

TILIA

Tilia, Linnæus, *Hort. Cliff.* 204 (1735), *Sp. Pl.* i. 514 (1753), and *Gen. Pl.* 267 (1767); Bentham et Hooker, *Gen. Pl.* i. 236, 986 (1862-7); V. Engler, *Monog. Gatt. Tilia*, pp. 1-159 (1909).

DECIDUOUS trees, belonging to the order Tiliaceæ, with tough fibrous inner bark. Leaves simple, long-stalked, alternate, arranged on the branchlets in two rows; unequal¹ and cordate or truncate at the base; acute or acuminate at the apex; serrate or toothed; venation pseudo-palmate, the midrib giving off secondary nerves pinnately on both sides, the lower two pairs of which arise together at the base, and give off tertiary nerves on the outer side only. Stipules ligulate, membranous, caducous.

Flowers white, fragrant, regular, perfect, in cymes; peduncle connate with the axis of a membranous elongated persistent bract, from the middle of which it apparently arises; inflorescence and bract springing from the axil of a leaf, alongside a bud, which develops into a branch in the following year.² Sepals five, distinct; petals five, imbricate in bud. Staminodes either absent or present as petaloid scales, one opposite each petal, and united with the base of the stamens. Stamens numerous, free, or in five clusters united together at the base. Filaments unbranched, or forked at the apex, with each branch bearing an extrorse half-anther. Ovary sessile, five-celled; style erect, dilated at the apex into five spreading stigmatic lobes; ovules two in each cell. Fruit nut-like, dry, indehiscent, one-celled, and one- to two-seeded by abortion. Seeds obovate, with fleshy albumen. Cotyledons reniform or cordate, palmately five-lobed, raised above ground on germination.

In winter the twigs are zig-zag and bear lateral buds, disposed alternately in two ranks; each bud with two to three scales visible externally, ovoid, obliquely displaced to one side of the semicircular leaf-scar, which is set on a prominent pulvinus. Stipule-scars small, linear or oblong, one on each side of the leaf-scar. Terminal bud absent; a circular scar at the apex of the twig, opposite the uppermost leaf-scar, indicating where the tip of the branchlet fell off in early summer. Base of the branchlet girt with a ring of scars, due to the fall of the bud-scales in the previous spring.

About twenty species of *Tilia* can be distinguished. These are widely distributed in the temperate regions of the northern hemisphere, extending southward in North America as far as the highlands of Mexico; but in the old world, while common in Europe and in northern and eastern Asia, no species is known in

¹ Cf. Van Tieghem, in *Ann. Sci. Nat. (Bot.)* iii. 378 (1906), on the peculiar asymmetry in the leaves and stipules of the lime.

² The occurrence of an inflorescence and a normal bud in one and the same axil is unusual; and is explained by the fact that the former is the result of the very early development of a flower-bud under the first scale of the normal bud, the other scales of the latter remaining dormant until the following season.

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northern Africa or in the Himalayas. A large number of hybrid forms have arisen, some of which are common in cultivation. The following key, based on the characters of the branchlets and leaves, will serve to distinguish the species and hybrids which are cultivated in this country.

I. LEAVES GREEN BENEATH, WITH AXIL-TUFTS OF PUBESCENCE, BUT WITHOUT ANY STELLATE TOMENTUM.

(a) *Axil-tufts*¹ present at the base of the leaf and elsewhere.

* *Branchlets glabrous, or nearly so. Leaves glabrous, except for axil-tufts beneath.*

1. *Tilia mongolica*, Maximowicz. North China and Mongolia. See p. 1679.

Branchlets quite glabrous, reddish. Leaves $2\frac{1}{2}$ in. wide, often trilobed, glaucous beneath with non-prominent tertiary veins, coarsely toothed.

2. *Tilia cordata*, Miller. Europe, Caucasus. See p. 1656.

Branchlets slightly pubescent at first, speedily becoming glabrous. Leaves 2 to $2\frac{1}{2}$ in. wide, bluish green beneath with non-prominent tertiary veins, finely serrate.

3. *Tilia vulgaris*, Hayne. A hybrid, occasionally wild in Europe. See p. 1664.

