elm taxonomists is the number of species and infraspecific taxa to recognize. The six levels of taxonomic treatment that have been used are (Richens, 1967):

1. *The one species treatment*: the inclusion of all British and European elms of the section *Ulmus*, with the exclusion of *U. elliptica* Koch, in a single species *U. campestris* L. (1753), a taxonomic treatment adopted by Linnaeus and early workers on the genus.
2. *The two species treatment*: separating *U. glabra* Huds. from the remainder *U. minor* Mill. *sensu lato*, a treatment most recently employed by Richens (1983).
3. *The three species treatment*: the recognition of *U. procera* Salisb., *U. minor* Mill. *sensu lato* and *U. glabra* Huds, a treatment adopted in *Flora Europea* 1 (Turin *et al.*, 1964).
4. *The four species treatment*: *U. elliptica* Koch plus the species of the three species treatment.
5. *The many species and hybrids treatment*: The recognition of six British species — *U. angustifolia* (Weston) Weston, *U. carpinifolia* Suckow, *U. coritana* Melville, *U. procera* Salisb., *U. scabra* Miller and *U. plotii* Druce. This treatment is recommended by Melville.
6. *The micro-species approach*: the recognition of a large number of elms. A treatment formerly advocated by Richens (1959) and now accepted by us.

Elms are unique in the British flora in this respect, and in that they are the subject of two major conflicting taxonomic treatments (Richens and Melville). We believe that all the past treatments have lumped the species together to a greater or lesser extent and that because of this the species are difficult to define and produce no interesting distributions. We have recently re-evaluated the diversity of the British

elms, with the specific aim of producing a workable taxonomic treatment in which the taxa are clearly defined. For the first time all characters are taken into consideration — outline of tree, suckering, bark, branches, terminal as well as lateral leaves, flowers and fruits. How we have produced this classification will be outlined in a later paper.

For the future, more detailed studies need to be made of the distribution of the taxa, as well as DNA studies to determine their evolution. For this it will be necessary to see how they fit in with the elms in Continental Europe.

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REFERENCES

- Aiton W. 1789.** *Hortus Kewensis* 1: London, 319–320.
- Bancroft H. 1934.** Notes of the status and nomenclature of the British elms. *Gardeners' Chronicle* 96: 122–123, 138–140, 208–209, 244–245, 298–299, 334–335, and 372–373.
- Bancroft H. 1935.** The elm problem. *Quarterly Journal of Forestry* 29: 102–106.
- Bancroft H. 1937.** The British elms. *The Journal of Botany (London)* 75: 337–346.
- Bauhin C. 1623.** *Pinax Theatri Botanici*. Basel, 426–427.
- Bock H. (H. Tragus) 1552.** *De Stirpium, maxime eorum, quae in Germania nostra nascuntur*. Strassburg, 1086–1088.
- Boulger GS. 1879.** British elms. *Gardeners' Chronicle* 12: 298.
- Clapham AR, Tutin TG, Warburg EF. 1952.** *Flora of the British Isles*. 1st edn 715–724, 2nd edn (1962), 562–566. 3rd edn (1987), 310–312. Cambridge (E.F.W. replaced by D.M. Moore): Cambridge University Press.
- Davey FH. 1909.** *Flora of Cornwall*. Penryn, 401–402.
- Dodoens R (Dodonaeus). 1554.** *Crüijdeboek*. Antwerp, 800–803.
- Dodoens R (Dodonaeus). 1557.** *Histoire des Plantes*. Antwerp, 527–530.
- Druce GC. 1907.** *Ulmus sativa* Mill., var. *lockii*. *Report of the Botanical Exchange Club of the British Isles* 2: 258.
- Druce GC. 1911.** *Ulmus plotii* Druce. *Journal of the Northamptonshire Natural History Society* 16: 88, 107–108.
- Druce GC. 1931.** Review of H. Gilbert-Carter, M.A. *Our Catkin-bearing Plants. Report of the Botanical Exchange Club of the British Isles* 9: 294–295.
- Elwes HJ, Henry A. 1913.** *The Trees of Great Britain and Ireland*, vol. 7. Edinburgh, 1892–1905.
- Gerard J. 1597.** *The Herball*. 2nd edn. London, 1295–1296. (Revised by Thomas Johnson in 1633).
- Gleditsch JG. 1773.** *Pflanzenverzeichnis*. Berlin, 353–354.
- Hudson W. 1762.** *Flora Anglica*. London, 94–95.
- Horwood AR, Noel CWF. 1933.** *The Flora of Leicestershire and Rutland*. Oxford: Oxford University Press.
- Jeffers JNR, Richens RH. 1970.** Multivariate analysis of the English Elm population. *Silvae Genetica* 19: 31–38.
- Koch KHE. 1872.** *Dendrologie* 2(1): 405–423. Erlangen.
- Ley A. 1910.** Notes on British elms. *The Journal of Botany (London)* 48: 65–72.
- Lindley J. 1829.** *A Synopsis of the British Flora*. London, 226–227.
- Lindquist B. 1930.** Two varieties of north-west European *Ulmus glabra* Hudson. *Report of the Botanical Society and Exchange Club of the British Isles* 9: 785.
- Linnaeus C. 1737.** *Hortus Cliffortianus*. Amstelaedami, 83.
- Linnaeus C. 1753.** *Species Plantarum* Vol.1. Holmiae, 225–226.
- L'Obel, M de (Lobelius) 1576.** *Plantarum seu Stirpium Historia*. Antwerp, 606–607.
- Loudon JC. 1838.** *Arboretum et Fruticetum Britannicum*. Vol.3. London, 1371–1409.
- Lyte H. 1578.** *A Niewe Herball*. London, 751–754.
- Melville R. 1937.** The accurate definition of leaf shapes by rectangular coordinates. *Annals of Botany* 1: 673–679.
- Melville R. 1938a.** Contributions to the study of British elms. I. What is Goodyer's Elm? *The Journal of Botany (London)* 76: 185–192.

