will be done. Some curious experiments published by Becquerel appear to show that cold below the freezing point, like the temperature of boiling water or the electric discharge, produces an alteration in the cell walls, which render them more pervious to fluids, and therefore no longer capable of retaining their cell contents.

It appears to me that the pyramid fruit trees and espaliers, which are now so much grown, are peculiarly exposed to the effects of frost, as they are pruned so that each branch overhangs, and consequently protects any below it to the least possible extent. There ought, nevertheless, to be some cheap and effective way of protecting temporarily trees of this small size from frost. Any means of anticipating it would, in view of any expedients of this kind, be of the greatest value. It may be well, therefore, to mention that in spring a dry state of the air, indicated by any very considerable difference in the readings of the dry and wet bulb thermometers, is likely to be followed by frost. The reason is simple; the night frosts, which injure vegetation, arise in the main from the loss of heat from the earth's surface by radiation. If there is much moisture present in the air this loss of heat is impeded. The luminous heat radiated from the sun passes through atmospheric moisture with little impediment, but the obscure or non-luminous form in which the earth radiates it back again is caught by it, as it were, in a trap. On May 17, at Blackheath, near London, the air was nearly saturated with moisture, the degree of humidity being represented by 94°, and the lowest temperature of the air by 44°. Both temperature and humidity fell, *pari passu*, till May 20, when the first stood at 32.6, and the other at 69°. It would be of the more importance to have warnings of the probable occurrence of low temperature, because Mr. Glaisher has shown from the Chiswick observations that periods of deficiency of temperature below the mean are often prolonged to as much as a fortnight. In the 44 years there were 80 such. I feel strong hopes that the telegraphic communication about the weather, which the Meteorological Office now collects from stations in the British Isles and Western Europe, will eventually lead to warnings of probable falls of temperature being obtained.

The apparently paradoxical fact that the temperature often falls lower, and plants correspondingly suffer in low grounds than in those which are adjacent and higher, has often been observed, and is well worth bearing in mind as a practical point in laying-out grounds. I am informed that the explanation is to be found in the downward gravitation of colder air, and its consequent collection in low-lying places and hollows.

In every department of scientific work it from time to time happens that announcements are made which take completely by surprise those who know what has really been made out by legitimate investigation in the subjects they bear upon. Nevertheless, the outside world always takes them up with more or less of un-critical faith. A paper published during last year by General Pleasanton, "On the Influence of the Blue Colour of the Sky in Developing Animal and Vegetable Life," appears to me to have received a great deal more attention than its utter absence of any genuine scientific character deserves. Subsequently presented to the French Academy, it has been the subject of an article by Duchartre in the *Bull. de la Soc. Cent. d'Hort. de France.* This writer points out some of the mistaken scientific views held by General Pleasanton, but though apparently inclined to reject the whole narrative as a hoax, thinks that it is vouched for by testimony too respectable not to require some explanation.

For my own part, having carefully read the original paper, I do not believe, for reasons I have elsewhere stated, that blue or violet light had anything to do with the extraordinary growth of the Vines, supposing that really to have taken place as described. I am slow indeed to comprehend how such a physical condition as exposure to blue light can be equally beneficial to the growth of Vines, the rearing of poultry, and the invigoration of the constitution of invalids. The erroneousness of the facts argued from the absence of all knowledge of modern publications in vegetable physiology, and the wildly crotchetty theories, such as electricity having produced the giant trees of California, disincline me, I must confess, to attach any serious weight to either General Pleasanton's views or his results.

I must not occupy your time with longer remarks. I will only, in conclusion, call your attention to the useful summary of the history of the Phylloxera vastatrix, given by the President of the Linnean Society in his annual address, and printed in *Nature* for June 13 last, and also to the completion, by Decaisne, with the 10th volume of the *Jardin Fruitier du Muséum*, of the history of cultivated Pears.

[Prof. Hind's paper on the Vegetation in the neighbourhood of Birmingham was then read. We shall print this in our next issue. Dr. Denny then read the following paper :—]

THE RELATIVE INFLUENCE OF PARENTAGE IN FLOWERING PLANTS.

One of the chief objects of my paper is to urge the study of a subject full of scientific interest, and of the greatest importance to the practical horticulturist, but which for the want of the accumulation of data derived from accurate experiments, at the present, is involved in much obscurity.

If we could by the observation of results acquired through the medium of a series of carefully performed experiments in artificial fertilisation, obtain any reliable evidence indicative of the relative influence the male (or pollen) and the female (or seed) parents bear in the production of their progeny, it would assist us immensely in carrying out our own designs for the improvement in the form and colour of our flowers, and the quality of our fruits and vegetables.

If, for instance, we knew that either parent, and which, was prepotent in conveying to its offspring certain qualities, say of flavour and aroma, or of size and form, or of quality as regards the texture of our fruits; of colour, perfume, form, substance, and the various qualities we may wish to perpetuate or modify in our flowers, we should be able to form some proximate idea, *à priori*, of the result that would follow our fertilisations.