Branchlets quite glabrous. Leaves 3 in. wide, dull green above, pale green beneath and with prominent tertiary veins, finely serrate with short points to the teeth.

4. *Tilia euchlora*, Koch. A hybrid, occasionally wild in the Caucasus. See p. 1674.

Branchlets usually quite glabrous. Leaves $2\frac{1}{2}$ to 3 in. wide, dark shining green above, pale green beneath and with prominent tertiary veins, finely serrate with long points to the teeth.

** *Branchlets densely pubescent with long hairs.*

5. *Tilia platyphyllos*, Scopoli. Europe. See p. 1661.

Leaves 3 to 4 in. wide, upper surface with short scattered pubescence, lower surface covered with long hairs.

(b) *Axil-tufts absent at the base of the leaf, present elsewhere.*

6. *Tilia americana*, Linnæus. North America. See p. 1685.

Branchlets glabrous. Leaves 5 to 6 in. long and $3\frac{1}{2}$ to $4\frac{1}{2}$ in. wide, broadly ovate, cordate at the base, glabrous beneath and with numerous prominent parallel tertiary veins; margin with long-pointed coarse serrations.

7. *Tilia paucicostata*, Maximowicz. Western China. See p. 1680.

Branchlets glabrous. Leaves $2\frac{1}{2}$ in. long and 2 in. wide; ovate, usually truncate at the base, glabrous beneath with few prominent irregular tertiary veins; margin with long-pointed fine serrations.

II. LEAVES GREEN OR GREYISH BENEATH, WITH SCATTERED STELLATE TOMENTUM.

(a) *Under surface of the leaves without axil-tufts, but with long hairs on the midrib.*

8. *Tilia Moltkei*, Schneider. See p. 1686.

A hybrid, with large leaves similar to those of *T. americana* in shape and serrations. Buds and branchlets glabrous.

¹ These are tufts of hairs at the junctions of the midrib and lateral nerves on the under surface of the leaf, which are now often termed *domatia*; they are the abodes of mites, and serve a useful purpose in the economy of the tree. They were fully studied and described by Lundström, in *Nov. Act. Reg. Soc. Sci. Upsala*, xiii. pt. 2, pp. 3-10 (1887). Cf. Lord Avebury, *Brit. Flowering Plants*, 123 (1905).

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9. *Tilia spectabilis*, Dippel. See p. 1686.

A hybrid similar to *T. Moltkei*, but with smaller leaves, which have long hairs on the principal nerves, as well as on the midrib. Buds pubescent in their upper half. Branchlets with traces of stellate pubescence.

(b) *Under surface of the leaves with axil-tufts.*

10. *Tilia Michauxii*, Nuttall. North America. See p. 1689.

Leaves usually large,¹ 5 to 7 in. in length and 4 to 6 in. wide; ovate-cordate, very oblique at the base, with long-pointed large triangular serrations. Buds and branchlets glabrous.

III. LEAVES WHITE OR GREY BENEATH, AND COVERED WITH A DENSE STELLATE TOMENTUM.

(a) *Branchlets glabrous.*

* *Axil-tufts present.*

- 10A. *Tilia Michauxii*, Nuttall. In some forms of this species the leaves are densely greyish tomentose beneath. See above, No. 10.

* *Axil-tufts absent.*

11. *Tilia heterophylla*, Ventenat. North America. See p. 1688.

Leaves ovate-cordate, very oblique at the base, 4 to 5 in. long, 3 to 4 in. wide, covered beneath with a silvery white tomentum; serrations coarse and short-pointed.

12. *Tilia Oliveri*, Szyszylowicz. China. See p. 1681.

Leaves orbicular-ovate, 3 to 4 in. long, 2½ to 3 in. wide, silvery white beneath; serrations minute, crenate.

(b) *Branchlets pubescent.*

* *Axil-tufts present.*

13. *Tilia Maximowicziana*, Shirasawa. Japan. See p. 1683.

Leaves orbicular-ovate, averaging 5 in. long and broad, covered beneath with a greyish tomentum; axil-tufts and tomentum on midrib and nerves brownish.

** *Axil-tufts absent.*

14. *Tilia tomentosa*, Moench. South-eastern Europe, Asia Minor. See p. 1675.