- Melville R. 1938b.** Is *Ulmus campestris* L. a nomen ambiguum.? *The Journal of Botany (London)* **76**: 261–265.
- Melville R. 1939a.** The application of biometrical methods to the study of elms. *Proceedings of the Linnean Society of London (Botany)* **151**: 152–159.
- Melville R. 1939b.** Ambiguous elm names. I. *Ulmus sativa* Mill. *Journal of Botany (London)* **77**: 244–248.
- Melville R. 1939c.** Ambiguous elm names. II. *Ulmus minor* Mill. *The Journal of Botany (London)* **77**: 266–270.
- Melville R. 1939d.** Contributions to the study of British elms. II. The East Anglian Elm. *The Journal of Botany (London)* **77**: 138–145.
- Melville R. 1940.** Contributions to the study of British elms. III. The Plot Elm, *Ulmus plotii* Druce. *The Journal of Botany (London)* **78**: 181–192.
- Melville R. 1944.** The British elm flora. *Nature* **153**: 198–199.
- Melville R. 1946.** Typification and variation in the smooth-leaved elm, *Ulmus carpiniifolia* Gleditsch. *Journal of the Linnean Society of London (Botany)* **53**: 83–90.
- Melville R. 1949.** The Coritanian Elm. *Journal of the Linnean Society of London (Botany)* **53**: 263–271.
- Melville R. 1951.** The elms of the Dumortier Herbarium. *Bulletin du Jardin Botanique de l'état Bruxelles* **21**: 347–351.
- Melville R. 1953.** Some historical factors in the distribution of British elms. In: Lousley JE, ed. *The Changing Flora of Britain*. Arbroath: T. Buncle & Co. Ltd, 180–181.
- Melville R. 1955.** Morphological characters in the discrimination of species and hybrids. In: Lousley JE, ed. *Species Studies in the British Flora*. London: T. Buncle & Co. Ltd, 55–64.
- Melville R. 1956.** An early specimen of *Ulmus carpiniifolia* Gleditsch. *Kew Bulletin* **14**: 179–181.
- Melville R. 1960.** The names of the Cornish and the Jersey Elms. *Kew Bulletin* **14**: 216–218.
- Melville R. 1975.** *Ulmus* L. In: Stace CA, ed. *Hybridization and the Flora of the British Isles*. London: Academic Press, 292–299.
- Melville R. 1978.** On the discrimination of species in hybrid swarms with special reference to *Ulmus* and the nomenclature of *U. minor* Mill. and *U. carpiniifolia* Gled. *Taxon* **27**: 345–351.
- Melville R. 1984.** Review of R. H. Richens' *Elm. Watsonia* **15**: 151–152.
- Miller P. 1768.** *Gardeners Dictionary*. 8th edn. London.
- Moench C. 1794.** *Methodus Plantas Horti Botanici et Agri Marburgensis*. Marburg, 333.
- Moss CE. 1914.** *The Cambridge British Flora*. Vol.2. Cambridge, 88–96.
- Parkinson J. 1640.** *Theatrum Botanicum*. London, 1403–1408.
- Planchon JE. 1848.** Sur les Ulmacées. *Annales des Sciences Naturelles: Botanique*. Ser. 3, **10**: 245–282.
- Planchon JE. 1873.** *Ulmus*. In: de Candolle AP ed., *Prodromus Systematis Naturalis Regni Vegetabilis*, vol.17. Paris, 151–163.
- Plinius Secundus. 1966.** *Historia Naturalis*, vol.4. London: Loeb, 434–435.
- Plot R. 1677.** *The Natural History of Oxfordshire*. London, 158–169.
- Plukenet LC. 1696.** *Almagestum Botanicum*. London, 393.
- Rackham O. 1975.** *Hayley Wood: Its History and Ecology*. Cambridge: Cambridge University Press, 84–87.
- Rackham O. 1980.** *Ancient Woodland: Its History, Vegetation and Uses in England*. London: Edward Arnold, 255–281.
- Rackham O. 1986.** *The History of the Countryside*. London: J.M. Dent, 232–247.
- Rehder A. 1938.** New species, varieties and combinations from the collections of the Arnold Arboretum. *Journal of the Arnold Arboretum* **19**: 264–274.
- Richens RH. 1955.** Studies on *Ulmus*. I. The range of variation of East Anglian elms. *Watsonia* **3**: 138–153.
- Richens RH. 1956.** Elms. *New Biology* **20**:: 7–29.
- Richens RH. 1958.** Studies on *Ulmus* II. The village elms of southern Cambridgeshire. *Forestry* **31**: 132–146.
- Richens RH. 1959.** Studies on *Ulmus* III. The village elms of Hertfordshire. *Forestry* **32**: 138–154.
- Richens RH. 1960.** Cambridgeshire elms. *Nature in Cambridgeshire* **3**: 18–22.
- Richens RH. 1961a.** Studies on *Ulmus* IV. The village elms of Huntingdonshire and a new method for exploring taxonomic discontinuity. *Forestry* **34**: 47–64.
- Richens RH. 1961b.** Studies on *Ulmus* V. The village elms of Bedfordshire. *Forestry* **34**: 181–200.
- Richens RH. 1965.** Studies on *Ulmus* VI. Fenland elms. *Forestry* **38**: 225–235.
- Richens RH. 1967.** Studies on *Ulmus* VII. Essex elms. *Forestry* **40**: 185–206.
- Richens RH. 1968.** The correct designation of the European Field Elm. *Feddes Repertorium Specierum Novarum Regni Vegetabilis* **79**: 1–2.
- Richens RH. 1976.** Variation, cytogenetics and breeding of the European Field Elms. (*Ulmus minor* Miller sensu latissimo = *U. carpiniifolia* Suckow). *Annales Forestales Analiza Sumarstvo (Zagreb)* **7**: 107–141.
- Richens RH. 1977.** New designations in *Ulmus minor* Mill. *Taxon* **26**: 583–584.
- Richens RH. 1980.** On fine distinctions in *Ulmus* L. *Taxon* **29**: 305–312.
- Richens RH. 1981.** Elms (Genus *Ulmus*). In: Hora B, ed. *The Oxford Encyclopedia of Trees of the World*. Oxford: Oxford University Press, 150–152.
- Richens RH. 1983.** *Elm*. Cambridge: Cambridge University Press.
- Richens RH. 1984.** *Ulmus* × *hollandica* Miller var. *insularum* Richens var. nov. *Watsonia* **15**: 105–108.
- Richens RH, Jeffers JNR. 1978.** Multivariate analysis of the elms of northern France and England: II. Pooled analysis of the elm populations of northern France and England. *Silvae Genetica* **27**: 85–95.
- Richens RH, Jeffers JNR. 1985.** The elms of Wales. *Forestry* **58**: 9–25.