A knowledge too of the ancestry of the varieties we purpose employing would also be desirable, to enable us to make allowances for the modifications likely to ensue from the tendency to reversion towards an ancestral type—a propensity which seems to be inherent in all plants that have been much changed from their original state by artificial breeding.

It would also be a matter of scientific interest, as well as of practical importance, perhaps, to know if the proportionate influence borne by the respective parents in crossing varieties is the same as in crossing species?

Whether, as the admission of fecundation is no test of the plants employed belonging to the same species, we have any well defined line of demarcation or practical test by which we can distinguish between species and varieties, so that we may know when to employ correctly the term hybridisation, and when cross-breeding?

Whether there exists any real difference in the powers or quality of the pollen of the long and short stamens from which we may expect to derive any specific effect on the progeny by the exclusive employment of the one or the other, or to succeed more readily in effecting difficult crosses?

Whether certain states of the atmosphere, and, if so, what apparent conditions of it favours fecundation?

Whether any clue can be obtained, or suggestions offered, to account for the antipathies that are found to exist between apparent varieties, as well as affinities between what are considered by botanists to be distinct species, precluding fertilisation in the former, and rendering it easy in the latter?

These are a few of the most important points that are constantly occurring to the practical horticulturist. To how many of them does our knowledge admit of a satisfactory reply being given?

There are, doubtless, many present whose vast practical experience in the artificial fertilisation of our fruits, flowers, and shrubs would enable them to give most valuable information upon most of these points; and as the purport of this meeting, I take it, is intended to be for genial discussion and for the interchange of knowledge and ideas, I trust to the generosity of those who are able to assist me in making the subject I have ventured to broach interesting by throwing more general light upon it than my circumscribed experience will afford.

From early youth I have taken much interest in artificial fertilisation, but kept no registered account of my crosses, or their results, until the controversy arose respecting the tricoloured Pelargoniums, as to whether their leaf markings could be reproduced by fertilisation and seed, or whether they were sports only, and owing to a diseased condition of the plant.

To ascertain for my own satisfaction the correct theory upon these points, as well as with the object of obtaining, if possible, some information regarding the relative powers the respective parents exert over their progeny, I commenced a series of experiments upon the scarlet section of the Pelargonium, employing varieties of the most opposite and varied character, and crossing them in every conceivable way.

I conducted these experiments, too, with the utmost possible care and minuteness of detail, both as regards the methods I adopted for preventing self or insect fertilisation, for ensuring the fertilisation being effected by the desired pollen only; and as regards the keeping an exact register of every cross, as well as a record of their results.

By this means I soon arrived at a satisfactory conclusion as regards the points at issue respecting the transmission of variegation of the foliage by fertilisation, from the fact of its being manifested to a greater or less degree in as large a proportion as from 50 to 60 per cent. of the offspring, where the green zonal had been fertilised by the pollen of the variegated; I also obtained some valuable information indicative of the powers the respective parents exert upon various other points in connection with the transmission and modification of the foliage and habit of the plant, as well as of the colour and form of the flower.

From the information thus derived, I am of opinion that by careful and persistent fertilisation, under the guidance of the observation of results, it is possible to produce almost any modification in the character and habit of our plants, and variety of colour and form in our flowers we might desire; for I am satisfied that by these means we possess a much greater power of moulding our flowers in accordance with preconceived design than is generally supposed; and, moreover, I think it possible that ultimately some insight may be obtained into the working of the laws that govern procreation in the vegetable kingdom, and that produce variation in our fruits and flowers.

The result of my experience derived from these experiments, as regards the relative influence of the parents, certainly tends in the reverse direction to my previous ideas, which were derived from books, from which I gleaned that the form of the flower and constitution and habit of the plant were inherited from its mother, whilst the colour of the flower only was supposed to be conveyed by the father. The recorded results of my crossings indicate an immense preponderance of influence over the progeny on the part of the father, in all respects—in colour and in form, in the quality, in size, and substance of the flower, as well as in the production of variegation of the foliage, and in the habit and constitution of the plant also, provided the plants employed are of equal strength.

I wish to be distinct upon this point of relative strength of the parents, because it seems to me that upon the equality or the preponderance of strength on either side very much hinges, as regards the results we obtain from our crossings, for power of constitution exerts most unmistakable influence, and where it preponderates on the part of the seed parent it will modify the otherwise prepotent influence of the pollen parent. This modifying influence manifests itself most as regards the habit and foliage of the plant, and next as regards the form and substance of the flower, and lastly as regards the production of a blend in the colour of the flower.