Leaves orbicular-ovate, 3 to 5 in. across, greyish or snowy white beneath, with stout or slender short petioles; serrations fine, regular, ending in short points. Buds, branchlets, and petioles grey tomentose.

15. *Tilia petiolaris*, Hooker. See p. 1677.

Possibly a sport of *T. tomentosa*, from which it differs in the pendulous habit of the tree, the long slender petioles, and the peculiar fruit.

16. *Tilia mandshurica*, Ruprecht and Maximowicz. Manchuria, North China, Korea. See p. 1682.

Leaves orbicular-ovate, 4 to 5 in. across, white beneath; margin often one- to two-lobed, with coarse serrations, ending in long awn-like points. Branchlets, buds, and stout petioles brown tomentose.

¹ In native specimens the leaves are smaller, averaging 4 to 5 in. long and 3 to 4 in. wide.

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17. *Tilia Miqueliana*, Maximowicz. Cultivated in Japan. See p. 1684.

Leaves remarkably variable in shape, deltoid or ovate, usually much longer than broad, 3 to 4 in. long and 2 to 2½ in. wide, grey beneath; serrations irregular, ending in short points. (A. H.)

TILIA CORDATA, SMALL-LEAVED LIME

Tilia cordata, Miller,¹ *Gard. Dict.* No. 1 (1768); Moench, *Verz. Ausl. Weissenst.* 135 (1785); Schneider, *Laubholzkunde*, ii. 372 (1909); V. Engler, *Monog. Gatt. Tilia*, 74 (1909).

Tilia europaea, Linnæus, *Sp. Pl.* 514 (1753) (in part); Loudon, *Arb. et Frut. Brit.* i. 364 (1838).

Tilia ulmifolia, Scopoli, *Fl. Carn.* i. 374 (1772); Sargent, in *Garden and Forest*, ii. 256, f. 111 (1889).

Tilia parvifolia, Ehrhart, *Beitr. Naturk.* v. 159 (1790); Willkomm, *Forstliche Flora*, 729 (1887); Mathieu, *Flore Forestière*, 29 (1897).

Tilia microphylla, Ventenat, in *Mem. Acad. Sc. Paris*, iv. 5 (1803).

Tilia sylvestris, Desfontaines, *Table Éc. Bot. Mus. Paris*, 152 (1804).

A tree, attaining 100 ft. in height and 20 ft. in girth. Bark smooth and grey on young trees; ultimately on old trunks divided by narrow longitudinal fissures into scaly ridges. Young branchlets green, slightly pubescent at first, speedily becoming glabrous, the pubescence, however, being often retained on short shoots; older branchlets dark brown. Leaves² (Plate 407, Fig. 8), membranous, 2 to 2½ in. wide, usually broader than long, smooth and not wrinkled, cuspidate at the apex, cordate at the base; margin non-ciliate, regularly serrate, the teeth ending in short cartilaginous points; upper surface dark green, shining, glabrous except for occasional long hairs on the nerves; lower surface bluish or glaucous green, glabrous except for the conspicuous dense orange-brown axil-tufts at the base, and at the junctions of the midrib, primary, and secondary nerves; tertiary veins scarcely prominent on the under surface, and more irregular, and less straight and parallel than in *T. vulgaris* and *T. platyphyllos*; petiole about half as long as the blade, slender, glabrous, or with a few scattered hairs.

Cymes directed upwards, five- to seven-flowered; bract long-stalked, glabrous; pedicels glabrous or with a few scattered hairs; sepals pubescent; petals glabrous; stamens about thirty, longer than the petals; staminodes absent; ovary tomentose, style glabrous. Fruit globose, faintly ridged, apiculate at the apex, covered with long scattered tomentum; shell thin and fragile.

In winter the buds are more globose than those of *T. vulgaris* or *T. platyphyllos*, and appear to be composed of two external scales, though the

¹ E. G. Baker, in *Journ. Bot.* xxxvi. 318 (1898), states that Miller's specimen in the British Museum is *T. platyphyllos*; but there is no evidence that this is a type specimen. It is plain from Miller's statement that *T. cordata* "grows naturally in the woods in many parts of England," and from his identification of it with *Tilia foemina, folio minore*, C. Bauhin, *Pinax*, 426 (1671), that he meant the small-leaved lime.

