considerable expense to bring into bloom at that time of year.—J. C. B.

Violets being universal favorites, perhaps a few notes on their cultivation as practiced here—differing as it does somewhat from the orthodox mode, on account of what may be called adverse conditions to their free growth, or soil being hot and stony—may be acceptable. I will briefly treat on the doubles first, these being grown here in greater numbers than singles and more admired, notably Marie Louise. In the kitchen garden, an open quarter which has been occupied during the summer with crops that had received good cultivation and liberal treatment is selected in the autumn when vacant. This is bastard dug and left as rough as possible until the middle of March or beginning of April, according to the state of the weather. When in a condition to work freely, it is lightly forked over, at the same time adding a liberal dressing of manure, afterward making the soil firm and level. I then look over the stock of plants in the pits in which they were wintered, and select well rooted, strong runners, which by this time have formed solid crowns, quite sturdy plants in miniature. Should an insufficient number of the kind of runners recommended be not forthcoming, recourse might with advantage be had to the division of the old plants, selecting the freshest and strongest crowns, generally found on the outside of the clumps. I am not much in favor of cuttings, only as a means to the more rapid increase of the stock. These are planted carefully with a trowel, 9 inches apart each way over the whole ground, making all firm as we go along. In a short time, say a month or so, the plants commence rooting freely in their fresh quarters, but make little top growth. The ground is mulched, completely burying the crowns, leaves, and all with leaf mould or any light material at hand, through which as growth progresses the leaves easily grow. I consider mulching, at this stage, very important, keeping, as it does, all clean and moist until a strong root hold, able to meet and respond to the call for the abundant feeding necessary to develop to the full extent the leaves and blooms during later growth, is established. To this, at least, I chiefly attribute the splendid growth of leaf and bloom we generally get here. As growth appears through this mulching, when time and means permit, a thorough soaking of diluted house sewage is occasionally given, with during showery weather a sprinkling of some artificial manure, as I contend that upon the ability of the plant to take up and utilize summer feeding mainly depend the quality and quantity of autumn and winter bloom. During the growing season the long straggling runners are cut out, leaving the close at home ones for winter bloom and stock. Careful hoeing and weeding complete the summer's routine of their cultivation.

In October it becomes necessary to lift and remove to the winter quarters—structures to which abundance of light and air has access. Ours are sunk pits, with a foot in height of concrete above the ground level, on which the lights are placed—rather primitive structures perhaps; nevertheless well suited for the purpose here, for being so low, the lights are not so liable to be blown away by the winter's storms, and the plants are easily protected during severe weather. In these the plants—now fine clumps bristling with blooms and buds—are placed, in rather light soil and about six inches from the glass, and as close together as the bulky roots admit. The whole is then given a soaking of clear water to wash flowers and leaves and settle the soil among the roots.

For a week or two after removal, a diligent picking of any leaves that damp has attacked is done, keeping off the lights, except in very wet or severe weather. Beyond this, an occasional watering when dry and a syringing overhead at times to assist the blooms to open more kindly during unfavorable weather, and so keep red spider at bay, are about all the winter treatment given. I would here like to give a word of warning as to watering during the winter season, and would strongly advise this being done with clear water, or if liquid is given, it should be very weak, or the newly expanded blooms will smell of whatever manure water is used. The foregoing notes apply chiefly to the cultivation of Marie Louise and the more delicate and weaker growing doubles. Singles and strong growers require more space between the plants and not quite such a rich larder, but runners of these ought also to be planted annually. With us, singles under glass are a comparative failure, but do well out of doors, producing a few blooms during the winter and abundance in the spring, with plenty of leaves at all times—most useful for bunching the doubles. I only grow four varieties—three doubles and one single. Marie Louise, unequalled in all points, and invaluable for supplying our heavy and constant demand. Comte de Brazza is the best white, being free in growth and flowering, but, strictly speaking, only a spring bloomer. Victoria produces magnificent blooms of good color—dark blue—in spring only; a very weak grower here, but grown in limited quantity for the sake of variety and the few extraordinary blossoms. Odoratissima is our only single.

To those who may be similarly situated in the matter of unsuitable soil, etc., I would strongly recommend them to plant early and annually on well cultivated ground in an open, sunny position, thus insuring well ripened crowns. Treat liberally, mulch early and thoroughly; cut close long straggling runners, but allow reasonable latitude to the short ones, as they will be useful hereafter for bloom and stock. By so doing success can reasonably be expected.—J. R., Merioneth. —The Garden.