To instance what I mean (I am alluding to the Pelargonium), if the pollen of a flower of brilliant and decided colour, but of bad form and substance, belonging to a plant of weakly constitution, be applied to the stigma of a finely formed thick petalled flower of a plant possessing a vigorous constitution, some few of their progeny will be influenced towards improvement in the form and substance of the flowers and habit of plant, with, perhaps, some blend in the colour; showing that the preponderance of vigour in the seed parent had exerted a certain amount of influence, but even under these circumstances much the greater proportion of the progeny would either resemble the father in all respects, or show reversion towards former progenitors, or an original type.

I will quote a case or two in point from my notebook. During the summer of 1869 I raised about 140 seedlings from crossings between Lord Derby and Leonidas. In about half of these Lord Derby was the pollen, and Leonidas the seed parent; and half resulted from crosses effected the reverse way. The flower of Lord Derby possessed the fine qualities, both as regards form of petal and smoothness of texture, but was wanting in depth and brilliancy of colour, and in substance also; and the plant was deficient in vigour of constitution as compared with Leonidas.

The flower of Leonidas was much inferior as regards form and quality, but of greater substance and brilliancy of colour, as well as larger than Lord Derby; and the plant possessed a vigorous constitution.

These seedlings flowered during the spring and summer of 1870 of that portion in which Lord Derby was used as pollen parent, and Leonidas as seed parent, about one-third resembled in all respects their father, a few produced flowers very considerably in advance of Lord Derby in size, in substance, and in colour of the flower, and with a superior constitution and habit of plant, showing the influence of the mother in combination with the father's. (I would instance Sir Charles Napier as an example, and which resulted from this cross). Of the remaining two-thirds, a few very nearly resembled in flower Leonidas except being paler in colour and having a somewhat increased breadth of petal, resulting from the father's influence (for instance, Iago); but a large proportion were inferior, showing reversion towards an ancestral type.

(*To be Continued.*)

In the discussion which followed upon the reading of Dr. Denny's paper, Mr. Fenn made some remarks on the variation manifested in the tubers of the Potato, as a result of cross-breeding, and repeated the remarks he has made on the same subject on previous occasions. Mr. Fenn's experience leads him to condemn too close interbreeding, a rapid degeneration being the consequence of this process. With reference to the question of sex, Mr. Fenn recommended the raiser to select as the pollen parent a strong individual, and then a vigorous progeny would ensue. Mr. Fenn's mode of fertilising the Potato consists in the removal of the anthers of a flower late in the evening, and the application to the stigma of the pollen from some other flower in the morning. As the Potato is protogynous (stigma mature before the pollen of the same flower), a strict cross is always effected by the means just alluded to. Mr. Fenn considers it preferable to cross a round Potato with another round one, or a kidney with a kidney.

Mr. Grieve agreed generally with the conclusions arrived at by Dr. Denny.

predecessors, proceeds to give his own opinion, which is this, that there is essentially and primarily but one organ, which, in process of development, splits or divides into two, one of which forms the bract, the other the scale. In Cupressineæ, of course the splitting does not take place.

—— M. Fr. Pfaff has recently been experimenting on the amount of Evaporation that takes place from the surface of Leaves. He examined several times daily, from May till the end of October, a small Oak, the number of leaves on which were by very ingenious calculations estimated at 620,464. The experimenter found that the evaporation varies from day to day according to circumstances, but taking the average of 14 days in May the quantity was nearly 884 kilogrammes; for the whole of June 26,023 kilogrammes, and in October 17,023 kilogrammes. A kilogramme, it may be added, is equal to 2 lb. 3 oz.

—— Mr. Glaisher remarks, on the State of the Weather, during the week ending June 29, in the vicinity of London:—The reading of the barometer at the beginning of the week, at sea level, was about 30.1 inches. Decreasing readings were recorded till the morning of the 25th, when 29.6 inches was reached; a general increase then occurred to 30 inches on the 27th, followed by a decrease to 29.8 inches on the 28th. By the end of the week 30 inches was again registered. The highest temperatures by day were respectively 76° and 78¾ on the 23d and 24th, but during the remainder of the week the maximum values were close to 70°. The lowest temperatures at night varied between 58¼° on the 25th and 46¾° on the 23d. The daily range of temperature was but 11½° on the 25th. The mean daily temperatures and their departures from average were as follows:—23d, 60°.9, +0°.2; 24th, 65°.3, +4°.1; 25th, 61°.4, —0°.2; 26th, 56°.9, —4°.8; 27th, 58°, —3°.6; 28th, 61°.5, 0°.0; 29th, 57°.8, —3°.6. The weather at the commencement and end of the week was fine and bright, and at times cloudless, but on the 25th, 26th, and 27th the sky was generally cloudy and rain fell occasionally. On the evening of the 24th a thunderstorm occurred, with very frequent and vivid flashes of lightning, but very little rain fell. The wind was generally south-westerly and westerly, and the pressures were generally light, though continuous. The maximum pressure on the square foot during the week was 10 lb. on the 26th. The amount of rain measured was nearly half-an-inch.