² The leaves on coppice shoots in the first year are remarkably large. Mr. Riddelsdell sent us specimens from Glamorganshire, with leaves 5 to 7 in. long and nearly as broad, coarsely toothed, deeply and narrowly cordate at the base, ending at the apex in a long acuminate point, and on short petioles scarcely an inch in length. As the coppice shoots lengthen year by year, the leaves gradually assume their normal form, small in size, broader than long, and with long petioles. Lees, in *Bot. Worcestershire*, 16 (1867), argues from the variable appearance of the leaves of coppice shoots of *T. parvifolia*, that the common lime is only a variety of the latter. The coppice shoots of most broad-leaved trees have peculiar leaves, different from those in the adult state, and more alike in allied species, so that their discrimination is difficult.

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pubescent tip of a third scale may be discerned at the apex of the bud; the first and second scales are shining, glabrous, ciliate.

This species is readily distinguished by the bluish tint of the under surface of the leaves, which are very different in their tertiary venation from the other common limes. The erect and not pendulous cymes of flowers are also a peculiar feature.

VARIETIES

This species, as limited here to the European and Caucasian small-leaved lime, displays little variation in the wild state, the varieties¹ established by Schneider on the shape and size of the leaf and the amount of the pubescence on the fruit, being probably due to soil conditions, and not worth enumerating. A few peculiar sports have been noticed, none of which appear to be known in England:—

1. Var. *vitifolia*, Schneider, *op. cit.* Leaves three-lobed. Wild in Hungary.
2. Var. *aureo-variegata*, Schneider,² *op. cit.* Leaves variegated with yellow.
3. Var. *cucullata*, Henry (*var. nova*). Similar to the variety so named of *T. platyphyllos*. De Vries, *Species and Varieties*, 355, 669 (1906) and *Mutation Theory*, 470, fig. 106 (1910), draws attention to a tree with peltate and pitcher-like leaves, which is growing at Lage Vuursche, near Amsterdam.

DISTRIBUTION

The small-leaved lime is a native of the greater part of Europe and of the Caucasus, the closely allied forms³ in Siberia, Manchuria, and Japan being now regarded as distinct species. In Europe, it extends from northern Spain to the Ural range, attaining its maximum development in Russia, where it occasionally forms pure woods, but more usually, as is always the case elsewhere, growing as isolated trees or in small groups with other deciduous trees. It occurs as far north as the province of Volgoda, where it disappears after becoming a small shrub at lat. 62°. In the Ural, it reaches as far north as lat. 58° 50'. The finest lime woods

¹ Var. *Blockiana*, Schneider (*T. Blockiana*, Borbas), and var. *ovalifolia*, Spach, with leaves larger and less cordate than usual, are possibly of hybrid origin.

² *Tilia ulmifolia*, Scopoli, var. *foliis variegatis*, Petzold and Kirchner, *Arb. Musc.* 156 (1864), is another name for this variety.

³ The Asiatic forms are distinguished as follows from the European *T. cordata*:—

A. *Tilia sibirica*, Bayer, in *Verh. Z. Bot. Ges. Wien.* xii. 23 (1862).

Tilia cordata, var. *sibirica*, Maximowicz, in *Bull. Ac. St. Petersb.* xxvi. 432 (1860). Indigenous in western Siberia. Not yet introduced. Differs mainly in the leaves, truncate or cuneate at the base, with sharper serrations, and long hairs on the nerves.

B. *Tilia amurensis*, Ruprecht, *Fl. Cauc.* 253 (1869).

Tilia Maximowiczii, Baker, in *Journ. Bot.* xxxvi. 319 (1898).

Tilia cordata, var. *mandshurica*, Maximowicz, in *Mél. Biol.* x. 584 (1880). Indigenous in Manchuria and Korea. Not yet introduced. Differs in the larger leaves, with fewer coarser serrations, which are tipped with long points.