THE SILVER MAPLE.

THE silver maple is one of the largest and most beautiful trees in a genus peculiar for the beauty of its species. To many people, perhaps, who know it only as a shade or street tree, the silver maple does not always appear to be a handsome or desirable tree. Planted, as it has been very generally, for such purposes, it often has a weak and overgrown appearance, as if it had outgrown its strength; the branches are brittle and easily broken by wind and snow, the foliage is often thin, and the leaves fall early. This is the silver maple to people who know it in towns only and who see a tree in the wrong place, and where all the conditions are unfavorable to the development of its beauty. There are trees, like the scarlet maple, the river birch

and our Eastern larch, which seem to flourish as well when they are placed in unnatural conditions of soil and surroundings as in the situations in which they grow naturally, and which thrive as well on a hillside as in their native swamps. The silver maple is more fastidious. Unfortunately, it grows very rapidly, and even in unfavorable situations few trees will attain a greater height or a thicker stem in the first forty or fifty years of their existence. It is this rapidity of growth that has made the silver maple a favorite with people who are in a hurry to obtain immediate effects, and do not care to look very far ahead; and at one time it was planted in the Northern States, especially in cities and their suburbs, in immense numbers, without much regard being paid to the fitness of the position selected for it.

The silver maple is an inhabitant of low, sandy river banks, and it is on river banks only or in low meadows that it displays its beauty; and the lover of trees, if he would see it at its best and would realize what the silver maple becomes when all conditions favor it, should float down one of the large streams which flow into the tributaries of the lower Ohio. Here may be seen the river forests of the Mississippi basin in their full richness and beauty, and maple trees unequalled in majesty and grace by those of any part of the world. In the rich alluvial soil which forms the low banks of such streams, the silver maple rises sometimes to the height of a hundred and twenty feet, with a trunk three or four feet in diameter. Ten or fifteen feet from the ground this divides usually into three or four stout, upright, secondary stems, which are destitute of branches for a considerable height above the division of the main trunk and then ultimately separate into many slender branches with slender, pendulous branchlets, the whole forming a wide and majestic head. The bark of the trunk on the old trees is bright reddish brown, more or less furrowed by deep longitudinal fissures, while the surface separates easily into large thin scales. On trunks of young trees and on the branches of old ones the bark is quite smooth and light gray, faintly tinged with red. The young branchlets are bright chestnut brown, with a smooth and lustrous surface, and are marked with large, pale spots. The winter buds are rather small and are covered with bright red, imbricated scales, with a conspicuous fringe of pale hairs on the margins. The ample leaves are often six or seven inches in length, rather less in width, and are deeply five-lobed by narrow sinuses, with acute, irregularly toothed divisions, the middle division being often larger than the others and somewhat lobed. They are thin and membranaceous, and borne on long, slender, bright red petioles they dance with the slightest breath of wind, displaying in turn the bright and cheerful green of their upper surface and the silvery whiteness which clothes their lower surface. In autumn they turn pale yellow.