In England the highest temperatures by day ranged from 80° at Leicester to 71° at Liverpool, the general average over the country being 75½°. The lowest temperatures at night varied from 50° at Bradford to 44½° at Portsmouth and Nottingham, with a general average of 46¾°. The greatest range of temperature in the week was 35½° at Nottingham, and the least 25° at Bradford, the general average being nearly 29°. The means of all the highest temperatures observed by day varied between 73° at Nottingham and 65½° at Liverpool, and of all the lowest observed at night between 54° at Bradford and 50° at Portsmouth. The highest mean temperature was 60¼° at Blackheath and Nottingham, and the lowest 57° at Portsmouth, the mean for the whole country being 58¼°. Rain fell on two days at Portsmouth, and on three at Blackheath and Hull. In the midland, western, and northern counties the general average was four or five days. The amount collected varied from nearly 2¾ inches at Wolverhampton to five-hundreths of an inch at Portsmouth, and the average fall over the country was little more than 1 inch. At Wolverhampton nearly 1¾ inch fell between 4 and 5 P.M. on the 24th. Thunderstorms occurred at Birmingham, Wolverhampton, and Bradford on the 25th, and at Norwich, Bradford, and Liverpool on the 24th.

In Scotland the highest temperature ranged from 73° at Edinburgh to 64¼° at Aberdeen, and the lowest from 49° at Greenock to 45¾° at Edinburgh, the respective averages over the country being 69° and 47¼°. The highest mean temperature was 55° at Dundee and Paisley, and the lowest 54¼° at Greenock, the average for the whole county being 54½°. Rain fell heavily at most places; more than 2⅛ inches was measured at Glasgow and Greenock, and more than 1 inch at the remainder of the stations. The average fall was 1¼ inch.

At Dublin the highest temperature was 71°, the lowest 43°, the mean 55¼°, and the rainfall nearly four-tenths of an inch.

—— Grimston Park, the seat of Lord Londesborough, which covers an area within a ring fence of nearly 2900 acres, was sold by auction, the other day, to Mr. John Fielden, of Dobroyd Castle, Todmorden, for the sum of £265,000.

—— Mr. Baker desires us to state that the Lily which is being distributed in gardens at the present time, under the name of Lilium Roezli, is identical with the plant which he described last year in our columns, under the name of L. canadense, var. Hartwegii; and that the former name, having been published by Regel, with a figure, in November, 1870 (*Gartenflora*, tab. 667), has the right of priority over his, and should, therefore, be the one to be adopted. He adds that the plant exhibited at the Royal Horticultural Society a fortnight ago, under the name of "californicum," is identical with an old favourite, the L. carolinianum of Michaux, figured in the *Botanical Register*, t. 580, and *Bot. Mag.* t. 2280—a native, not of the west, but of the east side of the American continent.

New Garden Plants.

Oncidium superbiens, *Rchb. f.* Linnæa, xxii. 843, 1848; Lindl. Folia Orchid. Oncidium, N. 3.—*Oncidium inferlobum* of English sales (according to Messrs. Veitch).

Pseudobulbis ancipitibus ligulatis monophyllis; folio longe petiolato attenuato oblongo ligulato acuminato; foliis fultientibus pluribus, similibus vaginato articulatis; panicula validissima maxima, multiramea, vaginis ramorum bracteisque ovaria pedicellata non æquantibus oblongis acutis cucullatis; sepalo dorsali unguiculato basi biauriculato superne triangulo cordato subacuto transverso; sepalis lateralibus longius unguiculatis, basi externa et interna inæqualiter seu tantum basi externa auriculata, cuneato oblongis acutis, tepalis ab ungue lato hastato triangulis crispis, labello cuneato ovato in ligulam longam lanceolatam acutam extenso; callo magno carinato antice abrupto in basi, carinula extus utrinque apposita; columna trigona buccis valde angulato productis, androclinio postice acuto, alis falcatis erectis cartilagineis.

When I described this magnificent species 24 years ago, I did not think I should ever see it in European gardens. The Cyrtochilum group was then, with the exception of Oncidium microchilum, regarded as impossible to be managed. Provided you like such straggling twining inflorescence, it is an excellent thing. The unguiculate oblong-acute sepals are of a beautiful cinnamon, the wavy broadly unguiculate petals are whitish-yellow, with many transverse brown bars. The lip purplish-violet with a brownish-whitish callus; while the brownish column boasts two horn-like dark purplish wings. This grand beauty appears to have been discovered in New Grenada by the Lindenian collectors, Messrs. Funck and Schlim (1433!) I have also specimens from Schlim (387)! Bruchmüller! Wagener! Braam! Wallis! Branlio Eñao! Roezl! I feel most pleased to state that this magnificent species has lately flowered with Messrs. Veitch. It may well attract the sympathy of Orchid growers. *H. G. Rchb. f.* [The Orchid above described is figured in the number of the *Botanical Magazine* for the present month, t. 5980.]