C. *Tilia japonica*, Simonkai, in *Math. Term. Koest.* xxii. 326 (1888).

Tilia cordata, var. *japonica*, Miquel, in *Ann. Mus. Lugd. Bat.* iii. 18 (1867); Sargent, in *Garden and Forest*, vi. 111 (1893), and *Forest Flora Japan*, 20 (1894); Shirasawa, *Icon. Ess. Forest. Japon.* i. text 115, t. 72, figs. 1-10 (1900). Indigenous in Japan, where it is a small tree, rarely higher than 60 ft. It was introduced into the Arnold Arboretum, U.S.A., in 1886, where it is hardy, producing flowers and fruit every year; but is said to be scarcely distinct from the European species. It appears to differ mainly in the flowers, which are 20 to 40 in each cyme, and possess staminodes. Specimens collected by Elwes at Asahigawa in Yezo show no difference in leaves and branchlets.

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in Russia are in the region extending southwards from Kostroma to the edge of the steppe; and here both this species and *T. platyphyllos* grow together. In Norway it is found as a wild tree as far north as lat. $62^{\circ} 9'$ on the west coast, and in Sweden up to $63^{\circ} 10'$ in Angermanland; but according to Schübeler, it thrives when planted as far north as $67^{\circ} 56'$ in Norway, $65^{\circ} 50'$ in Sweden, and 63° in Finland.

It appears to be not a native tree in Belgium, Holland, Denmark, and north-western Germany; and is nowhere very common in central Europe at present, though it is supposed to have been more widely spread in ancient times, as the word linden is very prevalent in German and Slavonic names of places. It is rather a tree of the plains than of the mountains; but it ascends in Bohemia and Bavaria to 2000 ft., and in Switzerland and the Tyrol to 4000 ft. Bolle informed Sargent that very old and enormous trees¹ of this species, one being nearly 23 ft. in girth, exist at Paelitzaerder on the Paarestein lake near Eberswalde.

In France, it is met with in most of the forests of the plains and low hills, except in the departments bordering on the Mediterranean. It is occasionally treated as coppice, being used for firewood and making charcoal. Bast, which was formerly a product of some importance, is now only produced in the forest of Chantilly, nearly all the bast used being now imported from Russia. Mathieu mentions a tree, planted at Gerardmer in the Vosges, which measured 95 ft. in height and 19 ft. in girth, and was supposed to be at least 250 years old.

The small-leaved lime extends southwards to about lat. 41° , occurring in northern Spain, Italy, and the Balkan States; but is unknown in Greece and Sicily. Huffel² says that both it and *T. platyphyllos* are common in the forests of the hills of Dobrudja, Roumania, where they are the dominant trees.

The small-leaved lime is a native of England, ranging from Cumberland southward. It occurs in woods in rather inaccessible positions, where it is a rare tree, and more commonly in coppice, situations in which the indigenous vegetation has often been preserved. Ray³ considered this species to be a true native; and in his time it was frequent and wild in woods and coppices in Essex, Sussex, Lincolnshire, and especially in Bedfordshire, "where there were thousands of lime trees." He adds that it was less common in the Forest of Dean, and rare in Cranborne Chase in Dorset. Many of the local floras give instances of its occurrence, as J. G. Baker⁴ for Yorkshire, who states that it occurs "at Slip Gill near Rievaulx, where aboriginal woods composed principally of oak and hazel cover the steeply-sloping rocky banks of one of the loneliest and pleasantest glens in the eastern calcareous range." Ley⁵ records it for different parts of Herefordshire. Murray⁶ says it is abundant in the Leigh woods near Bristol. It is said⁷ to be wild in several localities in Glamorgan-shire. Bromfield⁸ mentions wild trees in one locality in the Isle of Wight, and in aboriginal woods on the chalk at Bordean Hill, near Petersfield, Hants.

Bromfield supposes that Lyndhurst, in the New Forest, owes its name to the

¹ Bean, in *Kew Bull.* 1908, p. 397, mentions a tree in the Grosse Garten, Dresden, branching close to the ground, where the trunk was about 8 ft. through.

³ *Syn. Meth.* 316 (1696) and *Philos. Letters*, 250 (1718).

⁶ *Flora Herefordshire*, 54 (1889).

⁷ Riddelsdell, in *Journ. Bot. Suppl.* 18 (1907).

² *Les Forêts de la Roumanie* (1890).

⁴ *Flora N. Yorks.* 274 (1906).

⁵ *Flora Somerset*, 64 (1896).