The flowers of the silver maple, like those of our red maple, appear late in the winter, or in very early spring, long before the leaves; they are produced in sessile axillary fascicles on the shoots of the previous year, or on short spur-like branchlets developed the year before from the wood of the preceding season. The sterile and fertile flowers appear in separate clusters, sometimes together on the same tree, but more frequently on different trees. The buds from which they open are aggregated into compact clusters, and are covered with thick red and green scales fringed on the margin with long rusty brown hairs. The flowers are greenish yellow and have no petals; the calyx, which is five-lobed, is slightly hairy on the outer surface and is long and narrow in the sterile, and short and broad in the fertile flower. There are from three to seven stamens; in the sterile flowers the slender filaments strengthen until they become two or three times as long as the calyx, when the pollen is discharged from the anthers, while in the fertile flowers the filaments do not lengthen after the bud opens, and the anthers wither or fall off without opening. The ovary, which is reduced to a minute point in the staminate flower, is covered with hairs. It is possible that perfect flowers with a fully developed ovary and stamens may be found, as such is the usual order of nature in the case of flowers which have become generally unisexual by the abortion of one of their organs, but if such flowers exist they are uncommon. The ovary of the fertile flower develops into a large fruit with long broad wings, which are sometimes nearly straight and sometimes shaped like a scythe. The fruit ripens at the end of a few weeks after the flowering period, if it is not destroyed by spring frosts, as is often the case, for the silver maple, enticed into opening its flower buds by the succession of a few warm days in late winter, pays for its temerity with the loss of its fruit. Sometimes only one of the two samaras, of which the fruit of the maple is made up, is developed, and it is not an uncommon thing to find a tree producing one-sided fruit, the second and undeveloped ovary appearing as a rudiment at its base. The seed of the silver maple, if it happens to fall on moist open ground, germinates immediately, and produces plants which grow sometimes to be nearly a foot high before winter and strong enough to have in their favor the chances of surviving the hardships to which all seedling plants are subjected. In this habit of early flowering and quick development of the seed of our silver and scarlet maples, a habit which is peculiar to them, may be found, perhaps, a wise provision for their perpetuation. These two trees grow on low river banks or in swamps—situations which are often submerged for a considerable part of every year, especially in winter and early spring. If the seeds of these trees ripened in the autumn, like the seeds of other maples, and did not germinate until the following spring, they would run a serious risk of being water soaked and of losing their vitality. Now, however, they reach the ground at the very best period of the whole year for quick germination. The water has receded from about the trees, leaving a moist open surface, warm but not yet baked by the sun of early summer. It is a question which we do not pretend to answer, whether these trees acquired this habit of ripening their seeds early in the summer in order to maintain their existence in the low situations where they grow, or whether, the habit having been previously acquired, they were gradually driven to the swamps because their seeds were unable to germinate on the drier uplands at the period of the year when it reached the ground and could only germinate in soil from which the water had recently receded, and was, therefore, full of moisture.

The silver maple is widely distributed in eastern America; it is found in the north from the valley of the St. John's River, in New Brunswick, to southern Ontario, and extends southward to western Florida and westward to eastern Dakota, Nebraska, Kansas and the Indian Territory. It is not found very near the Atlantic coast or in the high Appalachian Mountains. It is very common, however, west of the mountains throughout the Mississippi Valley, where it is one of the largest and most generally distributed of the river trees.

The silver maple is often called also the soft maple, a name which it owes, probably, to the brittleness of its slender branches, for the wood of this tree is not soft, but hard, strong, close grained and valuable, furnishing excellent material for the floors of houses and for furniture. It was the Swedish traveler Kalm who first distinguished the silver maple, and sent it to his master, Linnæus, who named it *Acer saccharinum*, a name which has unfortunately become more associated with another of our maples than with the tree to which it properly belongs.

The silver maple has been cultivated in Europe since 1725, and flourishes there not so well, perhaps, as on the banks of its native streams, but better than many of our American trees; and in American and European nurseries a number of varieties with more or less cut or divided leaves, or with leaves blotched with yellow, or with white, or with more or less pendulous branches, have appeared. None of these varieties, however, are very distinct or in any way materially better or more beautiful than the wild tree.

The silver maple is a valuable tree in ornamental planting only when it can be placed in deep, rich and moist meadow land or by the banks of streams or lakes over which it can spread its long and graceful branches and display the beauty of its brilliant foliage. —Garden and Forest.

CONCENTRATED ESSENTIAL OILS OF LEMONS, LIMES, ETC.*

By ARTHUR A. BARRETT.

IN bringing under your notice this evening the subject of concentrated essential oils, I think it will be well to pass in rapid review the state of our knowledge of essential oils, and more particularly its recent development.

As the subject is rather an extensive one, I have limited myself to the oils of lemons and limes. These oils are of considerable commercial importance, and though our friends from Widnes and St. Helens whom I see here to-night may think the subject far less interesting than sulphureted hydrogen and hydrochloric acid, and beneath their notice, yet the total value imported of the two oils together is very considerable.

Until quite recently it was laid down in our manuals of chemistry that many essential oils were identical in composition with oil of turpentine and chemically indistinguishable from it. Gmelin, without attempting completeness, enumerates no fewer than 28 terpenes, all of which are represented as being compounds with the formula $C_{10}H_{16}$, yet differing from one another in some way not explained.

When the benzene nucleus theory came into vogue and the laws of isomerism began to be understood, these differences were attributed to isomerism or the position of the grouping in the molecule, but it was soon perceived that if this were so, the number of isomers was still strictly limited, and attempts were made to reduce Gmelin's 28 to more modest proportions.