THE BIRMINGHAM CONGRESS.

We resume the publication of the communications read at this meeting by inserting the continuation of Dr. Denny's paper, commenced in our last issue.

THE RELATIVE INFLUENCE OF PARENTAGE IN FLOWERING PLANTS.

Of that portion in which Leonidas was used as pollen, and Lord Derby as seed parent, nearly half resembled in all respects their father, and the rest were much inferior; not one showed that any appreciable amount of influence had been exerted by the mother towards improvement. It will be observed that in this cross the pollen parent possessed both the inferior flower and the most powerful constitution also. As regards the habit of these seedlings, they were all more robust than their mother's.

The same season I raised about 60 seedlings from a cross between Celestial and Lord Derby. Celestial, which was used as pollen parent, possessed a brilliant magenta-coloured flower, but of very bad form and substance, and possessed a weakly constitution; from this batch of seedlings a few produced flowers of a colour very similar to their father's (but somewhat less brilliant), and with a great improvement as regards the form, quality, size, and substance of the flower, accompanied, too, with a fair habit and constitution of plant, showing a marked influence on the part of the mother, which in this cross was decidedly the stronger of the two parents. Ianthe resulted from this cross. The remainder of this batch were mostly of very bad form and quality of flower, and weakly constitutions; but there were some very brilliant and novel colours, interesting examples of colour blending, amongst them were carmine, rose-crimson, pinks, and vivid scarlets—some in all respects resembled Celestial.

My large seedling nosegay Wellington was the result of a cross between Le Grand (nosegay) and Leonidas, Le Grand being used as pollen parent. Here the plants were about equally vigorous. Wellington resembles in the character of its flower its father, but with an increased breadth of petal derived from its mother; the colour of the flower is nearly that of the father's also, but it is somewhat a blend, the purple hue of Le Grand and the deep scarlet of Leonidas having produced a very dark crimson scarlet, almost maroon. The foliage, too, of Wellington is most distinctly of the nosegay type; its habit still more vigorous than either parent.

In breeding for variegates, and using the variegates (which, as a rule, are wanting in vigour) as pollen parents, and the robust green zonals as seed parents, about half the number of their progeny showed variegation, and possessed weakly constitutions, the remainder being green zonals; upon the order of procedure being reversed, by which the pollen parent became the parent of very much the greater vigour, the mother's influence was almost *nil*.

I believe that it is owing to the existence of a difference in the vigour of the respective parents that the production of novelties and varieties in our flowers (and probably in our fruits too) mainly depends, and that were it not for a preponderance of power on the mother's side, the progeny would almost invariably resemble the father; and hence the immutability of our flowers and vegetables, which are annually reproduced from seed, the result of self-fertilization.

But I consider another source of the production of novelties and variation exists in the tendency in all flowers (and fruits) that have been artificially bred up to a state far in advance of their original condition, to revert towards former progenitors (especially under the influence of self-fertilization), by which means new combinations of ancestral properties are formed, and hence new varieties.

Even under artificial fertilization I find in the Pelargonium this tendency to reversion to exert very considerable modifying influences. Especially have I observed it as regards the colour of the flower; for instance, the magenta shades that have been produced upon the scarlet Pelargonium have resulted from the crossing of pinks upon scarlets; and very many of my seedlings, the offspring resulting from the crossing of two magenta-coloured flowers, have produced pink ones as well as scarlets, showing reversion to both the colours of their immediate ancestors.

It is a point worthy of observation whether the colour of a flower or a change in the character of a plant that has been recently obtained are conveyed to their offspring in the same proportion as to numbers, and with the same certainty as those of long standing. I think not.

I must also mention a remarkable instance of reversion as regards foliage that has occurred in two of a number of seedlings raised this spring from Violet Hill Nosegay as seed parent, crossed by Ianthe, with the object of obtaining variety in the flower. Two of this batch of seedlings have come variegates. Now Violet Hill was bred for variegation, and was planted out at Messrs. Henderson's establishment at St. John's Wood in the spring of 1864, with a view to its breaking into variegation, but which it did not do, but was selected, and subsequently sent out, for its flower, and on account of its dwarf habit of growth.

My notes would furnish innumerable examples in support of the theories I have founded upon them, did time admit of my going further into detail. I would observe that I have purposely quoted the results of crossings which produced varieties that have been sent out by Mr. W. Paul, that they might, if desired, be referred to, and compared with their parents.

A close analogy seems to me to exist between the vegetable and the animal kingdoms as regards the ill-effects produced by breeding in-and-in, and the good resulting from crossing opposites, for I find it to be necessary for the maintenance of improvement in the flower, and the constitution of my seedlings, to introduce fresh varieties to breed from annually; and I find that crossing two flowers of the finest qualities does not produce such satisfactory results as where one of much inferior quality is employed. Of course it will be inferred from my previous observations that I use the superior quality flower as pollen parent.