⁸ *Fl. Vect.* 83 (1856).

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prevalence of this species there in ancient times. Limehouse, in London, according to Stowe, was originally called Limehurst, meaning a grove of linden trees in Saxon times. (A. H.)

Some doubt exists among botanists as to whether the small-leaved lime is truly native of England or not. It is not mentioned by Clement Reid as having been found in the fossil state in Britain; and by some it is supposed to have been introduced at an early epoch, perhaps by the Romans. But in some parts of the West Midlands it is found in woods remote from buildings, where one can hardly believe it was planted, so that it might fairly be considered a native but for one important fact. Notwithstanding many inquiries even in the districts where it now seems most at home, I have found no one who has seen a self-sown small-leaved lime. It seems hardly possible that a native tree should have lost its power of reproduction by seed, in a climate where it succeeds so well even as far north as Ross-shire; and in the north of France self-sown seedling limes are not uncommon, as I have myself observed in the Forêt de Retz. The tree has a remarkable power of persistence after repeated cutting, and of extending from stools to a considerable distance; so that in two old coppiced woods on my own property, it is now impossible to say where the stools originated. I have seen limes in remote rocky woods on the Wye valley near Moccas Court, whose stools had the appearance of very great age; and in the deep rocky gorge of Castle Eden Dene, on the coast of Durham, there are limes growing on such steep rocks that they could scarcely have been planted. But though rabbits will eat almost anything before they touch lime, I have searched in vain for seedlings in all these places. On the Carboniferous limestone rocks at Pen Moel near Chepstow, the residence of W. R. Price, Esq., I saw the tree growing in situations where it must have grown naturally from seed; and though Mr. Price has never found ripe fruit he has not the least doubt that it is indigenous here and elsewhere on the cliffs of the lower Wye valley.

E. Lees, in *Botany of Worcestershire*, 16 (1867) gives an excellent account of the occurrence of the lime in that county, where it is, in his opinion, "an undoubted native." He states that Shrawley wood, west of the Severn, which is about 500 acres in extent, is remarkable for a great part of it consisting of an undergrowth of lime, which is regularly cut as coppice-wood, and, therefore, is never in a flowering state.¹ On visiting this place, I agreed with Sir H. Vernon, of Hanbury Hall, near Droitwich, the owner of the wood, that the stools are in rows as though they had been planted; moreover there is not, so far as he knows, any lime in the adjoining woods. He says that this underwood used to be cut every seventeen years, and sent to the Potteries for making crates, but that this demand having ceased, it is now difficult to get rid of. It is now allowed to grow into poles, which are sometimes sold for copper-smelting in the Black Country, at about six or seven pounds per acre for twenty to twenty-five years' growth. In Sir H. Vernon's opinion, it would now pay better to grub the lime and plant larch in its place.

Lees² goes on to state that "Ockeridge wood, near Holt, though in a lesser

¹ Cf. p. 1656, note 2.

² Cf. also Lees' remarks in *Forest and Chase of Malvern*, abstracted in *Gard. Chron.* 1870, p. 1536.

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degree, nourishes the same tree, as well as various coppices on the banks of the Severn between Ombersley and Hawford, where *T. grandifolia* exists in a naturalised state." He mentions "a very old and remarkable pollard tree of *T. parvifolia* at Hawford, on the ridge not far removed from the Severn. The base is more than 40 ft. round and six large boles arise from this in a semicircular manner. In fact, commencing with the border of Wyre forest and proceeding southward, the lime appears in numerous woods, coppices, and old hedgerows, to the very end of the Malvern range near Bromsberrow. The base of the round hills near Alberley, Ockeridge wood, the western base of the Berrow Hill near Martley, the banks of Leigh brook, Rosebury Rock on the Teme, the Old Storridge Hill, the country about Great Malvern, and ancient woods in the parishes of Castle Morton and the Berrow, may be particularly mentioned. Many of the old lime trees get pollarded, and then, in the course of years, put on a very grotesque appearance."

REMARKABLE TREES

The small-leaved lime apparently never attains so great a height in England as the common lime, but is occasionally of great girth and is certainly long-lived. A tree (Plate 372), remarkable for its spreading habit, at Sprowston Hall, Norwich, was figured by Grigor in *Eastern Arboretum*, 200 (1841), where it is stated that it measured 24 ft. 7 in. "near the ground" and was believed to have been planted on 30th January 1649. It still survives in a shattered condition.