One of the first of the modern school of chemists to investigate the subject was Dr. Tilden of Birmingham. He succeeded in proving the identity of several of the terpenes, and was the first to point out that in the cases of oils of lemon and orange the terpenes did not contain much flavor. Owing, however, to the high temperature employed in his method of fractionation, he unfortunately or fortunately seems to have come to wrong conclusions as to the properties of the high boiling portions of the oil.

Dr. Tilden was the first to point out that in the case of oil of lemon the terpene does not contain much flavor. My object to-night is to prove to you that it really contains none. Dr. Tilden says: "Of the various constituents of volatile oils, the terpenes which are present in so many of them contribute less than any other to the peculiar odor of the oil."

In the case of oil of lemon he finds in addition to terpenes, a compound ether, $C_{11}H_{17}(C_2H_5O)_2$, which is decomposed by heat into a hydrocarbon ($C_{10}H_{16}$) and acetic acid. I have not been able to obtain any evidence of the presence of this body, and coupling this fact with the guarded words of Dr. Tilden, I have come to the conclusion that it does not exist.

About the same time—1877-79—that Dr. Tilden was at work, Dr. Gladstone and Mr. Kingzett made independent researches which confirmed Dr. Tilden's results as to the identity of the terpenes.

I have great pleasure in knowing that our countrymen led the way in the study of this important class of bodies, as at the present moment the classic research of Professor Wallach, professor of pharmacy at the University of Bonn, threatens to obscure entirely all that had previously been done.

Professor Wallach has devoted several years to the study of the terpenes, and his papers published in the "Annalen" relate the particulars of what may be described as a model research.

Without going into detail, I may say that generally Professor Wallach has succeeded in classifying the terpenes and bringing them into some sort of order. At the same time a large number which were thought to be distinct from one another have been proved to be identical.

Thus—

Cinene, the terpene of oil of	worm seed
Cajeputene, " "	cajeput
Hesperidene, " "	orange peel
Citrene, one of the " "	lemon peel
Carvene, " "	caraway
Menthene " "	peppermint

are all identical and may be termed limonene. This terpene is also present in oil of camphor, oil of dill seed, oil of erigeron, oil of pine needles. Naturally, it

* From a paper read recently before the Society of Chemical Industry, Liverpool.

having been proved that the terpenes of lemon, caraway, and peppermint were identical, it at once became probable that in the same way as the flavor of oil of caraway is due to carvol, peppermint to menthol and menthon, so oil of lemon would prove to owe its flavor to some quasi impurity of the terpene.

Chemists were not long in trying to isolate this, the characteristic constituent, and it is now possible to prepare it in an almost pure form. I am pleased to be able to lay before the meeting a sample of this body and also the body to which oil of limes owes its characteristic flavor. I have also samples of the terpenes from which these bodies have been separated.

If oil of lemon be distilled in a glass retort in the ordinary way over a gas burner or otherwise, and the distillation is not carried too far, the distillate will be found to be weaker than the original oil, while the residue in the retort is considerably stronger. This is the body, prepared in a more scientific way and completely freed from terpene, which I designate concentrated oil, and samples of which I now exhibit.

I term it concentrated oil, because up to the present I cannot say with certainty what is its exact chemical composition. I hope to continue my investigations in this direction, and will meanwhile give you particulars of its properties.

Concentrated oil of lemon is neutral to litmus paper and has a pure lemon smell. It has a specific gravity of 901, never less than 900, at 15° C., and boils at 220° to 240° C., at which temperature it is partly decomposed.

Treated with bisulphite of soda it forms a magma and it is probably an aldehyde. With oxidizing agents it yields a fatty acid. Warmed with metallic sodium it yields a brown mass.

A similar article to the one I am now showing was examined by Dr. Schweissinger, who published his results in the Pharmaceutische Centralhalle, and my results agree with his.

The terpene from which the concentrated oil has been separated retains a pleasant but weak odor, but is practically free from all flavor of lemon. The specific gravity is 0.850. It boils between 168° and 178°, and consists of pinene and limonene.

Concentrated oil of limes made from the fruit has not been previously prepared that I am aware of, though some work has been done in this direction by Mr. Francis Watt, chemist to the Montserrat Company. The oil which he examined and reported on to the Chemical Society of London was made from the leaves and young fruit of the lime fruit tree, *Limus limetta*. This is not a commercial article.