I am of opinion that the decadence in many of our old florists' flowers is owing to their having been bred in-and-in, and from the repeated crossing of flowers of a precisely similar strain and qualities, with the object (and probably supposed only means) of reproducing flowers possessing certain peculiarities in markings, or form, in accordance with the rigid rules prescribed for these flowers.

As regards the condition of the atmosphere that favours the effecting of difficult crosses, it would be no easy matter to note with any degree of certainty the precise period of each successful attempt, nor the precise condition of the atmosphere at the time; we read of special crosses having been effected under certain conditions of it, but I have never seen it specified what these conditions were. My experience indicates that bright clear weather, and the hours of sunshine, are conducive to fecundation.

I have alluded to the antipathies and affinities we find to exist, without any explicable cause; for instance, I have found it impossible to fertilise three or four varieties of the scarlet Pelargonium (viz., the Duke of Cornwall, Dr. Muret, Beauté de Suresnes, and all that section of the doubles which sprang from Beauté de Suresnes), which to all appearance are mere varieties of the zonal section, save with one another; and, showing the existence of affinity between what are supposed to be distinct species, I have fertilised without much difficulty a variety (peltatum elegans) of the Ivy-leaved section by the pollen of the zonal.

I have also alluded to the possible difference in the respective influence of the parents in true hybridisation. Upon this point I have not sufficient evidence to form a fair opinion; but certainly in the seedlings I have raised between the Ivy-leaved and the zonal sections, their foliage (with the exception of some distinctive evidence of their being hybrids) resembles almost entirely that of their mother, which you will observe is the reverse of my experience of the results produced between varieties.

Much has been written and said upon the difference in the quality and powers of the pollen of the short stamens, and if the supposed difference really does exist, it is a matter of considerable practical importance, and one worthy of further scientific investigation; but my experiments have hitherto failed to satisfy me of their possessing any difference.

In an admirable article upon hybridisation, written by Isaac Anderson-Henry, Esq. (and which at different periods has appeared in nearly all the horticultural journals), he says "that, owing to the granules of the short stamens being smaller than those of the long ones, they can the more easily descend the tubules leading from the stigma to the ovaries, and consequently facilitate the crossing of a large-flowered variety, or species, upon a smaller one."

I have not been able to detect this difference in size, although I have many times placed the granules of the long and short stamens side by side under a powerful microscope; nor, I believe, is it the opinion of physiologists of the present day that they do descend these tubules at all, in fact it has been shown that they send down filaments through them to the ovules.

The arrangement of the anthers upon filaments of different lengths looks to me like a provision to ensure all parts of the body and legs of the insect coming into contact with the pollen as it passes down the flower to obtain the nectar, thereby rendering the fertilisation of the next flower it visits the more certain.

The visible effects of impregnation are frequently manifested with a rapidity almost equalling that of an electrical phenomenon. I have observed the petals of the Pelargonium which, before impregnation, were quite firm, to fall within a few seconds of the application of the pollen to the stigma—a result due, I conclude, either to the immediate diversion of nourishment from the then superfluous part of the flower to the organs of generation, or to the existence in the vegetable kingdom of a power analogous to the nervous in the animal, but of which we are as yet in total ignorance.

Lastly, I would remark that, to enable reliable conclusions to be drawn upon any of these points, we require an accumulation of data derived from the careful observation of very many unbiassed workers, whose results have been obtained from experiments conducted with scientific precision upon all our flowers and fruits.

Such an accumulation of recorded facts (if they could be obtained) would prove a source of the greatest interest to the philosopher, by their tendency to throw some light upon the working of Nature's laws, and could not but afford most valuable information for the guidance of the practical horticulturists; and moreover by freeing horticulture from all empiricism, place it in its true and legitimate position among the modern sciences.

THE VEGETATION OF THE VICINITY OF BIRMINGHAM.

I propose to endeavour to convey some general idea of the district around Birmingham, and to make a few remarks on certain conditions of the atmosphere, and on the influence of that atmosphere on surrounding vegetation.

For convenience sake I divide this district into four sections, corresponding to the four points of the compass, by an imaginary line midway between each point.

The first question to which I shall advert is, what is the general state of the vegetation in the vicinity of Birmingham?

As I shall speak in a few moments of a well-known district on the line between the north and west section, having a most significant cognomen, and being the very opposite of salubrious, or favourable to vegetation, except as to almost forests of Horsetail and Coltsfoot, the last of which often seems to revel in poverty, filth, mud, and clay, let me mention that we have some parks about us that would ornament any locality in Britain. Almost due west we have close to us the park of Edgbaston, where many of our forest trees are noble specimens of their class. In and near this park we have specimens of the two Chestnuts, Oak, Sycamore, and others truly noble and magnificent, and a successful general vegetation. Or take another instance at the opposite point, nearly, or rather almost directly, north. A very few miles—less than four as the crow flies—will bring us to Great Barr and Park. This park, the rather ancient domain of the Scott family, who have held it about a century, presents specimens also of noble trees, and a most luxuriant flora general throughout the district. About Barr and Perry Barr, kindred localities, and on the road between here and the western boundary of Sutton Park, are some of the noblest Beeches which the eye would wish to rest on. Of Hornbeam we have in general fewer trees, and these mainly confined to the western and southern suburbs, and in our rather close vicinity.