There is a remarkably fine tree of this species at The Hall, Thirsk, the seat of Reginald Bell, Esq., who has kindly sent us photographs. In 1904 the trunk in its narrowest part was 20 ft. in girth, and the spread of the branches was about 250 ft. in circumference.

One of the finest small-leaved limes is growing on a flat by the River Teme, at Oakly Park, Ludlow, which, in 1908, as nearly as I could measure it, was about 110 ft. by 14½ ft.

A fine tree, of weeping habit, at Hursley Park, Hants, the seat of Sir G. A. Cooper, Bart., measures about 80 ft. by 15½ ft. Close to it stands the hollow trunk of a much larger tree of the same species, which was blown down some years ago, and measures 19½ ft. in girth. The spread of its branches is said to have exceeded 100 ft.

At Arley Castle, Bewdley, a good specimen measured, in 1903, 85 ft. by 9 ft. 9 in. At Woburn Abbey, the largest tree of this species measures 76 ft. by 7 ft. 4 in., but appears to be still young, as the bark is comparatively smooth.

In Lincolnshire, the tree is not uncommon in parks and hedgerows. In Burghley Park there are several old trees, one of which measured, in 1908, 80 ft. by 11 ft. 4 in. At Casewick House, another was 82 ft. by 9 ft. 6 in. in the same year. At Syston Park there is a fine specimen, which measured 97 ft. by 11 ft. in 1906.

(H. J. E.)

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TILIA PLATYPHYLLOS, LARGE-LEAVED LIME

Tilia platyphyllos, Scopoli, *Fl. Carn.* i. 373 (1772); Sargent, in *Garden and Forest*, ii. 256, f. 109 (1889); Schneider, *Laubholzkunde*, ii. 376 (1909).

Tilia grandifolia, Ehrhart, *Beit.* v. 158 (1790); Willkomm, *Forstliche Flora*, 733 (1887); Mathieu, *Flore Forestière*, 33 (1897).

Tilia pauciflora, Hayne, *Arzn.* iii. 48 (1813).

Tilia corallina, Smith, in Rees, *Cycl.* xxxv. No. 2 (1819).

Tilia mollis, Spach, in *Ann. Sc. Nat.* ii. 336 (1834).

Tilia europæa, Linnæus, *Sp. Pl.* 514 (1753) (in part); Loudon, *Arb. et Frut. Brit.* i. 364 (1838).

A tree, attaining 130 ft. in height and upwards of 20 ft. in girth. Bark at first smooth and grey, ultimately on old stems with narrow shallow longitudinal fissures and ridges separating on the surface into small quadrangular scales. Young branchlets moderately covered with long white hairs; older branchlets glabrescent. Leaves (Plate 407, fig. 6) 3 to 4 in. in width and length, slightly uneven or wrinkled, ciliate in margin, regularly serrate, the serrations ending in short cartilaginous points; upper surface dull green, covered with short pubescence; lower surface lighter green, covered with long whitish pubescence, densest on the midrib, nerves, and veinlets, and forming dense axil-tufts at the base of the blade and at the junctions of the primary nerves with the midrib and with the secondary nerves; tertiary veinlets parallel and prominent on the under surface; petiole stout, shorter than the blade, whitish pubescent.

Flowers in pendulous, usually three-flowered cymes; about $\frac{1}{2}$ in. in diameter, yellowish-white; sepals slightly pubescent externally, downy within; petals oblanceolate, longer than the sepals; stamens about thirty, longer than the petals; staminodes absent; ovary globose, tomentose; style glabrous. Fruit globose, pyriform, or ovoid, usually¹ with three to five prominent ribs, tomentose, apiculate at the apex; shell woody and hard.

In winter this species may be recognised by the twigs being slightly pubescent near the buds, which are minutely pubescent at the tip and show externally three glabrous ciliated scales.