- Richens RH, Pearce NJ. 1984.** Isoperoxidase variation in *Ulmus* L. *Forestry* **57**: 75–84.
- Ruellius J. 1536.** *De Natura Stirpium Libri tres*. Paris, 370.
- Salisbury RA. 1796.** *Prodromus Stirpium in Horto ad Chapel Allerton Vigentium*. London, 391.
- Smith JE. 1813–14.** *Ulmus major* Sm. In: Sowerby JE, ed., *English Botany*. Vol.36. London, t. 2542.
- Stace CA. 1991.** *New Flora of the British Isles*. Cambridge: Cambridge University Press.
- Stokes J. 1787.** In: Withering W, ed., *A Botanical Arrangement of British Plants*. 2nd edn. London.
- Suckow GA. 1777.** *Oekonomische Botanik*. Mannheim & Lautern, 39–41.
- Theophrastus E. 1916.** *De Historia Plantarum*. Vol.1. *Enquiry into Plants*. London. Loeb Edition. Translated by Sir Arthur Hort. 248–251.
- Thurston E. 1930.** *British and Foreign Trees and Shrubs in Cornwall*. Cambridge.
- Tournefort JP de. 1700.** *Institutiones Rei Herbariae*. Paris.
- Tutin TG, 1964.** *Flora Europaea*. 1st edn. 2nd edn, 1993, vol.1. 76. Cambridge: Cambridge University Press.
- Weston R. 1770.** *Botanicus Universalis*. London, 314–315.
- Weston R. 1775.** *English Flora*. London, 46.