But what have we on the boundary line between north and west?

In this north-western neighbourhood a series of associated localities exist, busy and prolific beyond conception, and known by the cognomen of the Black Country. Black indeed is this locality, and its blackness consists not entirely in its smoky atmosphere, though there is a fair supply of this ingredient. The ground is covered in every direction with slag and cinders and refuse coal-dust. Hills and mounds of sometimes incandescent residues of iron furnaces; and yawning chasms and mouths leading down to villages and communities and miles of space, buried almost hundreds and hundreds of feet beneath the surface, meet you on every hand. Close in the vicinity, however, of much of this, we now and then see fields of Wheat, which, though a little grimy, seem to enjoy almost as sturdy a life as some of the rough and ready, and humourous and honest, human denizens of the district. How is it that plants can live at all in such localities as this? The reply is that the country around is simply denuded of its normal surface by the mining operations, or covered over by the refuse. There is not quite so much actual smoke as dust—dirt and blackness, and the plant will put up with dust and dirt, when it will die of suffocation in an atmosphere loaded with smoke or soot in an impalpable state of division.

In the district between Oldbury and Smethwick there is more or less profuse vegetation, and though many other trees seem to grow without difficulty, nearly all the Oaks within a certain radius were a little while ago either dead or dying. Indeed, they still stand, and it is a curious sight to see these dead and leafless trees studded here and there, blackened and ghastly specimens of once luxuriant trees. In looking for a cause, it would seem that certain chemical works not far from Oldbury have the credit of the destruction mentioned. The leaf-buds and rudimentary leaves of the Oak are unquestionably possessed of a most delicate organisation, and a texture almost membranous. Possibly this may account for the special liability to which I have alluded. The injuries here indicated belong to a different agency and different principle from the injury produced by smoke. The injury from smoke is purely mechanical, not chemical, and is therefore perhaps slower in its operation.

Let us now for a few moments turn our attention again a little to the north-east. Not far from Barr, already mentioned, and seven miles from Birmingham, stands Sutton Park—one of the finest and most productive of the botanical stations of this district. It is composed of a mixture of woodland, heathy upland, bog, and lake. It is wild enough in some parts, and has an area of more than 3000 acres. The lake and the woodland are variously disposed, divided, and distributed. Yet there are many nooks and spots where Nature seems to revel in all the luxuriance of the supremest solitude. Some of these solitary nooks seem indeed hardly to have been visited or trod by man or woman, and yet Sutton Park is accessible to every man, woman, and child whose immediate resources enable him or her to arrive at the confines with a residue of 1*d.* to pay for admission. With all this, then, it may be that even here in some spots—

"Full many a flower is born to blush unseen."

Its precincts have, however, been threatened with invasion by the restless instincts of railway speculation. It is still intact, though our worst fears for its safety and preservation are excited. Upwards of 400 flowering plants have been reported from this station; and besides these Mr. James Bagnall has indicated 109 species of Urn Mosses in the same area. The south-eastern section of the locality near Birmingham is peculiarly rich and luxuriant, and comprises Solihull district between here and Kenilworth, and also Lapworth. The low-lying district to the east of Birmingham is a watery district, and afflicted, too, by something in excess far less agreeable, I mean the sewage of this great town. Within a radius of 10 miles from Birmingham, an area which has been worked by the Associated Naturalists of Birmingham, we have a verified flora numbering 729 species, comprised in 80 natural orders.

The confervoid algæ in the vicinity have also been studied, and Mr. A. W. Wills reports 138 species.

Secondly, I will make a very few remarks on the relation a city atmosphere holds with respect to vegetable life in its immediate vicinity. Some of these remarks will manifestly apply to all large towns, *cæteris paribus*.

One of the first facts we have to meet is that we supply plants and trees with a positively enormous quantity of food—that class of food from which nearly all the solid parts of plants and trees are derived. I do not refer, of course, to the water or to the ammonia, but to the carbonic acid, which must be furnished in the water. Professor Herepath estimated that about 12.7 oz. of carbon are daily converted by an adult into carbonic acid. Professor Helmholtz estimated the amount as on an average about 16 oz. Now 12.7 oz. produce, when oxidised into carbonic acid, about 25 cubic feet, and 16 oz. would give more than 30 cubic feet.

The human beings in this town alone must number 400,000, if not more. This, without counting animals, would give us 12,000,000 cubic feet per diem of carbonic gas for Birmingham. But this is far from the full aggregate, for we have to add to this sum that which is produced by every gaslight, every fire, and every other full oxidation of carbon. From 15,000,000 to 20,000,000 cubic feet of carbonic acid must then be produced daily in this large community.