VARIETIES

This species in the wild state varies considerably in the amount of pubescence on the leaves, branchlets, and petioles; and has been subdivided into five subspecies by Schneider, who acknowledges, however, the great difficulty of limiting them clearly. The most pubescent forms occur in northern Germany, northern France, and Scandinavia; while nearly glabrous forms are found in southern France, Austria, and the Balkan States. V. Engler disagrees with Schneider's classification; and considers that the limes occurring in southern France, the Pyrenees, Italy, etc., should be united with *T. caucasica*; but this view is hardly tenable. The bract is stalked in most cases, but is occasionally sessile; and abnormal forms occur

¹ A tree at Kew of undoubted *T. platyphyllos*, bore fruit in 1907, on which no trace of ribs was perceptible.

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(var. *multibracteata*) in which two bracts are borne on one peduncle. The fruit is remarkably variable, both in shape and in the prominence of the ribs.

The southern more glabrous forms are rarely cultivated in England, the only specimen which I have seen being a tree at Kew about 25 ft. high, which is named var. *obliqua*.¹ The branchlets are nearly glabrous; leaves very oblique and truncate at the base, glabrous above, with scattered pubescence below. It bears flowers similar to those of the type.

A large number of sports have arisen both under cultivation and in the wild state, the most noteworthy of which are:—

1. Var. *pyramidalis*, Simonkai, in *Math. Term. Koezl.* 334 (1888). Pyramidal in habit; leaves usually more or less cordate at the base. According to Schneider this is occasionally wild in south-eastern Europe.

2. Var. *tortuosa*, Bean, in *Kew Hand-list Trees*, 71 (1902). A peculiar sport, with all the twigs and branches twisted and curved. This² originated in the Royal Horticultural Society's garden at Chiswick in 1888 as a single specimen out of a bed of 500 large red limes. Grafts were sent to Kew from Chiswick in 1890, and three trees about 18 ft. high survive, in the Lime collection.

3. Var. *aurea*, Loudon (var. *aurantia*). Twigs golden yellow.

4. Var. *corallina*, Solander, in Aiton, *Hort. Kew.* ii. 229 (1789). Twigs bright red. Both these varieties are conspicuous in winter, and have been known for more than a century. According to Koch they were probably introduced from England to the Continent. The latter is the red-twigged lime of some English nurseries.

5. Var. *laciniata*, Loudon (var. *asplenifolia*, var. *filicifolia*). Leaves smaller than in the type, deeply and irregularly cut and twisted. This never attains a large size,³ and is only suitable for planting as a curiosity in gardens. It commonly throws out branches on which the foliage is normal.

6. Var. *vitifolia*, Simonkai, *op. cit.* Leaves lobulate or weakly three-lobed.

7. Forms with variegated leaves are known, as var. *albo-marginata*, Van Houtte.

8. Var. *cucullata*, Schneider (*T. cucullata*, Jacquin,⁴ *Frag. Bot.* 19, t. 11, f. 3 (1800)). A form with small leaves, of which the edges of the two sides are joined together at the base, making the leaf pitcher-shaped. It is said to occur wild in southern Bohemia, where, according to Willkomm, there are some old trees, with all the leaves showing this peculiarity, at the monastery of Goldenkron, near Krumau.

DISTRIBUTION

This species is widely distributed throughout central and southern Europe, extending as far eastward as the Ural Mountains. Its northern limit as a wild tree is not known with certainty, and Willkomm considers it not to be indigenous in

¹ Probably identical with *T. obliqua*, Host, in Schmidt, *Oestr. Baumz.* iv. t. 224 (1822), and Host, *Fl. Austr.* ii. 62 (1831). The Kew tree agrees with a dried specimen collected in Host's garden in 1832.

² Cf. *Gard. Chron.* iv. 708 (1888).

³ A. B. Jackson saw a tree at Blenheim, 40 ft. by 3½ ft., in 1908.

⁴ Jacquin figures leaves from trees in a cemetery at Sedlitz, near Kuttenberg in Bohemia. Leneck, in *Mitt. Nat. Ver. Univ. Wien*, 1893, pp. 19-29, figs. 1-11, gives an account of these abnormal leaves; and records a large-leaved lime growing at Leitmeritz in northern Bohemia, of which 20 to 30 per cent of the leaves were pitcher- or cowl-shaped. Cf. Just, *Bot. Jahresh.* xxii. pt. 2, p. 219 (1894).