In this oil of lime leaves, Mr. Watt found a body boiling between 220° and 230° C., which he believes to be methylonyl-ketone, $\text{CH}_3\text{COC}_6\text{H}_{11}$. This is possibly the same body which I am about to describe as concentrated oil of limes, made from the fruit.

Concentrated oil of limes as prepared by myself has a specific gravity of 920 to 923, is neutral to litmus paper and boils from 220° to 230° C. With bisulphite of soda it forms a magma. Warmed with metallic sodium, it comes very viscid, but not solid. With oxidizing agents it forms a fatty acid.

The terpene from which the concentrated oil has been separated contains a small quantity of a substance with a low boiling point, having a very objectionable smell, to which in a considerable degree the rankness of oil of limes is due. This is present in such small quantities that at present I have not been able to isolate it. The terpene when freed from this impurity has very similar properties to the terpene from oil of lemon. It retains a slight smell of limes, but is quite free from flavor. It boils at 176° to 180° C., and is probably nearly pure citrene.

Now as to the practical application.

Up to the present time the chief employment of these concentrated oils has been in the manufacture of liquors and sirups, and the improved flavor obtained by the absence of the objectionable greasiness of the terpene makes them specially suitable for this purpose. A great point in their use is that they dissolve at once to a clear solution, and in spirit of a much lower strength than has to be employed when using crude oils. In this country, where the high duty on alcohol makes spirit such a very expensive article, this is a very important advantage.

In using them it is a good plan to dilute the oils to about the same strength as the oils from which they have been prepared with strong spirit, say 56 per cent. over proof; 1 part to 29 parts of spirit. You then have a solution which can be used in old receipts without making any calculation. It is rather remarkable that this solution in strong spirit has but little smell, the odor being only developed when the solution is largely diluted with water. The same thing is noticed, but to a smaller extent, when ordinary oil of lemon is dissolved in spirit, but the terpene seems to aid the diffusibility of the odorous principle.

Having diluted the concentrated oil with strong spirit to the strength of the ordinary oils, they may be further diluted with weaker spirit or added to the bulk of the cordial or liquor to be flavored.

The following table represents in a convenient form the solubility of the concentrated oils in various strengths of spirit:

Strength of Spirit.	Concentrated Oil of Lemon.	Concentrated Oil of Limes.
Rectified Spirit, sp. gr. 888		
900	All proportions.	All proportions.
905	1 in 150	1 in 160
920	1 in 300	1 in 400
925	1 in 500	1 in 600
935	1 in 3,000	1 in 4,000

In confectionery uses have been found where the employment of concentrated oils is advantageous, and in articles where sugar or other dry powders are required to be flavored with lemon, and where oxidation is very rapid, the use of concentrated oil is an improvement. As the boiling point is so much higher than that of the crude oils, it may be advantageous to use concentrated oils where high temperatures are employed in this department.

I do not doubt also that in perfumery concentrated

oil of lemon will to a large extent displace the crude oil, owing, among other reasons, to the fact that it is quite free from the fixed fat and resin which is contained in ordinary oil.

How nasty this residue is, contaminated as it is with dirt from the hands of the none too cleanly Italian workmen who prepare the oil, you will have an opportunity of judging for yourselves from the sample on the table.

For perfumery I have to acknowledge one disadvantage, and that is that in an alcoholic solution the odor is only developed when the spirit has entirely evaporated; when the perfume has evaporated on the handkerchief, the purity of the odor becomes evident. I think that by using a small quantity of terpene in addition to the concentrated oil this difficulty would be got over, and the advantages of being able to use a weak spirit retained.

An important point is: Do the concentrated oils keep? The answer is: Yes, much better than the crude oils. They should be carefully stored, and the same precautions taken as are usual with valuable essences, and they keep well. It is quite impossible for them to become "turpentiney," as they contain no terpene, $\text{C}_{10}\text{H}_{16}$, whatever.

The deterioration of oil of lemon by keeping is due, in my opinion, to the production of nascent peroxide of hydrogen by the action of air and moisture on the limonene and pinene. This reaction, which has been so ably utilized by Mr. Kingzett in his Sanitas process, is highly objectionable in oil of lemon, rapidly destroying the aldehyde to which the flavor is due.

The best method therefore of preserving the flavoring principle of oil of lemon is to remove the terpene. It can then be kept, if excluded from the air, in the same way as any other aldehyde.

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