A second fact is that this gas, which feeds the plants and trees, is a deadly gas so far as animal life is concerned, and must be got rid of effectually if we are to live and breathe, and retain and enjoy health. Nay, even when diluted with 80 per cent. of common air it is fatal to animal life. A dilution to the extent of 90 per cent. with common air gives a mixture injurious to animal life, and cannot be breathed without injury. (Carpenter.)

What, then, becomes of this enormous sum of 15,000,000 or 20,000,000 cubic feet of carbonic acid produced every day? No doubt it becomes gradually diffused, and well it is so, or we could not live a single hour in our ordinary circumscribed atmosphere. It must be thus partially removed from the sphere of animal respiration, but it is not effectually done, or even half done, under the present arrangements of society; and decadence of health too often from this unsuspected cause results. But, even when diffused, it is not destroyed. It still exists in the atmosphere, especially in the neighbourhood of and in crowded communities, and it can only be effectually got rid of by vegetation, and vegetation on a large scale in and in close proximity to towns.

A third fact now meets us, namely, that we in towns are doing all we can to kill the very agents on which we depend for our lives and our health. Animals die without a constant supply of oxygen; vegetables die without a full and free supply of carbonic acid. Every city and every town in this kingdom is, however, engaged in the process of suffocating plants with their smoky and intolerable atmospheres. The moment any plant is introduced, a gradual process of suffocation commences, and this is followed in some cases by rapid death, or, if not, by a sickly decadence. This is as effectually done as if animals were prevented from exhaling the carbonic acid from their lungs, either altogether, or else partially prevented, as human beings are when they breathe an atmosphere previously contaminated with 5, 10, or 20 per cent. of this deadly excrementitious substance; or when the larynx or bronchial tubes are physically obstructed.

But for this one condition, we might have plants and flowers and trees growing in every locality, or in every corner of this crowded town, and these would relieve the inhabitants of the refuse and deadly acid which is often so unsuspectingly hurtful or fatal to health.

The breathing or respiratory mouths of the leaf, on the average, number, we may calculate, about 60,000 on every square inch of the under surface, or 60 times as many as the sudoriparous pores of various portions of the human skin. A fairly large leaf of the Rhododendron would give about 10 square inches of surface below. We should thus get in one leaf on its under side alone about 600,000 pores, and which excrete oxygen, and act as ordinary exhalents. These breathing and exhalent orifices are very small, and therefore much more easily obstructed by those minute particles which constitute the subsequent pellicle of smoke—soot. Smoke is, of course, sooty carbon in a very minute state of division, and the more impalpable and finer the particles the more effectually does it cover the breathing pores with an obstructive if not impenetrable layer.

The rain, even when free from soot, which indeed it seldom or never is, in towns, does not clear these pores, because the upper side of the leaf is much less abundantly furnished with pores than the lower. No doubt Nature arranged that in this way dust and dirt should not act so much as obstructions. But even dust and dirt merely would not very materially injure a plant exposed to light and rain freely, with the other known requirements. They are not like the thin penetrating fatal film deposited by smoke. To a certain extent the trees in all our very immediate suburbs, which are evergreen, or retain their leaves through the winter, may be shown to have a slight deposit of smoke, not so much, however, in the suburbs as to very severely injure the plant. Leaves in the botanic garden at Edgbaston, just a mile from the centre, will be found somewhat contaminated, and the smoke may be wiped off or washed off. Some plants are like delicate children, and the first decadence is perhaps one of rapid death. Other plants are hardy or less tender, and seem resolved apparently to die hard. It is a question of degree and variations in the several conditions; and none of the facts at all subvert those relentless conditions and laws by which the All-wise Creator has accomplished His wonderful designs and will. What can be done? What remedies have we in our power?

These are multitudinous; but we have many questions to deal with as to sanitary laws. The dense accumulation of people in a very large town produces much poverty, disease, death, squalor, filth, and other evils. Surely it could never be intended by Nature that human beings should collect themselves and their habitations so closely together as to shut out life often, and especially the means of breathing an atmosphere consistent with life, and even seeing something of the other works of Nature besides himself. The dense accumulations of large towns is a fatal mistake, and a fatal evil. Gradually this dire evil must practically force itself upon the notice of civilized nations, and in spite of the overbearing tendencies to concentration, the future policy of every wise people will perhaps inevitably be, and certainly should be, dispersion, and thus to further the aim of the Creator when He made the world of life strictly relational in its departments, and left the intelligent of His creatures to find out and carry out His all-wise, beneficent, and sovereign will.

Mr. Glaisher's paper "On Thermometers for Horticultural Use" (see our last issue), was then read.

Professor Dyer then read the heads of a paper "On Dracæna and Cordyline," by Mr. J. G. Baker, F.L.S.,